Session 2

PUBLIC DEBT AND FISCAL RULES

THE MEASUREMENT OF GOVERNMENT DEBT IN THE ECONOMIC AND MONETARY UNION

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Introduction

Government debt has gained a prominent role in the European Union because of the Maastricht Treaty provisions and of the Stability and Growth Pact. Together with the government deficit, gross consolidated government debt is used to monitor the fiscal developments in the Economic and Monetary Union (EMU or euro area).[1] In this context, it is often stated that in the absence of sufficient fiscal discipline, the conduct of a stability-oriented monetary policy becomes difficult. Overall, debates over fiscal measures and their effects on government debt are fascinating and useful to study. Otherwise, the measurement of government debt is often seen as a rather straightforward exercise. Nevertheless, much work has been done in recent years to improve the quality of debt measurement in the framework of the government accounts. Eurostat has published its *ESA95 Manual on Government Deficit and Debt*, which is seen as an indispensable complement to the European System of Accounts (ESA95) to aid the application of its methodology for calculating government deficit and debt in the EU Member States. The European Central Bank (ECB) has also prepared a G*uide on Annual Government Finance Statistics*. It describes the methodology for compiling the tables in the ECB Monthly Bulletin showing the euro-area general government fiscal position.[2] The ECB derives the euro-area aggregates from harmonised and regularly updated data provided by the National Central Banks (NCB) of the EU. Finally, the *IMF Government Finance*

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[1] According to the Maastricht Treaty establishing the European Community (as amended by the Treaty of Amsterdam), article 121 (1), second indent, requires "the sustainability of the government fiscal position; this will be apparent from having achieved a government budgetary position without a deficit that is excessive, as determined in accordance with article 104 (6)". Article 2 of the Protocol on the convergence criteria referred to in article 121 of the Treaty stipulates that this criterion "shall mean that at the time of the examination the Member State is not the subject of a Council decision under article 104 (6) of this Treaty that an excessive deficit exists." Article 104 sets out the excessive deficit procedure. According to article 104 (2) amd (3), the Commission shall prepare a report if a Member State does not fulfil the requirements for fiscal discipline, in particular if: (a) the ratio of the planned or actual government deficit to GDP exceeds a reference value (defined in the Protocol on the excessive deficit procedure as 3 per cent of GDP), unless: – either the ratio has declined substantially and continuously and reached a level that comes close to the reference value; or alternatively, – the excess over the reference value is only exceptional and temporary and the ratio remains close to the reference value; (b) the ratio of government debt to GDP exceeds a reference value (defined in the Protocol on the excessive deficit procedure as 60 per cent of GDP), unless the ratio is sufficiently diminishing and approaching the reference value at a satisfactory pace.

[2] Section 6 of euro-area statistics.

Statistics Manual 2001 (GFSM) was published in December 2001. It is much closer to the System of National Accounts (SNA93) than the "old" GFSM of 1986.

Based on this work, the paper deals with the measurement of government debt in the EMU also focussing on its comparability across national economies. Section 1 introduces mainly two measures of government debt: ESA95 debt and EDP debt. Work is ongoing to derive extended debt measures, which are based on broader instrument coverage and on a wider inclusion of institutional units. Section 2 deals with the analysis of government debt statistics as available for EDP debt and ESA95 debt, followed by some conclusions.

1. Measures of government debt

Essentially two main government debt measures are currently considered: EDP government debt and ESA95 government debt. Other government debt measures refer to extensions based on broader instrument coverage or a wider inclusion of institutional units. This second type of extended measures refers to public sector debt, which also includes, in a consolidated presentation, the debt of public corporations and of general government.

1.1 EDP debt

Referring to the methodology used in the European Union, the measurement of government debt has been strongly influenced by the Protocol No. 20 on the excessive deficit procedure annexed to the Maastricht Treaty in 1992.[3] Together with the Council Regulation (EC) No. 3605/93, it defines *government*, *debt* and other aggregates like *surplus/deficit*, *interest expenditure*, *investment*, and *gross domestic product* by reference to the accounting rules as described in the ESA – at that time ESA79.[4]

"EDP debt" is general government gross debt as defined in the Council Regulation (EC) No. 3605/93: its article 1 (5) defines general government gross debt as: (1) comprising the consolidated liabilities of the ESA95 general government sector (*S.13*); (2) in the ESA95 categories: currency and deposits (*AF.2*), securities other than shares, excluding financial derivatives (*AF.33*), and loans (*AF.4*); and (3) measured at "nominal value", in line with Protocol 5 of the EC Treaty, further defined in the regulation as the "face value." This means, in particular, that the government debt is not affected by changes in market yields, and excludes usually

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[3] Council Regulation (EC) No. 3605/93 of 22 November 1993 and its amendment, Council Regulation (EC) No. 475/00 of 28 February 2000, on the application of the Protocol on the excessive deficit procedure annexed to the Treaty establishing the European Community.

[4] The excessive deficit procedure requires prompt submission of fiscal data twice annually. See Council Regulation (EC) No. 1467/97 of 7 July 1997 and the Ecofin Council conclusions on the "Code of best practice on the compilation and reporting of data in the context of the excessive deficit procedure" from 18 February 2003.

unpaid accrued interest.[5] The national accounts categories, considered for EDP debt, are called "EDP debt instruments." EDP debt is sometimes labelled as "Maastricht debt" and the relevant ESA95 categories as "Maastricht debt instruments."

1.2 ESA95 debt

There is no specific definition of government debt in ESA95, but general provisions are made on institutional sectors, liabilities and their valuation rules. Accordingly, ESA95 government debt includes all debt liabilities of government institutional units. These are all liabilities excluding shares and other equity: *currency and deposits*, *securities other than shares*, *loans*, *insurance technical reserves,* and *other accounts payable*. The stock of ESA95 government debt should be recorded at market value at the end of the accounting period. This refers to securities other than shares. Otherwise, the nominal value is used for currency. For loans and deposits, the amount of principal is applied that the debtors are contractually obliged to repay the creditors when the deposits would be liquidated on the date the balance sheet is set up. ESA95 debt also includes accrued interest and can be derived gross or net of selected assets, consolidated or non-consolidated. Such calculations depend mainly on the availability of appropriate balance sheet data.

1.3 Extended measures of government debt

ESA95 debt and EDP debt exclude two types of government liabilities. First, these are liabilities recognised by extended accounting systems like provisions for expected but uncertain future payments arising from past events. Furthermore, unfunded pension schemes operated by government units for their employees, paid out of government's current resources, and without special reserves are not included as well as contingent liabilities like guarantees. Second, liabilities of entities are also not covered, which are regarded as subsidiaries of government in other accounting systems but outside the general government sector in national accounts. Both possible amendments are currently discussed in the framework of updating SNA93.

1.3.1 GFSM government debt

The *IMF Government Finance Manual 2001 (GFSM)* was published in December 2001. It is closer to SNA93 than the previous version of the GFSM.[6] It

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[5] One exception is the treatment of zero-coupon bonds, for which the nominal value is defined as the redemption value.

[6] It is recognised that the implementation of the fully integrated accrual accounting system presented in the GFSM will take a long time for many countries. Countries will need to revise their fiscal data classification systems to reflect fully the accrual basis of recording while still capturing data on a cash basis. In this context, three approaches are described, either relying on already available accrual

(continues)

shows a full reconciliation of transactions, other flows, and balance sheets, at market value, like SNA93 and ESA95.

However, it treats unfunded pension schemes operated by employers differently from SNA93 or ESA95 because it records financial transactions for them and a balance sheet liability. So GFSM debt includes liabilities for government employee unfunded pension schemes, which are not covered in EDP debt or ESA95 debt.[7]

1.3.2 Debt according to standards adopted by the Public Sector Committee of the International Federation of Accountants

The International Accounting Standards Board (IASB) develops International Accounting Standards (IAS), which will be adopted by quoted companies resident in the European Union countries by 2005. In parallel, the International Federation of Accountants' Public Sector Committee (IFAC PSC) prepares a series of International Public Sector Accounting Standards (IPSASs) based on the IASB work.

A Steering Group has been established to oversee work on the convergence of accounting and statistical standards. The detailed work is being undertaken by an IMF/OECD task force. It has already made proposals to the newly established Advisory Expert Group of the Inter-Secretariat Working Group on National Accounts (ISWGNA) to update the SNA93 in ways that are consistent with existing and emerging accounting standards.

Some of the proposals under consideration affect government debt like the treatment of contingent liabilities in the form of government guarantees, and the treatment of provisions. In general, guarantees are not recognised as "economic assets" in national accounts. These are contingent liabilities that are not recorded in the system except when they are traded.

Other issues are more conceptual. Do the future social security benefits specified by current law constitute government debt in the same sense as the other debt components? The answer to this question depends at least partly on how the liability is perceived by households. If households believe that these benefits will be paid with the same probability that the other debt components will be paid, then it may be sensible to count the present value of the benefits as government debt. Similar questions arise for civil service, retirement or medical benefits also including the expected cost of contingent liabilities that arises from loan guarantees and insurance programs.

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accounting data, or using national accounts' data that are already available on an accrual basis, or reclassifying cash data to the new framework.

[7] See GFSM, paragraph 4.35.

1.3.3 Public sector debt

This second type of extended measures refers to public sector debt, which also covers, in a consolidated presentation, the debt of public corporations.

The fact that governments own public corporations, financial and non-financial, and have the capacity to direct them to conduct quasi-fiscal activities argues to the importance of more general reporting of supplementary information on the public sector accounts and public sector debt. *Generally accepted accounting practices (GAAP)* focus on the ability to control as a criterion for consolidated reporting. Their application to government finance reporting may in future provide added impetus to reporting on the fully consolidated public sector, with separate reporting by sub-sector. Nevertheless, the delineation between the public and the private sector might be rather cumbersome to define.

2. Analysis of government debt statistics

2.1 EDP government debt

2.1.1 Statistical data

The data underlying the measurement of EDP government debt are compiled and published by the ECB in its Monthly Bulletin, Table 6.2 of the euro-area statistics section. Table 6.2 shows the details of EDP government debt for the euro area broken down by financial instrument, by holder, by government sub-sector, by original and residual maturity, and by currency.

Measures of government debt are often expressed as ratios of GDP. The measure of GDP used for compiling the debt ratio is the ESA95 GDP.

Chart 1 shows EDP euro-area government debt as a percentage of GDP since 1991. It increased to 75.4 per cent of GDP in 1996, up from 57.4 per cent of GDP in 1991 and decreased afterwards to 69.0 per cent of GDP in 2002.

EDP government debt in the euro-area countries span a wide range. The highest reported debt-to-GDP ratios were in Italy, Belgium and Greece with values above 100 per cent in 2002 as shown in Chart 1. While the debt ratio of Belgium was significantly higher in 1991 (more than 130 per cent of GDP), it remained nearly unchanged in Italy and increased by more than 20 percentage points in Greece since that year.

Like in Belgium, the government debt-to-GDP ratios in the Netherlands and in Ireland decreased, from 77 to 52 per cent and from 103 to 32 per cent respectively as shown in Chart 2. The government debt ratios increased significantly in various euro-area countries like in Germany (from 40 to 61 per cent), Spain (from 45 to 54 per cent), France (from 36 to 59 per cent), Austria (from 57 to 67 per cent) and in Finland (from 23 to 43 per cent). Otherwise, the debt ratio was broadly stable in Luxembourg (between 5 and 6 per cent) and in Portugal (between 58 and 61 per cent).

Chart 1

EDP Government Debt by Euro-Area Country (Italy, Belgium and Greece)

(percent of GDP, end of year)

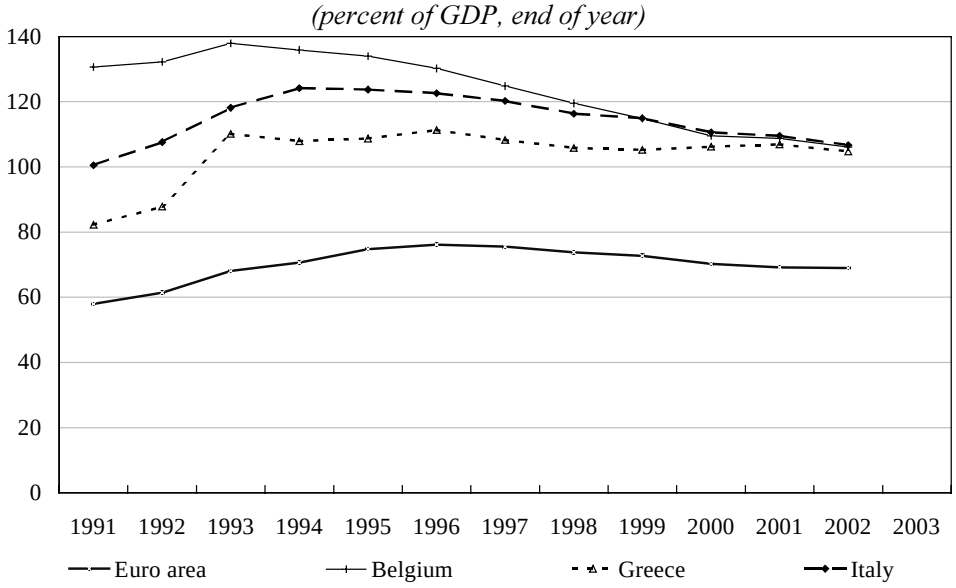


Chart 2

EDP Government Debt by Euro-Area Country (Except Italy, Belgium and Greece)

(percent of GDP, end of year)

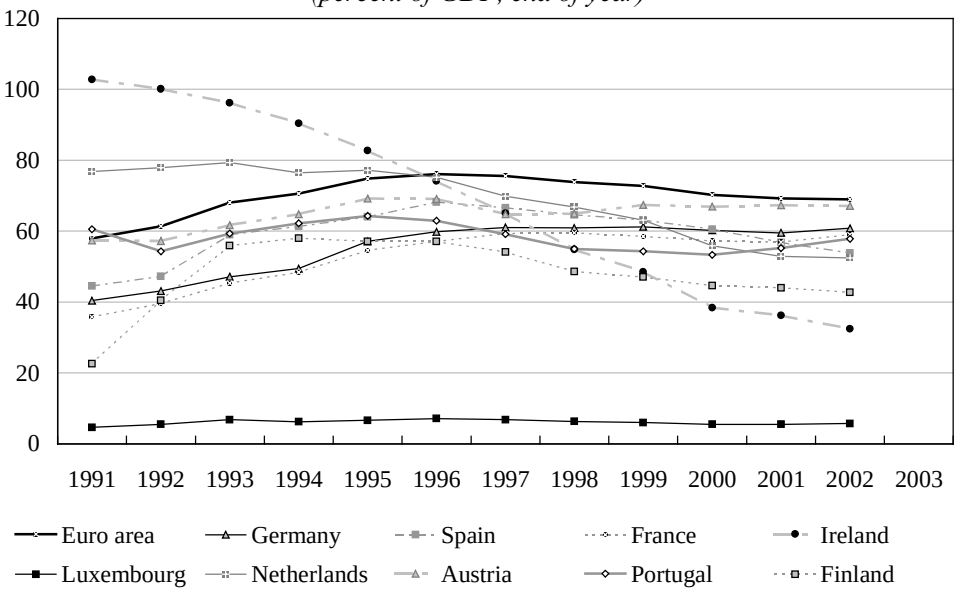


Chart 3

EDP Government Debt by EU Non-euro-area Country

(percent of GDP, end of year)

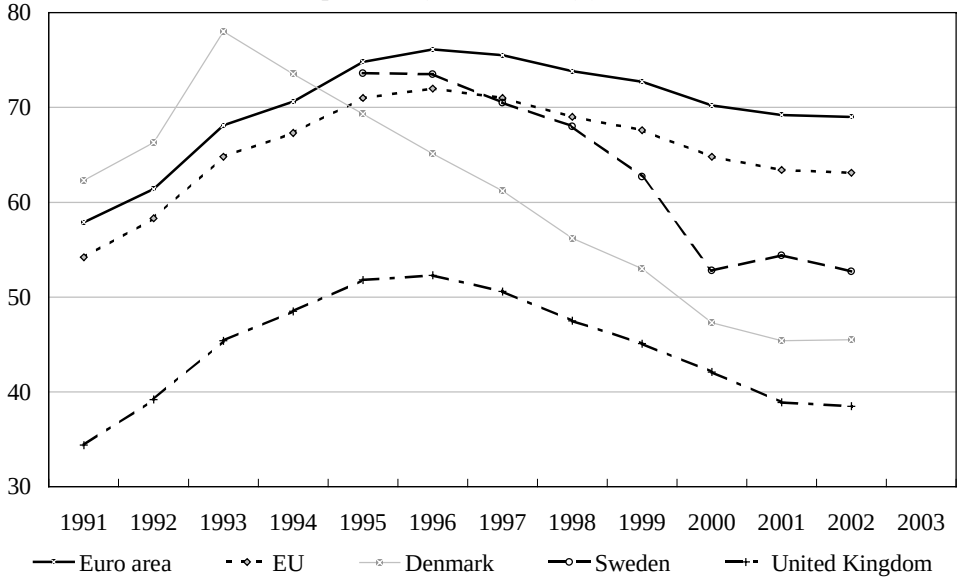


Chart 4

EDP Government Debt by Acceding Country

(percent of GDP, end of year)

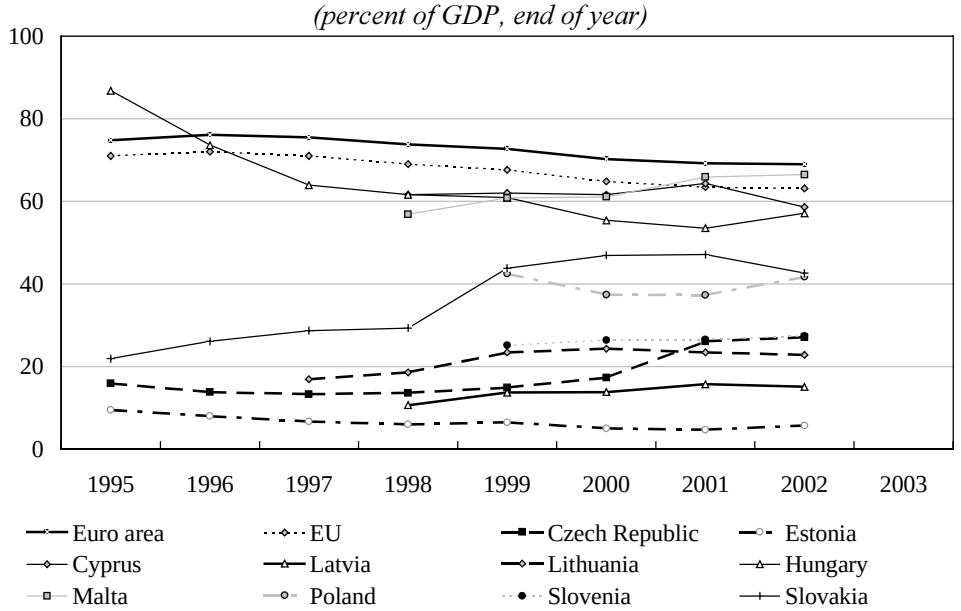
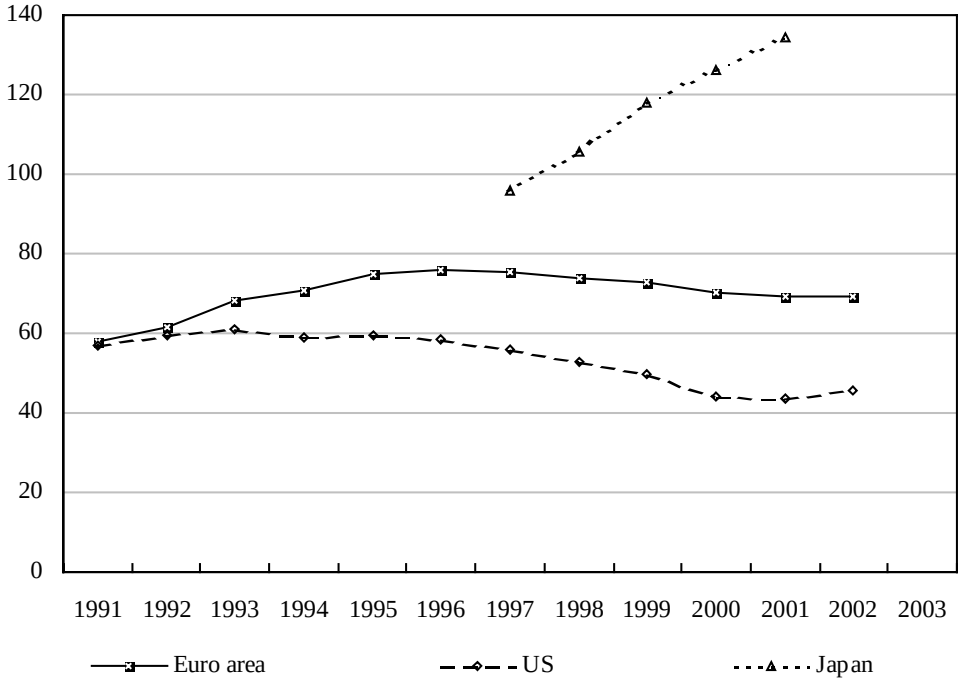


Chart 5

EDP Government Debt for the Euro Area, the US and Japan

(percent of GDP, end of year)



Compared to the euro-area EDP government debt, the corresponding figure for the EU was somewhat smaller because of the comparatively lower debt levels in Denmark (46 per cent in 2002), Sweden (53 per cent) and the UK (39 per cent) as shown in Chart 3. All acceding countries reported government debt-to-GDP ratios for 2002, which were below the ratio for the euro-area countries as a whole ranging between 6 per cent for Estonia and 67 per cent for Malta in 2002 (see Chart 4).

Comparable EDP government debt data have also been compiled for the US and Japan as presented in Chart 5. The corresponding debt ratio for the US decreased to a rather low value of 43.6 per cent in 2001, rebounding to 45.7 per cent of GDP in 2002. In 1991, this ratio was only 57.4 per cent. In Japan, the government debt-to-GDP ratio covering the debt instruments as included in EDP debt increased substantially during the recent years accompanied by extraordinary high government deficits.[8] The debt ratio was 134.6 per cent of GDP in 2001.

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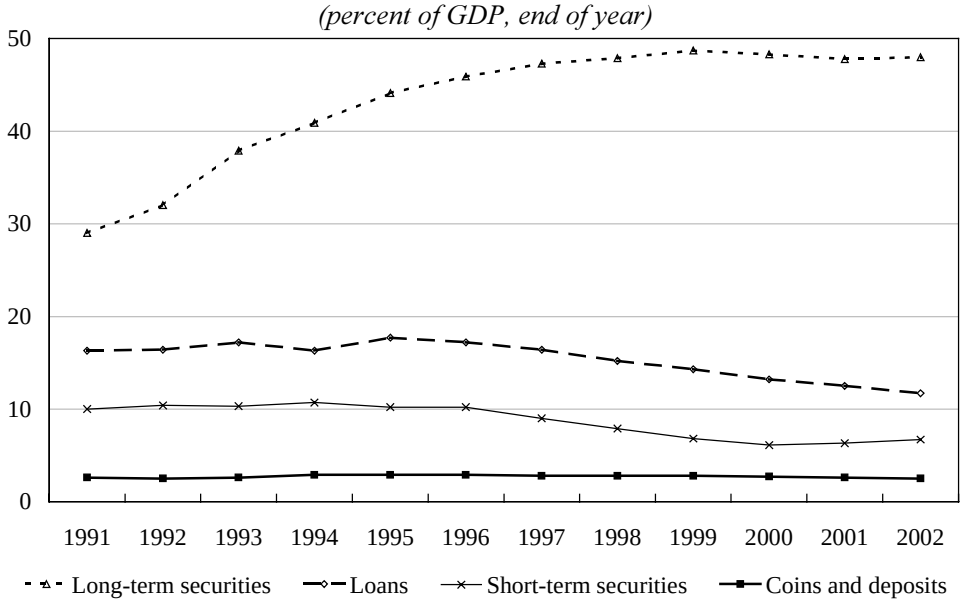
[8] The general government debt figures for the US and Japan cover the EDP government debt instruments. The US data are at nominal value adjusted for accruals, while the Japanese data are at market value.

Chart 6

EDP Government Debt by Financial Instrument

(percent of GDP, end of year)



2.1.2 EDP debt by financial instrument

Chart 6 shows the development of EDP debt with the breakdown by financial instrument. The financial instruments are *coins and deposits*, *loans*, *short-term securities* and *long-term securities*. Nearly two third of euro-area government debt in 2002 was issued as *long-term debt securities*, compared to one half in 1991.

The debt-to-GDP ratio of *short-term securities* issued as government debt fell to less than 7 per cent in 2002, down from 10 per cent in 1991. The importance of *loans* as a government debt instrument has also decreased. Loans taken by euro-area government were only 12 per cent of GDP in 2002, compared to more than 16 per cent in 1991. *Coins and deposits* corresponding to the value of liabilities of general government in coins, transferable deposits and other deposits count for less than 3 per cent of GDP in the euro area.

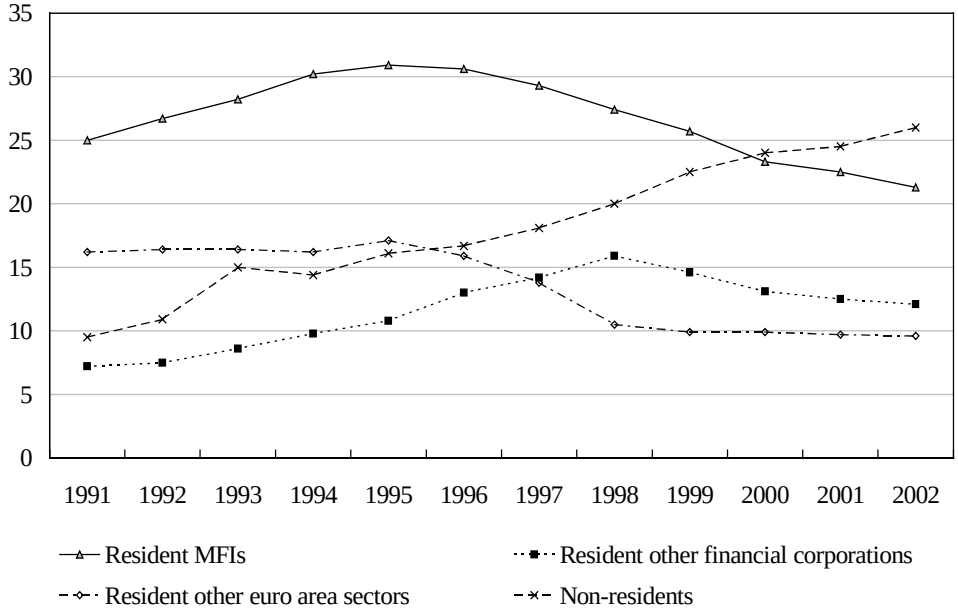
2.1.3 EDP debt by creditor sector

EDP government debt can also be shown with a breakdown by creditor sector or holder. These holders are mainly resident creditors, which are split into MFIs, other financial corporations and other sectors. Other creditors include also residents of euro-area countries other than the country whose government has issued the debt.

Chart 7

DP Government Debt by Creditor Sector

(percent of GDP, end of year)



As shown in Chart 7, the EDP government debt held by resident MFIs fell to 21.5 per cent of GDP in 2002, down from 25 per cent of GDP in 1991. MFIs cover NCBs, which hold loans as short-term loans and overdraft facilities established before 1993 or before entry into the euro area, deposits made by the NCB before 1993 at the Treasury, and government securities held by the NCB. Other MFIs, which cover public (government-owned or controlled) and private institutions, hold deposits at the Treasury, short-term and long-term loans extended to government units, in particular to state and local government units for financing their investment programmes, and debt securities issued by government units.

By contrast, debt as a percentage of GDP held by *other financial institutions* increased from 7 to 12 per cent between 1991 and 2002. They include insurance corporations and pension funds, which often have large holdings of government bonds. In some cases these institutions are required by law to hold a minimum proportion of their portfolio as government bonds. The remaining financial intermediaries are mainly mutual funds. Financial auxiliaries include supervisory bodies, fund managers and brokers. In contrast to financial intermediaries, they do not place themselves at risk by acquiring financial assets and incurring liabilities on their own account so, by definition, are not likely to hold significant government liabilities.

Other sectors comprising non-financial corporations, households and non-profit institutions serving households decreased substantially their holdings of EDP government debt instruments. Their holdings fell from 16 per cent of GDP in 1991 to less than 10 per cent in 2002. In addition to coins, households had, in some countries, significant deposits directly at the Treasury or sometimes via the postal office. The larger part of government debt held by households is usually in the form of non-tradable government bonds issued in small denominations and sometimes specifically targeted at the general public. Non-financial corporations as well as non-profit institutions serving households may also park their cash assets in government securities and hold claims in the form of deposits or loans.

Other creditors holding debt are units of the rest of the world, which is seen from a national point of view, and covers residents of other euro-area and extra-euro-area countries. As a percent of GDP their holdings nearly tripled between 1991 and 2002 as shown in Chart 5. This part of the debt covers holdings of securities by non-residents, loans granted by foreign institutions (such as euro-syndicated credit), including loans granted by European institutions such as the European Investment Bank (EIB), deposits by foreign institutions made with government, particularly treasuries, mostly by foreign banks. It also includes deposits made by other governments, notably of other EU countries in the context of extended cooperation between treasuries in respect of the timing of T-bill issuance. Finally, it included debt issued by the domestic government and held by a government unit of another country, possibly both participants of the euro area, e.g. German Bund holdings of a Finnish social security fund.

2.1.4 EDP debt by government sub-sector

Size and development of EDP debt is mainly determined by central government debt as indicated in Chart 8. Both, the state and local government debt components comprise only 4 to 6 per cent of euro-area GDP without any major changes between 1991 and 2002. Social security fund debt is rather negligible in the euro area.

2.1.5 EDP debt by maturity

The development of EDP debt with a breakdown by original and residual maturity is illustrated in Chart 9. *Original maturity* is the length of life of an instrument when first issued, while *residual maturity* is defined as the time from now until the redemption of an instrument. Flexibility might be required for the classification by original maturity of fungible instruments in order to achieve the same classification for all tranches. Coins and transferable deposits are recorded under short-term because they can be redeemed at any point in time. Some deposits although legally redeemable at short notice are in practice held long-term because of incentives to holders to continuously roll over their investments. Similarly, other

Chart 8

EDP Government Debt by Government Sub-sector
(percent of GDP, end of year)

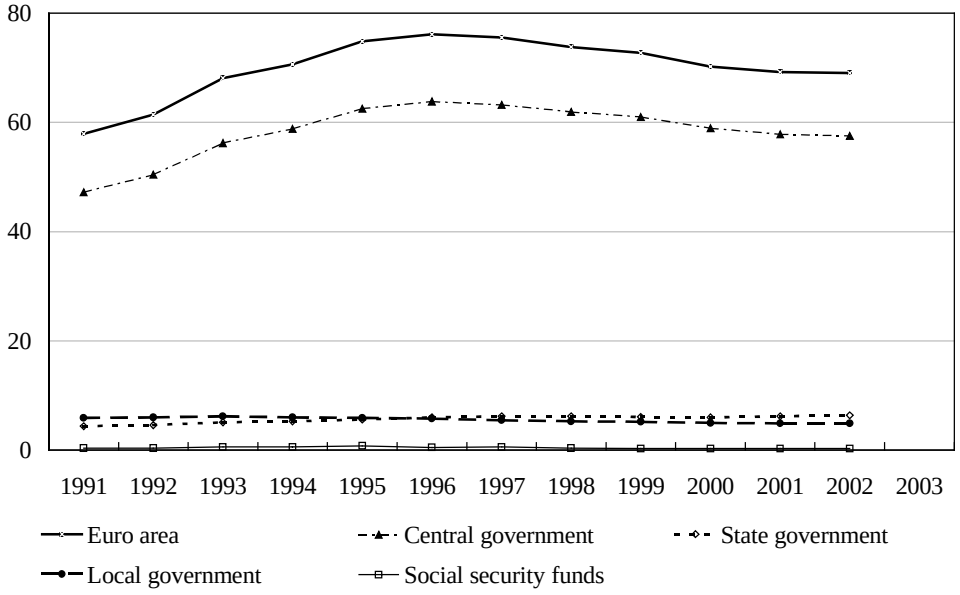
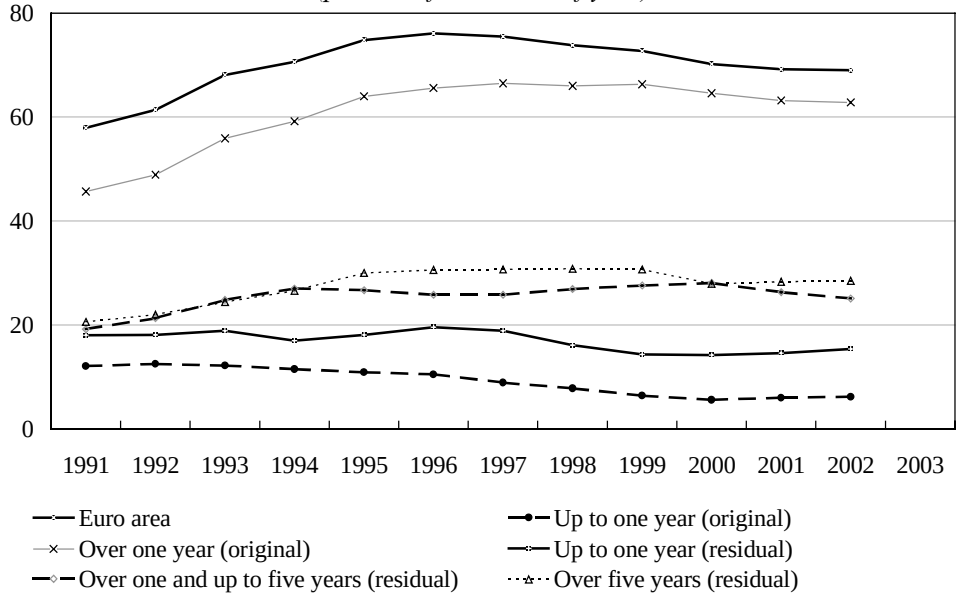


Chart 9

EDP Government Debt by Maturity
(percent of GDP, end of year)



time deposits might legally be long-term, but have arrangements for redemption on demand with penalties.

The categories of short-term and long-term for original maturity are often used for public finance analysis. In 2002, nearly 63 per cent of GDP or 90 per cent of government debt were with an original maturity of more than one year (long-term). Nevertheless, it is an imprecise indicator of the liquidity and interest rate risks that issuers might be exposed to. Better indicators might be residual maturity to assess liquidity risks; and residual maturity corrected for variable rate instruments to assess interest rate risks.

2.1.6 EDP debt by currency

The breakdown of debt instruments by currency indicates the exposure of government debt to changes in exchange rates. There is a split of debt data into debt denominated in euro or participating currency and other currencies. Debt denominated in participating currency includes all elements of EDP debt in a currency that was legal tender of a country now part of the euro area before it joined Monetary Union, except its domestic currency. It includes the ECU before 1999. By convention, this entry is put at zero for the years after a country joins the euro area, irrespective of whether each liability has been legally or technically "converted" or "transformed" into the euro. For years after 1999 it includes the euro for countries that were (or still are) outside the euro area in the year to which the figures relate. For the period from 1991 to 2002, debt held in foreign currencies was between 1 and 2 per cent of GDP.

2.1.7 Consolidated and non-consolidated EDP debt

The liabilities that are assets of government units have to be identified to compare consolidated and non-consolidated EDP debt. Consolidation for some instruments can involve large amounts when direct institutional financial links exist between different government units, for example when central government lends to local government or when social security funds have large holdings of government bonds. In the latter case, consolidation can be sensitive to sudden swings in the composition of investment portfolios.

Chart 10 presents EDP debt consolidated and non-consolidated. It shows that the consolidating elements are rather stable and also small. Non-consolidated EDP debt was 71.6 per cent of GDP in 2002, which was 2.6 per cent higher than consolidated EDP debt.

2.2 ESA95 government debt

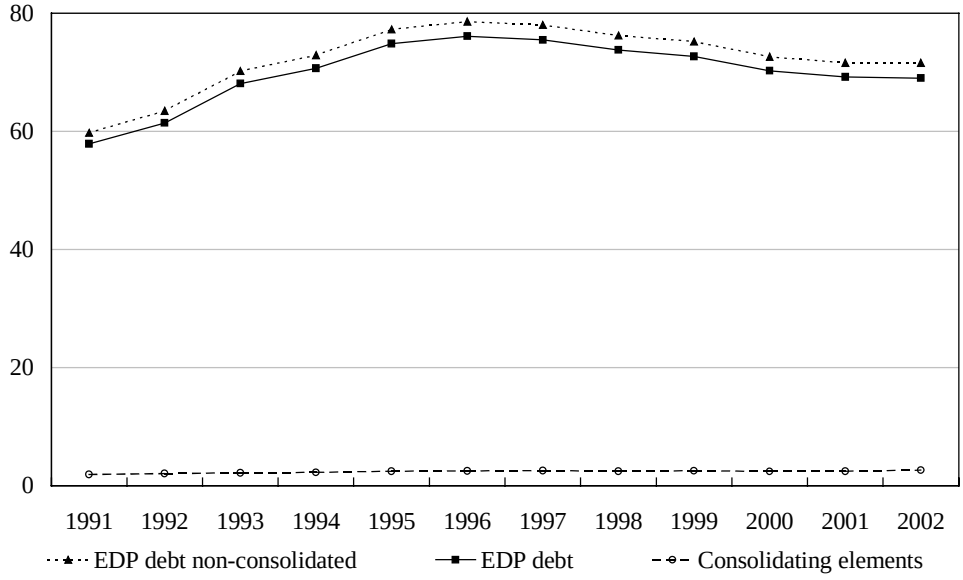
2.2.1 Statistical data

Annex B of ESA95 specifies the tables, which the Member States shall

Chart 10

EDP Government Debt, Consolidated and Non-consolidated

(percent of GDP, end of year)



transmit to the Commission (Eurostat) within the time limits given for each table.[9] This Transmission Programme also entails various tables with data for the government sector. Table 7 covers the balance sheets showing financial assets and liabilities by sector, from which non-consolidated and consolidated government debt figures can be derived for the euro area. Government liabilities are further broken down by sub-sector, financial instrument and original maturity.

Various caveats in relation to these annual stock data have to be taken into account when compiling euro-area aggregates. There are still derogations in place, which were granted to EU countries concerning the coverage, timeliness and breakdown of data included in Table 7. For the time being, only nine of twelve euro-area countries compile and transmit financial balance sheet data to the Commission, while the data sets for Greece, Ireland and Luxembourg will become available first by September 2005.

The national government data, which are provided by nine euro-area countries, are still incomplete, specifically related to the consolidated series. Consequently, the compilation of consolidated ESA95 debt is not yet feasible and, therefore, the derivation of the consolidating elements.

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[9] As in the SNA93 the balance sheets and flow accounts were included into the ESA95, which cover transactions, other changes in volume of assets as well as holding gains or losses.

Accrued interest is not always treated in the same way. Some compilers add accrued interest to the underlying financial instrument, others include this debt component into other accounts payable, while others do not include it at all. Furthermore, not all countries compiling financial accounts apply the market valuation principle, which also complicates the compilation of ESA95 debt. Finally, the coverage of data referring to the debt categories not included in EDP debt seems to be rather incomplete.

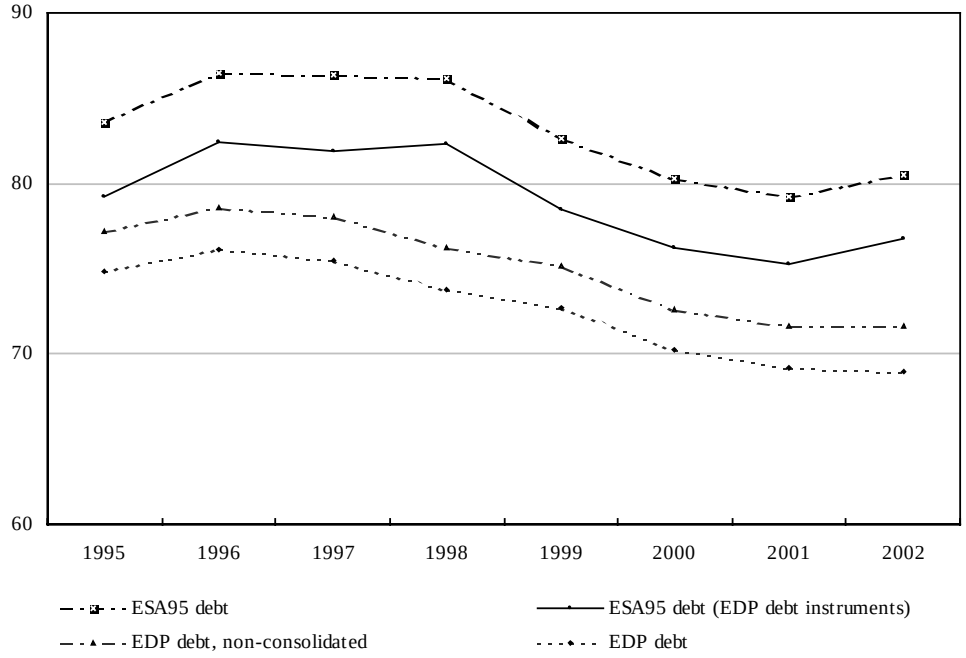
2.2.2 ESA95 gross non-consolidated debt

Taking into account the shortcomings of the national ESA95 debt data, the compilation of ESA95 debt for the EMU is seen as preliminary. It is based on the available annual data sets for nine euro-area countries supplemented by quarterly financial accounts and securities issues data available for Greece, Ireland and Luxembourg.

Chart 11 presents, together with EDP debt, ESA95 non-consolidated debt, which was 83.7 per cent of GDP in 1995 and 80.5 per cent of GDP in 2002. ESA95 non-consolidated debt was 11.5 per cent of GDP higher than EDP debt in 2002.

Chart 11

EDP Debt and ESA95 Debt
(percent of GDP, end of year)

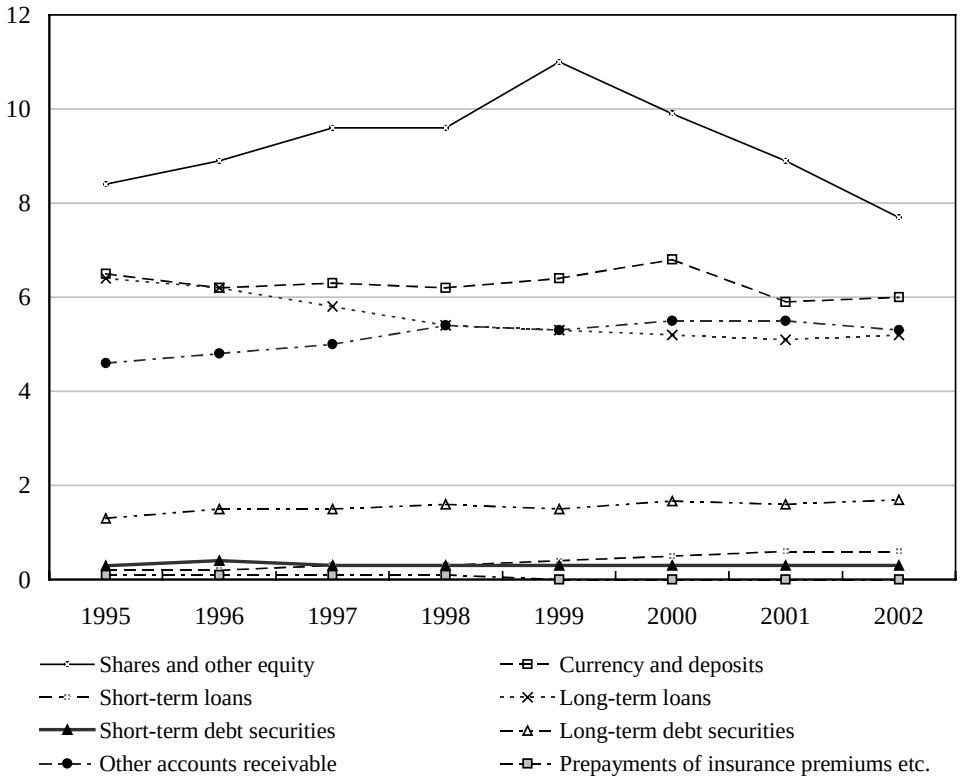


2.2.3 ESA95 financial assets

ESA95 debt can be shown net of certain financial assets. The government's financial assets include mainly currency and deposits, loans owed to the government, debt securities, shares and other equity, and other accounts receivable. Financial assets held by government were 26.8 per cent of GDP in 2002, which was almost equal to the ratio observed in 1995, but higher for the years between.

Chart 12

ESA95 Financial Assets Held by Government
(percent of GDP, end of year)



The movements of the financial assets held by government were mainly determined by share price movements in that period (see Chart 12). The effect due to net acquisition of shares and other equity was rather negligible in this context. The

holdings of shares and other equity by government were 8.4 per cent of GDP in 1995 and increased to 11.0 per cent of GDP in 1999, but decreased continuously to 7.7 per cent of GDP in 2002. In addition, the holdings of currency and deposits, loans granted and other accounts receivable were 6.0, 5.8 and 5.3 per cent of GDP in 2002, while holdings of debt securities counted 2 per cent of GDP.

2.2.4 ESA95 net debt position

Net debt positions are derived by subtracting government holdings of financial assets from gross debt. In this context it is difficult to assess the extent to which assets might be useful to meet outstanding debt liabilities.

Chart 13

ESA95 Debt, Gross and Net

(percent of GDP, end of year)

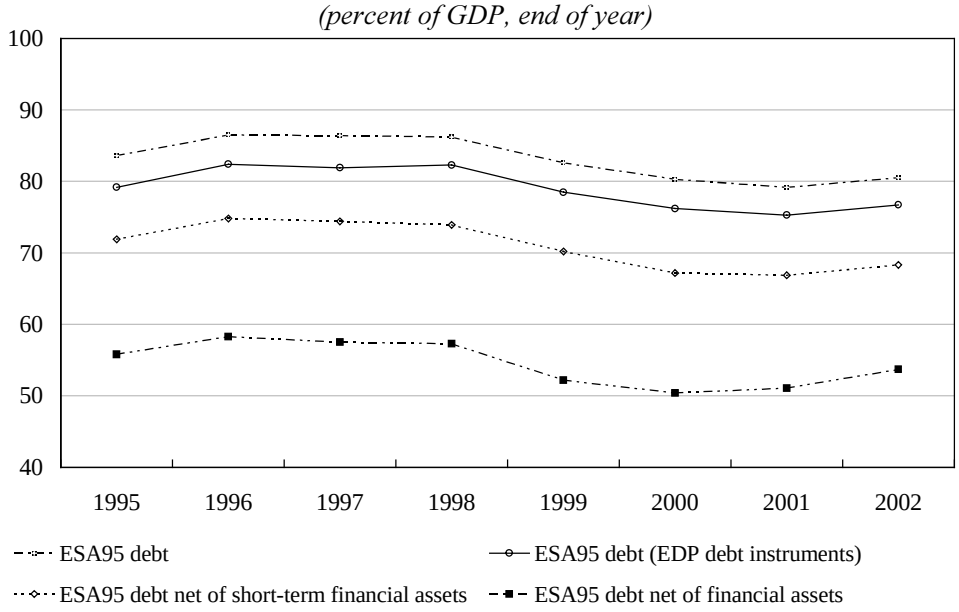


Chart 13 provides two selected net debt positions: the first position is equal to ESA95 debt net of all short-term financial assets, which are supposed to be liquid, like currency and deposits, short-term debt securities and loans as well as other accounts receivable.

The second net debt position excludes all financial assets leading to a debt-to-GDP ratio of 53.7 per cent, which was 26.8 per cent lower than ESA95 gross

non-consolidated debt and 15.3 per cent lower than EDP debt in 2002. Table 1 shows all available ESA95 debt components, gross and net and broken down by original maturity and financial instrument by end of 2002.

Table 1

ESA95 Debt, Gross and Net
(percent of GDP, end of 2002)

	ESA95 gross debt	Government financial assets	ESA95 net debt
	1	2	3 = 2–1
Total	**80.5**	**26.8**	**53.7**
Short-term	**16.1**	**12.2**	**3.9**
Currency and deposits	4.2	6.0	
Debt securities	6.8	0.3	
Loans	1.3	0.6	
Other accounts	3.8	5.3	
Long-term	**64.4**	**14.6**	**49.8**
Debt securities	52.0	1.7	
Shares and other equity	-	7.7	
Loans	12.4	5.2	

2.3 Reconciliation between EDP debt and ESA95 debt

The sum of debt liabilities recorded in the general government balance sheet under ESA95 differs from EDP debt in three aspects. While both debt concepts are based on the same delineation of the government sector, the instrument coverage, the treatment of accrued interest and the valuation methods applied diverge. To reconcile between EDP gross consolidated debt and ESA95 gross non-consolidated debt, a further step has to be made, the move from consolidated to non-consolidated data, which can only be done for the EDP debt, for which the necessary data sets are available (see also Table 2).

Table 2

Reconciliation Between EDP Debt and ESA95 Debt by Component

EDP debt, consolidated	
Consolidating elements	
EDP debt, non-consolidated	
ESA95 debt instrument coverage	
Inclusion of accrued interest	
Move from nominal to market valuation	
ESA95 debt, non-consolidated	

2.3.1 Instrument coverage

The financial categories not considered in EDP debt but included in ESA95 debt are financial derivatives such as swaps and FRAs, insurance technical reserves, trade credit and other accounts payable.

Looking at the reconciliation between the two debt concepts, the *instrument coverage effect* can be measured by subtracting ESA95 non-consolidated gross debt for only those instruments included in EDP debt from the ESA95 non-consolidated gross debt. As shown in Chart 11, this effect was 3.8 per cent of GDP in 2002, which was mainly due to the inclusion of debt in form of trade credits and other payables, while debt in form of financial derivatives was rather negligible. Otherwise, the magnitude of the effect might be overestimated because of the inclusion of accrued interest as partly covered by other payables. As mentioned above, accrued interest is either recorded with the underlying instrument or identified separately in ESA95 debt.

2.3.2 Accrued interest and market valuation

While the instrument coverage effect can be isolated properly only the compound effect due to the inclusion of accrued interest and the application of market valuation can be compiled. The revaluation effect may involve large amounts, particularly for recently issued zero coupon bonds, while it may be rather small for short-term securities, loans and deposits. For compiling the *compound interest accrued and valuation effect*, the EDP non-consolidated debt has to be subtracted from the ESA95 non-consolidated debt with the corresponding instrument coverage. For 2002, EDP non-consolidated debt was 71.6 per cent of GDP and the corresponding ESA95 debt 76.7 per cent of GDP, so the compound interest accrued and valuation effect was 5.1 per cent of GDP.

The overall (and surprisingly small) difference between the EDP (gross consolidated) debt (69 per cent) and the ESA95 (gross non-consolidated) debt (80.5 per cent) was 11.5 per cent of GDP in 2002, broken down into the *instrument coverage effect* (3.8 per cent), the *compound interest accrued and valuation effect* (5.1 per cent) and the *consolidating effect* (2.6 per cent). For the time being, no further split of the accrued interest and valuation effect can be provided.

3. Conclusions

In this paper, two measures of government debt in the EMU have been derived from the national accounting framework, EDP government debt and ESA95 government debt. They have been shown as ratios of GDP. It was possible to reconcile between the two debt ratios by isolating the instrument coverage effect, the compound interest accrued and valuation effect and the consolidating effect. These various effects were rather small and stable.

The available ESA95 financial balance sheet data allow the derivation of debt positions net of selected financial assets. Their development deviates to some extent from the pattern shown for gross debt figures due to share price movements.

Compared to the data provided for the measurement of EDP debt and ESA95 debt no comprehensive data are available for extended government or public sector debt. The project to update SNA93 has already started, which also deals with the review of the existing accounting standards for the government and public sector. Implementing new proposals might also improve the coverage of data for public corporations, which are necessary to compile harmonised public sector accounts useful for international comparisons.

APPENDIX

Conceptual issues are related to questions like: (1) Which entities should be included in government? (2) Which financial instruments are seen as part of debt? (3) Which methods are applied to value debt? (4) How to treat accrued interest in relation to debt? (5) How to derive consolidated debt? and: (6) How to move from gross debt to net debt.

1. Entities to be included in government

Government institutional units are described in the ESA95as "institutional units which are other non-market producers whose output is intended for individual and collective consumption, and mainly financed by compulsory payments made by units belonging to other sectors, and/or all institutional units principally engaged in the redistribution of national income and wealth."[10] The principal economic functions of government institutional units are (1) assume responsibility for the provision of goods and services to the community or to individual households at prices that are not economically significant, (2) to redistribute income and wealth by means of transfer payments, financing both of these activities primarily from taxation or transfers from other government units. Government institutional units comprise central government, state government, local government and social security funds units, which are aggregated to the corresponding sub-sectors.

Essentially two criteria have to be checked to determine whether a unit belongs to the general government sector.[11] First, is the unit a public or a private institutional unit? This depends on who controls it.[12] Second, is the public institutional unit a market or a non-market producer? This depends on the 50 per cent criterion, which examines whether more than 50 per cent of the production costs are covered by sales. This criterion should apply over a range of years.

Furthermore, a public institutional unit redistributing national income and wealth has to be classified within the government sector, while a public institutional unit dealing with financial intermediation belongs to the public financial corporation sector. The government sector does not include public corporations and it is therefore to be distinguished from a broader defined public sector (see Table 1).

The delimitation of the *government sector* described above is influenced by institutional arrangements in the different economies and can distort comparisons of the debt data. This distortion applies particularly to health and education services when general government sectors are compared and to the provision of public utilities and transport when the public sectors are compared. In the process of

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[10] See ESA95, paragraph 2.68, and also SNA, paragraph 4.104.

[11] Separate criteria are needed to classify social security funds units.

[12] Control is defined as the ability to determine general policy, and is an essential criterion for sector classification.

Table 1

Sector Classification of Institutional Units

		Controlled by government?	
		Yes	No
Financed mainly By sales of goods And services?	Yes (market)	Public corporations	Private corporations, households or non-profit institutions
	No (non-market)	General government	

implementing ESA95, questions were discussed in which sector to classify, for instance, public hospitals and homes for elderly people. Significant differences among the EU countries were revealed concerning the way government made payments to public hospitals. In this context, only payments made according to a system of pricing applied to both public and private hospitals were considered as sales also determining the classification of such units.

Another example referred to schools. Following the criteria listed above it has to be considered whether, in a specific case, the general government controls a school or not. This could be checked by the criteria like whether the government's approval is needed for creating new classes, for making investments in fixed capital or for borrowing or whether the government can prevent the school from ending its relationship with government. Otherwise, the government does not control the institutional unit if it just finances the school or it supervises the quality of education the school has to provide.

Following the delimitation of the general government sector the *public sector* covers, in addition to the general government units, also all public producers organised as public financial and non-financial corporations. Essentially, the latter are government owned or government controlled businesses. A broader coverage is provided by the public sector and any private sector non-profit institutions serving households and corporations that are mainly financed by government and produce public service outputs. Such organisations are classified to the private sector in national accounts because they do not satisfy the criterion for being controlled by government but some of these organisations exist mainly to produce public services financed by payments from government and user charges. For example, in some countries universities are classified to the private sector but receive a high proportion of their income from government and are expected to conform to various standards and procedures stipulated by government. The organisations often feel like they are part of the public sector even though statistically they are not.

While the coverage of the general government sector has been thoroughly examined during recent years, there are no comprehensive national accounts data for

this broad definition of the public sector that includes non-profit institutions serving households and private corporations that are mainly financed by government and produce public service outputs. In some countries there are national accounts' data for the narrower definition of the public sector that includes general government and public corporations.

2. Financial instruments to be treated as government debt

The financial instruments that may be treated as government debt are defined as the SNA93 or the ESA95 financial instrument categories: *coins and deposits*, *securities other than shares*, *loans*, *insurance technical reserves* and *other accounts payable*. Accordingly, the definition of government debt is such that it includes all liabilities of government institutional units except shares and other equity.

It has to be considered whether *financial derivatives*, both forwards and options, should also be excluded or not. According to the IMF External Debt Statistics Guide, financial derivatives should be excluded as no principal amount is advanced that is required to be repaid, and no interest accrues on any financial derivative instrument. The net incurrence of financial derivatives is regarded as liabilities. It includes inflows and outflows related to purchases and sales of options, warrants, margin calls on futures, lump sums and termination payments related to all types of derivatives such as swaps and FRAs. Recording net settlement payments as financial transactions requires the recording of holding gains or losses in the other flow accounts. The obligation to make a payment appears as a liability in the account of the payer, and as a financial asset in the account of the receiver. Any profit or loss realised on a future is also recorded in financial derivatives. The change in value of the future in the balance sheet, immediately before the holding gain or loss is realised, is recorded in other flows as nominal holding gains or losses. Accordingly, the change in the balance sheet, or debt, under ESA95, is the result of transactions and other flows.

Coins and deposits correspond to the value of liabilities of general government in coins, transferable deposits and other deposits. Generally, the Treasury issues coins and they are therefore a government liability, but not necessarily debt. Transferable deposits are unlikely to be incurred by government since these are deposits that can quickly and easily be converted into currency or transferred by cheque or other means. Other deposits include time deposits, savings deposits, savings books and savings certificates. For example, some government treasuries operate savings accounts for households, perhaps managed by postal services or other public agencies. This category would also include specific arrangements for banks or public corporations depositing cash with government. Both deposit categories also include short-term liabilities in the form of repurchase agreements.

Short-term securities other than shares include bills and other short-term notes and bonds with an original maturity of less than one year, issued

predominantly by the Treasury.[13] Short-term securities are usually very liquid, of large denomination and exchanged on the money markets between banks, other financial institutions and large investors. Other government units might also issue such short-term instruments, sometimes called commercial paper or euro-commercial paper. *Long-term securities other than shares* cover all types of debt securities as bonds, notes and T-bills with an original maturity of more than one year and issued by the various government sub-sectors.

Loans cover short-term and long-term borrowing by government units from the central bank, MFIs, other financial corporations and the rest of the world. The category includes also imputed transactions in loans in respect of debt assumptions as well as imputed loans in respect of finance leases.

Liabilities in the form of *trade credits and other accounts payable* can arise through prepayments by non-government entities. This is often a feature of contracts using the private sector to operate public infrastructure, or when government takes delivery of goods and services and pays later. Finally, *insurance technical reserves as well as prepayments of insurance premiums and reserves of outstanding claims* on the liability side of the government accounts might occur due to non-autonomous pension funds established by government units.

3. Valuation of government debt

Debt can be measured at the reference date at different value. The *market value* of debt is determined by its prevailing market price, which is the best indication of the value that economic agents currently attribute to specific financial claims. It provides a measure of the opportunity cost to both the debtor and the creditor.[14] The valuation principle adopted in the ESA95 or SNA93 follows broadly this method.[15] Securities other than shares are to be valued at their current market prices. For currency, the nominal or face value is used, and for deposits the amount of principal that the debtors are contractually obliged to repay the creditors when the deposits would be liquidated on the date the balance sheet is set up. The same applies to loans for which the values have to be recorded in the balance sheets that the debtors are contractually obliged to repay to the creditors, even in cases when the loan was traded at a discount or premium.[16]

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[13] ESA95 defines short-term as an original maturity of one year or less. While ESA95 allows flexibility up to two years, and even five years for certain securities issued by general government, its use is not recommended, as it would substantially distort international comparisons.

[14] When market-price data are unavailable for tradable instruments, there are two general methods for estimating market value or, as it is sometimes called, for fair value: (a) discounting future cash flows to the present value using a market rate of interest; and (b) using market prices of financial assets and liabilities that are similar.

[15] See ESA95, paragraphs 7.25 to 7.32.

[16] See ESA95, paragraphs 7.46 to 7.51.

The *nominal value* of debt is a measure that is, according to the Council Regulation 3605/93,[17] considered equivalent to the face value of liabilities. It is therefore equal to the amount (contractually agreed) that the government will have to refund creditors at maturity. In principle, interest accrued on a liability is not accounted for in the valuation of this liability. The nominal value rule also means that deposits cover interest accrued when it is actually credited to the holder and available for withdrawal. Instruments that pay no coupons, like zero coupon bonds, are recorded for the full redemption value. Instruments carrying actual coupons are also measured at a redemption value, which would be much closer to the issue value than with zero coupon bonds. The redemption price of some securities is linked to an economic index such as a retail price index. The nominal value of an index-linked liability corresponds to its face value adjusted by the index-related change in the value of the principal accrued to the end of the year.

The major difference between the two valuation measures is therefore that market value takes account of market price changes, whereas nominal value does usually not. Nevertheless, liabilities denominated in foreign currencies shall be converted into the national currency at the representative market exchange rate prevailing on the last working day of each year.

4. Accrued interest recorded as government debt

In the SNA93 and the ESA95 interest is recorded as accruing continuously even if, in cash terms, it is paid infrequently or through the difference between the buying and selling price of the instrument. Interest, which accrues, but is not paid in cash, is recorded as being reinvested in the instrument that generates the interest. This means that the value of the instrument[18] recorded in the balance sheet, and hence total debt, increases as a result of accruing unpaid interest. Interest on a deposit account that is added to the account is regarded as having been paid and so is added to the nominal value of the instrument.

5. Consolidation of government debt

There are two consolidation issues: The first one deals with the *consolidation within the government sector*. The second is the extension of the *consolidation principle to intra (EMU) "cross-border" positions between national governments*.

Consolidated accounts can be shown for the different types of account identified in ESA95: stocks, financial transactions, and other flows in financial instruments (revaluations and other changes in the volume of assets).

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[17] Council Regulation (EC) No. 3605/93 of 22 November 1993 on the application of the Protocol on the excessive deficit procedure annexed to the Treaty establishing the European Community (OJ L 332, 31.12.1993, p. 7).

[18] For traded instruments one would expect to see this reflected in the market price.

Table 2 shows consolidated and non-consolidated government debt as well as all consolidating elements allowing reconciliation between the two aggregates. At the level of a sub-sector of general government, there are three ways to measure debt depending on the consolidation rule.

The value of debt instruments owned outside general government. These are the financial assets held by the private sectors and the rest of the world *vis-à-vis* government (as shown in column 6 of Table 1). This is sometimes called the sub-sector EDP debt component. The sum of the sub-sector debt components is general government consolidated gross debt. Another way to define the sub-sector debt component is to define it as the sub-sector non-consolidated debt (column 7 of Table 1) less the financial assets it owns that are liabilities of other general government sub-sectors (columns 1 to 4 or column 5), which is equal to column 6.

The value of debt instruments owned outside the sub-sector. This corresponds to "debt issued by" the sub-sector and to sub-sector non-consolidated debt. For central government, it corresponds to cell 1.7 excluding cell 1.1 (n-c l CG minus l CG CG).

6. Net government debt

Government debt is usually recorded as a gross concept in the sense that assets are not deducted from liabilities. At any given time, it is the outstanding amount of those actual current, and not contingent, liabilities that require payments of principal and/or interest by the debtor and some points in the future and that are owed to non-resident or resident non-government units by resident government units of an economy, an economic or a monetary union.

The analysis of government debt sometimes takes into account government assets. In this context, there is difficulty in ascertaining the extent to which assets might be made usable to meet outstanding government debt.

Table 2

Financial Assets and Liabilities by Government Sub-sector on a From-whom-to-whom Basis

			Financial assets by sub-sector						
			1	2	3	4	5	6	7
Liabilities by Sub-sector	1	Central government	l CG CG	l CG SG	l CG LG	l CG SSF	l CG GG	c l CG PR	n-c l CG
	2	State government	l SG CG	l SG SG	l SG LG	l SG SSF	l SG GG	c l SG PR	n-c l SG
	3	Local government	l LG CG	l LG SG	l LG LG	l LG SSF	l LG GG	c l LG PR	n-c l LG
	4	Social security funds	l SSF CG	l SSF SG	l SSF LG	l SSF SSF	l SSF GG	C l SSF PR	n-c l SSF
	5	General government	l GG CG	l GG SG	l GG LG	l GG SSF	l GG GG	C l GG PR	n-c l GG
	6	Private and Rest of the World	c l PR CG	c l PR SG	c l PR LG	c l PR SSF	c l PR GG	c l PR PR	n-c l PR
	7	Total	n-c a CG	n-c a SG	n-c a LG	n-c a SSF	n-c a GG	n-c a PR	n-c a = n-c l

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ACCOUNTING REGIMES AND FISCAL RULES

Paul Boothe[*]

Introduction

Over the past twenty years, economists have invested a good deal of effort in studying the economic, political and institutional determinants of fiscal policy.[1] Part of that literature has focused on fiscal rules – commitments by political leaders to certain norms of fiscal behaviour. The creation of the European Monetary Union (EMU) and the related Stability and Growth Pact (SGP) provided strong motivation to examine all aspects of fiscal rules and their impact on fiscal policy in Europe.

At the same time, a parallel literature was developing in the area of public sector accounting. Professional accounting bodies like the International Federation of Accountants (IFAC) began to advocate that traditional methods of accounting for public sector activities be changed to mirror more closely accounting in the private sector. International organizations such as the International Monetary Fund (IMF) and the Organization for Economic Cooperation and Development (OECD) have also recommended such changes in public sector accounting regimes.

With the economic impacts of various fiscal rules now relatively well understood and the political determinants of fiscal policy extensively studied, attention has turned to the impact of budget institutions on fiscal policy outcomes.[2] The purpose of this paper is to contribute to this emerging literature by examining the interaction of accounting regimes and fiscal rules. In particular, we look at the incentives for policy makers that are created when governments change the way that they account for capital – a change that is currently underway in Canada and a number of other countries.

The remainder of the paper is organized as follows. A brief look at some relevant literature concludes this introduction. We next develop a simple, dynamic simulation model of a government budget to aid in analyzing the accounting regime-fiscal rule interaction. The model is first employed to examine the impact of accounting regimes on some standard fiscal rules related to deficits, government debt and the accumulation of public-sector capital. We then turn to the incentives created by accounting regimes when governments have preferences regarding the mix of capital versus operating spending or find themselves in different fiscal

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[1] For a recent survey, see Alesina and Perotti (1999).

[2] For example, see Poterba and von Hagen (1999).

circumstances regarding starting values for deficits, debts or capital stock. The recent experience of Canadian provinces is briefly reviewed before we offer some policy conclusions.

Some relevant literature

According to Tanzi (2003), the virtues of a balanced budget have long been recognized. He cites as his authorities well-know historical figures such as Cicero, David Hume and George Washington (p. 4). While it is unlikely that such individuals concerned themselves with public sector accounting, Wynne (2003) tells us that the cash basis of accounting has been used to measure fiscal balance for the last 150 years.[3] Of course, regardless of accounting regime, there are many methodological issues related to the measurement of fiscal balance (Blejer and Cheasty, 1991). As well, fiscal rules are more or less effective depending on their design and a host of other, external factors (Kopits, 2001).[4]

Research has shown that one of the key external factors affecting fiscal policy outcomes is budget institutions. For example, Poterba and von Hagen claim that "[h]igher levels of transparency are associated with lower budget deficits." Further, they go on to argue that "…institutions must themselves be regarded as endogenous. The questions when, and why, governments adopt institutional reforms remain important challenges for future research in the political economy of fiscal policy" (p. 4).

An important institutional reform currently underway in developed countries is the move from cash to accrual accounting for capital. Analysts' views on this change are mixed. Proponents argue that such a change will correct an inherent bias against the accumulation of public sector capital inherent in a cash accounting regime.[5] For example, Balassone and Franco (2001) point to the double burden of transition to balanced budget and lower debt levels and the impact of consolidated balance fiscal rules on public investment.

However, others are less supportive of the move to accrual accounting for capital. They cite the benefits flowing from the simplicity of cash

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[3] It is useful at this point to define more precisely the terms "cash" and "accrual" accounting. Until recently, many governments in developed countries have employed what accountants call "modified accrual accounting". Under this accounting regime, physical capital is treated as an expenditure in the year it is constructed and no depreciation of the capital is charged as an expense in subsequent years. Because we are focusing in this paper on the accounting treatment of capital, we will call this regime "cash accounting". We will call the regime where capital is not expensed and depreciation is charged "accrual accounting". This corresponds to what accountants sometimes call "full accrual".

[4] For example, von Hagen *et al.* (2002) show that fiscal consolidation based on expenditure reductions more likely to succeed than those based on revenue increases. This is confirmed for Canada in Boothe and Reid (2001).

[5] Proponents include Blanchard and Giavazzi (2003), Brunila *et al.* (2001), Buti *et al.* (2992), Dur *et al.* (1997), Robinson (1999) and Salinas (2002).

accounting-including accountability and ease of administration.[6] For example, Tanzi (2003) quotes Financial Times columnist John Plender's 2003 article that argues that "…the further the budget discussion moves from cash, the greater the risk of becoming lost in the fiscal fog of war" (April 4, 2003, p. 18). Indeed Canada's Public Sector Accounting Board recommends that the cash accounting focus on the government deficit be replaced with five separate measures under accrual accounting (PSAB, 2003).

In this paper, we take no position on the desirability of cash versus accrual accounting regimes for the public sector. Rather, we take our inspiration from Poterba and von Hagen to look at when and why governments may choose to move from one accounting regime to the other.

1. The model

To help analyze the interaction of fiscal rules and accounting regimes, we construct a simple, dynamic model of a government budget. The equations describing the model are presented in Table 1. The model is recursive and deterministic, combining accounting identities with government behaviour described by various fiscal rules. We begin by describing a cash accounting regime.

1.1 Cash accounting model

The revenue side of the government budget is exogenous. Total revenue, *R*, grows at the (exogenous) growth rate of the economy, *g*. Total expenditure, *E*, is the sum of transfers to individuals and firms, *TRN*, gross public sector investment, *I*, services to individuals and firms, *SER*, and debt service payments, *DS*. The budget surplus, *S*, is simply the difference between total revenue and total expenditure. The model is closed by a budget-balance rule where *TRN* is determined residually to ensure $S=0$ in each period.

Investment is determined by fiscal rule for capital accumulation. In this basic model, the government sets the capital-revenue ratio, *K/R*, equal to a constant, so that *I* is set to ensure the desired growth in the capital stock is realized, *i.e.* so that $K = g*K(-1)$. Services are provided by operating public capital and are set equal to a fixed proportion, a, of last period's capital stock. Debt service costs are determined by applying the interest rate on government debt/assets, r, to the last period stock of government financial assets/debt, $A(-1)$. The capital stock depreciates, *DEP*, at a constant rate, *d*. The model is completed by identities that account for the growth of K and A.

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[6] Skeptics include Wynne (2003) and Tanzi (2003). Diamond (2002) is cautious in recommending the change to developing countries that may not have the systems in place to support accrual accounting.

Table 1

Basic Cash Accounting Model

$R = (1+g)^* R(-1)$	total revenue	(1)
$E = TRN + I + SER + DS$	total expenditure	(2)
$S = R - E$	Surplus	(3)
$TRN = R - I - SER - DS$	transfers expenditure (no deficit rule)	(4)
$I = g^*K(-1) + DEP$	gross public investment (constant K/R rule)	(5)
$SES = a^*K(-1)$	services expenditure	(6)
$DS = -r^*A(-1)$	debt service expenditure	(7)
$DEP = d^*K(-1)$	Depreciation	(8)
$K = K(-1) - d^*K(-1) + I$	capital stock	(9)
$A = A(-1) + S$	financial assets	(10)

Basic Accrual Accounting Model

Replace (2), (4) and (10) with:

$E = TRN + SER + DS + DEP$	total expenditure	(11)
$TRN = R - SER - DEP - DS$	transfers expenditure (no operating deficit rule)	(12)
$A = A(-1) + S - (I - DEP)$	financial assets	(13)

Variables

R is total revenue
g is revenue (economy) growth rate
E is total expenditure
TR is transfer expenditure
SER is services expenditure
DS is debt service
S is surplus
I is gross investment
a is cost of operating capital
K is capital stock
r is interest rate on financial assets/debt
A is financial assets/debt
DEP is depreciation
d is depreciation rate

1.2 Accrual accounting model

To transform the basic cash accounting model of the government budget into one that conforms to an accrual accounting regime, we modify the definition of total expenditure and accumulation identity for government financial assets/debt. Under accrual accounting, spending on public sector capital is excluded from total expenditure, while the depreciation of public sector capital is included. Thus equation (2) becomes:

$$E = TRN + ES + DS + DEP \tag{11}$$

The anti-deficit rule under an accrual accounting regime become a anti-"operating deficit" rule. Thus, equation (4) becomes:

$$TRN = R - SER - DEP - DS \tag{12}$$

As we shall see, the change in the fiscal rule from no cash deficit to no operating deficit has important implications for budget outcomes.

The accumulation identity for government financial assets/debt, equation (10), becomes:

$$A = A(-1) + S - (I - DEP) \tag{13}$$

In words, any net investment in capital that cannot be financed from the government's operating surplus must be financed by borrowing.

1.3 Calibrating the model

To run simulations we need to calibrate the model by specifying parameters and starting values for variables. The parameters and starting values are presented in Table 2 and are chosen to roughly correspond to the budget of the Canadian province of Alberta.[7] Revenues are set at $20 billion and grow at an annual rate of 5 per cent. The budget is initially in balance. Public sector capital and government rate on government debt are both set at 5 per cent. The ongoing cost of providing government services is equal to 25 per cent of the capital stock. Investment is chosen to maintain a constant ratio of capital to revenue and transfers are determined residually to ensure budget balance.

2. A double-virtue fiscal authority

To establish a benchmark, we begin by looking at what we describe as a "double-virtue" government, where "virtues" refer to components of their fiscal rules. In this benchmark case, the first virtue is a rule for the accumulation of public

[7] In reality, the Province of Alberta is a net creditor rather than a net debtor.

Table 2

Parameters

g	0.05
a	0.25
r	0.05
d	0.05

Starting Values

R	20.00
E	20.00
TRN	16.17
I	0.95
SER	2.35
DS	0.50
K	10.00
DEP	0.48
A	–10.00

sector capital, *i.e.* that a constant ratio of capital to revenue be maintained, *i.e*. $K/R = 2$.[8] The second virtue is an anti-deficit rule, *i.e.* $S = 0$. Under a cash regime, the two rules imply that a portion of current revenue must be reserved to fund new capital. Under an accrual regime, capital accumulation can be financed by borrowing.

Figure 1 shows the results produced by the interaction of the accounting regimes and the fiscal rules. We see that the level of financial debt is constant under cash accounting, growing with accrual accounting. The mix of spending also differs across accounting regimes. In the case of the cash regime, capital spending is financed by current revenue, reducing the revenue available for other purposes. In the accrual regime, capital spending is partially financed by borrowing, leaving more revenue available for other purposes. However, as debt accumulates so do interest charges, which reduces the revenue available for other spending. Under the current parameterization, at the ten-year horizon, the former effect outweighs the latter and transfers are greater under accrual than under cash accounting.[9]

The results presented in Figure 1 lead to a well-known, but nevertheless important policy implication. Changes in accounting regimes may require corresponding changes to fiscal rules. Maintaining the same fiscal rules while changing accounting regimes, may result in important changes in the trajectory of public debt and the mix of expenditures over time.

---

[8] It is easy to imagine that revenues grow in line with nominal GDP, making this a *K/GDP* rule.

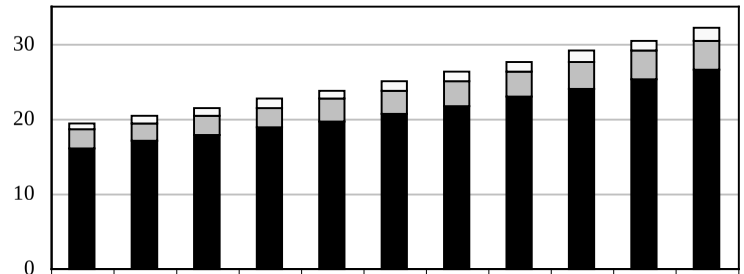
[9] It is important to note that the differences between the results produced by the two regimes are sensitive to parameterization. The most important differences come from the choice of the growth rate of revenue, *g*. When *g* equals zero rather than 0.5, the results from the two models are equivalent, *i.e.* debt and capital are unchanged and investment is confined to depreciation. When *g* equals –0.5, investment is zero and debt is repaid under the accrual regime using the cash generated by expensing depreciation.

Figure 1

Financial Assets
Constant K/R + No Deficits

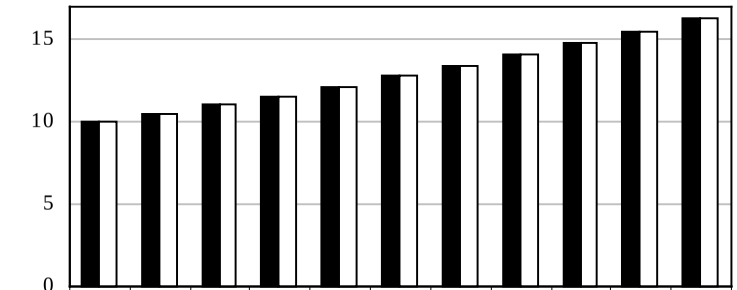
	0	1	2	3	4	5	6	7	8	9	10
Cash	(10.00)	(10.00)	(10.00)	(10.00)	(10.00)	(10.00)	(10.00)	(10.00)	(10.00)	(10.00)	(10.00)
Accrual	(10.00)	(10.50)	(11.03)	(11.58)	(12.16)	(12.76)	(13.40)	(14.07)	(14.77)	(15.51)	(16.29)

Program Expense + Investment
Cash Regime: Constant K/R + No Deficits



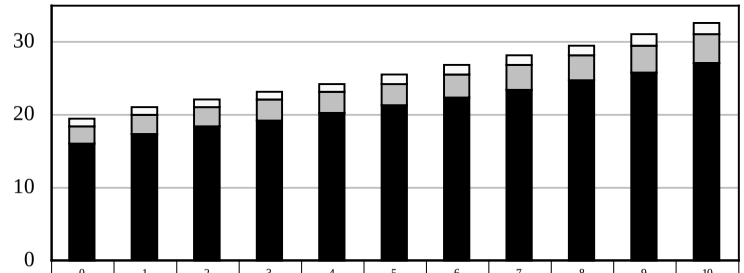
	0	1	2	3	4	5	6	7	8	9	10
I	0.95	1.00	1.05	1.10	1.16	1.22	1.28	1.34	1.41	1.48	1.55
SER	2.38	2.50	2.63	2.76	2.89	3.04	3.19	3.35	3.52	3.69	3.88
TRN	16.17	17.00	17.88	18.79	19.76	20.77	21.83	22.95	24.12	25.36	26.65

Capital
Constant K/R + No Deficits



	0	1	2	3	4	5	6	7	8	9	10
Cash	10.00	10.50	11.03	11.58	12.16	12.76	13.40	14.07	14.77	15.51	16.29
Accrual	10.00	10.50	11.03	11.58	12.16	12.76	13.40	14.07	14.77	15.51	16.29

Program Expense + Investment
Accrual Regime: Constant K/R + No Deficits



	0	1	2	3	4	5	6	7	8	9	10
I	0.95	1.00	1.05	1.10	1.16	1.22	1.28	1.34	1.41	1.48	1.55
SER	2.38	2.50	2.63	2.76	2.89	3.04	3.19	3.35	3.52	3.69	3.88
TRN	16.17	17.50	18.38	19.29	20.26	21.27	22.33	23.45	24.62	25.86	27.15

3. Changing the authority's virtues

To be fair to advocates of accrual accounting for the public sector, the need for new fiscal rules and corresponding indicators to accompany the change of accounting regime has long been recognized.[10] One such rule change is to focus attention on changes in government debt rather than deficits. In this section, we replace our "anti-deficit" rule with a rule that requires that a constant ratio of debt to revenue be maintained, *i.e.* $A/R=2$.[11] We retain our rule regarding the ratio of capital to revenue from the previous section.

To implement the new rule under the cash accounting regime, we modify equation (4) so that now transfers ensure that a constant debt/revenue ratio is maintained:

$$TRN = R + g^{*}A(-1) - I - SER - DS \qquad (14)$$

No changes are required to implement the rule under an accrual accounting regime. In other words, an anti-deficit rule and a constant A/R rule are equivalent under accrual accounting.

The results for key variables under the two accounting regimes and $g = 0.5$ are presented in Figure 2. As we can see, the two regimes produce equivalent results despite the fact that deficits are incurred under cash accounting while they are not under accrual accounting. These findings lead to the (again) well-known policy implication that key fiscal trajectories under a debt rule are insensitive to the choice of accounting regimes. We tested the sensitivity of this finding to changes in g and confirmed that results are similar across regimes when $g = 0$. In this case neither regime records deficits. When $g = -.0.5$, results are again similar although cash accounting records surpluses, while accrual does not. In addition, we tested different fiscal rules for debt (for example, declining A/R) and again found that results were similar across regimes.

4. A single-virtue fiscal authority

It is indeed a virtuous fiscal authority that constrains its actions by rules for both deficits or debts and capital accumulation. Much more common are situations where governments specify rules for deficits or debt but are unconstrained with respect to public sector capital. Indeed, as discussed above, one of the key reasons periods of deficit reduction, governments using cash accounting simply replaced fiscal deficits with "infrastructure" deficits by ignoring the depreciation of their capital.

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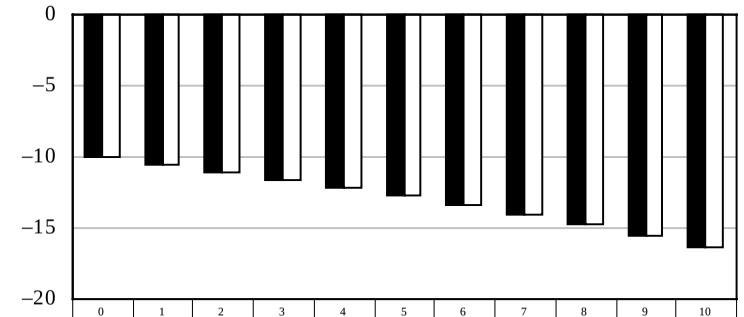
[10] See PSAB (2003).

[11] As before, this could be easily thought of as a Debt/GDP rule.

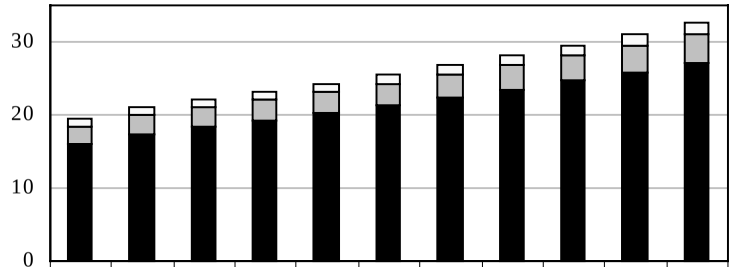
Table 2

Financial Assets
Constant K/R + Debt Rule



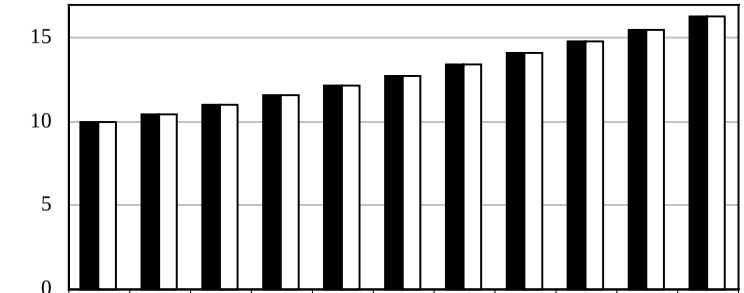
	0	1	2	3	4	5	6	7	8	9	10
■ Cash	(10.00)	(10.50)	(11.03)	(11.58)	(12.16)	(12.76)	(13.40)	(14.07)	(14.77)	(15.51)	(16.29)
□ Accrual	(10.00)	(10.50)	(11.03)	(11.58)	(12.16)	(12.76)	(13.40)	(14.07)	(14.77)	(15.51)	(16.29)

Program Expense + Investment
Cash Regime: Constant K/R + Debt Rule



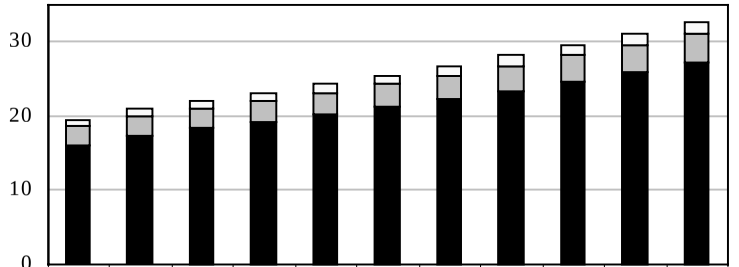
	0	1	2	3	4	5	6	7	8	9	10
□ I	0.95	1.00	1.05	1.10	1.16	1.22	1.28	1.34	1.41	1.48	1.55
▨ SER	2.38	2.50	2.63	2.76	2.89	3.04	3.19	3.35	3.52	3.69	3.88
■ TRN	16.17	17.50	18.38	19.29	20.26	21.27	22.33	23.45	24.62	25.86	27.15

Capital
Constant K/R + Debt Rule



	0	1	2	3	4	5	6	7	8	9	10
■ Cash	10.00	10.50	11.03	11.58	12.16	12.76	13.40	14.07	14.77	15.51	16.29
□ Accrual	10.00	10.50	11.03	11.58	12.16	12.76	13.40	14.07	14.77	15.51	16.29

Program Expense + Investment
Accrual Regime: Constant K/R + Debt Rule



	0	1	2	3	4	5	6	7	8	9	10
□ I	0.95	1.00	1.05	1.10	1.16	1.22	1.28	1.34	1.41	1.48	1.55
▨ SER	2.38	2.50	2.63	2.76	2.89	3.04	3.19	3.35	3.52	3.69	3.88
■ TRN	16.17	17.50	18.38	19.29	20.26	21.27	22.33	23.45	24.62	25.86	27.15

4.1 Deficit elimination rules

In Figure 3 we present results from a simulation where fiscal authorities want to eliminate an existing deficit but are unconstrained with respect to the level of public capital. We assume that authorities begin with a deficit equal to $4 billion (excess transfers) and commit to reduce it by $1 billion per year so that it is eliminated by the fourth year of their mandate.[12] Subject to the deficit elimination constraint, we assume that authorities' objective is to maximize operating spending, *i.e.* the sum of *TRN*+*SER*.

In any given period, authorities must choose between providing transfers or investing in additional capital. Whether they operate under a cash or an accrual accounting regime, authorities' optimal strategy is to concentrate incremental spending on transfers. The reason is that under both regimes their deficit target requires that they forego transfers in the current period to create cash to finance investment. While the capital stock declines in an equivalent manner under both regimes, the debt trajectories and mix of spending over time differ. Under accrual accounting, the cash generated by amortization is used to reduce debt, while under cash accounting all revenue not allocated to services and debt payments can be spent on transfers. Thus, under cash accounting, transfer spending is higher.

The policy implication of these simulations is that a fiscal consolidation program is less stringent under cash accounting than under accrual. The reason is simply that under cash accounting, authorities are able "finance" a portion of the adjustment through unrecorded depreciation of capital. Or put another way, a cash deficit is easier to eliminate than an accrual deficit. Whether such a strategy is desirable or not depends on one's perspective. For policy makers searching for the least politically costly way of eliminating a structural deficit, cash accounting may be preferable – especially if the period of adjustment is relatively short and the resulting decline in public sector capital manageable.

4.2 Capital accumulation rules

Of course, it may be that fiscal authorities, especially those who have achieved fiscal balance, have objectives other than maximizing operating spending. For example, it may be that authorities wish to maximize capital accumulation because of the particular political benefits that flow from public investment. In Figure 4, we present the results of simulation that models such behaviour.

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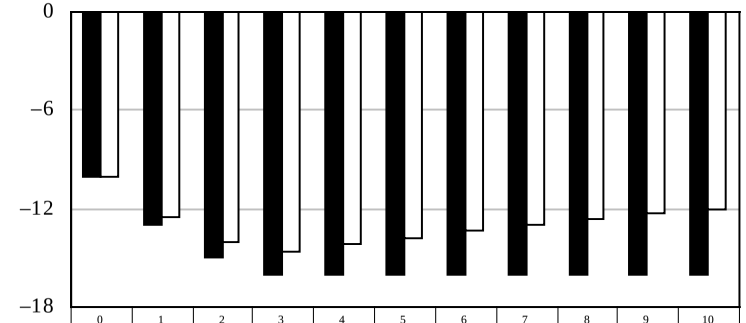
[12] In the Canadian parliamentary system, governments customarily call general elections in the fourth year of their mandate.

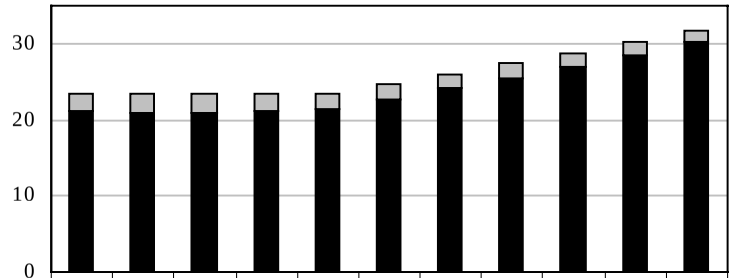
Table 3

Financial Asssets
Pro-Transfers + Eliminate Deficit



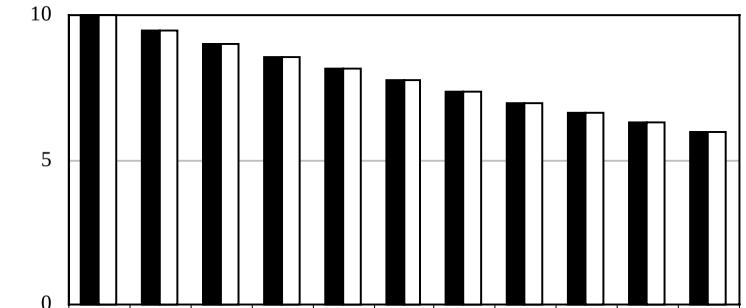
	0	1	2	3	4	5	6	7	8	9	10
Cash	(10.00)	(13.00)	(15.00)	(16.00)	(16.00)	(16.00)	(16.00)	(16.00)	(16.00)	(16.00)	(16.00)
Accrual	(10.00)	(12.50)	(14.03)	(14.57)	(14.15)	(13.74)	(13.35)	(12.98)	(12.63)	(12.30)	(11.99)

Program Expense + Investment
Cash Regime: Pro-Transfer + Eliminate Deficits



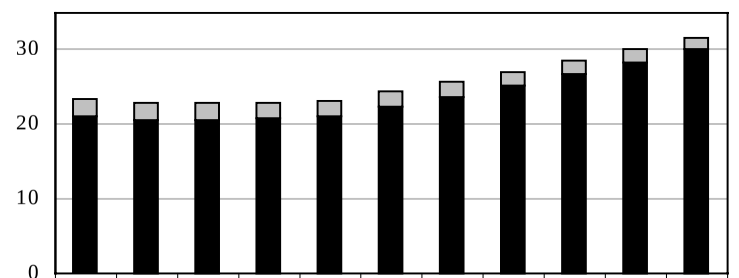
	0	1	2	3	4	5	6	7	8	9	10
I	-	-	-	-	-	-	-	-	-	-	-
SER	2.38	2.50	2.38	2.26	2.14	2.04	1.93	1.84	1.75	1.66	1.58
TRN	21.12	21.00	21.03	21.15	21.37	22.69	24.07	25.50	27.00	28.57	30.20

Capital
Pro-Transfers + Eliminate Deficit



	0	1	2	3	4	5	6	7	8	9	10
Cash	10.00	9.50	9.03	8.57	8.15	7.74	7.35	6.98	6.63	6.30	5.99
Accrual	10.00	9.50	9.03	8.57	8.15	7.74	7.35	6.98	6.63	6.30	5.99

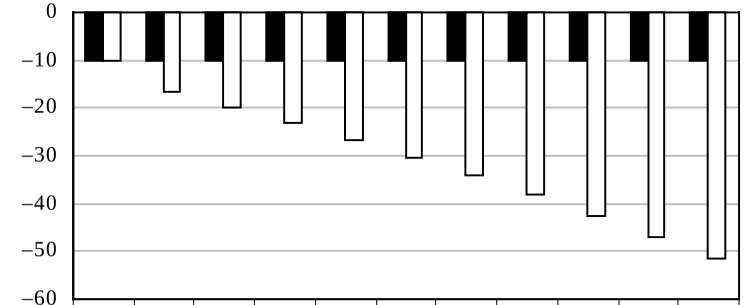
Program Expense + Investment
Accrual Regime: Pro-Transfer + Eliminate Deficits



	0	1	2	3	4	5	6	7	8	9	10
I	-	-	-	-	-	-	-	-	-	-	-
SER	2.38	2.50	2.38	2.26	2.14	2.04	1.93	1.84	1.75	1.66	1.58
TRN	21.12	20.50	20.58	20.74	21.01	22.37	23.79	25.27	26.80	28.40	30.07

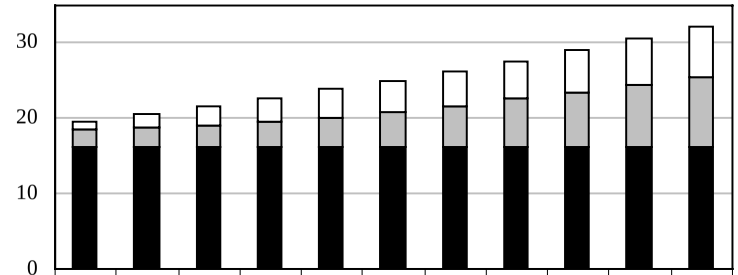
Table 4

Financial Assets
Pro-Investment + No Deficits



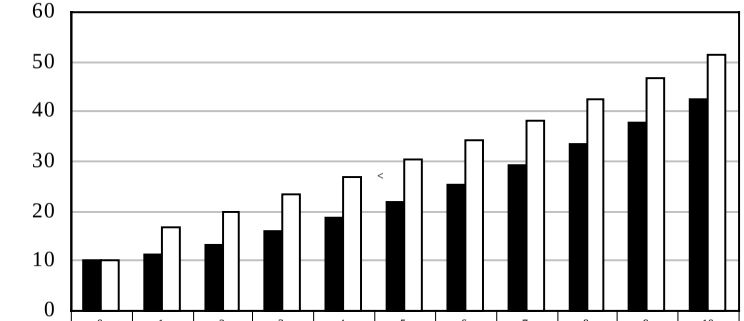
	0	1	2	3	4	5	6	7	8	9	10
Cash	(10.00)	(10.00)	(10.00)	(10.00)	(10.00)	(10.00)	(10.00)	(10.00)	(10.00)	(10.00)	(10.00)
Accrual	(10.00)	(16.80)	(19.96)	(23.26)	(26.73)	(30.37)	(34.20)	(38.21)	(42.45)	(46.88)	(51.53)

Program Expense + Investment
Cash Regime: Pro-Investment + No Deficits



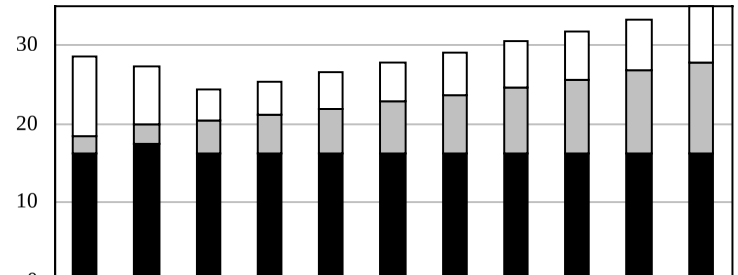
	0	1	2	3	4	5	6	7	8	9	10
I	0.95	1.83	2.55	3.16	3.69	4.18	4.65	5.10	5.55	6.01	6.47
SER	2.38	2.50	2.83	3.33	3.95	4.68	5.49	6.38	7.33	8.35	9.44
TRN	16.17	16.17	16.17	16.17	16.17	16.17	16.17	16.17	16.17	16.17	16.17

Capital
Pro-Investment + No Deficits



	0	1	2	3	4	5	6	7	8	9	10
Cash	10.00	11.33	13.32	15.81	18.71	21.96	25.50	29.33	33.41	37.75	42.34
Accrual	10.00	16.80	19.96	23.26	26.73	30.37	34.20	38.21	42.45	46.88	51.54

Program Expense + Investment
Accrual Regime: Pro-Investment + No Deficits



	0	1	2	3	4	5	6	7	8	9	10
I	10.00	7.30	4.00	4.30	4.63	4.98	5.35	5.72	6.15	6.55	7.00
SER	2.38	2.50	4.20	4.99	5.82	6.68	7.59	8.55	9.55	10.61	11.72
TRN	16.17	17.50	16.17	16.17	16.17	16.17	16.17	16.17	16.17	16.17	16.17

Constrained only to avoid deficits, the investment maximizing government would simply eliminate all transfer spending To avoid this unrealistic outcome, we impose the additional constraint that transfer spending cannot be reduced below its initial value. Facing these two constraints, the optimal strategy under both accounting regimes is to hold transfers constant and devote all revenue in excess of that needed to fund the operation of existing capital and debt service to new investment.

Although the optimal strategy is common to both accounting regimes, the fiscal outcomes differ substantially. In the case of cash accounting, no deficits means no borrowing, so that capital accumulation must be financed out of current revenue. In the case of accrual accounting, the accumulation of debt-financed capital does not affect the no-deficit constraint in the current period but only in future period through its impact of the level of services provided and interest payments on government debt. Thus, capital accumulation is only constrained by its impact on the budget constraint in future periods.[13]

In Figure 4 we see that under cash accounting, government debt remains constant, while under accrual it grows substantially. Not only is investment higher under accrual accounting but spending on services from capital is substantially higher as well. Indeed, we see that by year 10, annual operating expenditures are higher under accrual than cash accounting by almost seven per cent.

The policy implication from this simulation is that in an environment where authorities are constrained to maintain budgetary balance, governments who favor capital accumulation will find an accrual accounting regime more attractive than a cash regime.

5. Recent Canadian experience

Canada is one of a number of jurisdictions that is making the transition from cash to accrual accounting for the public sector. The national accounting profession's body concerned with accounting standards, the Public Sector Accounting Board recommends that governments adopt a full accrual accounting regime and that interested parties focus on five separate measures including net debt level, annual surplus, change in net debt, accumulated surplus, and statement of cash flow. A summary of Canadian provinces' fiscal rules and accounting regimes is presented in Table 3.

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[13] Because of the nature of this constraint, the accrual version of the model is no longer recursive. In this case the model was solved iteratively, by choosing the highest level of investment that avoided an accrual deficit in the next period.

Table 3

Province	Accounting Treatment of Capital	Fiscal Rule	Focus of Budget Communications	Notes
Newfoundland	Accrual		Cash deficit/surplus	
Nova Scotia	Accrual	Budget balance over 2 years, foreign debt limits	Accrual deficit/surprlus and Debt/GDP	
New Brunswick*	Cash	Budget balance over 4 year term	Cash deficit/surplus	Fund accounting allows savings to be treated as budgetary revenue
Prince Edward Island	Accrual		Accrual deficit/surplus	
Quebec	Accrual	Budget balance over 2 years	Accrual deficit/surplus	
Ontario	Accrual	Budget balance over 2 years	Accrual deficit/surplus	
Manitoba	Accrual	Budget balance over 2 years, debt targets	Accrual deficit/surplus	Fund accounting allows savings to be treated as budgetary revenue
Saskatchewan*	Cash	Budget balance over 4 year tem	Cash deficit/surplus	Fund accounting allows savings to be treated as budgetary revenue
Alberta	Accrual	Restrictions on deficits and debt targets	Accrual deficit/surplus plus debt level	Debt concept does not include new borrowing for capital investment
British Columbia	Accrual	Deficit elimination over 3 years	Accrual deficit/surplus and Debt/GDP	

All provinces have either moved from cash to accrual accounting for capital or have announced their intention to do so. Interestingly, none have announced changes to the fiscal rules that were put in place under the old accounting regime. At least three currently use fund rather than fully consolidated accounting so that transfers from other funds are recorded as budgetary revenue. In addition, only three of ten provinces focus their budget communications on debt as a key fiscal indicator. For one of the three, the debt concept targeted does not include borrowing for capital spending.

Thus, we see that although Canadian provincial governments are moving to accrual accounting for capital as recommended by national and international accounting bodies and other organizations, none have made corresponding changes to their fiscal rules or changed the focus of their budget communications. As a result, the change in accounting regimes has led to a significant relaxation in the discipline imposed by fiscal rules on authorities. Although it is too soon to measure with any confidence, anecdotal evidence suggests that some provincial governments are using the change in accounting regime to expand capital spending substantially.

6. Conclusions

The results in this paper will not be surprising to students of fiscal policy. Turning first to positive issues, because fiscal balance means different things under the two accounting regimes, rules that discourage or prohibit deficit financing are harder to satisfy under cash accounting and easier to satisfy under accrual accounting. However, fiscal rules that focus on net debt provide the same degree of fiscal discipline under both regimes.

Depending on 1) current fiscal circumstances (*i.e.*, is the government embarking on a program of fiscal consolidation and/or debt reduction?), 2) preferences with respect to spending on capital-based services versus transfers to individuals and organizations, and 3) the trajectory of revenues (*i.e.* are revenues growing, shrinking or static?), authorities will prefer some combinations of accounting regimes and fiscal rules over others. For example, in periods of fiscal consolidation authorities seeking to satisfy an anti-deficit rule will prefer cash accounting because it allows some of the "deficit" to be eliminated through (unmeasured) depreciation of public sector capital. In periods of fiscal balance, authorities seeking to satisfy an anti-deficit rule will prefer accrual accounting because it allows the overall level of government spending to be higher while maintaining fiscal balance.

Turning next to normative issues, it is clear that accountability is best served if changes in public sector accounting regimes are accompanied by corresponding changes to (or, at least, clarification of) fiscal rules. Qualitative evidence from Canada suggests that this is not always the case. It is unrealistic to expect that legislators, the media and the public will be able to change their fiscal policy focus

from a single measure, the government balance under cash accounting, to the multiple measures under accrual accounting suggested by some professional accounting bodies. Accountability might be best maintained if government adopted net debt measures as their primary fiscal indicator when operating in an accrual accounting environment.

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THE ROLE OF PUBLIC DEBT IN THE UK FISCAL RULES

Robert Woods[*]

Introduction

In 1997 the UK fiscal framework was substantially reformed, including through the legislation for the Code for Fiscal Stability (1998). This was related to developments in countries, such as New Zealand and Australia, which had sought to enhance the credibility of fiscal policy alongside similar attempts to enhance the credibility of monetary policy. The Code for Fiscal Stability requires the Government to set out its objectives for fiscal policy and the operational rules it uses. The UK Government has set two fiscal rules. This paper focuses on the sustainable investment rule, or the debt rule, which requires the Government to hold public sector net debt as a share of GDP at a stable and prudent level over the economic cycle.[1]

The paper begins by briefly reviewing the reasons why governments accumulate debt and the history of government debt in the UK. It also considers some of the costs of high debt levels. Section 1 reviews the academic literature on fiscal sustainability and considers why a limit on debt levels may be desirable. Section 2 then discusses the case for debt rules in general and the role of the debt rule in the UK fiscal framework in particular. In Section 3, the paper illustrates how the debt rule is used to assess the long-term sustainability of the UK's public finances in the light of an ageing population drawing on the Government's Long-term public finance report published last year.[2] Section 4 concludes.

1. Debt – some UK history and issues

1.1 A brief history of UK debt

In the UK public debt has existed since the end of the 17th century. As can be seen from Figures 1 and 2, public debt has fluctuated greatly since then, exceeding 200 per cent of GNP on three occasions. The charts also show the periods when the

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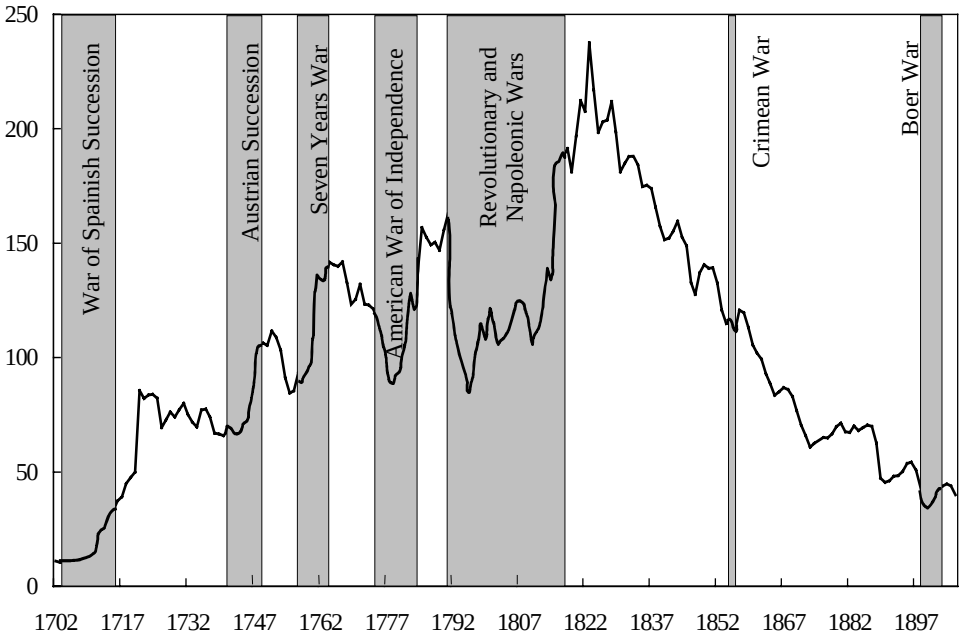
The views expressed here are those of the author and are not necessarily the views of the UK Treasury or the UK Government. I am very grateful for contributions from Frank Eich, Pietro Toigo and Matthew Pointon, participants at the Banca D'Italia workshop and some helpful comments from Chris Allsopp. I should also like to thank Kirk Hay for his able assistance.

[1] The prudent level of debt is defined as 40 per cent of GDP. The Government's other fiscal rule is the golden rule which implies that over the economic cycle the government borrows only to invest and not to fund current spending. This is not discussed in detail here. For more information on the golden rule see Balls and O'Donnell (eds.) (2002), Chapter 9.

[2] H.M.Treasury (2003), *Long-term Public Finance Report: Fiscal Sustainability with an Ageing Population*, December.

Figure 1

Ratio of Market Value of Debt to GNP, 1702-1906



Source: Janssen, Nolan and Thomas (2002).

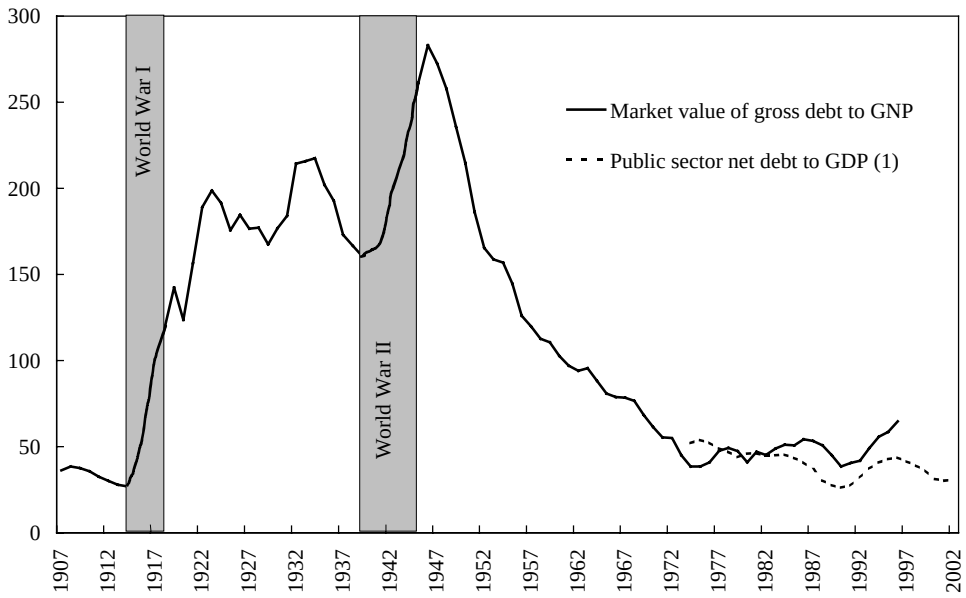
UK was involved in a major war and illustrate the historic tendency to build up debt during war years and then reduce it during peacetime.

Barro (1987) studied the evolution of UK budget deficits between 1701 and 1918, regressing the change in the budget deficit on a temporary military spending term. Unsurprisingly given the figures above he found that: “Temporary changes in military spending accounted for the bulk of budget deficits from the early 1700s through to 1918. This association explains the main increases in the ratio of public debt to GNP, as well as the decreases that typically occurred during peacetime.”

As can be seen in Figure 2, the debt to GNP ratio was also reduced sharply after World War II. Having risen from 160 per cent in 1939, to just over 280 per cent in 1946, it was reduced to around 50 per cent by the mid-Seventies. Since the early Eighties a key driver of the evolution of public debt has been the economic cycle (see Figure 3), reflecting the effect of the automatic fiscal stabilisers. In addition since 1997, the debt to GDP ratio has also been reduced following tough decisions on government spending and the decision to use the proceeds of the spectrum auction to pay back debt.

Figure 2

Ratio of Market Value of Debt to GNP and Public Sector Net Debt to GDP



[1] Measure of debt used in the sustainable investment rule.
Sources: Janssen, Noland and Thomas (2002) and Office for National Statistics.

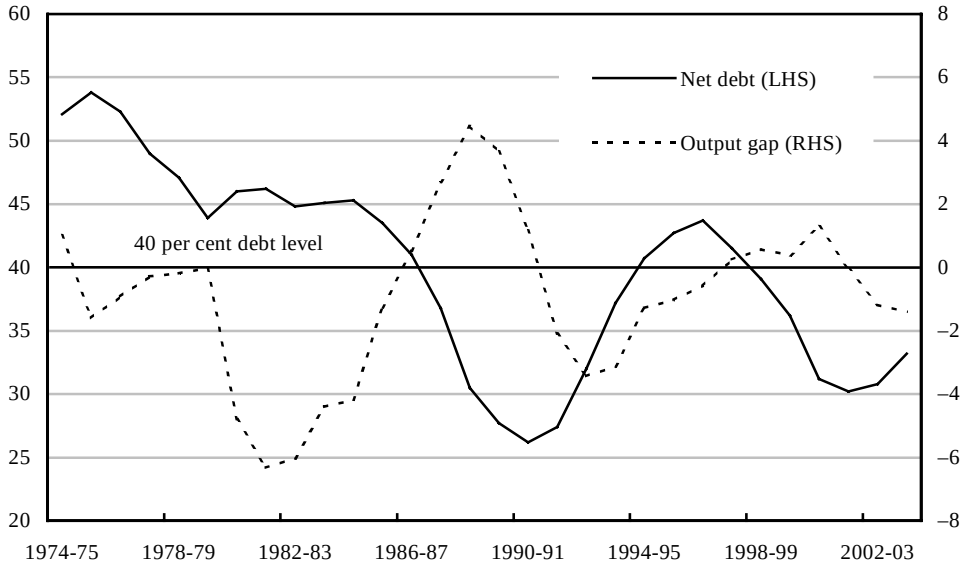
1.2 Why do governments issue debt?

Governments issue debt for much the same reason as individuals – to allow them to smooth expenditures in the face of fluctuations in income (or tax receipts). If borrowing were not possible, in order to smooth consumption a government would need either to maintain a stock of net liquid financial assets or tax revenue would have to be continually adjusted to meet spending plans. In the latter case, the administrative costs would be prohibitive. More fundamentally, frequent tax rate changes would also run counter to the theory underlying the concept of tax smoothing (Barro, 1979). If there is a "deadweight cost" incurred when raising taxation, a cost that increases as the tax rate rises, cost minimisation implies that governments should aim to hold tax rates constant over the economic cycle, rather than varying them from year to year.

The smoothing of spending can occur over various time horizons. Individuals typically smooth their spending over their entire lifetime, borrowing earlier in their adult life, building up net assets over their main working years, and running down their assets after retiring from the workforce. Any remaining assets (after inheritance tax) usually transfer to the individual's descendants after death. A government's

Figure 3

Output Gap and Public Net Debt, 1974-75 to 2003-04
(percent of GDP)



Source: Office for National Statistics and H.M.Treasury.

motives to borrow may reflect considerations related to fairness between generations as well as factors related to the economic cycle.

The idea that fiscal policy should be counter-cyclical dates back to Keynes. Elmendorf and Mankiw (1999) comment that: "…most economists believe that some output variability arises from rigidities or coordination failures. These changes in output, relative to the potential determined by the available factors of production, are socially costly. In this case, timely adjustments to the government deficit and debt may raise social welfare." A specific way of thinking about the potential welfare-enhancing role of government debt over the cycle is that it enhances the liquidity of households by providing an additional means of smoothing consumption and by effectively loosening borrowing constraints.[3] In part, counter-cyclical fiscal policy arises automatically from the design of tax and transfer programmes, and in the UK also from the way that the budgets for the discretionary part of government spending are set in nominal terms.[4] In addition, fiscal policy can be operated on a

[3] This is explored in Aiyagari and McGrattan (1998).

[4] In the UK case it is estimated that a 1 per cent reduction in actual output relative to potential output increases public sector net borrowing by 0.7 per cent after 2 years. See H.M.Treasury (2003), *End of Year Fiscal Report*, p. 41.

discretionary basis. Problems of lags and conflicting objectives have discouraged the use of discretionary fiscal policy in recent decades, however.[5]

Like households, governments also borrow to buy assets that provide a flow of services over time. Borrowing allows the government to spread the upfront costs associated with capital projects across generations, so that the costs and benefits are matched more fairly and each generation pays only for the capital that it consumes.[6] This idea is sometimes referred to as the "benefit principle".[7]

Both the "benefit principle" and the tax-smoothing motive can also extend to incidences of temporary higher expenditure which are unrelated to the economic cycle or capital investment, for example wars. Funds borrowed during wars paid for the extraordinary spending required on Britain's defence. This benefited both current and future generations, and thus it was fair that the cost was spread over time. Sometimes the costs of war can be so great that there is a real risk governments would simply not be able to raise the required level of funds through taxation alone, and have no choice but to borrow – certainly the levels of taxation required could be highly distortionary and governments might seek to avoid them on tax smoothing grounds.[8] Other examples of temporary events that might justify government borrowing include natural disasters.

Even in the absence of major catastrophes such as war, most countries have positive levels of net public debt. In part, this may reflect an explicit recognition of the intergenerational factors associated with investment spending. However, in many cases it has also been symptomatic of poor control of public spending and the overall fiscal position. Borrowing continually to fund current consumption will push the cost onto future generations.

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5 A detailed discussion of the case for using fiscal policy in a more discretionary way for stabilisation purposes in the context of the UK joining EMU, including the possible institutional reforms needed, is given in *Fiscal Stabilisation and EMU,* H.M.Treasury (2003).

6 This sort of approach was advocated by Musgrave (1959). He also argued that the deficit should vary over the business cycle for stabilisation purposes although he also noted that when the budget balance is altered for stabilisation purposes: "…the function of taxes as an index of opportunity cost [of government spending] is impaired." (p. 522).

7 For example, see Elmendorf and Mankiw (1999), p. 1661. Another approach they present to considering inter-generational concerns is to use a social welfare function including current and future generations. If the net marginal product of capital exceeds the rate the social planner discounts income (a function of the inter-generational discount rate for utility, the growth rate of income and the inter-temporal elasticity of substitution) then deferring consumption to future generations is socially optimal. On p. 1662 they present some simple parameterisations but comment that applying this approach is: "by no means straightforward".

8 Following Barro(1979), Aiyagari, Marcet, Sargent and Seppälä (2002) consider the behaviour of UK debt and show that it can be related to the solution to a Ramsey problem with incomplete markets (in particular without state contingent debt).

1.3 Problems with high debt levels

There are a number of channels through which high debt levels can impact negatively on economic growth, thus reducing the consumption possibilities of all generations. For an economy operating at its full potential, higher government consumption financed by borrowing puts upward pressure on interest rates and reduces private investment, this is commonly known as the "crowding out effect". This in turn reduces the potential output of future generations. If investment is at or below the optimal level this will lower welfare.[9]

The "crowding out effect" will be more powerful where increased public debt levels lead to higher risk premia as the perceived risk increases that the government might seek to relieve the debt burden by non-conventional means, either by allowing inflation to rise or by defaulting.[10] As a result, lenders will demand a risk premium when lending to the government. Again, higher interest rates will dampen or crowd out interest-rate sensitive components of aggregate demand, including investment.

Elmendorf and Mankiw (1999) make an estimate of the cost of the crowding out effect of debt in the US (where the government debt ratio is about half of GDP) in terms of output. They estimate that if the crowding out effect of debt were fully reversed, US output would be about 3 per cent higher.[11] In terms of incomes (as opposed to GDP) it does not matter much whether the extra investment is assumed to be at home or abroad: "As long as the rate of return to wealth is the same at home and abroad, the location of the extra wealth does not affect our income".[12]

Another potential effect on economic growth comes from the burden of paying debt interest bills. High debt levels imply high levels of debt interest payments – resources that would otherwise be available for spending on programmes or could be distributed as tax cuts. For any given level of spending, a higher level of taxes would need to be collected in order to finance the interest payments on the debt. As taxation is generally distortionary, this will tend to reduce incentives to work and save. High debt interest payments may also crowd out other potentially more productive forms of public expenditure, such as infrastructure

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9 Feldstein (1984) noted that the tax smoothing argument for debt finance ignores this additional excess burden of debt finance: "If the initial capital stock is smaller than optimal and the increase in government borrowing reduces the capital stock further, the debt financing entails a separate excess burden that must explicitly be recognized in the choice between debt and taxes." (1984, p. 2).

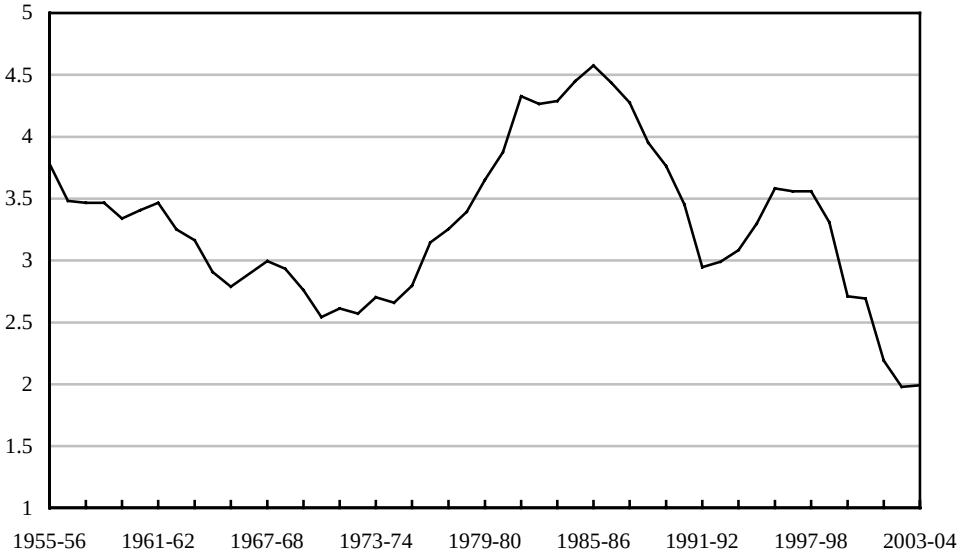
10 Elmendorf and Mankiw (1999) observe that: "…staggering budget deficits as a share of national income were the root cause of the hyperinflations in Twenties Germany and Eighties Bolivia."

11 P. 1632. Their estimate includes an assumption that in the long term debt has a one for one effect on crowding out capital. This may seem on the high side but they argue it is consistent with studies by Auerbach and Kotlikoff (1987) and Blanchard (1985) and the effects may be very long term. For example, in the Auerbach and Kotlikoff study the capital stock is only reduced by one-fifth of its eventual decline after 20 years.

12 P. 1637.

Figure 4

UK Debt Interest Payments
(percent of GDP)



Source: Office for National Statistics.

investment or education spending. As Figure 4 shows, debt interest payments as a share of GDP in the UK are currently around 2 per cent of GDP.[13]

Again Elmendorf and Mankiw (1999) try to quantify the effect on output of the cost of debt service through distortionary taxation in the USA. They estimate the deadweight loss from servicing the US government debt is about ½ per cent of GDP.[14]

High levels of public debt also make the economy vulnerable to the need for large adjustments in fiscal policy due to changes in the debt interest burden, for exampleas a result of changes in real interest rates. With very high debt levels, interest payments can make up a significant part of overall government spending. A sudden increase in real interest rates could then raise the share still further requiring an abrupt change in other spending or tax policies.[15]

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[13] Note, in order to compare the real burden of debt over time it is necessary to allow for the effects of differential rates of inflation.

[14] P. 1639.

[15] For example, consider the case of a country seeking to stabilise net public debt at 80 per cent of GDP. If the government can borrow at real interest rates of 3 per cent and the country's real economic growth rate is 2 per cent, a primary surplus of 0.8 per cent of GDP is needed in order to stabilise the public debt ratio

(continues)

More generally, high levels of debt make governments more vulnerable to shocks, not just major wars but also serious recessions, as it reduces the government's ability to use fiscal policy to cushion shocks. If the debt level is not maintained at low levels during favourable economic times, there will be reduced scope for supporting monetary policy and cushioning the economy when faced with unfavourable cyclical shocks. Indeed, it is conceivable that high levels of public debt could lead to perverse short-run responses to changes in the fiscal stance (for example, a tightening of the fiscal stance could have an expansionary impact on the economy as concerns about long-term fiscal sustainability diminish).[16]

A key problem is that as the debt burden increases it can lead to both higher real interest rates and lower GDP growth rates. This adds to the debt burden and can lead to vicious circles, which have often ended in default or high inflation. This has contributed to the recent financial crisis in Argentina. Debt nearly doubled ahead of the financial crisis, rising from 35 per cent of GDP in 1995 to nearly 65 per cent in 2001. A debt level of 65 per cent may seem low in European terms, but, as pointed out by the Federal Reserve Bank of San Francisco (2002) emerging markets, facing macroeconomic instability and with a history of defaults, may have a substantially lower threshold for a sustainable debt to GDP ratio.[17] In the case of Argentina, this led to sharply rising interest rates, with the yield on a 10-year bond rising by around 20 percentage points between January and November 2001, as a result of increasing investor uncertainty over credit worthiness. As summarised by Hausmann (2002): "The dominant diagnostics were self-fulfilling bad expectations about a weak public debt position, a pessimism that led to rising interest rates and lower output." The endogeneity of GDP growth and real interest rates to fiscal policy is sometimes ignored in assessments of fiscal sustainability. This may lead people to be too relaxed about the effects of high debt levels.

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at the target level. Now suppose an economic shock leads to higher world real interest rates with the government's real rate increasing to 5½ per cent – assuming trend growth is unchanged, a primary surplus of 2 per cent of GDP is now required. In the absence of corrective action, public debt would climb from 80 per cent of GDP to over 100 per cent of GDP inside ten years. This experience can be contrasted with that of a lower debt country, e.g. one trying to stabilise public debt at around 40 per cent of GDP. Such a country would need to raise its primary surplus from 0.4 per cent of GDP to 1 per cent of GDP if faced by the same shock – a much less dramatic adjustment. Moreover, if corrective action were not taken immediately the public debt ratio would rise by a more modest 11 percentage points of GDP over a ten year period.

16 Giavazzi and Pagano (1996).

17 In Argentina's case another factor was that a relatively high proportion of the debt was in foreign currency. More generally the reasons why emerging market economies may have a lower debt tolerance threshold than advanced economies include their tendency to have: narrower tax bases, with a high dependence on commodity or primary products that are particularly sensitive to global developments; lower spending to GDP ratios - which means there is less scope for retrenchment when fiscal consolidation is needed; and within government spending, interest costs account for a high share of GDP and have been volatile, e.g., because it is short maturity and large proportions are often in foreign currency. (See chapter III of IMF (2003), *World Economic Outlook*, September, for a further discussion).

2. Fiscal sustainability and debt in the UK fiscal framework

This section introduces the UK's two fiscal rules, reviews the popular measures of fiscal sustainability in the academic literature, and provides a brief discussion of their merits in providing a guide to the implementation of fiscal policy. The end of the section explains the UK Government's policy on debt and its debt rule.

Firm fiscal rules can help reduce the tendency for fiscal policy to deviate from sound economic principles to provide short-term gains to certain interest groups. Indeed, as Keech (1985) suggests, even if a fiscal rule is not optimal it may well be the best economic response in a situation where the unconstrained political process delivers less desirable outcomes. In the UK, fiscal policy is operationalised through fiscal rules as required by the legislation enshrined in the Code for Fiscal Stability.[18]

The current UK Government has adopted two rules to guide fiscal policy:

- **The golden rule**: over the economic cycle, the Government will borrow only to invest and not to fund current spending; and
- **The sustainable investment rule**: public sector net debt as a proportion of GDP will be held over the economic cycle at a stable and prudent level. Other things being equal, net debt will be maintained below 40 per cent over the economic cycle.

The need for the second debt rule arises because the golden rule by itself does not provide any limit on debt or net borrowing. This might not matter if the benefits from public investment were financial as in the private sector. The investment would then imply future returns and it would be appropriate, as in the private sector, for the costs to be distributed over time as the returns accrue. However, the benefit of some public investment is social and it will not be self-financing. Indeed, one of the motivations for public investment will be that the social return is higher than the private return and therefore while efficient from the social point of view, they might not be undertaken by the private sector. If the investments are not self-financing, other things being equal, higher debt-servicing costs would require future reductions in other areas of public spending or higher taxes and so some limit on debt levels is needed.

2.1 Approaches to fiscal sustainability in the literature

2.1.1 The inter-temporal budget constraint

The typical starting point for assessing fiscal sustainability involves imposing an inter-temporal solvency condition. The condition implies that the present discounted value (*PDV*) of all future revenue should be equal to the *PDV* of all

[18] Finance Bill (1998).

future spending and today's outstanding debt burden. This is the government's solvency condition, which can be expressed by the Inter-temporal Budget Constraint (IBC):

$$\sum_{s=t}^{\infty} T_s (1+r)^{-s+t} = \sum_{s=t}^{\infty} S_s (1+r)^{-s+t} + D \tag{1}$$

where T_s is revenue in year s, S_s is spending in year s, r is the real discount rate, t is the current year and D the initial stock of net debt (all in real terms).

In order to clarify the impact of this solvency condition on implementation of fiscal policy, it is useful to express it in terms of specific fiscal variables, starting from the budget identity:

$$D_t = S_t - T_t + (1+i) D_{t-1} \tag{2}$$

where D_t is debt accumulated at time t, S_t is spending and T_t is revenue and i is the (nominal) interest rate. In order to capture the effective capability of a government to repay its financial obligation, the budget constraint is usefully expressed as a percentage of GDP. Defining $PB = T–S$ as the primary balance, and labelling variables as percentage of GDP in lower case, it is possible to obtain an expression for current debt in terms of future primary surpluses and debt:

$$d_{t-1} = \frac{1+g}{1+r} pb_t + \left(\frac{1+g}{1+r}\right)^2 pb_{t+1} + ... \left(\frac{1+g}{1+r}\right)^T pb_{t+T-1} + \left(\frac{1+g}{1+r}\right)^T d_{t+T-1} \tag{3}$$

where g is the real rate of economic growth. In order to satisfy the condition of the IBC, the no-Ponzi condition that the present discounted value of final debt is equal to zero must hold. Put differently, $\lim_{n\to\infty} \frac{D_n}{(1+r)^n} = 0$ so that the last term in (3) drops out. The current level of debt must therefore be equal to the *PDV* of all primary balances:

$$d_{t-1} = \sum_{s=1}^{\infty} \left(\frac{1+g}{1+r}\right)^s pb_{t+s-1} \tag{4}$$

which defines the primary surplus necessary to meet the IBC, pb^*:

$$pb^* = \left(\frac{r-g}{1+g}\right) d_{t-1} \tag{5}$$

The IBC does not imply that debt is necessarily ever fully paid off. Rather, it shows that any fiscal stance (expressed in terms of the primary balance) compatible with the IBC is a function of past levels of debt, d_{t-1}. Expression (5) also highlights

the fact that the difference between the real interest rate, *r*, and the real growth rate, *g*, is key to the assessment of intertemporal solvency.[19]

An important question is to ask whether expression (5) provides the policymaker with a satisfactory tool to inform the conduct of fiscal policy. The IBC approach is appealing from a theoretical point of view, as it is derived from a straightforward budget identity. It is also comprehensive – both in terms of the revenue and spending items considered, and in the time horizon covered. The policy prescriptions from expression (5) are simple: if projected primary surpluses are lower than the primary surplus pb^* compatible with the IBC, then the fiscal stance needs to be tightened to establish solvency. Vice versa, if current and future revenues are more than enough to cover current and future spending and current debt, then the government will be able to loosen its fiscal stance.[20]

An alternative form of the IBC would take account of a government's assets as well as its liabilities.[21] This implies the value of current government **net** liabilities should equal the PDV of current and future primary current surpluses if the financial rate of return on public sector capital equals the cost of borrowing. If the cost of borrowing exceeds the financial rate of return on public sector capital, future primary current surpluses will have to be correspondingly higher and vice versa.[22] One practical problem with this approach is measuring government assets. However, as methodologies improve (see Section 3.2) these difficulties may be reduced.

Returning to expression (5), the condition that satisfies the IBC may not be demanding enough. Satisfying the IBC implies only that a government's debt, on average, is not growing at too fast a rate, given the level of interest rates and economic growth rates, and will hold as long as the debt to GDP ratio converges to any ratio. Effectively, sustainability is not measured in terms of a debt to GDP ratio but in terms of a government's ability to service its debt.

In addition, a measure calculated over an infinite time horizon will be of limited help for the policymaker setting fiscal policy over the medium term. The IBC does not prescribe a specific pattern of adjustment for fiscal policy, nor does it offer a clear assessment of the urgency of policy actions and the cost of delaying

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[19] If $r < g$, the economy is dynamically inefficient in the Diamond (1965) model, and the government no longer needs to run primary surpluses to achieve sustainability. Instead, it should, on welfare grounds, issue more debt until the upward pressure on the interest rate makes it at least equal to the economic growth rate. However, in the Diamond model there is no uncertainty and therefore there is no difference between the marginal product of capital and the risk free interest rate. Abel *et al*. (1989) show that this does not necessarily hold in stochastic models and suggest that other measures should be used to assess dynamic efficiency. In these circumstances, the risk free rate appropriate for the debt calculations will tend to be lower than the rate of return on capital.

[20] Since the IBC is derived from the budget identity (2) it will hold by definition at all times *ex post*. However, the policymaker will want to rule out some of the options to meet the IBC *ex ante* (e.g., inflation or default).

[21] Buiter (1985).

[22] It is worth emphasising that it is the financial returns rather than the social returns that matter for sustainability although, as discussed at the start of this section, the financial return may not be the motivation for public investment.

them. As the IBC requires only that a fiscal adjustment takes place sometime in the future, the guidance on what the optimal course for fiscal policy in the medium term would be is relatively weak. Debt ratios could go up rapidly, e.g. to finance age-related spending increases, and still satisfy the IBC because of assumed primary surpluses in the far distant future.

Consequently, using the IBC as the only guide for fiscal policy might pose a credibility problem. The IBC does not define any optimal debt pattern, and it is perfectly consistent with rising debt levels in the medium term. However, the size of the public debt ratio can be a key factor influencing the private sector's perception of the government's commitment to meet its budget constraint as well as its ability to do so. Given the infinite time horizon over which sustainability is assessed, it could be potentially difficult for economic agents to discriminate between a policymaker who is pursuing a sustainable policy and one who is allowing for an increase in debt without planning the necessary adjustments to ensure sustainability. Indeed, over long horizons it will be very difficult for a government elected for a limited period to pre-commit future governments.[23]

In turn, loss of trust in a government's ability or willingness to service its debt could be self-fulfilling, as the private sector would require a higher risk premium to hold government debt, altering the key parameters in equation (5). An explicit debt rule could help address this credibility problem and clearly anchor agents' expectations through an easily-monitored debt benchmark. A simple feedback like this would in turn help to strengthen the government's commitment to sticking to its long-term path and is likely to be more effective than a more opaque IBC-based rule.[24] The next sub-section will discuss how an explicit debt target can be incorporated into indicators of long-term sustainability.

2.1.2 From solvency to sustainability

To derive an indicator that provides a useful guide for fiscal policy over the medium-term horizon, people have typically defined a concept of sustainability in the form of a given debt to GDP ratio. A common starting point is to consider the fiscal stance that maintains the debt to GDP ratio constant at its current levels.

Using the information from the IBC, the most immediate indicator of sustainability would measure the adjustment in the primary balance necessary today

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[23] As the ECB (2004) comments: "From the government's intertemporal budget constraint, it follows that sustainability requires all debt to be covered by future primary (*i.e.*, excluding interest expenditure) surpluses. However, this condition is not sufficiently specific to anchor expectations about the future course of fiscal policy, as governments can promise to cover current high debts with large primary surpluses in an ever more distant future. This leaves agents with much uncertainty as to whether, by the time required, action will be taken as promised.", p. 51.

[24] A general discussion of this issue is given in chapter 2 of H.M.Treasury (2004), *The Stability and Growth Pact: A Discussion Paper,* March.

to maintain debt at its current level d^{-}. Using (5) and imposing the desired debt target d^{-}, it is possible to obtain the expression for the required surplus[25]:

$$pb^{\sim} = \frac{r-g}{1+g} d^{\sim} \tag{9}$$

An analogous approach (see Chalk and Hemming, 2000) is to define sustainability as the policy that maintains the ratio of public sector net worth to GDP at its current level, on the basis that net worth offers, at least in theory, the most encompassing measure of the public sector's balance sheet. Using a similar approach as above, the difference between the primary deficit necessary to achieve this objective and the current primary deficit can be calculated.

The *fiscal gap indicator* defines a specific time horizon by which the chosen debt target must be reached. The fiscal gap indicator shows by how much current policy needs to be changed immediately and permanently (expressed in terms of a change in the primary balance) to achieve a certain, predetermined debt target at a given point in the future.[26] Pursuing a policy that will achieve this debt target is then interpreted as sustainable. Unlike the IBC, the fiscal gap concept therefore focuses explicitly on debt when assessing sustainability.

The fiscal gap for a debt target in target year T equal to debt in the initial year t can be calculated by the following formula:

$$\Delta pb = (r-g)\left[d_t + \left(\frac{1}{1+r}\right) \frac{\sum_{s=t}^{T} - pb_s \left(\frac{1+r}{1+g}\right)^{T-s}}{\left(\frac{1+r}{1+g}\right)^{T-t} - 1} \right] \tag{10}$$

As can be seen from (10), the required change in the primary balance to GDP ratio, Δpb, depends on the initial debt to GDP ratio, the time horizon, the projected primary balance under unchanged policies, and r and g. The formula can also be modified for debt targets other than the initial ratio.

The fiscal gap is closely related to the tax gap indicator proposed by Blanchard *et al*. (1990). In this setting, the tax gap is defined as the difference between the current effective tax rate and the tax rate that would achieve a given debt to GDP ratio by a given target year. The difference between the tax gap and the fiscal gap is one of emphasis, with the former taking spending policies as given and focussing on the revenue side of the government's accounts.

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[25] Expression (9), while algebraically very similar to (5), implies a different approach, as it imposes a debt target defined ex-ante. In much of the literature, this target is taken to be the current level of debt.

[26] This definition follows Auerbach (1994).

By comparison with the IBC, the key additional variables in this family of indicators are the target year chosen and the level of debt adopted as the target. With regard to the target year, it is best to present calculations over a range of time horizons. Blanchard *et al.* propose a three-tiered indicator, where sustainability is assessed 1, 5 and 40 years ahead. Assessing sustainability over the current year has the advantage of not requiring forecasts, and hence being constructed from publicly available data. However, the resulting snapshot would not be very informative, as it would include the effect of the cyclical position of the economy in that particular year. A medium-term indicator would capture the impact on the primary balance of cyclical movements, and would draw on widely available medium-term forecasts. But even a medium-term indicator would miss longer-term pressures, e.g. those related to demographic developments. So an assessment over a 40-year horizon would usefully complete the analysis by including the long-term trends in revenues and spending.

Such a tiered approach overcomes one criticism of the fiscal and tax gap indicators. Indeed, this approach is adopted by the UK government. In addition to presenting 5-year ahead medium-term projections towards the end of which the economy is assumed to be on trend (thus stripping out cyclical and otherwise temporary effects), the analysis of the fiscal position is complimented with an assessment of long-term sustainability based on fiscal gaps calculated over 20, 30, 40 and 50-year time horizons.[27] Section 3 gives a flavour of the results.

An alternative to presenting the fiscal gap over several different horizons would be to define a fiscal gap indicator that imposed that a given debt target was *never* to be exceeded. This could be useful if revenues and/or spending evolved in a non-linear way, which might be possible over longer time periods, for example due to a cohort effect from an ageing population. Section 3.1 presents the results obtained applying this indicator to the case of the UK.

The second key variable for these sort of indicators is the chosen definition of sustainability, *i.e.* the debt target. Sustainability is defined *a priori* in the sense that it is implicit in the chosen debt target. There is potentially an unlimited range of debt targets although it is often taken as simply the debt to GDP ratio at the beginning of the projection period. This is not the approach taken in the UK, however, where a specific debt target has been set out in the sustainable investment rule. This is discussed further in Section 2.3.

The use of fiscal and tax gaps has the advantage of being intuitive and as they can be constructed to hit a specific debt target, they can be easily explained in the context of existing policy rules, as in the UK case. The link to debt levels over specific horizons also means they can deliver clearer medium-term policy prescriptions than the IBC-based indicators. Further, ease of monitoring assists in promoting transparency which can help strengthen credibility.

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[27] H.M.Treasury (2003), *Long-term Public Finance Report: Fiscal Sustainability with an Aging Population*.

Finally, one presentational challenge for all the sustainability indicators surveyed here is that they identify the long-term challenges in the form of fiscal imbalances, *i.e.* the amount by which fiscal policy should be tightened/loosened to achieve a given definition of sustainability. This should not be read as a one-dimensional policy prescription. The appropriate response to many long-term challenges may take the form of structural policies, such as raising the trend growth rate and the reform of pension or social security arrangements.

2.2 Fiscal sustainability under uncertainty

The sustainability indicators considered above implicitly assume a world of certainty, where the basic parameters (e.g., productivity growth, interest rates and life expectancy) are known over the time horizon covered. In reality though, there is a high degree of uncertainty even over short horizons and it is important to devise a fiscal strategy that allows for this.

2.2.1 Sensitivity analysis

One way to deal with uncertainty when assessing long-term sustainability is to carry out sensitivity analysis to "stress-test" the results. This can be done by running projections based on a range of assumptions that are varied around their baseline values. Among the key issues to consider are the sensitivity to real interest rates and real GDP growth rates.[28]

Figure 5 provides a simple illustration. Suppose a country had GDP in 2000 of 100 and economic growth was 2 per cent per year. In addition it is assumed that the government had debt of 25 per cent of GDP in 2000, and that, based on current policies, the government's primary balance was projected to be in deficit by 1 per cent of GDP every year in the future. The rate of increase of the debt to GDP ratio will depend on the interest rate relative to the growth rate. If the interest rate, r, is equal to the growth rate, g, then the debt to GDP ratio will simply rise by the primary balance (1 per cent of GDP) every year. In this case, the debt to GDP ratio would reach 50 per cent after exactly 25 years. For a given growth rate, a higher interest rate would imply a faster increase in the debt to GDP ratio. For example, with an interest rate of 3 per cent, the debt to GDP ratio would reach 50 per cent after around 18 years and then continue to rise to reach 60 per cent after 25 years.

For any desired debt target and target year, the fiscal stance needs to be tighter (or less loose) – as indicated by the fiscal gap calculations – the larger the

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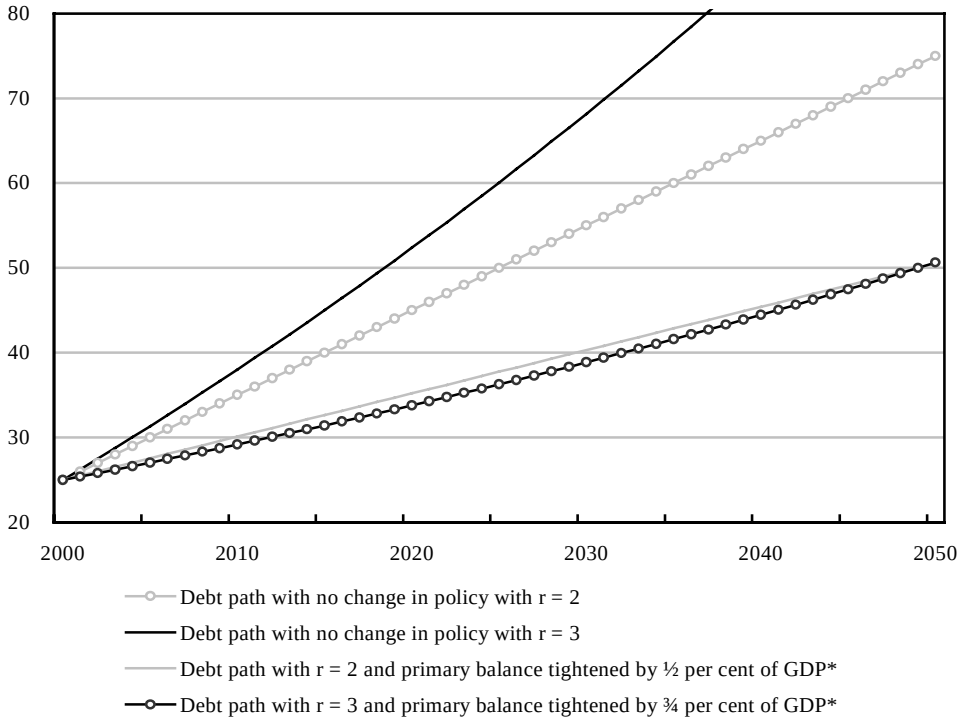
[28] Recalling equation (2) and allowing for growth, the evolution of the debt to GDP ratio can be stated as: $d_t = \frac{(1+r)}{(1+g)} d_{t-1} + pb_t$

So, everything else equal, the debt to GDP ratio in year t will be higher, the bigger the ratio of $(1+r)/(1+g)$.

Figure 5

Illustrative Example of Debt Paths and Fiscal Gap Calculations



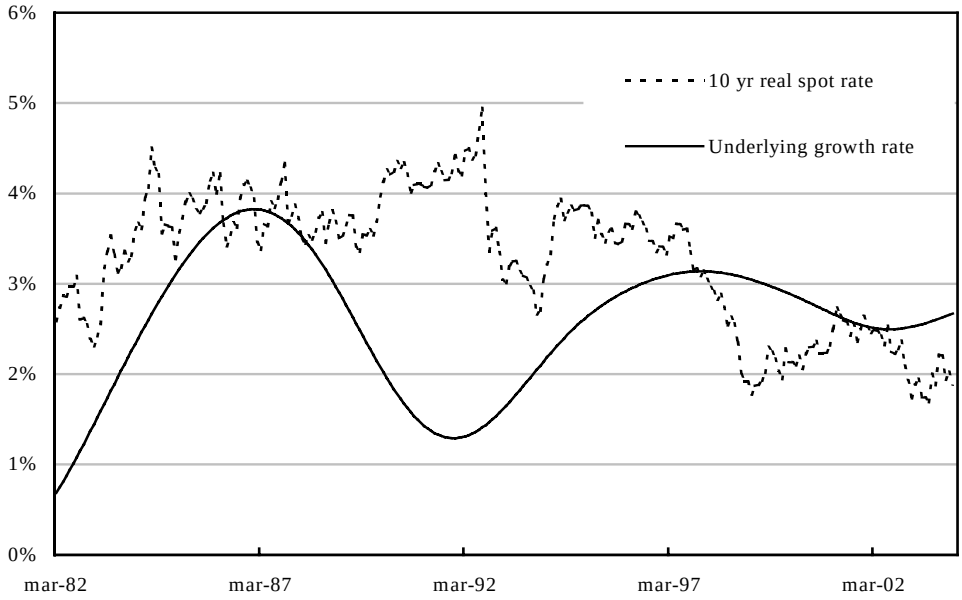
* Debt target of 50 per cent of GDP in 2050.

differential between *r* and *g*. For example, if the government aimed for a debt to GDP ratio of 50 per cent in 50 years' time, then it would have to tighten its primary balance by ½ per cent of GDP in the case with a real interest rate of 2 per cent but by ¾ per cent of GDP for a real rate of 3 per cent.

Figure 6 compares UK real interest rates (estimated from 10 year index linked gilt yields) with underlying GDP growth rates estimated using a Hodrick-Prescott filter. While accepting that the Hodrick-Prescott filter estimate of underlying growth is rather variable in the earlier years when real growth was volatile, in the period since 1997 when growth has been more stable the figure suggests that the real interest rate, r, has been below the real growth rate, g, by just under ½ a percentage point on average. Figure 6 also suggests there may have been a structural break in

Figure 6

Real Interest Rates (10 Year Spot)[1] and Underlying Growth Rate[2]



1 Source: Bank of England.

2 Estimated using a Hodrick-Prescott filter. Note this differs from H.M.Treasury's official estimates of trend growth as set out in *Trend Growth: Recent Developments and Prospects* (April 2002), which estimates trend growth based on identifying on-trend points using survey and other economic data.

real interest rates around 1997 associated with the change in the UK's monetary policy regime.[29] [30]

The UK Government's long-term projections focus on the risks from different assumptions about real growth and real interest rates as well as illustrating the effects of different demographic assumptions, in particular higher: longevity, net migration and fertility rates.[31]

Scenario modelling builds on simple sensitivity analysis in that it combines a number of assumptions to describe a possible future state of society and the economy. For example, it could be argued that a population projection with a higher life expectancy assumption (relative to the principal projection) could describe a society with generally higher health standards. It would then be reasonable to

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29 See Balls and O'Donnell (2002) for further information.

30 If the UK position were to remain like this into the future the UK's fiscal position would be stronger than indicated in the sustainability indicators in Section 3.

31 H.M.Treasury (2003), *Long-term Public Finance Report: Fiscal Sustainability with an Ageing Population*, December.

combine the higher life expectancy population projection with the assumption that health spending per person would rise later in life than in the principal case and that more older people would be in employment.[32]

While sensitivity and scenario analysis can give some sense of the risks to sustainability and the range of illustrative fiscal actions that might be necessary to ensure sustainability, the choice of variants is arbitrary. Moreover, the analysis does not attach a probability distribution to the different scenarios, nor define a stochastic process that generates the uncertainty, and therefore it does not provide quantitative estimates of risks.

2.2.2 Modelling fiscal risks

A different approach is to model risk explicitly by developing a measure of sustainability that quantifies the vulnerability of public finances to uncertainty. These approaches have been studied with an eye to emerging markets, which face a particularly volatile economic environment and are more vulnerable to external shocks than developed economies (IMF, 2003). However, there could be scope to apply this sort of analysis to developed countries as well.

One way to incorporate risk is by redefining sustainability in terms of a government's ability to service its debt under all possible circumstances. This implies a "prudential" approach to debt ceilings, whereby debt is kept at a low level to create a margin against future risks. Mendoza and Oviedo (2003)[33] use a model of the economy to incorporate uncertainty, where the primary surplus is affected by exchange rates, shocks to the tax base and interest rates. They estimate the lowest level of debt compatible with a state of "financial crisis" whereby the primary balance permanently remains at the level that is generated after a large negative shock to the public finances. Requiring debt to be at a level compatible with a permanent financial crisis is clearly very stringent, and derives from the fact that the approach is intended to apply to emerging market economies where such worse case scenarios have sometimes persisted for some time.[34]

Barnhill and Kopits (2003) have developed a conceptually similar approach, which extends the Value-at-Risk methodology, commonly used in the assessment of financial institutions risk, to the public sector balance sheet. This is a comprehensive approach in the sense that it is based on net worth rather than debt. This approach estimates the portion of government net worth that could be lost due to economic uncertainty. The methodology calculates a government's net worth, and then estimates the possible future movements of the main variables that could affect government net worth. The main variables are those that are subject to a high degree

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[32] This approach was used in the Wanless Review describing potential future UK health outcomes. See Wanless, D. (2002), *Securing our Future Health, Taking a Long-Term View*.

[33] Following this, the IMF (2003) also explores this approach.

[34] For example, the IMF (2003) note that governments in oil-exporting countries faced this situation after the collapse of oil prices in the Eighties and that slumps in commodity prices are generally quite long lasting.

of volatility and at the same time have a large effect on public finances (e.g. exchange rates, interest rates or oil prices). Based on these estimates, an overall probability distribution for government net worth can be calculated, deriving which proportion is "at risk" from movements in these variables. Then for a given level of confidence, an estimate of the potential loss in net worth the government could face over a given period of time in a "worst case" scenario is presented.[35] [36]

These recent approaches are interesting in that they explicitly attempt to estimate the amount of prudence necessary to guard against risk. To provide reliable information on sustainability in the future, the value-at-risk approach still needs to deal with the problem of estimating government assets as discussed earlier. Another criticism concerns the use of past data to estimate future risk. Where the economic environment is changing rapidly, past trends might be poor indicators of the future.

A more fundamental question concerns the fact that these approaches estimate risk, while the judgement on the right amount of prudence necessary to offset such risk is left to the policymaker. For example, what is the appropriate policy response in the event of debt exceeding the level considered to be sustainable in the worst-case scenario? The presence of welfare costs caused by a tightening of fiscal policy presents a trade-off between reacting to relatively small risks to maintain a high level of prudence and pursuing other policy objectives. The question then becomes what is the right amount of risk that a government should bear, an issue that is beyond the scope of this paper, and possibly of any indicator of sustainability, and may be better left to the judgements expressed through the policy-making process. In the case of the UK, this judgement has been expressed in the choice of a ceiling of 40 per cent for the net debt to GDP ratio. The next section discusses why this ceiling was chosen in the UK.

2.3 Turning theory into policy – the sustainable investment rule

A government's inter-temporal budget constraint does not determine a specific debt level. It is simply a solvency condition. Fiscal gap type measures suggest the primary balance needed to maintain a certain debt to GDP ratio in the very long term but this does not imply the level of debt is optimal. Moreover, while the sustainability indicators surveyed in Section 2.1 can be calculated with reference to a desired level of debt, much of the literature adopts a definition of sustainability that keeps debt constant at the initial level.

There is, however, a case for taking an explicit view on the desired level of debt. One reason is that committing to a clear benchmark level of debt helps to

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[35] The IMF (2003) provides an example: "…the estimated net worth may currently be, say 100 per cent of GDP, the calculations may suggest that because of the risks the government faces there is a 5 per cent chance that in one year its net worth will only be 60 per cent of GDP. In this case, the government's "value-at-risk" is said to be 40 per cent of GDP", p. 134.

[36] An application of this approach to Equador found the single most important source of risk was interest rates, see IMF (2003), p. 135.

anchor expectations and helps avoid self-fulfilling losses of credibility in fiscal policy. Another reason is that it may be desirable for fiscal policy to complement the objective of sustainability with other welfare objectives, and therefore to take a view on the optimal level of debt. This is discussed in more detail in this section.

2.3.1 Which target for debt?

While a moderate level of public debt could be justified on welfare and efficiency grounds, high levels of public debt make the economy vulnerable to the need for large adjustments in fiscal policy and are likely to have negative consequences for long-term growth.[37] This suggests that there may be a non-zero level of debt that represents an optimal trade-off between the need to undertake public investment (and funding this in an equitable way) and the economic costs associated with higher levels of public debt. The UK Government's debt rule takes an explicit view on the desired debt target, interpreting a ratio of 40 per cent of GDP as the prudent and sustainable level of net debt.

As discussed in Section 2.1, there is a wide range of possible debt targets underpinning the analysis of sustainability, including maintaining the inherited level of debt. This approach implicitly assumes a world of certainty, as it does not capture the risks associated with high levels of debt. However, as discussed in Section 2.2, uncertainty is an important dimension of sustainability that needs to be taken into account in a real world setting.

Uncertainty arises both in the form of risks of permanent and temporary shocks to the macroeconomic environment. As discussed in Section 2.2.1, one of the shocks could take the form of a permanent increase in the real interest rate. Faced with such a shock, a high debt country would need a much sharper fiscal tightening than a low debt country. Sustainability indicators that are based on stable debt to GDP ratios (e.g., fiscal gaps based on the same level of debt in the target year as in the initial year) ignore this important difference between high and low debt countries. Low levels of debt (in terms of GDP) also provide a useful safety margin in the face of temporary shocks, or simply cyclical movements of the economy, by allowing room for the stabilisation role of fiscal policy. Last but not least, the level of debt may affect the economic growth rate negatively as discussed in Section 1.3. Everything else equal, high debt countries will tend to have a more limited range of policy options than low debt countries.

It is therefore important to complement an assessment of sustainability using the sort of indicators considered in Section 2.1 with a prudential approach to fiscal policy, in other words a policy that is likely to be sustainable even in the face of adverse shocks. This implies adopting a view on the desirable level of debt beyond the current level of debt inherited from past history.

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[37] The paper by Aiyagari and McGrattan (1998), discussed below, provides a formal analysis of the optimal level of debt which explicitly identifies some of the costs and benefits of debt.

The economic literature does not provide a clear-cut criterion for optimal debt limit but rather provides a number of approaches to deriving a desirable level of debt. The relatively small number of academic studies is reviewed by H.M.Treasury (2002):[38]

- One approach consists of inferring the optimal debt ratio by observing the gearing ratio prevailing in the private sector. This approach implicitly assumes away the Modigliani-Miller theorem, and conjectures that the competitive pressures have induced the private sector to find an optimal gearing ratio. On the basis of an estimate of the government's assets, the observed 60/40 to 40/60 gearing ratios in the private sector would imply that the optimal debt ratio for the UK might lie between 30 and 50 per cent of GDP. However, this approach ignores the different roles and risk characteristics of the private and public sector (e.g., a government's sovereign right to tax).
- An alternative approach is to try to estimate the growth-maximising debt ratio. Smyth and Hsing (1995), using the US data, suggested that economic growth is maximised when public debt is around 50 per cent of GDP. Robson and Scarth (1997) argue for a target of 20 per cent of GDP in the Canadian context. However, other studies (Asilis, 1994) show that the costs of being away from the optimal level of debt are small. This approach has two downsides. First, it is very aggregated and so it ignores the underlying policies that lead to a given stock of debt, when growth rates are most likely to be influenced by the nature of the expenditure that has generated the debt. Second, the approach focuses on growth, which does not necessarily correspond with a broader welfare objective.
- A third approach tries to infer the optimal debt ratio from tests of dynamic efficiency. A simple way to assess dynamic efficiency is to analyse the differentials between growth rates and interest rates. However, this assumes that the government's risk-free rate of return is equal to the rate of return in the economy. As noted earlier, this may not hold due to uncertainty[39] and so a more appropriate test for dynamic efficiency should consider the difference between investment and profit levels. Using this approach, one US study by Zee (1988) suggests that the optimal public debt level is around 20 per cent of GDP.

Aiyagari and McGratten (1998) consider the optimal level of debt in a formal model[40] in terms of the balance between the benefit of having government debt for its role in enhancing the liquidity of households and helping to ease credit constraints, against the costs of adverse wealth distribution and incentive effects, plus the cost of the crowding out effect (as discussed in Section 1). When they parameterise the model using US data they conclude that the optimal debt-GDP ratio is 2/3 – around the post-war US average. However, in terms of their model, the estimated welfare costs of being away from the optimal debt level are small. For

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38 P. 174.

39 Abel *et al*. (1989).

40 The model involves a large number of infinitely lived households whose saving behaviour is influenced by precautionary saving motives and borrowing constraints.

example they find: "…the loss to being at a debt/GDP ratio of zero rather than 2/3 is only 0.08 per cent of consumption."[41]

In sum, the academic literature does not provide a definitive view on the optimal level of public debt. Empirical results are sensitive to the assumptions adopted, and it would generally be more appropriate to define a *range* of desirable debt targets. This reflects the point that the optimal level of debt is likely to vary over time (the impact of wars was discussed in Section 1) and the costs of being away from the optimum level may not be very high within a range. The discussion in Section 2.2.2 also presented some arguments for taking a prudential approach. Section 2.3.2 sets out the considerations that led the UK Government to choose its 40 per cent net debt to GDP ceiling.

2.3.2 The UK Government's policy on public debt

Neither theory nor empirical evidence provides a definitive guide for policymakers on what is the optimal level of public debt. This is reflected in the International Monetary Fund's *Manual on Fiscal Transparency*: "…judgements about excessive debt, and particularly excessive debt-to-GDP ratios, are hard to make … assessments of fiscal sustainability have to be made on a country-specific basis, relying on particular knowledge about the implications of, and market reactions to, the government's past and future fiscal policies." (IMF 1998)

Judgements on the desirable public debt to GDP ratio for any one country are therefore contingent on the size and frequency of the economic shocks to which that country has been exposed and the worthwhile investment opportunities that are available to the government. Care needs to be taken, therefore, when studying empirical evidence and international experiences in an attempt to learn lessons in the British context. Nonetheless, the UK Government's policy was consistent with the emphasis on debt reduction seen other industrialised countries.

In setting the debt-level target (in terms of the sustainable investment rule) and producing its fiscal plans, the Government had to weigh up the need to:

- Invest in the reform and modernisation of the public sector that is necessary to deliver the public services Britain needs;
- Fund investment in a way that does not impose an unfair burden on current or future generations;
- Maintain public debt at levels, which do not expose the Government to risk and that are unlikely to have a substantive negative impact on long-term growth and employment.

At that time, the Government concluded that, other things being equal, a reduction in net public debt – to below 40 per cent of GDP – was consistent with a

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[41] P. 462.

balanced and responsible approach to fiscal management.[42] Having achieved this, the challenge is to keep net debt below 40 per cent. Recent projections given in Budget 2004,[43] show net debt stabilising at just over 36 per cent at the end of the medium-term projection period, comfortably below the level defined by the sustainable investment rule.[44] At the same time, the debt rule is consistent with a doubling in public sector net investment to 2¼ per cent of GDP by 2007-8 to meet the Government's key spending priorities.[45]

The level of debt is intended to be a prudent one, *i.e.* a level, which is likely to be sustainable even with unfavourable shocks. The rationale for setting debt at a prudent level is consistent with the more formalised approach as set out in Section 2.2. External commentators have shared the view that this level of net debt is cautious.[46]

3. Assessing long-term sustainability in the UK

3.1 Long-term sustainability of the UK public finances

The UK Government assesses the long-term sustainability of the public finances on an annual basis in its *Long-term Public Finance Report* (LTPFR). This complements the twice yearly production of medium-term fiscal projections which report against the Government's two fiscal rules.

The LTPFR provides a comprehensive assessment of the fiscal sustainability of current policies using bottom-up spending projections and a range of sustainability indicators and variants. The baseline projections in the 2003 LTPFR were based on the assumption of 2 per cent productivity[47] growth per year beyond 2008-9, the end of the medium-term forecast horizon. GDP is assumed to grow in line with changes in productivity and the size of the working-age population as given by the Government Actuary's Department principal population projections. As

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42 Two definitional points about the UK's sustainable investment rule are worth highlighting. First, it is based on a concept of net debt as opposed to the gross debt concept used in the EU context. Net debt just nets off liquid financial assets from total financial liabilities and is a better reflection of a government's immediate solvency and is usually preferred to the gross concept where both sets of figures are available. Second, the debt rule is based on the whole of the public sector. This follows a long tradition in UK fiscal policy. The UK Government believes that fiscal rules should apply across the public sector because the burden of repaying the debt of public corporations could ultimately fall on the taxpayer.

43 H.M.Treasury (2004).

44 The gross general government debt is forecast to remain well below 60 per cent of GDP (the Treaty reference level), thus allowing the UK to meet its European debt commitment.

45 If the golden rule were met exactly so that the current budget was zero then a net debt ratio of 40 per cent of GDP would be consistent with net investment of 2 per cent of GDP in the steady state assuming trend real GDP growth of 2½ per cent (and GDP deflator growth of 2¾ per cent). This falls to about 1.8 per cent for trend growth of 2 per cent.

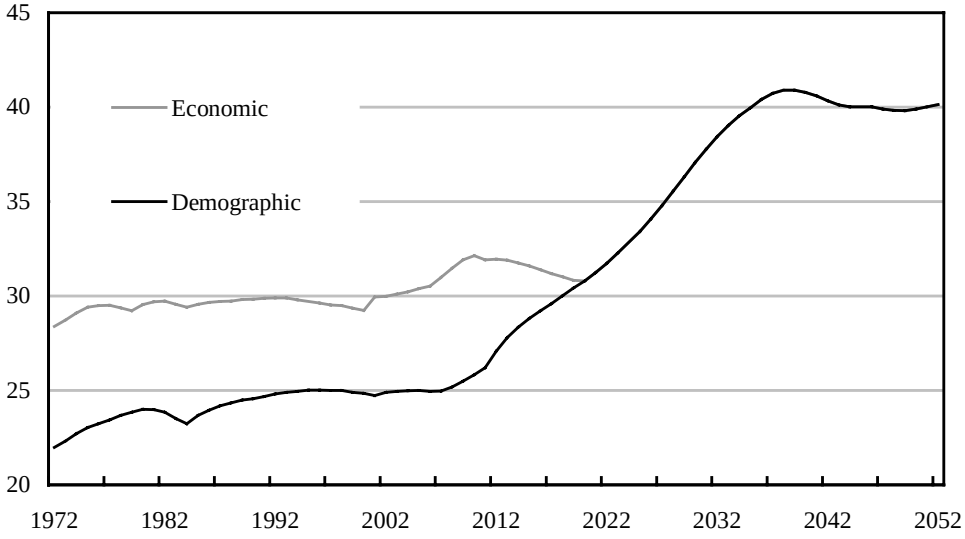
46 For example, Buiter (2003) and Institute for Fiscal Studies (2004).

47 Output per worker.

Figure 7

Demographic and Economic Old-age Dependency Ratios[1]

(percent)



Source: Government Actuary's Department, historical data and 2001-based population projections.
[1] The economic old age dependency ratio represents the ratio of people above working age over the number of people of working age. The demographic old age dependency ratio is the number of people over 65 relative to those aged 16-64. The ratios differ in the earlier years as the state retirement age for women is currently 60. The ratios converge as the retirement age for women gradually increases to 65 over 2010 to 2020.

in other developed economies, the UK population is expected to age in aggregate (see Figure 7). This is due to three distinct demographic trends: the post-war baby boom generation gradually reaching retirement age; expected further increases inlongevity; and a fertility rate below the natural replacement rate. In the UK case, these trends are moderated somewhat by projected continued net migration.[48]

Table 1 shows projected spending in the baseline case. The increases in education and health spending between 2002-3 and 2012-13 mainly reflect Government policies to increase resources in these areas over the medium term up to 2007-8. Beyond the medium term, spending changes are driven by changes in the population size and structure. It can be seen that total spending (excluding interest and dividends payments) is projected to fluctuate between 40 and 42 per cent of GDP over the coming five decades.

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[48] A detailed presentation of how spending and revenue are projected into the future is given in the 2002 and 2003 Long-term public finance reports.

Table 1

Spending Projections
(percent of GDP)

	2002-03	2012-13	2022-23	2032-33	2042-43	2052-53
Pensions[1]	5.0	5.1	4.9	5.4	5.3	5.3
Health[2]	6.5	8.2	8.5	9.3	9.7	9.7
Education	5.1	5.5	5.3	5.5	5.4	5.4
Long-term care[3, 4]	0.9	1.1	1.1	1.1	1.1	1.1
Total age-related spending	**17.5**	**19.8**	**19.7**	**21.2**	**21.4**	**21.5**
Other spending	21.5	20.7	20.2	20.6	20.2	19.8
Total spending[5]	**38.9**	**40.5**	**39.9**	**41.8**	**41.7**	**41.3**

1 Defined as the sum of the basic state pension, the State Second Pension, Minimum Income Guarantee and Pension Credit, Winter fuel payments, over 75 TV licences, and Christmas Bonus.
2 Gross NHS spending.
3 Compression of morbidity assumed.
4 Excluding long-term care provided within the NHS which is accounted for under Health (for which no compression of morbidity is assumed).
5 Total spending including gross investment but excluding interest and dividends payments.

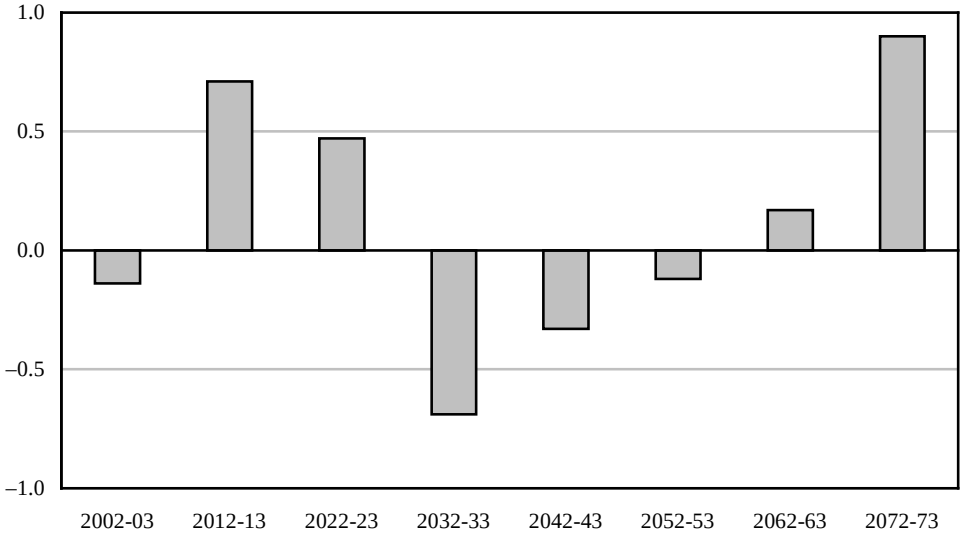
To obtain estimates of the inter-temporal budget gap and fiscal gaps, projections of revenues are also required. In the baseline case revenue is projected to increase more or less in line with GDP, with the share of revenue in GDP fluctuating around 40½ per cent beyond the medium term (excluding interest and dividends received).

Combining the spending and revenues gives the projected general government primary balance (see Figure 8). It can be seen that the primary balance is projected to move from a surplus equivalent to 0.7 per cent of GDP in 2012-13 to a deficit by the late 2020s. The projected deficit is most marked as a share of GDP in the 2030s, when spending pressures related to the ageing of the population are projected to be greatest. However, after 60 years the primary balance returns to surplus, reflecting the fact that part of the ageing process has run its course and that, based on current policies, social security spending will continue to decline gradually as share of GDP.

From the primary balance it is only one step to calculate the inter-temporal budget gap and the fiscal gaps. In theory, the inter-temporal budget constraint, the government's solvency condition, should be calculated over an infinite horizon. For the calculations it is assumed that the economy has reached its steady state in 2102, the final year projected by the model.

Figure 8

Primary Balance
(percent of GDP)



Source: H.M.Treasury, 2003.

Table 2

Inter-temporal Budget Gaps[1]
(percent of GDP)

Discount rate (percent)	**2.5**	**3**	**3.5**
Lower productivity (1¾ per cent)	–¼	1	1¾
Baseline (2 per cent)	–1¼	¼	1¼
Higher productivity (2¼ per cent)	–2½	–¾	–½

[1] Tax increase (or decrease) in 2002-3 and a permanent, proportionate tax increase (or decrease) thereafter needed to ensure inter-temporal balance. Rounded to the nearest quarter percentage point.

Table 2 shows the inter-temporal budget gaps for three different discount rate assumptions and the three different productivity growth rate assumptions. The results suggest the inter-temporal budget gap in the UK is small, indeed whether fiscal policy needs to change at all to maintain inter-temporal fiscal balance depends on the discount rate assumption. In the low discount rate case, even with low productivity growth there is no need for a fiscal tightening.

The differences between the variants can be explained as follows:

- for a given discount rate, higher productivity growth will imply that most social security transfers will decrease more rapidly as a share of GDP, reflecting the current policy of price indexation. For example, for a discount rate of 3 per cent and a productivity growth rate of 2 per cent, taxes need to be raised by an equivalent of ¼ per cent of GDP to meet the IBC, while taxes could be lowered if productivity growth amounted to 2¼ per cent per year; and
- for a given productivity growth rate, taxes will need to be raised by more (or decreased by less) the higher the discount rate. This is due to the fact that with a higher discount rate the distant future projected primary surpluses (Figure 7) are given less weight in the calculations.

The fiscal gap calculations do not require an assumption about the steady state and can be carried out over any finite time horizon. As noted earlier, the LTPFR presents fiscal gaps over four different time horizons: 20, 30, 40 and 50 years ahead. Calculating fiscal gaps over a range of target years helps policy-makers draw more robust conclusions about the possible impact of an ageing population.

Table 3 shows the fiscal gaps in the baseline scenario with 2 per cent productivity growth per year and the three different interest rate assumptions for a target level of net debt of 40 per cent of GDP, *i.e.* consistent with the Government's sustainable investment rule.[49] In this example the target net debt to GDP ratio is a little higher than the ratio at the end of the medium-term projection horizon. If the Government decided to reach a 40 per cent net debt to GDP ratio by 2022-23, then it could ease fiscal policy under the three interest rate assumptions, while this is true

Table 3

Fiscal Gaps[1] in Baseline Scenario with 2 per cent Productivity Growth
(percent of GDP)

Interest rate (per cent)	**2.5**	**3**	**3.5**
Target year			
2022-23[2]	–1	–¾	–½
2032-33	–¼	–¼	0
2042-43	0	¼	¼
2052-53	0	¼	1

1 Change to the primary balance needed to attain desired debt level in the target year starting in 2009-10. Rounded to nearest quarter percentage point.

49 Further variants can be found in the *Long-term Public Finance Report* (2003).

2 Net debt target is reached at end of year specified.

Table 4

Fiscal Gaps[1] in Baseline Scenario with 2 per cent Productivity Growth and an Interest Rate of 3 per cent
(percent of GDP)

Debt target	**30**	**40**	**50**
Target year			
2032-33[2]	¼	–¼	–½
2042-43	½	¼	0
2052-53	½	¼	0

1 Change to the primary balance needed to attain desired debt level in the target year starting in 2009-10. Rounded to nearest quarter percentage point.
2 Net debt target is reached at end of year specified.

only for the two lower interest rate assumptions with a target year of 2032-33. This implies that under current policies the net debt to GDP ratio would reach 40 per cent of GDP sometime around 2030. With the primary balance projected to move into negative territory by the late 2020s, the Government would need to tighten its fiscal stance modestly to meet its debt target for later target years apart from in the low interest rate variant.

Table 4 also shows the fiscal gaps calculations for alternative debt targets of 30 and 50 per cent of GDP for the case with productivity growth of 2 per cent per year and a real interest rate of 3 per cent. As would be expected, everything else equal, with a lower debt target the Government would have to tighten its fiscal stance by more (or loosen by less) than with a higher debt target. However, once you have a horizon of 30 years or more the difference between a 30 per cent and a 50 per cent debt target is not large given the order of uncertainty involved. Indeed over the 50 year horizon it is no more important than the choice between real interest rates of between 2½ and 3½ per cent.

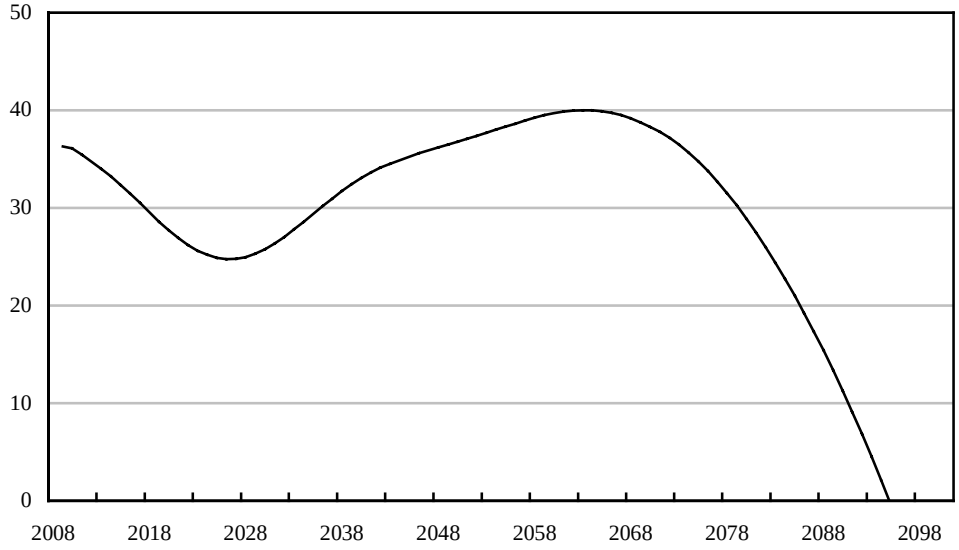
The 2003 LTPFR also introduced an alternative sustainability indicator, which is closely related to the fiscal gap approach and was briefly discussed in Section 2.1. The main difference is that this indicator calculates the required change in the fiscal stance to *never* exceed the debt target rather than to meet a debt target in a specific target year.

Figure 9 shows the projected debt trajectory for the UK[50] where the ¼ point of GDP tightening of the fiscal stance required for net debt never to exceed the 40 per

50 In the baseline case with 2 per cent productivity growth and real interest rates of 3 per cent.

Figure 9

Net Debt under an Alternative Sustainability Indicator[1]
(percent of GDP)



1 With primary balance tightened by ¼ per cent of GDP in 2009-10. Based on baseline case with 2 per cent productivity growth and real interest rates of 3 per cent.
Source: H.M.Treasury

cent is started in 2009-10. Figure 9 shows that if this policy were continued over the long term, the Government would end up building up a net asset position.

The results show that on the basis of current policies and a range of reasonable assumptions, the UK's public finances are sustainable in the long term. The LTPFR also referred to international studies and concluded that the UK was in a strong position relative to other major economies to face the challenges ahead.

3.2 Contingent liabilities and whole of government accounts

A contingent liability is one that may arise, dependent on one or more events happening. By its very definition, it is not certain that the Government will have to meet this liability and in some cases the chances are very slim indeed. Contingent

liabilities are not included in national accounts measures of debt, but clear reporting of contingent liabilities can help improve the transparency of the public finances.[51]

The UK is one of the few countries in the world in which the Government has a statutory requirement to report its liabilities, assets and all other key financial information in the same way as private sector companies. Since 1997, the UK Government has introduced a series of reforms to ensure greater transparency and it has increased the availability of information about national and departmental finances.

The *Code for Fiscal Stability* (1998) commits the Government to apply best-practice accounting methods in the production of its accounts. In 2000, the Government introduced new legislation that requires departmental accounts to follow Generally Accepted Accounting Practices (UK GAAP), adapted as necessary for the public sector context. In line with these statutory requirements, government departments now produce full resource accounts including contingent liabilities.

The Government is committed to further improvements and is currently working towards the production of Whole of Government Accounts (WGA).[52] WGA will present a comprehensive snapshot of the public finances, prepared on a basis comparable with the private sector, as well as accounting for public spending and cash flows in the previous 12 months. The programme will also deliver further benefits in information quality, it will:

- improve data consistency, e.g. it is acting as a catalyst for the convergence of accounting policies across the public sector;
- extend the range of data, e.g. on provisions, contingent gains and liabilities and future contract expenditure; and
- be independently audited and certified by the Comptroller and Auditor General.

In addition, through the WGA programme the Government aims to make it possible to progressively increase the amount of audited data included directly in the UK National Accounts, for example by replacing modelled depreciation data with actual data.

4. Conclusions

The UK Government's medium-term objective for fiscal policy is to ensure sound public finances and that spending and taxation impact fairly within and between generations. The UK's fiscal rules ensure this is achieved by ensuring that

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[51] Identifying and then quantifying what the contingent liabilities of the government are is no easy task and can range widely, for example the IMF (2003) comment: "The rise (in public debt in emerging economies) appears to be largely accounted for by interest and exchange rate movements and the recognition of off-balance sheet and contingent liabilities… In a number of countries, the costs of recapitalizing banking systems have been particularly high."

[52] The way in which accruals-based balance sheet information might be used to complement the analysis of fiscal sustainability is discussed in chapter 3 of H.M.Treasury (2003), *Long-term Public Finance Report*.

the Government will borrow only to invest and not to fund current spending over the economic cycle and by keeping net debt to GDP ratio below 40 per cent over the cycle. The debt ceiling is needed given that some public investment is not expected to yield a financial return unlike that in the private sector. Setting a debt rule also helps to anchor expectations and aids transparency which in turn helps to build credibility. The focus on maintaining a low debt ratio is justified in terms of the adverse effects of high debt levels on growth and the increased vulnerability to shocks when debt ratios are high. Extreme debt levels can lead to default or high inflation, both of which are costly.

The UK Government's debt rule is set at a deliberately prudent level that is low by historical and international standards and should be sustainable even with unfavourable shocks. A prudential approach is justified given the well-known uncertainties in making fiscal projections and can be compared with the more formal recent approaches applied to some developing countries. The debt ceiling is also consistent with the increase in the ratio of public net investment to GDP that is required to modernise and reform the UK public sector without imposing an unfair burden on the current generation.

The evidence reviewed in the paper illustrates that it is hard to come to a precise analytical answer as to what the optimal debt level is, but for long-term fiscal sustainability this may matter less than having a clear and credible debt target for the debt ratio. Nevertheless, for prudential reasons, there are clear advantages in going beyond simply trying to stabilise the debt ratio at its current level. The UK Government has consistently argued for a greater focus on debt and long-term fiscal sustainability in the context of the EU Stability and Growth Pact.[53] This is especially important in the context of longer-term fiscal challenges including those related to ageing populations.

Section 3 set out how the UK uses its debt rule in its analysis of long-term fiscal sustainability, applying a range of indicators. In the future, GAPP-based Whole of Government Accounts will provide further useful complimentary information, for example on the government's assets, depreciation and contingent gains and liabilities.

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[53] A paper was published alongside the recent Budget: H.M.Treasury (2004), *The Stability and Growth Pact: A Discussion Paper*, March.

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THE IMPACT OF THE EU FISCAL FRAMEWORK ON ECONOMIC ACTIVITY: A QUANTITATIVE ASSESSMENT

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Introduction

It is a common view that the EU rules-based fiscal framework provided by the Maastricht Treaty and the Stability and Growth Pact has influenced budgetary policies in EU countries, not only in the run-up to EMU, but also after the introduction of the single currency. However, there is no general agreement on the quantitative impact that the presence of the EU fiscal framework exerted on budget balances in EU countries, nor is there widespread agreement on the implications it has had for growth.[1] In the recent policy debate, for instance, it is often claimed that the EMU macroeconomic framework is excessively oriented towards the goal of stability, while lacking sufficient focus on the objective of growth. In particular, the framework for fiscal discipline provided by the Treaty and the Pact is often perceived as a constraint to fiscal policy in sustaining aggregate demand during weak junctures. Conversely, other commentators put the emphasis on the negative growth effects associated with worsened consumers' and investors' confidence that may result from lack of fiscal discipline.

The impact of the EU fiscal framework on economic activity should be evaluated from a medium/long-term perspective. This permits to address the basic question whether the fiscal consolidations that emanated from the EU rules-based framework for fiscal discipline resulted into a contraction in aggregate demand and then output via Keynesian channels or whether it contributed to growth by limiting the crowding out effect associated with high and persistent deficits. This paper provides a quantitative analysis of the impact the fiscal framework has had on economic activity from such a perspective.

There are two major difficulties with such an analysis. First, there is the necessity of assessing what would have been the level of budget balances in EU countries in the absence of the EU rules for fiscal discipline. In particular, it is necessary to distinguish to what extent the reduction in budget deficits that occurred in the second half of the Nineties in many EU countries was the effect of the requirements of fiscal discipline in the Maastricht Treaty and the SGP or to what

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The views expressed here are those of the authors and should not be attributed to the European Commission.

[1] For an overview of the EU countries' fiscal consolidation in the run-up to EMU see European Commission (2000) and Von Hagen *et al.* (2001). Analysis and discussions on the conduct of fiscal policies in EU countries after the introduction of the single currency are contained in Sapir *et al.* (2004) and Hughes-Hallet, Lewis, and Von Hagen (2004).

extent it was instead a response to high debt levels and would have occurred in any case. Second, a general equilibrium analytical setting is required to analyse the impact of such counterfactual budget balances on aggregate demand components, debt and interest rates. Taking into account the above analytical requirements, the strategy followed to perform the analysis is as follows. In a first step "fiscal rules" are estimated (similar as in, e.g., Gali and Perotti (2003)) describing the reaction of fiscal authorities (in terms of chosen levels of budget balances) to major macroeconomic variables, such as the cyclical position and the level of debt. Such fiscal rules are estimated for two different sub-periods: before and after the start of phase II of EMU. It is shown that the reaction of EU fiscal authorities in the two sub-periods changes quite significantly, with a greater weight put on the debt stabilisation motive after the start of phase II of EMU. The estimated change in the parameters for the fiscal rules (summarising the behaviour of fiscal authorities) is interpreted as resulting from the introduction of the EU fiscal framework. Counterfactual budget balances in absence of the Treaty and SGP provisions are then obtained from predictions using the fiscal rules for the period before EMU phase II. In the second step of the analysis, these counterfactual levels of budget balances are used in simulations with the European Commission's QUEST model to analyse what would have been the performance of the economies in terms of aggregate output in absence of the EU fiscal framework. In order to work on a sample of countries which is sufficiently homogenous from the viewpoint of the working of the major macroeconomic relations (among which those relating to monetary policies and exchange rates) only euro area countries are considered for the analysis.

What would have been the impact on economic activity of an absence of the fiscal discipline provided by the EU fiscal framework? According to our analysis, the changes in fiscal behaviour observed after 1994 on average amounted to a reduction in deficits of almost 0.9 per cent of GDP. In a counterfactual scenario of an absence of fiscal discipline simulated with the QUEST model, this would have led to a sizeable build-up of government debt. In the most optimistic case, a scenario ignoring an additional risk premium effect of higher government debt on interest rates, the short run gains of an absence of fiscal discipline would not have exceeded half a percent of GDP and would have faded away quickly. When risk premia effects of higher public debt on interest rates are included, the gains from an absence of fiscal discipline over the last decade would have been even smaller in the short run, and would have become negative in the medium term.

The paper is structured as follows. The next section discusses our estimates of fiscal policy rules before and after 1994 and the changes we attribute to the Maastricht Treaty and SGP. These form the input into our counterfactual model scenario with the QUEST model, described in section 2. This section also discusses empirical evidence on the effects of deficits and debt on interest rates and risk premia and describes simulations which take such effects into account. Section 3 concludes.

1. Determining counter-factual budget balances in absence of the EU fiscal framework

The first necessary step in our analysis of the economic impact is the estimation of counterfactual budget balances in the absence of the EU fiscal framework. This amounts to answering the following question: which values for budget balances would have been recorded in the absence of the EU rules-based framework but allowing for the "normal" budgetary response of budget balances to output gaps and debt levels? In order to answer this question, fiscal rules are estimated for each of the euro area countries before and after 1994. This also allows us to assess to what extent the behaviour of the fiscal authorities has been changed by the EU fiscal framework.

It has become common practice in the applied analysis of budgetary policies to estimate fiscal rules that summarise the behaviour of fiscal authorities on the basis of a limited set of macroeconomic determinants that explain developments in budget balances (see, e.g., Von Hagen *et al.*, 2001, Melitz, 2002, Gali and Perotti, 2003, Ballabriga and Martinez-Mongay, 2003). Most of the fiscal rules estimated in existing work can be derived as the outcome of a problem in which fiscal authorities choose budget balances in such a way as to minimise a loss function which is a function of the output gap and the deviation of the actual debt level from a target level. The underlying notion is that fiscal authorities are motivated by an objective of output stabilisation (so that budget balances should respond positively to expected output gaps) and by a debt stabilisation motive (so that a positive response of budget balances to the existing stock of debt is expected). The budget measures employed in the empirical estimation of fiscal rules is generally net of interest payments, given that this budget item is not directly under the control of fiscal authorities. In some analyses, like in Gali and Perotti (2003), the dependent variable employed in estimating fiscal rules is the cyclically adjusted primary balance. Using such a measure of countries' fiscal positions presupposes that fiscal authorities decide about the level of the budget anticipating the impact of the cycle on the cyclical components of revenues and expenditures and permits to analyse the macroeconomic determinants of "discretionary" fiscal policy. Concerning the explanatory variables that have been included in existing empirical work on fiscal rules, the output gap is generally used as a measure for the cycle, while the lagged debt-to-GDP ratio is normally used to capture the debt stabilisation motive of fiscal authorities. The lagged dependent variable (e.g., the primary budget balance) is quite often included in the empirical specification to allow for a role of inertia in budgetary policy.

Table 1 overleaf reports the results for panel data estimation of fiscal rules across the 11 EU member states. Annual data for the period 1970-2003 are taken from the AMECO database. The specification chosen follows that in Gali and Perotti (2003). Two alternative dependent variables have been considered: the primary balance and the primary cyclically adjusted budget balance. The explanatory variables included are the output gap, the 1-year lagged debt-to-GDP

Table 1

The EU Fiscal Framework and Budgetary Behaviour (EU-11)

Dependent Variable	Primary Budget Balance		Primary Cyclically-adjusted Budget Balance	
	1970-1993	1994-2003	1970-1993	1994-2003
Output gap	–0.066	0.363***	–0.086	0.097
	(–1)	(–3.93)	(–1.5)	(1.39)
Lagged debt/GDP ratio	0.027***	0.085***	0.03***	0.067***
	(4.5)	(5.03)	(5.4)	(4.04)
Lagged dependent variable	0.74***	0.47***	0.69***	0.45***
	(14.9)	(6.31)	(15.46)	(5.78)
Constant term	–1.37***	–4.85***	–1.5***	–3.51***
	(–4.3)	(–3.95)	(–5)	(–2.99)
Number of observations	238	110	238	110
R square within groups	0.57	0.63	0.62	0.47
Wald Chi square	319.4	875.61	371.76	916.5

Note: Z statistics reported in parenthesis. ***, **, * denote statistical significance at, respectively, 1, 5, and 10 per cent level. Estimation method: instrumental variables fixed effects panel regression. The output gap variable is instrumented using its own lag and the lagged US output gap. All variables are expressed as a percentage of trend output.

ratio and the lagged dependent variable.[2] Formally, the estimated equations are as follows:

$$b_{c,t} = \alpha_c + \beta y_{c,t} + \gamma d_{c,t-1} + \rho b_{c,t-1} + \varepsilon_{c,t}$$

where $b_{c,t}$ is alternatively the primary balance or the cyclically-adjusted primary balance in country *c* and year *t*, $y_{c,t}$ is the output gap, $d_{c,t}$ is the debt/GDP ratio, and $\varepsilon_{c,t}$ is an error term.

[2] The results reported in table 1 refer to output gap data obtained as the percentage difference between actual and trend (HP-filtered) output. Estimates have also been performed using potential output computed through the European Commission production function approach (see Denis, McMorrow and Roeger, 2002) and very similar results have been obtained.

To account for the endogeneity of the output gap (*i.e.*, the fact that not only the output gap affects budget variables but also that budgetary policy has an impact on the cycle) this variable has been instrumented with its own 1-year lag and the lagged US output gap.[3] The chosen specification has been estimated separately for the sub-sample 1970-1993 (before the EU fiscal framework) and the 1994-2003 sub-period (after the introduction of the EU fiscal framework).

Several results of interest emerge from the panel-data estimation of fiscal rules.

- A first finding is that while before the introduction of the EU fiscal framework budget measures (both primary budget balances and primary cyclically-adjusted budget balances) were not significantly affected by the output gap, after phase II of EMU the output gap has a significantly positive impact on primary balances, while the coefficient for the primary cyclically-adjusted budget balance remains non-significant but turns from negative to positive. This finding refutes the view that the introduction of the EU fiscal framework has resulted into a less counter-cyclical stance for fiscal policy in EU countries.[4]
- A second major result is that both primary and primary cyclically-adjusted budget balances react positively to debt levels. The regression coefficient for the lagged debt-to-GDP ratio is positive and significant in both sub-periods irrespective of the budget measure used as dependent variable. This supports the view that fiscal authorities pursue debt stabilisation objective when deciding about budgetary policy.
- Third, the magnitude of the coefficient of the debt variable increases after the introduction of the EU fiscal framework, meaning that such debt stabilisation objective has become more relevant after phase II of EMU.
- Finally, results show that the degree of inertia in budget balances has diminished after the introduction of the EU fiscal framework. The regression coefficient for the lagged dependent variable drops from about 0.7 to about 0.45 after phase II of EMU.

In summary, the estimated fiscal rules indicate that the introduction of the EU fiscal framework resulted into an enhanced debt stabilisation motive for fiscal authorities and a reduced degree of inertia in budgetary policy. As for the reaction of budgets to cyclical conditions, there is no evidence that it became more pro-cyclical. Overall, the results from panel data estimation reported in Table 1 suggest that the introduction of the EU fiscal framework led to an improvement in budget balances.

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[3] More generally, the use of the lagged dependent variable in panel data analysis raises an issue of inconsistency of estimates, generally addressed by relying on GMM estimators. However, given the purpose of the present analysis (understanding how fiscal rules changed after the introduction of the EU fiscal framework) and the relatively small sample used this issue of inconsistency is likely to be of little relevance.

[4] The same result is obtained in Gali and Perotti (2003).

Primary budget balances (both nominal and cyclically adjusted) became in fact more sensitive to debt levels and easier to adjust over time.[5]

The estimation of fiscal rules as reported in Table 1 permits the construction of counterfactual budget balance values in absence of the EU fiscal framework. In other words, they permit to obtain an estimation of which value for budget balances would have prevailed in absence of the EU fiscal framework but allowing fiscal authorities to follow their output and debt stabilisation motives. Calculation of such counterfactual values for budget balances is a necessary first step to assess the impact of the EU fiscal framework on economic activity. The computation of counterfactual budget balances requires using the fiscal rules estimated before the introduction of the EU fiscal framework to predict values for the budget balances for the following period. Such predictions have been obtained after estimating fiscal rules as in Table 1 separately for each country (regressions results are reported in the Annex, Table A1). The counterfactual primary budget balance for a given country in the 1994-2003 period, $b_{t\in[1994,2003]}$, is constructed as follows:

$$b_{t\in[1994,2003]} = \alpha_{1974-1993} * X_{t\in[1994,2003]} + \varepsilon_{t\in[1994,2003]}$$

where $\alpha_{1974\text{-}1993}$ is the vector of the estimated coefficients for the 1970-1993 period, $X_{t\in[1994,2003]}$ is the vector of explanatory variables and $\varepsilon_{t\in[1994,2003]}$ is the estimated regression residuals for the 1994-2003 period. The difference between counterfactual budget balances so obtained and actual values amounts to 0.88 percentage point of GDP on average.[6] Such difference has been used as a shock to the European Commission's QUEST model to simulate what consequences the absence of the rules for fiscal discipline of the Maastricht Treaty and SGP would have had on euro area economies. The values for counterfactual balances so obtained are to be taken cautiously, given the limited degrees of freedom available for the estimation of fiscal rules and the associated problem of robustness and precision of estimated coefficients. Moreover, our strategy to quantify

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[5] While the choice of the year when the new fiscal policy regime starts being effective (1994, corresponding to the start of EMU phase II in our case) is likely not to be crucial for results, estimates can be quite sensitive to the choice of the time length of the sample. Ballabriga and Martinez-Mongay (1994) estimate country-by-country fiscal rules akin to ours introducing a dummy (taking value 1 in the years of operation of the EU fiscal framework) interacting with the debt coefficient to account for the discipline effect of the introduction of the fiscal rules. They analyse systematically how the value of the coefficient changes when changing the starting date of operation of the fiscal framework and find that similar qualitative results are obtained irrespective of the starting year, with the most significant increase in the debt coefficient taking place in most countries when assuming that the EU fiscal framework starts producing effects in 1996. Gali and Perotti (1993) estimate panel equations using the same specification as ours but limiting the sample to years after 1980 and assuming that the EU fiscal framework starts being effective in 1992. The qualitative results obtained in Gali and Perotti (1993) are similar to ours. In their case, however, the quantitative change in the debt coefficient and in the coefficient of the cyclically-adjusted primary balance is smaller. A possible explanation for this difference lies in a non-linear behaviour of the budget balance with respect to GDP, with the impact being smaller at low levels of debt (as was the case in the Seventies).

[6] Such figure is obtained as the GDP-weighted average of the difference between counterfactual and actual primary budget balance for the different EU-11 countries. See the Annex (Table A2) for differences between counterfactual and actual primary balances at the country level.

counterfactual primary budget balances does not take into account the impact of the EU fiscal framework on the composition of budgetary policies. This choice is motivated by the fact that while the EU fiscal framework provides rules for the containment of deficits, it is silent on issue of composition, so that the way EU countries managed their public budgets on their revenue and expenditure side was not directly affected by the EU fiscal rules, but rather by other country-specific considerations.[7] Hence, the shock given to the QUEST model to simulate a scenario of "absence of fiscal discipline" is not to be interpreted as the exact impact on primary balances associated with the EU fiscal rules that would have prevailed in each year and country but rather the estimation of an average benchmark for analytical purposes.

2. Simulating the effects of the EU fiscal framework with the QUEST model

2.1 Brief description of the QUEST model

The European Commission's QUEST model is an applied macroeconomic model whose foundations can be characterised as a New Neoclassical synthesis model. Behavioural equations in the model are based on inter-temporal optimisation of households and firms with forward-looking expectations.[8] Unemployment arises in the model due to matching frictions, and wages are the result of firm-union bargaining. Prices adjust sluggishly and the nominal wages response is delayed because of overlapping wage contracts.

Since planning horizons are finite, there is no complete tax discounting and Ricardian equivalence does not hold. Moreover, a share of consumers is assumed to be liquidity-constrained, *i.e.*, has to finance consumption out of disposable income. The model has therefore Keynesian features in the short run, but the effectiveness of fiscal policy is more limited than in the traditional econometric models because of the built-in inter-temporal budget constraints.

Total consumption, C_t, is represented as the aggregation of the responses of two groups of households, one forward-looking group that follows the optimal consumption rule given by the life cycle/permanent income hypothesis and a liquidity-constrained group whose consumption depends on current disposable income:

$$C_t = (1-\lambda) * \delta [H_t + F_t] + \lambda * Ydis_t$$

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[7] The fiscal adjustment after phase II of EMU was based either on revenue increases or expenditure cuts depending on the countries considered and the time periods (see, e.g., Von Hagen, Hughes-Hallet and Strauch, 2001). Some countries adopted a "switching policy", whereby they raised revenues in the run-up to EMU and reduced government spending afterwards (Buti and Sapir, 1998).

[8] The model has a richer theoretical structure than applied traditional macroeconometric models in several respects. Compared with computable dynamic general equilibrium models it allows for adjustment costs and nominal rigidities. For more details, see Roeger and in 't Veld (1997, 2002).

where λ is the share of liquidity constrained consumption, H human wealth, F financial wealth and *Ydis* current real disposable income. Consumption and saving behaviour of the first group is based on inter-temporal utility maximisation of households under a finite planning horizon. Consumers decide how much to consume and how much to save each period by maximising the present discounted expected utility from the consumption stream subject to their intertemporal budget constraint. Human wealth H is the present discounted value of the entire future stream of after-tax income (including unemployment benefits *U.ben*):

$$H_t = E_t \sum_{j=0}^{\infty} b_{tj} \left[(1 - t_l) L_{t+j} w_{t+j} + U_{t+j} ben_{t+j} \right]$$

and financial wealth F equals the sum of total equity wealth, V, bonds and money holdings and net foreign assets, *NFA:*

$$F_t = V + B + M + NFA$$

The second group of consumers is "liquidity constrained" and cannot achieve inter-temporal optimisation. Hence, their consumption is a function of current real disposable income ("rule-of-thumb" consumers).

Turning to the investment specification in the QUEST model, this is based on profit maximisation by firms, assuming that investment is subject to adjustment costs (modelled as a convex function of the rate of change of the firm's capital stock). The optimisation problem yields the following investment rule:

$$I_t = \frac{1}{\phi} \left(\frac{q_t}{(PI_t / P_t)} - 1 \right) K_t$$

where ϕ is an adjustment cost parameter, K_t the capital stock and PI_t/P_t denotes the relative price of investment goods relative to the GDP deflator. The shadow price of capital, q_t, is equal to the marginal product of capital plus any anticipated future events which are expected to influence the marginal product after period t. Q_t is a function of current and discounted future expected profitability, including adjustment costs, and adjusted for profit taxes.

As for the working of fiscal policy in the QUEST model, short-run fiscal multipliers are normally positive, due to imperfect discounting and liquidity constraints (*i.e.*, increases in government expenditure and reduction in taxes raise output). Reduction in taxes boost output not only in the short-run (via a demand stimulus) but also in the long-run, due to increased investment and reduced distortions in the labour market. In the case of government expenditure, instead, the effects of fiscal expansions on output tend to vanish over the medium term and may even turn negative. As expected, future taxes affect permanent income, the expansionary effects of an increase in fiscal spending will be weakened if it leads to an increase in expected future tax liabilities.

As shown in Giudice, Turrini and in 't Veld (2004), expansionary fiscal policies via increases in governments expenditure may have almost nil or a negative medium-term impact on output in the QUEST model due to the offsetting behaviour of forward-looking households and firms. A first offsetting "non-Keynesian" channel works through consumption. A reduction in government expenditure in QUEST affects consumption of the liquidity-constrained households who see their current disposable income decline if wages and employment are falling. However, the non-liquidity-constrained households could increase their consumption as interest rates fall and if they anticipate higher disposable incomes in the future. The removal of distortions that this entails could boost employment and output and already affect life-time income in the short run.[9]

Besides the consumption channel, QUEST allows for the working of non-Keynesian effects through the investment channel. A reduction in public expenditure, in particular public employment, will raise unemployment and exert downward pressure on wages. This in turn tends to boost profits and raise investment spending.[10]

In general, the Keynesian effects of fiscal policy dominate in the model, at least in the short run, but, as shown in Giudice *et al.* (2003), under certain conditions these effects become so small that non-Keynesian effects soon become to dominate.

The monetary policy assumption in the scenarios described below is based on a forward looking Taylor-type rule. The monetary authorities are assumed to set short-term interest rates at a level that depends both on the deviation of the forecast of inflation from the target inflation rate and on the magnitude of the output gap. In the first benchmark simulation reported the risk premium on euro area interest rates is assumed to be independent of debt levels, while in subsequent simulations debt levels are allowed to affect the risk premium, and therefore the difference between euro-area and rest-of-the-world interest rates.

2.2 What would have happened without the EU fiscal framework? Counterfactual model simulation, benchmark scenario

To assess the effect of the EU fiscal framework on the EU economy, the difference between counterfactual (calculated from the fiscal rules as described in section 1) and actual budget balances, are given as shocks to the model. This

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[9] However, expansionary effects through the consumption channel may occur in the medium term, but if a sizeable share of households is liquidity constrained, the boost to consumers' spending that might result from lower future tax liabilities is not strong enough to offset the negative impact of the reduction in government spending on impact.

[10] This is the investment channel emphasised, for instance, in Alesina *et al.* (2002). This mechanism operates in the model through the wage setting specification which states that the real wage negotiated each period is the outcome of a Nash bargaining solution and depends on the reservation wage (value of leisure, unemployment benefits), labour productivity and a measure of labour market tightness (unemployment). If a fiscal expansion affects the latter and puts upward pressure on wages, it will have a negative effect on investment by lowering expected profitability.

counterfactual "absence of fiscal discipline" scenario is simulated to come fully into effect in 1994 and to last until 2010. Accordingly, primary budget balances are increased by 0.88 percent of baseline GDP over this period. To focus the simulation analysis on the effects of the size of the budget deficits rather than on those of the composition of budgetary adjustment, such shocks to budget balances have been equally split between revenues and expenditures in the model.[11]

Table 2 shows the results of this simulation for the euro area average. The fiscal loosening arising from the estimated fiscal rules implies an *ex post* increase in the deficit-to-GDP ratios of almost 1 percentage point on average for the euro area as a whole. The fiscal relaxation leads to a build-up of government debt over the years and by 2004, the debt-to-GDP ratio is more than 8 percentage points higher. In this counterfactual simulation, the fiscal loosening has a positive impact on GDP but the effects of a lasting fiscal expansion are relatively small. GDP is around 0.3 per cent higher in the first year, and this expansionary effect becomes gradually smaller in the following years. As for the impact on interest rates of the simulated counterfactual fiscal expansion, a small positive effect on interest rates is observed, with long rates 0.11 percentage points higher and real short term rates up by 0.06 percentage points on impact.[12]

The result that the fiscal multiplier appears as small and shrinking over time is due to the fact that the counterfactual increase in the deficit is rationally perceived as persistent by economic agents in the model. Permanent (or protracted) fiscal expansions have a much smaller impact multiplier than temporary expansions in the model since forward-looking agents immediately adjust their behaviour both to current and future changes in the policy environment. In particular, the anticipation of increasing future tax liabilities partly offsets the stimulus from higher current government transfers to households and lower taxes. Consumers' expenditure is boosted by higher transfer payments, but those consumers that are not liquidity-constrained anticipate a higher tax burden in the future and this suppresses their consumption growth to some extent. In addition, private investment is strongly crowded-out by the increase in fiscal spending due to increased real interest rates, wage pressure and expected higher tax liabilities in the future.

A further crowding-out effect arises via the behaviour of net exports. The conventional import leakage channel is reinforced by the fact that the demand expansion at home is accompanied by a jump appreciation of the exchange rate, followed by a gradual depreciation in following years. The resulting loss in competitiveness leads to a worsening of the trade balance.

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[11] More precisely, the shock to primary budget balances is equally split between taxes and expenditures. Shocks to taxes are in turn equally divided among three tax rates (labour income tax, corporate profit tax and value added taxes) and shocks to expenditures equally divided between transfers to households and government consumption.

[12] Nominal short-term interest rates are determined by a monetary policy rule which targets expected inflation and the output gap and assumes no change in the targeted equilibrium real interest rate. The fiscal expansion simulated has a small positive effect on inflation and output, leading to an increase in interest rates. The 10-year long rate is the forward convolution of short-term interest rates.

Table 2

Counterfactual Simulation of "No Fiscal Discipline"
(euro area, no impact of debt on interest rates risk premium)

	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	*2010*
GDP *(percent)* (Difference from baseline)	0.26	0.18	0.18	0.17	0.16	0.15	0.11	0.09	0.08	0.06	0.04	*–0.11*
Consumption *(percent)* (Difference from baseline)	0.53	0.51	0.54	0.56	0.58	0.58	0.59	0.59	0.60	0.61	0.62	*0.62*
Investment *(percent)* (Difference from baseline)	–0.86	–1.01	–1.08	–1.16	–1.25	–1.34	–1.45	–1.64	–1.85	–2.00	–2.11	*–3.16*
Short-term interest rate *(percent)* (Difference from baseline)	0.11	0.11	0.11	0.11	0.11	0.10	0.09	0.10	0.11	0.12	0.13	*0.10*
Long-term interest rate *(percent)* (Difference from baseline)	0.11	0.11	0.11	0.12	0.12	0.12	0.12	0.12	0.12	0.11	0.08	*–0.16*
Real short-term int. rate *(percent)* (Difference from baseline)	0.06	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.05	0.05	*0.04*
Euro-Dollar exchange rate *(percent)* (Difference from baseline)	–0.46	–0.34	–0.22	–0.12	–0.02	0.09	0.18	0.26	0.36	0.47	0.59	*1.32*
Trade balance/GDP *(percent of GDP)* (Difference from baseline)	–0.09	–0.11	–0.11	–0.11	–0.10	–0.09	–0.09	–0.08	–0.07	–0.06	–0.05	*0.03*
Deficit/GDP *(percent of GDP)* (Difference from baseline)	0.89	0.95	0.96	0.96	0.94	0.92	0.98	0.97	0.93	0.90	0.94	*0.94*
Debt/GDP *(percent of GDP)* (Difference from baseline)	0.25	1.16	2.03	2.88	3.69	4.49	5.26	6.07	6.90	7.61	8.28	*12.1*

In the counterfactual scenario presented above the effect of the increase in deficits and debt on interest rates is limited and risk premium is assumed to be unaffected by the debt/GDP ratio. In the following section, we analyse the potential effects an increase in public deficits and debt can have on interest rates taking also into account effects occurring through the risk premium.

2.3 Counterfactual simulations with risk premia effects

In order to allow for a response of the risk premium to changing debt ratios in the QUEST model it is first necessary to define a likely range of values for the impact of debt on risk premia in the average euro-area country. Existing empirical evidence on the relation between deficits, debts and interest rates are useful to guide this choice.

Empirical estimates of the effects of public deficits and debt on interest rates vary widely, depending on the data and methodology used, but most of the recent studies find significant effects of public deficits and/or public debt on interest rates. Existing studies referring to advanced economies indicate that an increase in the deficit of 1 per cent of GDP normally raises nominal interest rates by between 20 to 100 basis points and real interest rates by between 15 and 80 basis points (see, e.g., Gale and Orszag, 2003 and Brook, 2003). In general, available evidence indicates that the impact is relatively higher in the US than in EU countries. Another regularity observed is that estimates using debt measures as explanatory fiscal variable tend to find smaller impacts on interest rates compared with analyses using deficits as explanatory variable. This difference can be explained by the fact that an increase in the deficit will increase the steady-state debt level by the same amount only if temporary, while the increase will be several times higher if the increase in the deficit is persistent.[13]

Concerning the estimated impact of debt on interest rates in EU countries, Tanzi and Chalk (2000) run a pooled random effects regression of interest rates on debt over the years 1970-98 across EU countries and find that an increase in the average EU debt to GDP ratio of 10 percentage points leads to an increase in real interest rates of 0.6 percentage points. However, for the 1980-98 sub-sample the effect of debt amounts to be only 0.1 percentage points.

The analyses mentioned above refer to the relationship between deficits, debt and overall interest rates, without distinguishing to what extent the impact is due to changes in national savings or to modified risk premia on government bonds. A

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[13] Laubach (2003) studies the relationship between long-horizon expected government debt and deficits, as measured by official US projections, and expected future long term real interest rates. He finds that a 1 percentage point increase in the projected deficit-to-GDP ratio increases the 10 year bond rate expected to prevail in 5 years by 25 basis points. A percentage point increase in the projected debt-to-GDP ratio raises future interest rates by 4 to 5 basis points. For these estimates of the effects of deficits and debt to be consistent which each other, it implies that investors view the increases in projected deficit-to-GDP ratios as highly persistent, but not strictly permanent.

strand of the literature focuses more directly on the effect governments' fiscal positions have had on risk premia. Bernoth, Von Hagen and Schuknecht (2003) analyse differences between bond yields on government bonds of different EU countries and comparable bonds issued by Germany in the same currency over the period 1991-2002. Their findings are that an additional GDP point of debt raises yield spreads significantly but by a relatively small amount (by a bit more than 1 basis point).[14] In Alesina *et al.* (1992) the difference between government and private sector bonds denominated in the same currency is used as a proxy of credit risk premia and employed as dependent variable in regression analysis on a panel of 12 OECD countries over the period 1974-89. The study estimates an average impact of 1.6 basis points of each additional GDP point of debt when limiting the sample to high-debt countries.[15] The proxy used in Alesina *et al.* (1992) to measure credit risk has the main limitation of not being able to control for changes in private risk. A further limitation is that differences in liquidity risk are also not taken into account. In subsequent studies this issue has been addressed by measuring as a proxy of credit risk the difference between the interest rate on government bonds and the returns on swaps (with same maturity and denominated in the same currency). Since there is no principal at risk in swap contracts, such measure permits to control for differences in private risk. Adopting such measure for credit risk, Lemmen and Goodhart (1999) estimate an impact of 1.5 basis point for each additional percentage point of the debt-to-GDP ratio in a panel of EU countries. Codogno, Favero and Missale (2003) disentangle the credit risk component from the liquidity premia component in interest rate swaps and find that debt ratios are not significant in explaining interest rate swap spreads in most EU countries, with the exception of Spain, Italy and Austria, where debt has been found to be a significant and quantitatively relevant explanatory factor.

Given the strong evidence of a significant effect of governments' fiscal positions on interest rates, the counterfactual simulation described in section 2.2 is repeated here to include a risk premium effect in line with this evidence. As estimates based on (projected) deficits depend on the expected persistence of such deficits, the first scenario (reported in Table 3.a) incorporates an additional risk premium effect of 1 basis point per 1 percentage point increase in government debt, corresponding to a risk premium of 10 basis points when the debt-to-GDP ratio has increased by 10 percentage points.[16] This corresponds to the estimates in Tanzi and Chalk (2000) for the EU in the later sample 1980-98 and is also in line with estimates found of risk premia on governments bonds. Compared to some of the other estimates found in the literature, it is however on the low side, and an

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[14] The estimated impact is much lower than that found in Bayoumi, Goldstein, and Woglum (1995), analysing the impact of the debt of US municipalities over their own interest rate spreads.

[15] A similar result is found in Caselli, Giovannini, and Lane (1998).

[16] Technically, in this simulation the risk premium in the uncovered interest parity condition in the model, linking expected exchange rate changes to interest rate differentials, appears as a linear function of the differences in the debt-to-GDP ratio from that in the baseline. The implicit assumption is that changes in the risk premium in government bonds fully spill-over to private sector bonds.

Table 3

Counterfactual Simulation of "No fiscal Discipline" with Risk Premium (Euro Area)

3.a – 10 Basis-point Increase in Risk Premium for a 10 per cent Increase in Debt/GDP

	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	*2010*
GDP *(percent)* (Difference from baseline)	0.20	0.13	0.09	0.07	0.04	0.00	–0.03	–0.05	–0.08	–0.11	–0.14	*–0.28*
Consumption *(percent)* (Difference from baseline)	0.36	0.11	0.22	0.22	0.23	0.24	0.25	0.27	0.29	0.30	0.32	*0.38*
Investment *(percent)* (Difference from baseline)	–1.62	–2.03	–2.21	–2.41	–2.57	–2.73	–2.93	–3.15	–3.35	–3.49	–3.59	*–4.09*
Short-term interest rate *(percent)* (Difference from baseline)	0.11	0.10	0.10	0.11	0.11	0.12	0.15	0.17	0.18	0.19	0.21	*0.20*
Long-term interest rate *(percent)* (Difference from baseline)	0.13	0.14	0.16	0.17	0.18	0.19	0.20	0.21	0.21	0.20	0.17	*–0.08*
Real short-term int. rate *(percent)* (Difference from baseline)	0.06	0.04	0.04	0.04	0.05	0.05	0.06	0.07	0.07	0.08	0.08	*0.08*
Euro-Dollar exchange rate *(percent)* (Difference from baseline)	1.42	1.53	1.59	1.65	1.70	1.74	1.79	1.85	1.91	1.97	2.04	*2.41*
Trade balance/GDP *(percent)* (Difference from baseline)	0.00	0.10	0.10	0.13	0.14	0.15	0.18	0.18	0.18	0.19	0.19	*0.16*
Deficit/GDP *(percent of GDP)* (Difference from baseline)	0.92	1.00	1.00	1.01	0.98	0.96	1.04	1.02	0.99	0.96	1.00	*1.01*
Debt/GDP *(percent of GDP)* (Difference from baseline)	0.30	1.25	2.20	3.10	3.94	4.79	5.57	6.40	7.26	7.99	8.67	*12.58*

3.b – 20 Basis-point Increase in Risk Premium for a 10 per cent Increase in Debt/GDP

	1994	*1995*	*1996*	*1997*	*1998*	*1999*	*2000*	*2001*	*2002*	*2003*	*2004*	*2010*
GDP *(percent)* (Difference from baseline)	0.15	0.08	0.00	–0.04	–0.09	–0.17	–0.17	–0.20	–0.24	–0.29	–0.33	*–0.47*
Consumption *(percent)* (Difference from baseline)	0.17	–0.11	–0.13	–0.14	–0.14	–0.13	–0.12	–0.08	–0.05	–0.03	0.00	*0.13*
Investment *(percent)* (Difference from baseline)	–2.46	–3.16	–3.44	–3.77	–3.99	–4.22	–4.53	–4.77	–4.96	–5.05	–5.08	*–5.18*
Short-term interest rate *(percent)* (Difference from baseline)	0.12	0.10	0.08	0.12	0.11	0.13	0.21	0.24	0.25	0.27	0.30	*0.30*
Long-term interest rate *(percent)* (Difference from baseline)	0.17	0.18	0.20	0.23	0.25	0.27	0.29	0.30	0.30	0.30	0.27	*0.00*
Real short-term int. rate *(percent)* (Difference from baseline)	0.05	0.04	0.03	0.05	0.05	0.05	0.08	0.10	0.10	0.11	0.12	*0.12*
Euro-Dollar exchange rate *(percent)* (Difference from baseline)	3.51	3.59	3.59	3.59	3.59	3.54	3.55	3.58	3.59	3.60	3.62	*3.59*
Trade balance/GDP *(percent)* (Difference from baseline)	0.09	0.34	0.34	0.38	0.41	0.42	0.47	0.47	0.45	0.45	0.44	*0.30*
Deficit/GDP *(percent of GDP)* (Difference from baseline)	0.96	1.05	1.05	1.05	1.01	0.99	1.10	1.09	1.05	1.02	1.07	*1.08*
Debt/GDP *(percent of GDP)* (Difference from baseline)	0.36	1.35	2.39	3.33	4.22	5.12	5.90	6.76	7.65	8.40	9.10	*13.06*

alternative scenario with a risk premium of 2 basis points for a 1 percentage point increase in the debt-to-GDP ratio is also shown (Table 3.b).

The results when risk premia are taken into account are markedly different from the scenario described in Table 2. The positive GDP effects of a fiscal expansion are now short-lived and have almost disappeared after a few years. The risk premium leads to higher interest rates and crowding out of private spending. The stimulus to private consumption is in this case about half as large, while private investment falls further below base. With a larger risk premium (Table 3.b) the increase in interest rates more or less offsets the boost the fiscal expansion gives to private consumption and spending falls back to levels around base. In this case the crowding out of private investment is much stronger and it illustrates the large effect public debt can have on capital accumulation. The exchange rate depreciates, by 1.5 and 3.5 per cent respectively, and the gains in competitiveness and lower demand in later years is associated with an improvement of the trade balance. But the increase in net exports is not enough to offset the decline in private demand and GDP falls below base in the medium run.

Hence, when effects of persistent deficits and rising debt on interest rates are taken into account, the results under a scenario of absence of fiscal discipline turn out to be only temporarily positive, but with larger adverse effects in the medium term (Figure 1). According to these simulations, the EU rules-based fiscal framework has only had a temporarily negative impact on growth in the short run, but it has helped to avoid a situation in which accumulating public debt would have crowded-out private investment and reduced potential growth in the medium and long term.

3. Conclusions

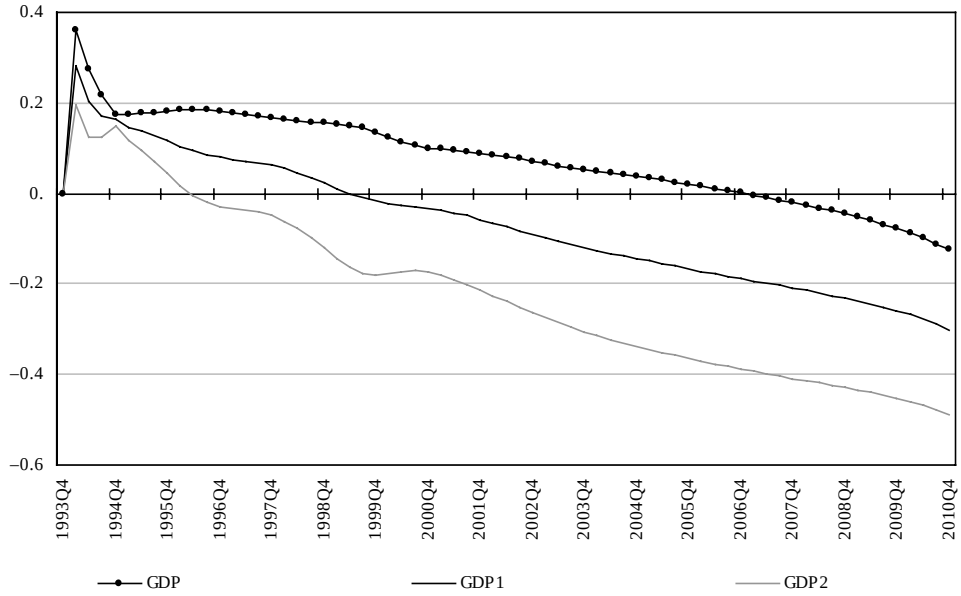
The aim of this paper was that of providing a quantitative assessment of the impact that the introduction of the EU fiscal framework contained in the Maastricht Treaty and the Stability and Growth Pact had on economic activity in the EU.

Our analysis was based on two steps. In a first steps we estimated counterfactual budget balances that would have prevailed in the euro-area in absence of the EU fiscal framework via the estimation of fiscal rules. A comparison based on fiscal rules estimated before and after the second phase of EMU (*i.e.*, 1994) shows that the changes in behaviour of the fiscal authorities were quite significant, with euro-area countries running on average primary balances higher by almost 0.9 GDP points after 1994.

In a second step, the estimated counter-factual primary budget balances have been used to provide shocks to the European Commission's QUEST model, in order to simulate which impact this scenario of "absence of fiscal discipline" would have had on the euro area. Simulations show that this protracted budgetary expansion would have led to an accumulation of almost 8 per cent of GDP of additional government debt over the 1994-2004 period. Its impact on GDP would have been

Figure 1

Counterfactual absence of fiscal discipline scenario
(Euro-area GDP, 1994-2010)



Note: GDP = no risk premium; GDP1 = risk premium of 1 basis points per 1 percent point increase debt; GDP2 = risk premium of 2 basis points per 1 percent point increase debt.

positive but would have shrunk progressively, to become negative in the long run (by 2010). The direct positive impact on aggregate demand due to increased expenditure and reduced taxation would have been offset over time by the crowding-out of private investment. Such offsetting effect of private investment becomes even stronger when an impact of debt on interest rate risk premia is taken into account. In that case, the gains from an absence of fiscal discipline over the last decade would have been even smaller in the short run, and would have become negative already after few years (after 6 years or 3 years, depending on whether risk premia are assumed to increase by 1 or by 2 basis points for each additional GDP point of debt).

We are aware of the limitations of the analysis, in particular of the problems of robustness and precision in the estimation of counterfactual budget balances associated with the small number of degrees of freedom to estimate fiscal rules. However, the qualitative results obtained are independent of the exact size of counterfactual deficits: a protracted increase in primary balances would have had a small positive effect on GDP at impact that would have faded away to turn negative after some years.

Overall, the analysis suggests that the EU fiscal framework as provided by the Treaty and the SGP has not had long-term negative consequences, but instead has helped to avoid a situation in which accumulating public debt would have crowded-out private investment and reduced potential growth.

ANNEX

Table A1

The EU fiscal framework and budgetary behaviour (EU-11)

	BE	DK	DE	EL	ES	FR	IE	IT	NL	AT	PT	FI	SE	UK
Pre-EMU phase II														
Output gap	0.25*	1.44	–0.23***	0.18	–0.03	0.14	–0.55***	–0.14	0.02	0.32	0.03	0.30**	–0.17	0.20
	(0.53)	(1.72)	(–2.00)	(0.80)	(–0.15)	(0.58)	(3.11)	(–0.73)	(0.07)	(1.16)	(0.24)	(2.57)	(–0.27)	(1.37)
Debt at t–1	0.04**	0.07***	0.00	0.00	0.01	–0.04	0.04*	0.06***	0.03	0.02	0.09***	–0.12*	0.03	0.01
	(2.87)	(3.44)	(0.00)	(0.26)	(0.66)	(–1.15)	(2.07)	(3.26)	(1.17)	(0.85)	(4.05)	(–1.79)	(0.72)	(0.44)
Primary budget balance at t–1	0.58**	0.27	0.52***	0.58***	0.81**	0.41	0.69***	0.41**	0.31	0.46**	0.44***	0.25	1.01***	0.66***
	(2.66)	(1.13)	(4.12)	(3.58)	(2.59)	(0.76)	(6.45)	(2.28)	(0.92)	(2.58)	(3.26)	(1.25)	(3.74)	(5.99)
Constant	–3.99**	0.51	0.30	–1.31	–0.58	1.20	–2.97*	–6.02***	–0.91	–0.52	–4.91***	5.29*	–1.80	–0.96
	(–2.88)	(0.59)	(0.26)	(–1.55)	(–1.12)	(1.05)	(–2.02)	(–3.15)	(–0.73)	(–0.55)	(–4.10)	(2.86)	(–1.08)	(–0.59)
No. of observations	23	22	22	23	23	16	23	23	18	23	20	23	23	23
R square	0.7473	0.8217	0.3987	0.47	0.594	0.363	0.83	0.649	0.333	0.527	0.711	0.829	0.594	0.660
F	36.37	58.99	13.89	9.49	8.56	1.77	33.8	16.55	3.44	3.71	15.05	106.82	13.02	15.59
Post-EMU phase II														
Output gap	0.57*	1.82**	2.74***	0.10	0.07	0.25	1.07***	0.65*	1.25***	0.47	0.25	0.83**	1.23	5.75
	(2.41)	(3.12)	(9.04)	(0.17)	(0.26)	(0.52)	(4.72)	(1.22)	(5.25)	(1.55)	(1.88)	(2.78)	(1.65)	(1.50)
Debt at t–1	0.00	–0.02*	0.29***	0.13	0.07	0.14	0.23***	0.16**	0.14***	0.35***	0.29**	–0.08	0.21*	–0.09
	(0.10)	(–0.44)	(8.60)	(0.55)	(1.20)	(0.65)	(4.10)	(2.71)	(6.43)	(3.93)	(3.20)	(–0.45)	(2.03)	(–0.38)
Primary budget balance at t–1	0.35	–0.18	–0.88***	0.23	0.79**	0.18	–0.40	0.36	–0.37	0.59***	–0.42*	0.17	0.60**	–0.24
	(1.13)	(–0.35)	(–7.95)	(1.01)	(3.04)	(0.20)	(–1.67)	(1.92)	(–1.29)	(5.52)	(–2.13)	(0.61)	(2.55)	(–0.35)
Constant	3.62	7.19	–15.02***	–10.04	–3.87	–7.29	–9.98**	–15.53*	–5.20***	–22.41***	–16.51**	7.91	–11.79	4.86
	0.73	(1.39)	–(8.36)	(–0.39)	(–0.99)	(–0.65)	(–2.49)	(–2.30)	(–4.93)	–(3.96)	–(3.13)	(0.78)	(–1.73)	(0.46)
No. of observations	10	10	10	10	10	10	10	10	10	10	10	10	10	10
R square	0.789	0.828	0.924	0.197	0.891	0.685	0.701	0.612	0.921	0.874	0.628	0.937	0.791	0.900
F	13.67	6.84	30.69	1.15	18.43	13.46	7.81	4.99	71.19	33.51	3.64	74.76	9.98	28.29

Note: Z statistics reported in parenthesis. ***, **, * denote statistical significance at, respectively, 1, 5, and 10 per cent level. A lower number of observations for France and the Netherlands are due to missing data for debt in the early Seventies. An outlier for the German primary balance has been identified in 1975 and has been consequently dropped from the sample. The output gap variable is instrumented using its own lag and the lagged US output gap. All variables are expressed as a percentage of trend output.

Table A2

Difference Between Counterfactual and Actual Primary Budget Balances
(percent of trend GDP, annual average over the 1994-2003 period)

Country	Primary balance
Belgium	–0.25
Germany	–0.05
Greece	–3.40
Spain	–0.44
France	–1.52
Ireland	–2.40
Italy	–1.30
Netherlands	–1.02
Austria	–0.28
Portugal	0.30
Finland	–4.00
EU-11 (average)	–0.88

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MARKET-INDUCED FISCAL DISCIPLINE: IS THERE A FALL-BACK SOLUTION FOR RULE FAILURE?

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Introduction

Sound fiscal policies are considered a precondition for monetary and financial stability. Fiscal misbehaviour may undermine the credibility of the Central Bank's commitment to monetary stability. A high public debt may induce pressure for both *ex ante* bail-out (refraining from raising interest rates under inflationary tensions) and *ex post* bail-out (debt relief through unanticipated inflation). Unsustainable fiscal policies have often been at the root of episodes of high inflation or even hyperinflation.

In situations where a number of governments share the same currency and retain autonomy in matters of public expenditure, taxation and recourse to debt, the stability of monetary and financial conditions represents a public good. Governments individually face a less steep interest rate schedule in a monetary union than under flexible exchange rates. There is an incentive for each government to exploit the benefits accruing from the discipline of others without complying with the rules.

Hence the need for discipline-inducing mechanisms.

The pros and cons of fiscal rules at the national level have long been debated. Both theoretical and empirical work reached ambiguous results.[1] However, when European monetary union (EMU) was devised, the need for rules counteracting undisciplined fiscal behaviour was widely recognised.[2] Several of the founding members of the EMU had bad fiscal records. Past experience suggested not relying on market mechanisms. In 1992, the Treaty of Maastricht set the fiscal criteria to be met in order to join EMU. Limits on deficit and debt levels were introduced (at 3 per cent and 60 per cent of GDP, respectively). In 1997, the Stability and Growth Pact (SGP) complemented these criteria by setting a medium term target of a budgetary position close to balance or in surplus, with a view to permanently restraining deficit and debt while allowing room for fiscal stabilisation.

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[1] See Kopits and Symansky (1998), Balassone and Franco (2001a), Giordano (2003) and the papers in Banca d'Italia (2001).

[2] See Committee for the Study of Economic and Monetary Union (1989) and European Commission (1990). Canzoneri and Diba (2001, p. 71) note that "… the central bankers who wrote the Delors Report knew that it was impossible to make the ECB totally immune from external pressures".

Over the Nineties EMU fiscal rules were quite successful in inducing all EU countries to improve their budgets. The euro area deficit declined from about 5 per cent of GDP to 1 per cent in 2000. However, in recent years new priorities came to the fore. In particular, the issue of tax reforms gained prominence and tax cuts were introduced in several countries. Together with the slowdown of the economy in 2002, these cuts reversed the deficit reduction process.

In 2002 and 2003 France, Germany, Greece, the Netherlands, Portugal and Italy recorded budget deficits which were clearly inconsistent with the close-to-balance clause of the SGP. In most of these countries the deficit reached or exceeded 3 per cent of GDP. Moreover, one-off measures have been extensively used to meet budgetary targets. New accounting and financial operations – which, even if formally consistent with EMU rules, do not improve the underlying public finance conditions – have also been relied upon.

The SGP is now widely criticised. It is argued that it reduces budget flexibility, discourages public investment, disregards the aggregate fiscal stance and works asymmetrically over the cycle.[3] The current framework may come under further pressure because of the EU enlargement.

The debate about the future of the SGP is quite open. Not all the criticisms are warranted and no alternative rule clearly dominates the present one. In the end, the European governments may retain the SGP in view of its capacity to combine fiscal discipline and flexibility, of the budgetary risks coming from population ageing and of the difficulty to reach an agreement about an alternative set of rules. However, there is also the possibility that the SGP survives but becomes an empty shell.

In this context it is important to consider whether there is a fall-back solution, that is whether financial market mechanisms linking higher deficits to higher interest rates can put pressure on governments to correct fiscal misbehaviour.[4] This implies reconsidering, in the light of recent developments, the debate that took place in the late Eighties when the EMU was designed.

In this paper, we tackle this issue in three steps. First, we examine the institutional requisites for a market mechanism to be effective at disciplining fiscal policy and check whether such requisites are met in the current European setting (section 1). Second, we explore the theoretical and empirical link between a country's fiscal record, the rating of its debt and the risk premium embodied in the interest rates it is demanded to pay (section 2). Third, we discuss, also by looking at

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3 For a review and an assessment of the debate see Buti *et al.* (2003) and Franco *et al.* (2003).

4 A similar issue arises in decentralised countries where sub-national governments' fiscal discipline can be ensured via either market incentives or fiscal rules. See Balassone and Franco (2001b) and Balassone *et al.* (2004a).

few case-studies, the factors determining governments' sensitivity to market signals and their willingness to change their fiscal stance accordingly (section 3).

1. Prerequisites for market effectiveness

1.1 Theory

Default premia and credit constraints could in principle discipline irresponsible sovereign borrowers. Market-based fiscal discipline would initially take the form of a rising interest premium on the debt of a country running excessive deficits. If these deficits persisted, the interest premium would increase at an increasing rate until, eventually, the offending country could be denied access to additional credit. The increase in the cost of borrowing along with the threat of reduced availability of credit would then provide the incentive to correct irresponsible fiscal behaviour. The key question is whether and under what conditions will credit markets provide sufficient incentives to restrain irresponsible borrowing.

Bishop *et al.* (1989) indicate four conditions to be met for the market to be effective:

a) there is freedom of movement of capital;

b) full information on sovereign borrowers is available;

c) the market assumes that there is no external guarantee and no possibility of monetisation;

d) the financial system can absorb the bankruptcy of a sovereign borrower.

Lane (1993) identifies the following four necessary conditions:

a) no government unit should have privileged access to the market;

b) the market must have access to all the information necessary to evaluate the financial reliability of each unit;

c) the bailing-out of troubled government units must not be allowed;

d) borrowers must respond to market signals.

The two sets of conditions are similar. Both cases require that the central bank is independent.

Privileged access may take different forms: direct financing by Central Banks, preferred financing by banks, differential treatment of public bonds with respect to the tax system or to accounting rules.

The evaluation of a government's financial situation can be hindered by insufficient information and/or by "creative accounting". Difficulties may be amplified by differences between public and business accounting rules.

The credibility of the ban on bail-outs depends on both the capability of the financial system to withstand the failure of a "large" borrower and on the role played by governments in providing main public services and goods. A sovereign borrower may get too big for any market and may be directly responsible for the provision of essential services so that the costs of a bailout may be outweighed by those of its failure. The no-bail-out clause would consequently become an empty shell.

According to Lane (1993), if any of the three conditions above is not met, market signals risk coming too late and the change in market perception of the state of government finances may change too suddenly with possibly disruptive consequences.

1.2 The European case

The possibility to rely on market-induced fiscal discipline was considered when defining the conditions to be met by a country before joining EMU.

Advocates of the market approach argued that the effectiveness of market discipline would have been enhanced in EMU both by the likely higher capital mobility induced by the single currency and by the credibility of the no-bail-out commitment stated in the Treaty. The EMU wide capital market would have also been more robust to shocks caused by borrowers' failure (Bishop *et al.*, 1989).

CEPR (1991) argued that market reactions would not have been sufficient to tackle the problem of fiscal discipline in a monetary union. It noted that "the true sanction – the denial of further lending – comes too late and too abruptly. There is a quantum jump between rising rates of interest and the inability to borrow" (p. 34). It also noted that "the mere threat of a liquidity crisis may prompt financial intermediaries to act in anticipation and deny further lending at a relatively early stage" (p. 34). However, CEPR also suggested that these shortcomings could have been corrected by introducing proper prudential rules for the financial systems and rejected fiscal rules as unnecessary and unwise.

The Delors Committee acknowledged that market forces can exert a disciplinary influence but noted that the "constraints imposed by market forces might either be too slow and weak or too sudden and disruptive" (Committee for the Study of Economic and Monetary Union, 1989, p. 24). The Committee concluded that countries in EMU should have accepted some constraints on their fiscal policy.

Lamfalussy (1989) pointed out that closer economic integration might generate expectations that a country in critical conditions would be bailed out in the end by the other countries. For this reason, the fiscal stance of governments might have not been fully embedded in credit risk premia.

The European Commission (1990) took a similar view: financial markets differentiate among sovereign borrowers, but "it cannot be taken for granted that market discipline would be sufficient, due to expectations of Community assistance

and/or inadequate response of governments to market signals" (p. 112). It concluded that there was a need for rules and procedures at the Community level.

These views are to be considered in the context of the period. Several of the founding members of the EMU had bad fiscal records. Widening general government deficits and corresponding rises in government debt were observed in many countries till the early Nineties. Between 1989 and 1993 public deficits in the EU as a whole increased by 3.8 percentage points, to 6.0 per cent of GDP. Debt-to-GDP ratios were also on an upward path in most countries. For the Union as a whole, the debt ratio rose from 54 per cent in 1989 to 72 per cent in 1996. Some countries had two-digit deficit ratios and debt ratios above 100 per cent. These circumstances did not suggest that market discipline had been especially effective in Europe.[5]

Moreover, accounting practices for general government were not homogeneous across Europe, even in national accounts, thus providing further obstacles to effective risk assessment by market agencies and investors.

In the end, regulation was seen as a necessary supplement to market forces.

The crisis in which the SGP has plunged in 2003 induces to reconsider the issue.

As to the conditions laid down by Bishop *et al*. (1989) and Lane (1993), the situation is differentiated. Some conditions are fulfilled, others remain problematic.

In the EMU framework, the freedom of movement of capital is ensured and governments' privileged access to the market is not allowed. The Maastricht Treaty established the independence of the European Central Bank, prohibited the ECB and the National Central Banks from directly financing governments and prohibited governments from having privileged access to the financial market.

The information available to market agents on government finance have greatly improved. Thanks also to the statistical requirements provided for by the Treaty and the SGP, homogeneity in accounts has markedly increased. Controls on the accounts are routinely conducted by Eurostat and the European Commission. However, some problems remain open. In order to meet the short term targets, countries have frequently adopted one-off cash-raising measures instead of making the necessary structural adjustment. Monitoring has been hampered by delays in data provision, with the implication that the whistle has often been blown far too late (Balassone *et al*., 2004b). Data on off-budget liabilities and budgetary prospects have generally been rather limited.

The credibility of the no-bail-out commitment remains an open issue, at least for large highly indebted countries playing a major role even in the large European

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[5] However, it must be acknowledged that in some countries market reactions were restrained by restrictions to capital movements and by preferential access to financial markets.

financial market. Still in 1997 the IMF noticed that "although the no-bail-out clause in the Maastricht Treaty rules out the possibility of direct EU assistance to individual EU member countries, it is unlikely that market participants will price sovereign debt as if it were corporate debt" (IMF, 1997, p. 192). After 1997, interest rate spreads among European sovereign borrowers have declined markedly. This may reflect either the trust of markets in the disciplining effect of EMU fiscal framework or their expectation of a (at least partial) bail-out for high debt countries in case of difficulties.

2. Fiscal conditions, credit ratings and risk premia

Governments can reduce the real value of their current liabilities in two ways. They can increase inflation above what was expected by the market at the time government bonds were issued, so that the nominal interest rate does not entirely reflect effective inflation. Alternatively, they can repudiate their debt, either in the form of a simple cancellation by law of their debt obligations or of some tax with retroactive effects on debt repayments.

Both inflation and default risks are priced by the market. When investors perceive such risks, they ask compensation for them, which raises the cost of government debt service.

The inflation risk can be eliminated or reduced by issuing government debt denominated in domestic currency and indexed to domestic inflation, by issuing debt denominated in foreign currency (Giavazzi and Pagano, 1990), and by shortening the maturity of government debt (Missale and Blanchard, 1990).

The default risk increases when devaluation by means of inflation is not allowed. It can be reduced by lengthening the maturity of public debt (Drudi and Giordano, 2000).

Before EMU, yield differentials within Euro area countries were determined, in addition to inflation and default risk, by expected exchange rate movements (which should also incorporate inflation expectations), differences in tax treatments and liquidity.

The loss of monetary sovereignty has made it impossible for EMU countries to pursue independent inflation policies and has enhanced the exposure of EMU national governments to default risk. Since inflation risk is likely to be the same for every country in the EMU zone, intra-EMU exchange risk is zero and tax treatments are somewhat harmonised across countries belonging to the Union, yield differentials in the area should mainly reflect differences in creditworthiness and liquidity.

Identifying and measuring the impact of each determinant of yield differentials is not easy. In empirical studies this task has been typically

accomplished by using different definitions of spreads. This solution is however somehow problematic. Creditworthiness has often been related to: a) the level, composition and rate of change of public debt; b) institutions and rules; c) macroeconomic conditions.

Information on country risk is also available to market participants via credit ratings produced by specialised agencies. Such ratings are based, for the most, on the analysis of few macroeconomic variables.

In the sections which follow we examine the determinants and characteristics of sovereign ratings and review the results obtained by a number of selected empirical studies aiming at testing whether and to what extent fiscal fundamentals are priced by the market.[6] We supplement this analysis with an heuristic examination of available data.

2.1 Sovereign ratings

Ratings are summary measures of assessments over the probability that a borrower will default. Given the large economies of scale in processing the information to assign ratings and the time necessary to build up the needed reputation, the rating industry is highly concentrated. There are only three agencies performing a significant worldwide activity (Moody's, Standard & Poor's and Fitch-IBCA). In general, ratings assigned to the same borrower do not differ much.

Ratings are inversely correlated to yields. The relationship is non-linear, *i.e.* increases in yield corresponding to a single notch decrease in rating get larger as the rating worsens.

Furthermore, ratings may affect the number of potential investors either discouraging the more risk-averse or because statutes and regulations of some investors demand higher provisions for lower rating assets and do not allow to buy assets carrying ratings below a certain level (Dale and Thomas, 1991; Cantor and Packer, 1997).[7]

The extent to which ratings reinforce market signals also depends on whether the rating agencies lead the market (thereby conveying additional information to market participants) rather than follow it (thereby simply summarising information already available to market participants).

In their statements on rating criteria, major agencies list numerous economic, social and political factors. However the relative weight given to each factor is

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6 A summary of the results obtained for EU countries is also presented in Table 1A at the end of the paper.

7 In this respect, it should be noted that the Basel accord introduces the use the credit assessment of the leading rating agencies for determining risk weights for sovereign bonds. Only sovereign bonds rated AA or more would get a zero risk weight. Below that rating level the risk weight rises gradually.

difficult to assess as some factors are difficult to quantify[8] and agencies, for obvious reasons, provide relatively little guidance on the issue (Standard & Poor's, 1994; Huhne, 1996; Truglia, 1998).

Cantor and Packer (1996) focus on "eight variables that are repeatedly cited as determinants of sovereign ratings" (p. 77): per capita income, GDP growth, inflation, central government debt, external balance, foreign currency debt, economic development and default history. They run OLS regressions relating Moody's and Standard & Poor's ratings to these 8 variables for a sample of 49 countries and find that they explain more than 90 per cent of the sample variation. Somewhat surprisingly, however, central government debt turns out not to be significant.

Sy (2001) reports the findings of a follow up study whereby the factors identified by Cantor and Packer continue to adequately explain ratings in 1996 and in 1997. The relationship breaks down in 1998 though, in the wake of the Asian crisis.

Indeed, the reliability of ratings as indicators of the probability of a crisis and, possibly, of a default has been questioned after the Asian crisis. Ferri *et al.* (1999) argue that "credit rating agencies aggravated the East Asian crisis. In fact, having failed to predict the emergence of the crisis, rating agencies became excessively conservative. They downgraded East Asian crisis countries more than the worsening in these countries' economic fundamentals would justify" (p. 335).[9]

The inability of rating agencies to forecast the East Asian crisis has been stressed by international financial institutions (BIS, 1998; IMF, 1998, World Bank, 1998) and acknowledged by the agencies. After the crisis, the latter revised their rating models to give more weight to short-term foreign currency debt (Fitch-IBCA, 1998; Truglia, 1998).

Reisen (2000) argues that there are reasons to have less confidence in sovereign ratings than in US corporate ratings and that pricing in markets reflects these lower degree of confidence, as the correlation between ratings and yields is lower for sovereign than for corporate bonds. He takes a rather pessimistic view by arguing that "sovereign ratings lag rather than lead the markets" and that "it seems that there is little scope to improve on that performance" (p. 77).

However, there is some evidence that ratings lead the market.

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[8] Beers (1997), after explaining that the S&P ratings are a summary measure of scores assigned to a number of factors determining economic and political risks, points out that "there is, however, no exact formula combining the scores to determine ratings" (p. 462).

[9] See also Ruggerone (2003).

Cantor and Packer (1996) show not only that ratings are highly correlated with yield spreads[10] but also that rating announcements may cause a change in the market's assessment of sovereign risk. They find that changes in ratings are anticipated by the market in the sense that relative spreads increase (decrease) in the month preceding a downgrading (upgrading). However, they also find that spreads increase (decrease) further after the announcement of the downgrading (upgrading.). These results are essentially confirmed by Reiser and von Maltzan (1999).

Standard and Poor's (1994) reports that yields are relatively insensitive to downgrading as long as the ratings stays above-investment-grade, while yields become very responsive to even small downgrading when the rating plunges below-investment-grade. This is confirmed by Ferri *et al*. (1999). They analyse the impact of downgrading during the East Asian crisis (which was in many cases large, down to the lower B-notches and even into C-notches) and find that "after the downgrading the yield spread of East Asian crisis countries' bonds denominated in USD with respect to US Treasury bonds of equivalent maturity significantly rose" (p. 343).

Larrain *et al.* (1997) find that rating changes Granger-caused yield spreads during the Asian crisis. However, Reisen and von Maltzan (1999) run a Granger causality test correcting for joint determinants of ratings and spreads and find that sovereign ratings are mutually interdependent with changes in bond yields.

Reinhart (2002) argues that "… sovereign credit ratings systematically fail to anticipate currency crises but do considerably better predicting defaults" (p. 21). She points out, however, that downgrading usually follows currency crises, possibly highlighting how currency instability increases default risk.

Overall the available evidence seems to suggest that the credit rating system is effective in signalling fiscal crisis which are well under way, but cannot be relied upon to anticipate crisis at an early stage.

2.2 Yield spreads

Several papers have investigated interest rate spreads in recent years. This section examines three strands of empirical work, referring to the US experience, to OECD and EU countries.

States and municipalities in the USA

Capeci (1991) considers general obligation issues by 136 US municipalities in 1982 and 1987 to investigate how the market reacts to changes in credit quality,

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[10] They find that ratings alone explain a higher percentage of variation of yield spreads in their sample than the eight macroeconomic variables on which they base their rating analysis.

both directly and indirectly through changes in credit ratings. He finds that both the credit rating and the cost of borrowing are sensitive to changes in the fiscal condition of the issuer (in particular, the size of its tax base and its debt burden). The effects of changes in the rating on the cost of borrowing are less clear.

Drawing on a set of survey data on general obligation bond yields for US states,[11] Bayoumi *et al.* (1995) test the "market discipline hypothesis". They focus on an important aspect of such hypothesis, that is the existence of a non-linear relationship between yields and debt variables. Bayoumi *et al.* specify an equation for the yield spread (relative to the yield on the New Jersey bond) that includes, in addition to state tax rates and the ratio of state debt to trend gross state product, the unemployment rate, to account for cyclical factors, and a measure of the strength of constitutional constraints on state borrowing. There are two coefficients associated with debt, respectively measuring the level effect of debt on yields and the non-linearity caused by the interaction between yields and interest payments.[12]

The results by Bayoumi *et al.* are broadly consistent with the market discipline hypothesis. All coefficients, with the exception of that on the tax rate, turn out to be significant at conventional levels. More interestingly, the statistical significance and the point estimates of the second coefficient on debt imply a highly non-linear supply curve.[13] The authors thus conclude that credit markets do appear to provide incentives for sovereign borrowers to restrain borrowing.

OECD countries

Alesina *et al*. (1992) investigate whether high debt countries pay a default risk premium on their debt by comparing the interest rates on public and private financial instruments denominated in the same currencies in 12 OECD countries over the period 1974-89. In particular, they measure the default risk either by the difference between the public interest rate and the private interest rate or by the ratio of the two of them. The problem with these measures is that they depend on changes

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[11] The sample consists of 38 states over the period 1981-90 (380 observations).

[12] The right-hand side of their supply function contains, in addition to a constant and annual dummy variables, a ratio where in the numerator appears the sum of all explicative variables, including the quantity of outstanding debt (B); in the denominator there is the term $1-\alpha B$. The equation is estimated using non-linear, two-stage least squares. If the estimated coefficient on B in the denominator, α, turns out to be zero, then the supply function is linear, implying that the market will accept any level of debt at a constantly increasing default premium. If, instead, the coefficient is greater than zero, the supply function is non-linear with a maximum quantity supplied given by 1over the estimated coefficient.

[13] The mean debt ratio in the sample is 2.3 percent, with a maximum and minimum of 7.1 and 0.2 percent. The mean yield spread is 32.4 basis points; the maximum spread is 146.4. At the mean values of the sample, each percentage point increase in the debt ratio raises the yield by 23 basis point, but the slope rises to over 35 points at debt levels which are one standard deviation above the mean. A backward bend in the supply curve occurs at a level of debt equal to 8.7 percent of gross state product, about 25 percent higher the maximum debt observed in the sample.

in private risk. Moreover they cannot distinguish between credit risk and liquidity risk.

Alesina *et al.* (1992) find that in countries with high public debt the spread between public and private rates of return is positively related to the size of outstanding debt and its rate of growth. This is not the case in countries with a stable and sustainable debt-to-GDP ratio. The evidence thus suggests that the markets perceive a default risk on the public debt of some OECD countries. The strength of the correlation and the size of the default risk is however very small.[14]

Caselli *et al*. (1998) examine a panel of OECD countries over the period 1970-91. They find that the cost of servicing public debt depends on primary balance, debt level, inflation and growth. The debt level has a relatively large effect in high-debt countries.

EU countries

Lemmen and Goodhart (1999) analyse the determinants of market's perception of government creditworthiness using an unbalanced panel of 13 EU member countries over the period 1987-96. Following Alesina *et al.* (1992), they aim at explaining public/private sector yield differentials by means of variables that measure the size of government. In contrast to Alesina *et al.* (1992), they measure the default risk by the spread of 10-year benchmark government bond yields over the corresponding swap yield of the same maturity denominated in the same currency.[15] Since the private risks entailed in interest rate swap yields are significantly lower than in corporate bond rates (there is no principal at risk in an interest rate swap) this measure is less sensitive to changes in private risk. However, like in Alesina *et al.* (1992), the measure cannot distinguish between credit risk and liquidity risk.

Lemmen and Goodhart consider the following determinants of the default risk: (i) the government's tax raising capability, measured as the difference between the highest level of general government current receipts and current receipts (as a percentage of GDP); (ii) the debt-to-GDP ratio; (iii) political conditions that affect the country's creditworthiness, measured by the variability of inflation; (iv) the government's capacity to increase seigniorage revenue, measured by lagged inflation.

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[14] In the specification that includes countries with high public debt only, a one percentage point increase in the debt ratio is found to imply an increase of 1.6 basis points in the risk premium, as measured by the difference between private and public interest rates, or a 0.1 per cent increase in the public/private interest ratio.

[15] The swap yield usually exceeds the domestic benchmark government bond yield, as government debt is perceived as less risky than private debt. Only for Italy, and for short periods for Belgium, Portugal and Spain, the spread has at times been positive. Italy exhibits a relatively high and variable default risk; therefore, in some regressions it is excluded from the sample.

The results show that the risk of government default depends positively on the first difference of the debt-to-GDP ratio and the variability of inflation. As expected, inflation and the first difference of taxable capacity are found to significantly reduce the risk.[16]

Lønning (2000) compares the yields on Deutsche Mark denominated bonds issued in 11 EU countries with those on equivalent German government bonds over the 1994-96 period.[17] He regresses the yield differentials against variables supposed to be relevant factors affecting the risk of default, such as the government debt, the budget deficit, the structural budget deficit, the current account and the country rating. The coefficients of these variables generally have the expected sign. The coefficient for rating is always significant, whereas coefficients for other variables are either significant or not significant depending on what variables are included. The author interprets this finding as evidence both that rating conveys information about default risk beyond the information contained in the macroeconomic variables included in the regression, and that markets and rating agencies differ in their evaluation of default risk. The results suggest that at least part of the yield differentials on government debt between countries is a default premium. However, like in other studies, default premia turn out to be quite small.[18]

Codogno *et al*. (2003) recognise that interest rates on euro-denominated bonds issued by different governments have not fully converged and try to assess the relative importance of differences in creditworthiness of sovereign issuers and differences in liquidity in determining the observed interest rate spreads.[19] Like in Lemmen and Goodhart (1999), Codogno *et al.* (2003) measure the default risk by the spread of 10-year benchmark government bond yields over the corresponding rate estimated on swap contracts. In addition to the deviation of each country's debt-to-GDP ratio from Germany's one, their specification includes variables approximating banking and corporate sector risk premia in the US, which are meant

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16 In their baseline specification, a one percentage point increase in the first difference of the debt ratio is found to induce an increase of 1.5 basis points in the risk premium. However, the relationships are not very robust to changes in the sample. In the regressions where Italy is excluded from the sample, taxable capacity turns out to be insignificantly negatively associated with the default risk. Also, the first difference of the debt-to-GDP ratio appears to have a negative effect on the spread in the sub-period 1987-91.

17 Data for government bonds with large enough issues (at least 1 billion Deutsche mark) are found for 13 national bonds. Observations are annual.

18 In the paper the author reports the result of a rough numerical example, which suggests a default premium of about 20 basis points, which compares with a maximum difference of 34 points in the interest rate on European government bonds included in the sample.

19 As the variability of both credit risk and liquidity over the sample period (1991-2002) is limited, they focus on fluctuations rather than levels of the spreads. Moreover, as liquidity-related variables affect yields at high frequencies while risk-related variables are only observed at low frequencies, they address the effect of fiscal fundamentals on credit risk using monthly data and evaluate the effect of liquidity factors in daily data.

to account for international exogenous risk.[20] These variables appear in the regression both linearly and interacted with the deviation of debt ratios in order to test whether the impact of international factors on yield differentials depends on local fiscal fundamentals.

Codogno *et al.* (2003) find that the market perception of the default risk is an important component of yield differentials only in some countries. In particular, they find that for most countries differences in debt-to-GDP ratios have no significant effects on relative asset swap spread when considered separately. However, for Austria, Italy and Spain, deviations in debt ratios are significant in the specification that includes their interaction with international risk variables. Furthermore, in the case of Italy and Spain a substantial part of total yield differential can be attributed to the default risk. In contrast, the international risk factors enter significantly in the linear specification for all countries except Italy and Spain. Liquidity factors play in general a smaller role.

The latter finding contrasts with those of Bernoth *et al.* (2004), who consider a new data set of US dollars and Deutsche Mark (Euro after 1998) denominated government bond issue spreads (with respect to US and Germany government issues, respectively) between 1991 and 2002 in 13 EU countries. They show that the bond yield spreads depends both on the fiscal conditions (debt ratio, deficit ratio, debt service to revenue level) of the issuer country and the liquidity of the bond market, so that countries whose national debt has a larger share in the total EU debt may pay lower interest rates than EU countries with smaller shares in spite of a higher debt ratio. Both default and liquidity risk premia reduce with EMU membership.

Also FitchRatings (2004) observes that spreads on euro-area government bonds seem to be driven as much by liquidity as credit risk and notes that Finland and Ireland, both solid AAA sovereigns, are paying 20-25 basis points over German Bunds on 10-year debt and only a few basis points less than AA Belgium. Italy continues to pay 15-20 basis points more than the cheapest governments.

Finally, Afonso and Strauch (2004) focus on a slightly different issue. They select relevant fiscal policy events that took place in 2002 to assess how markets react when the SGP is put under stress. In particular, using daily data, they estimate the impact of these fiscal events on the 10-year interest rate swap spreads. They find a significant reaction of spreads only to some policy events. In no case the impact exceeds five basis points. Furthermore, they cannot detect any persistence of the market reaction.

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[20] The variables in the baseline specification are: the spread between ten-year fixed interest rates on US swaps and the yield on ten-year US government bonds; the spread between the yield on Moody's Seasoned AAA US corporate bonds and the yield on ten-year US government bonds.

A summing up

Determinants of creditworthiness have a relatively strong impact on spreads for US state and municipal bonds where the yield curve bends backward at relatively low levels of debt. This can be taken as evidence of low risk of disruptive effects from delayed market signals. However, the impact of determinants of creditworthiness is much smaller in the EU where small yield spreads are observed even in correspondence of high debt-to-GDP ratios. This difference may reflect the different rank of the borrowers: municipalities rather than sovereign countries. The effectiveness of credit markets in imposing fiscal discipline on governments seems to depend on the level and structure of government.

According to FitchRating (2004), 15-20 basis points is perhaps the most that could be attributed to credit differentials between AAA and AA euro-area governments. The spread between AAA and AA US States is only about half this size. FitchRatings concludes that it is unlikely that financial markets can give a strong incentive for fiscal discipline to euro-area sovereign borrowers, since "a euro-area government whose budgetary position weakens is likely to have to pay more for its debt, but that the extra cost will be small."

2.3 A look at the data

In this section we present some evidence on the developments over the period 1980-2003 in spreads between EU government bond yields, in sovereign credit ratings, as well as in some fiscal variables, which may have had a role in determining the market perception of sovereign creditworthiness.

In the sample period German long-term bond yields have usually been the lowest.[21] The spreads in long-term government bond yields between Germany and Euro area countries reduced markedly over the last two decades.[22] A similar pattern can be observed for the three EU countries that have not joined the monetary union (Denmark, Sweden and UK – Figure 1).[23]

The reduction in government bond yields during the Eighties was mainly driven by the sharp decrease in inflation in high yield countries: the average spread between EU countries and Germany dropped by 2.4 percentage points, to 1.9 per cent (Table 1). The convergence was faster in the period 1992-98, as the introduction of the common currency approached; the average spread reached

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21 There are only a few episodes in which Luxembourg and the Netherlands have lower yields.

22 Long-term government bonds are typically ten-year bonds or bonds with the closest available maturity.

23 In the specification that includes countries with high public debt only, a one percentage point increase in the debt ratio is found to imply an increase of 1.6 basis points in the risk premium, as measured by the difference between private and public interest rates, or a 0.1 per cent increase in the public/private interest ratio.

Figure 1

Long-term Government Bond Yield Spread Against Germany
(percentage points; end of year data)

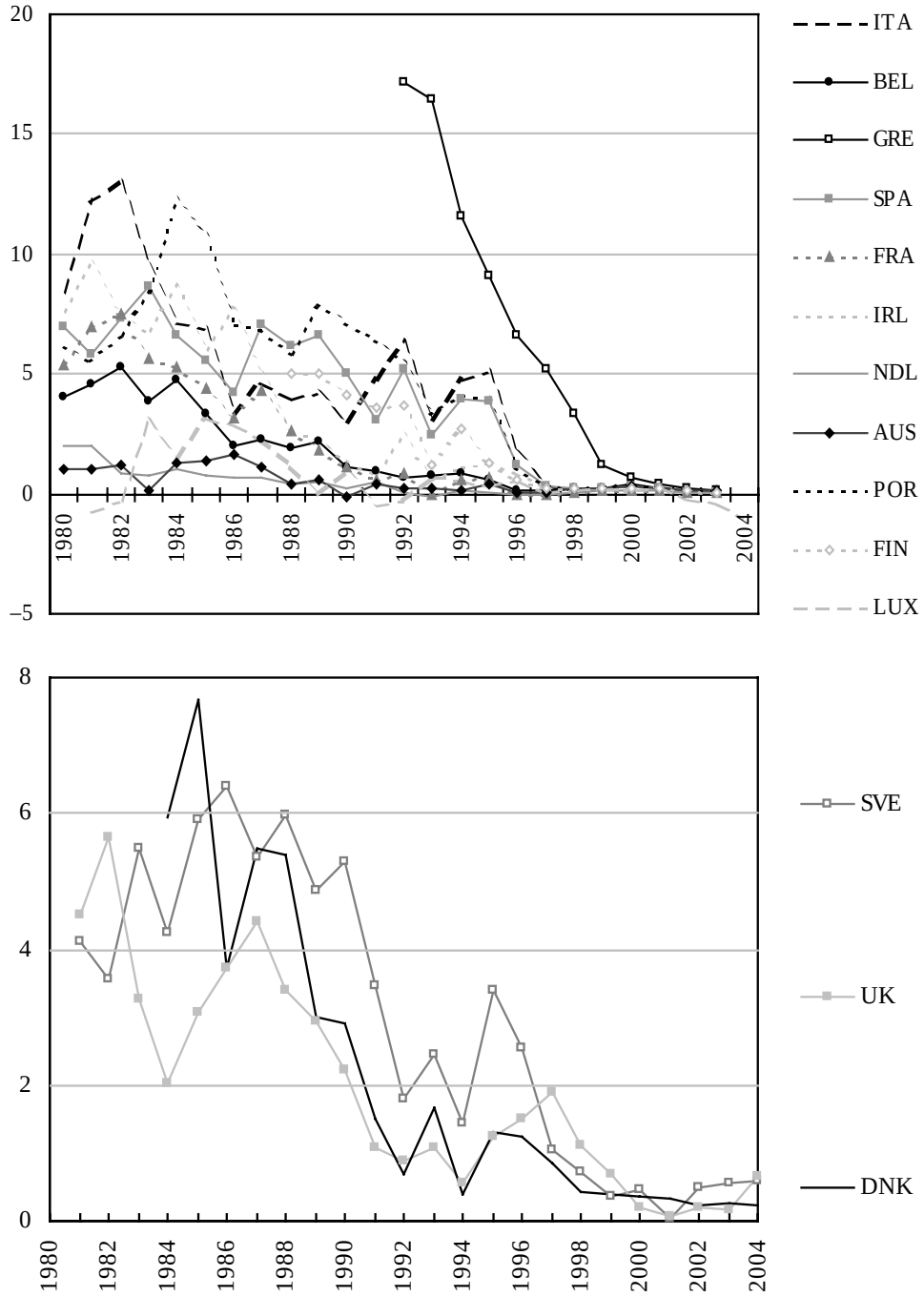

Table 1

Long-term Government Bond Yield Spread Against Germany
(percentage points)

	Jan. 1980	Dec. 1991	Dec. 1998	Dec. 2003
Austria	0.51	0.40	0.19	0.11
Belgium	3.34	0.92	0.22	0.08
Denmark	n.a.	0.69	0.40	0.23
Finland	n.a.	3.64	0.20	0.04
France	4.12	0.59	0.04	0.05
Greece	n.a.	n.a.	3.31	0.16
Ireland	8.67	0.89	0.15	0.07
Italy	7.07	4.74	0.13	0.17
Luxembourg	–1.01	–0.28	0.24	–1.00
Netherlands	1.69	0.50	0.09	0.04
Portugal	6.11	6.40	0.26	0.11
Spain	7.06	3.11	0.21	0.05
Sweden	3.19	1.79	0.36	0.57
UK	5.76	0.89	0.68	0.65
Average	4.75	2.05	0.46	0.18

46 basis points at the end of 1998 (24 points, excluding Greece that joined EMU two years later, on January 1, 2001). From 1999 onwards the spreads continued to narrow, although not in a continuous manner. At the beginning of 2004 there still remain small differences in yields, suggesting that differences in liquidity and credit risk between euro-area countries are still present.

Sovereign risk, as assessed by rating agencies, exhibits a similar evolution. In the analysis that follows we refer to the index of global creditworthiness measured semi-annually in *Institutional Investor*'s Country Credit survey of sovereign risk experts at financial institutions around the world.[24] Compared with Moody's and Standard and Poor's ratings, this index exhibits a much higher variability and is available for a longer period.

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[24] The country credit ratings developed by *Institutional Investor* are based on information provided by senior economists and sovereign-risk analyst at leading global banks and money management and securities firms. They grade each country on a scale of zero to 100, with 100 representing the countries that have the least chance of default. The ratings are released every year in March and September.

In Figure 2 and Table 2 we report sovereign risk (computed as 100 minus the credit rating) differentials against Germany. Germany has always been the country with the lowest chance of default in the sample, with the exception of 2003, when its credit risk ranked above the average.

Also country ratings have converged over the last two decades. The average differential against Germany decreased by 6.3 points in the period 1980-91, and by almost 3 additional points over the years preceding the monetary union (1992-98). However, in contrast to government bond yields, the largest drop (from a positive differential of 11.4 points to a negative one of 0.5) occurred in the last five years. Interestingly, in line with some of the empirical findings discussed above, convergence in credit ratings seems to have followed that in interest rates.

Finally, a comparison of Table 1 and Table 2 shows that at the end of 2003, whereas the three EU countries which did not join the monetary union exhibit the highest yield spread against Germany, their sovereign rating is among the highest in the sample. This seems to suggest that what the market is pricing in these case is liquidity or/and exchange rate risks.

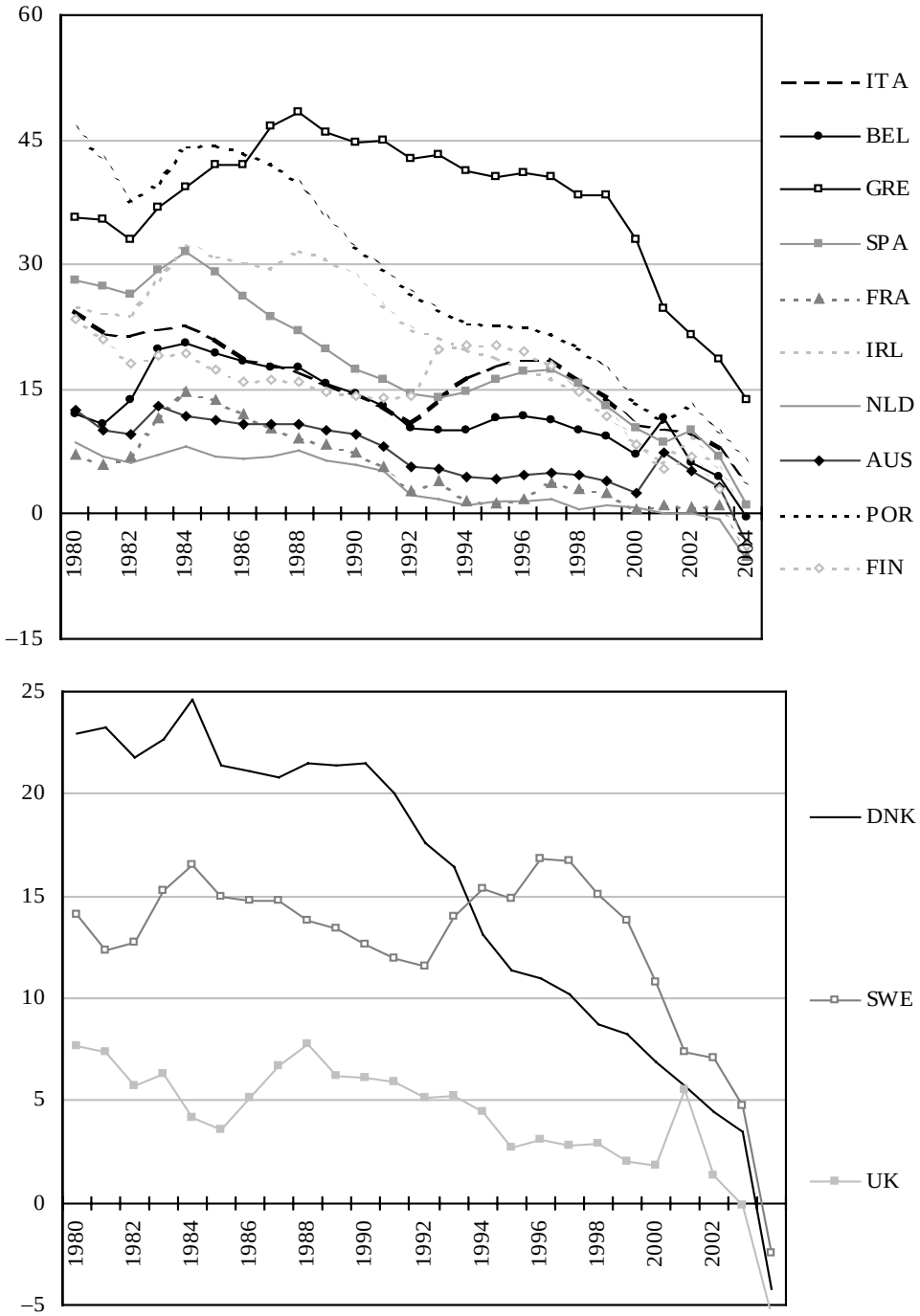
Table 2

Sovereign Risk Differentials Against Germany

	Sept. 1979	**Sept. 1991**	**Sept. 1998**	**Sept. 2003**
Austria	12.6	5.6	4.1	–3.5
Belgium	12.1	10.3	9.4	–0.4
Denmark	23.0	17.6	8.2	–4.2
Finland	23.4	14.3	11.8	–3.8
France	7.2	2.8	2.5	–4.9
Greece	35.7	42.7	38.3	13.7
Irland	25.0	22.3	12.5	–0.7
Italy	24.5	10.8	13.9	3.7
Netherlands	8.6	2.3	1.0	–5.4
Portugal	46.3	26.6	17.4	6.4
Spain	28.0	14.4	12.9	1.1
Sweden	14.1	11.6	13.8	–2.5
UK	7.7	5.1	2.0	–5.5
Average	20.6	14.3	11.4	–0.5

Figure 2

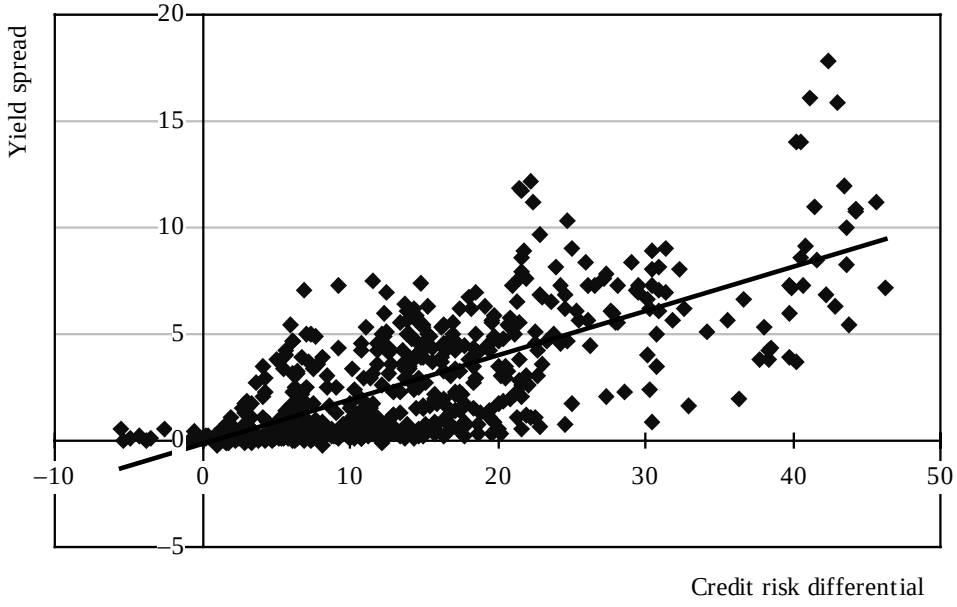
Sovereign Risk Differentials Against Germany



A scatter-plot of the sovereign credit risk differentials against government bond yield spreads shows the positive relationship between the two series (Figure 3). The results of simple regressions of yield spreads against rating differentials using different samples are reported in Table 2A in the Appendix. The correlation index between credit risk and yield differentials is 0.73 in the overall sample period.[25] It is highest in the years 1992-98 (0.77). It is lower in the period 1999-2003 (0.67), reflecting the fact that in the years preceding the monetary union agency ratings got very much along market perception, whereas in the following years ratings continued to converge while full convergence in interest rates had virtually already been achieved. This is particularly evident if we exclude Greece from the sample, in which case the correlation in the last 5 years of the sample drops to 0.32. The correlation in the overall period remains the same (0.73) if we restrict the sample to the high-debt countries (Belgium, Greece, Italy, Ireland and the Netherlands). However, in this case the correlation is highest in the period 1999-2003 (0.85), and remains so even if we exclude Greece from the sample. Since in monetary union differences in inflation and/or exchange rate risks, as well as in tax treatment, are no longer relevant, default risk is expected to account for a much

Figure 3

Sovereign risk and yield differentials



[25] The correlation remains above 0.7 even if we exclude Greece, which is to some extent an outlier.

larger share of the yield spread now than in the past. Finding a higher correlation between credit rating and yield spreads in the post-EMU period in high-debt countries somehow confirms this expectation.

In the analysis that follows we focus on the relationships between the measures of government bonds yield spread and credit risk that we have employed so far and some fiscal variables. In order to explain the movements in either the yield spread or in the rating, we alternatively consider the change in the debt-to-GDP ratio or the net borrowing, as these are the variables which the data suggest having the biggest impact on yield spreads and credit rating.[26] In the regressions with the yield spread as the dependent variable the change in the debt-to-GDP ratio and the net borrowing are considered in deviation from the German ones. Furthermore, the inflation differential with respect to Germany is included as an additional explicative variable. Also following the evidence, we consider the contemporaneous relationship between yield spreads and fiscal variables, whereas we look at the impact of fiscal outturns on the rating released one period ahead.[27]

Figure 4 plots sovereign credit risk against net borrowing. Figure 5 plots yield spread against net borrowing differential. Both graphs show a positive relationship between the variables.

The results of all regressions, using different measures of the fiscal condition and different samples, are shown in Tables 3A and 4A in the Appendix.[28] All measures of fiscal condition appear significantly and positively correlated with both the government bond yield spread and the credit risk. The relationship is generally stronger in the subsample of high debt countries and in the period 1992-98. The causal link between the relevant variables, especially for high-debt countries in the years preceding the monetary union, is however dubious. Rating, spread and fiscal variables in years 1992-98 appear to move all in the same direction, perhaps suggesting that in that period both rating agencies and markets were looking at the same signals (*i.e.*, fiscal developments) to assess the probability with which the country would have succeeded in joining the union. Net borrowing in year t explains 31 per cent of the variation in the credit rating in year $t+1$ in the entire sample and 34 per cent of the variation in the sub-sample of high-debt countries. As expected, yield spread is strongly and significantly related to inflation differential. Altogether,

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[26] We also considered the impact of changes in the debt-to-GDP ratio (or of the net borrowing) on changes (rather than levels) in yield spreads or in ratings. None of these relationships turned out to be significant.

[27] We analyse the impact of a change in debt-to-GDP ratio (or of net borrowing) at the end of year t on the rating released in September of the year $t+1$.

[28] The results presented here are obtained using simple OLS regressions. They do not change qualitatively if we perform a panel analysis using randomd effect GLS estimation instead. Indeed, the within-country R-squared is generally significantly higher than the one obtained using OLS regression, above all in the sub-sample of high-debt countries.

Figure 4

Sovereign risk and net borrowing

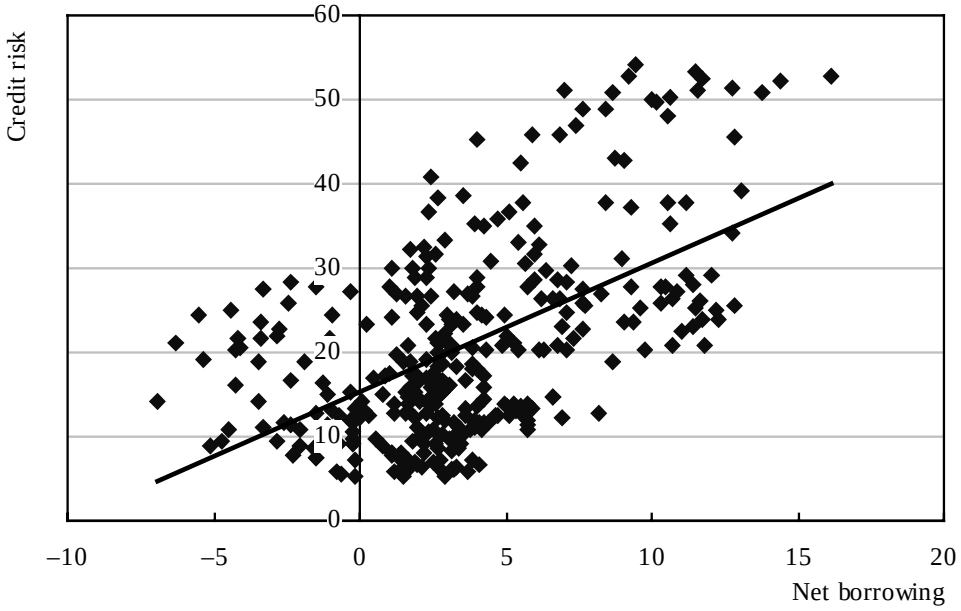
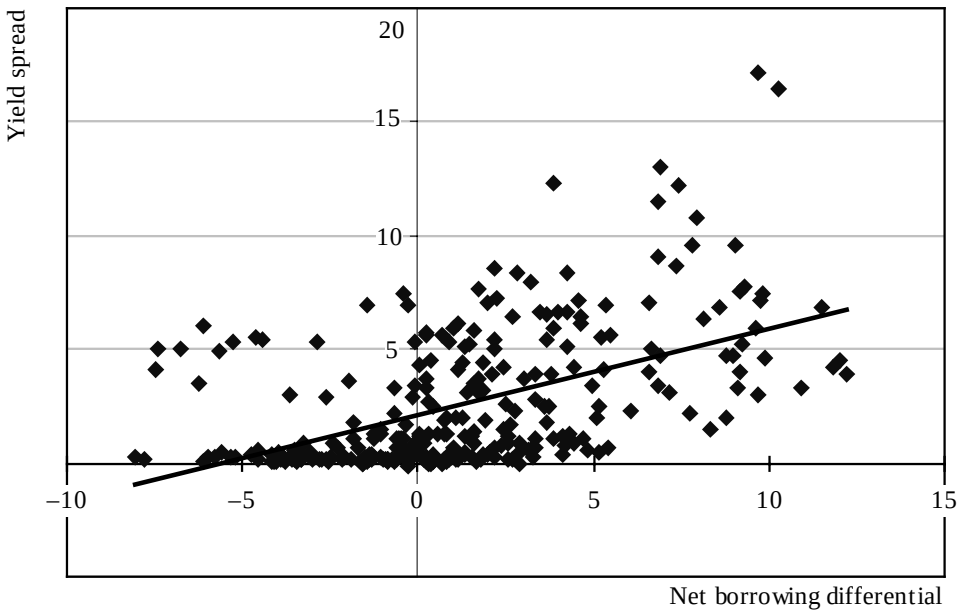


Figure 5

Yield spread and net borrowing differential



variation in the yield spread in the entire sample, 77 per cent for high debt countries.

Even controlling for inflation, the impact of fiscal conditions appears quantitatively large, especially in the Nineties. In the entire sample, a 1 percentage point increase in the net borrowing differential makes the spread increase by 23 basis points; in the sub-sample of high-debt countries the impact is larger (31 basis points). However, in the period 1999-2003, where the spread should mainly account for differences in creditworthiness (and liquidity), the relationship is much weaker and almost never significant. The same qualitative results apply if we use the change in debt-to-GDP ratio as the explanatory variable.

3. Government's sensitivity to market signals

In the previous section, we have analysed the literature and the data to investigate the link between fiscal performances and the cost of borrowing. We have found that the market provides the right signals to sovereign borrowers.

However, this condition alone is not sufficient to ensure the effectiveness of market discipline. Lane (1993) stresses the importance of governments' sensitivity to market signals, that is whether, by how much and how quickly do sovereign borrowers respond to market incentives.

Policy-makers' reaction time may be excessively long if they have short time horizons. The debt structure may also contribute to delay reactions. While the increase in yields on new bonds may immediately signal market's reaction to excessive borrowing, the burden on the budget may increase slowly if most of the debt is made of long-term bonds.[29]

FitchRatings (2004) considers, as an example, an AAA country with debt increasing up to 100 per cent of GDP. The country may be downgraded to AA and its spread may widen by 20 basis points. It notes that the annual interest costs will eventually rise by 0.2 per cent of GDP and it concludes that this extra-burden might add little to the pressures the country's government would be feeling; it is certainly not enough to ensure that market forces can discipline governments where the SGP has failed.

3.1 A descriptive analysis

Some indications on the reactions of policy makers to market signals may be obtained by studying the cases of the four EU countries whose debt passed 100 per

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[29] In the case of Italy, which is the country where - due to the relatively short duration of debt and to its high level - the impact of a change in interest rates is strongest, a 1 percentage point increase in the interest rate on all maturities would induce an increase in interest expenditure of 0.2 percentage points of GDP in the first year and 0.45 in the second year, while it will take many years for the rise to exert its full impact.

cent of GDP in the Eighties or in the Nineties: Belgium, Greece, Ireland and Italy (Table 3).

Belgium

In Belgium the debt-to-GDP ratio was 67.9 per cent in 1969 and it was on a declining path until 1974, when it reached a low of 57.8 per cent. In the same years the ten-year yield spread between Belgian and German government bonds was negative, except for 1969.

After 1974 the debt ratio grew fast. In 1980 it amounted to 77.6 per cent. The yield spread with respect to Germany turned positive: in 1980 it was 4 percentage points. In six years the debt ratio grew by 20 points and the yield spread by 5.

Notwithstanding the rise in spreads, Belgium ran deficits averaging at 12 per cent of GDP in the following three years. The debt-to-GDP ratio grew by almost 25 additional points, to 112 per cent in 1983. The yield spread reached a peak of 5.3 points in 1982. The rating declined sharply, from 86.9 in 1980 to 74.2 in 1982.[30]

It was only at that stage that a sizeable fiscal correction kicked in. The 1981 primary deficit of 5 per cent of GDP turned into a surplus in 1984, which became sizeable in 1987 (3.0 per cent of GDP) and grew to a high of 6.9 per cent of GDP in 2000.

However, the overall deficit remained sizeable until 1993 (7.3 per cent of GDP) due to the high interest bill. The yield spread declined slowly, coming close to zero only in 1996. The debt ratio started declining only from 1994, after having peaked at 134.0 per cent in the previous year. The rating improved slowly between the second half of the Eighties and the first of the Nineties, to reach the 1980 level in the early 2000s.

Greece

Fiscal conditions in Greece deteriorated sharply at the beginning of the Eighties. The deficit-to-GDP ratio, still below 3 per cent in 1980 rose to about 9 per cent in 1981 and averaged around that level until 1988. Correspondingly, the debt ratio rose from 25 per cent in 1980 to 69 per cent in 1988. The country's sovereign rating deteriorated sharply: from 62.1 in 1980 to 47.2 in 1988. Nevertheless, Greece continued to run high primary deficits until the early Nineties. The debt ratio reached above 110 per cent in 1993. At that stage the long-term bond yield spread with respect to Germany was about 17 percentage points.

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[30] We refer here to the ratings developed by *Institutional Investor* described in section 2 of the paper. Germany's rating averages to 95 over the Eighties and to 90 thereafter.

Table 3

Fiscal and credit risk indicators for selected EU countries

	1969	1974	1980	1982	1984	1987	1993	1996	2000	2002
debt/GDP	67.9	57.8	77.61	101.01	115.81	130.63	134.14	130.18	109.6	105.26
spread	0.6	–1.3	4.0464	5.2581	4.7255	2.2694	0.7632	0.11	0.3855	0.122
overall balance/GDP	2.5	2.9	8.68	10.89	9.6	7.63	7.34	3.82	–0.12	–0.06
primary balance/GDP	..	..	2.69	1.78	–0.15	–2.85	–3.56	–5.04	–6.87	–6.06
rating	..	..	86.9	74.4	73.8	76.5	79.8	79.6	83.1	89.5
debt/GDP	19.8	23.3	25.23	33.83	46.35	63.23	110.17	111.32	106.21	104.88
spread	..	..	..	..	..	..	16.4232	6.6295	0.6446	0.2445
overall balance/GDP	–1.9	1.3	2.65	6.84	8.44	9.18	13.77	7.44	1.91	1.24
primary balance/GDP	..	..	0.65	4.05	4.06	2.56	0.98	–3.1	–5.09	–4.29
rating	..	..	62.1	57.2	51.2	45.7	48.6	50.3	70	75.3
debt/GDP	53.6	56.4	68.06	82.56	96.36	111.33	93.74	74.15	39.32	33.35
spread	2.5	6.1	7.5804	7.4141	8.6425	5.0213	0.5532	0.8221	0.2532	0.1281
overall balance/GDP	3.9	7.5	12.08	13.11	9.31	8.39	2.29	0.22	–4.29	0.29
primary balance/GDP	..	..	5.84	4.56	0.38	–0.75	–3.96	–4.36	–6.37	–1.09
rating	..	..	73.4	65.9	62.1	62.3	70	74.5	88.5	88.5
debt/GDP	37.9	51.4	57.82	64.64	75.95	90.44	118.14	122.65	110.6	106.7
spread	0.4	–0.4	8.3944	12.9691	7.1855	4.6393	3.1059	1.775	0.408	0.2147
overall balance/GDP	2.9	6.3	8.3	11.2	11.5	11	10.3	7.1	1.8	2.3
primary balance/GDP	..	..	3.2	4.2	3.5	3.2	-2.8	–4.4	–4.6	–3.4
rating	..	..	75.8	71.9	72.1	77	73.5	72.4	84.2	86.2

Greece's primary balance turned into a surplus only in 1994. The debt ratio was still about 105 per cent in 2002. While the rating is now well above its 1980 level, the yield spread is just 0.2 percentage points.

Ireland

In Ireland the debt-to-GDP ratio was about 50 per cent during the first half of the Seventies. The deficit ratio was about 3 per cent until 1974 when it rose sharply to 7.5 per cent. The deficit reached 12 per cent of GDP in 1980. The long-term bond yield spread with respect to German bonds rose from 2.5 points in 1969 to 6.1 in 1974. Between 1974 and 1980 the debt ratio grew by 12 points, to 68.1 per cent. At that stage the spread was about 8 percentage points, the rating was 73.4.

Ireland kept recording high deficits until the second half of the Eighties. In 1987 the deficit ratio was still 8.4 per cent; the debt ratio peaked at 111.3 per cent. The yield spread remained around the 1980 level until 1986 and the rating dived close to 60.

Only in 1987 did the primary balance turn into a surplus, which became sizeable in the following year and remained so thereafter. In the first half of the Nineties the debt ratio was about 90 per cent. The yield spread declined to about 1 percentage point. The rating went back to the 1980 level. Since then extremely high growth rates markedly accelerated the process of debt reduction: in 2002 the debt ratio was 33.4 per cent, the yield spread was down to 0.1 points and the rating improved to 88.5.

Italy

In Italy fiscal conditions started deteriorating in the first half of the Seventies, with the deficit ratio reaching almost 7 per cent and the debt ratio growing by more than 13 points (to 51.4 per cent) between 1970 and 1974. The yield spread with respect to Germany remained low in this period but rose sharply thereafter, reaching 8.6 points in 1977.

Between 1975 and 1980, the deficit ratio was on average 8 per cent of GDP. The debt ratio was close to 60 per cent. The yield spread remained at about 8 points. In 1980 Italy's rating was 75.8.

Italy kept recording two digit deficit ratios well into the Nineties. The debt-to-GDP ratio peaked at 124.3 in 1994. Mainly due to a relatively sharp decline in the inflation rate, the yield spread, after an increase to 13 points in 1983, declined to 3.3 points in 1986. At the same time, Italy's rating showed no significant deterioration.

The primary balance showed a surplus first in 1992, peaking at 6.7 per cent of GDP in 1997. The debt ratio declined slowly, to reach 106.7 per cent in 2003. The

yield spread with respect to Germany declined further. It reached 0.2 points in 2002. In the same year, Italy's rating was 86.2.

A summing up

From the overview we may conclude that, with the exception of Italy, the deterioration in public finance conditions was readily and sizeably priced by the market.[31] While the time elapsed until a significant fiscal correction was enacted was longest in Italy (almost 20 years), it took quite a while also in the other three countries: almost a decade in Belgium and 13-14 years in Greece and Ireland.

Moreover, for Belgium, Greece and Italy it took another decade for the primary surplus to compensate the interest bill enough to allow the debt-to-GDP ratio to start declining. Belgium, Greece and Italy have been running low deficits since 1999 but their debt-to-GDP ratios are still about 105 per cent.

Thus, it seems that even if markets provide prompt indications about emerging fiscal imbalances, there is still be a role for fiscal rules in forcing policy makers to timely react to imbalances. In this way, both the direct costs of a prolonged period of fiscal instability and the costs of the needed correction can be sizeably reduced.

3.2 A panel analysis

In this section we present the results of a panel regression, which investigates the relationship between the structural primary budget balance (defined as general government net borrowing corrected for the effect of the business cycle, aiming at capturing the fiscal policy stance) and the country creditworthiness (measured by either the agency rating or the yield spread against German bonds).[32] As the aim is to test whether fiscal policy reacts to either market or agency perception of government creditworthiness, we consider one-year lagged values for the measures of credit risk. We also include among the regressors, in addition to the lagged structural primary balance, the lagged stock of debt, expecting that the presence of a high stock of debt would induce fiscal authorities to pursue more responsible policies.

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31 As already pointed out, the reaction of financial markets to fiscal imbalances in the different countries was obviously affected by restrictions to capital movements and preferential access to financial markets.

32 As already pointed out, the yield spread is not a pure measure of the country creditworthiness. This particularly applies to the period before 1999. However, irrespective of the determinants of the spread (whether it reflects inflation, exchange-rate or default risk, or other), it may be worth investigating whether authorities generally react to changes in their financing ability.

The sample consists of 14 EU countries (excluding Luxembourg) over the period 1981-2003.[33] In the regression using the yield spread as an explicative variable we drop, of course, Germany from the sample.

Our estimating equations is the following:

$$STRUCT = \alpha_0 + \alpha_1 STRUCT(-1) + \alpha_2 RISK(-1) + \alpha_3 DEBT(-1) + \varepsilon,$$

where STRUCT is the structural primary balance as a percentage of GDP, DEBT is the debt-to-GDP ratio and RISK is the credit risk, measured alternatively by the *Institutional Investor* country risk assessment or the government bond yield spread against Germany.

Given the presence of the lagged dependent variable among the regressors, we apply the Arellano-Bond fixed-effects dynamic panel estimation.[34]

The results obtained by using the yield spread as a measure of the credit risk are presented in Table 5A at the end of the paper. Table 6A reports the results when the credit risk is measured by the country rating.

All coefficients come out with the expected sign in almost all regressions. For the whole sample the estimated coefficient of lagged primary deficit is 0.68, significantly different from zero and lower than one as expected, both when we use the yield spread and the country risk among the explicative variables. The estimated coefficient on lagged debt is –0.04 in both regressions, significantly different from zero and negative as expected. Also the coefficient on the lagged measure of perceived risk is almost always negative as expected (with the exception of the sub-period 1992-98), not always significant though, suggesting that fiscal authorities may have only occasionally reacted to market's or agencies' perception of country creditworthiness.

The relationship appears more robust between primary deficit and yield spread than between primary deficit and credit rating, quantitatively stronger and more significant over the sub-period 1999-2003 in the highly indebted countries. In the entire sample, a one-percentage-point increase in the yield spread in one year seems to induce governments to improve the structural primary balance in the following year by 0.17 percentage points of GDP. Fiscal authorities' reaction rises to 0.68 points of GDP if we look at the sub-sample of high-debt countries in the years 1999-2003. However, being recent years characterised by decreasing yield spread in the high-debt country, some kind of asymmetric reaction by governments to favourable and unfavourable developments of the macroeconomic conditions may have determined these results. A high negative coefficient may indeed reveal a

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[33] The panel is unbalanced as we use, within the period 1981-2003, all available information for each country.

[34] In all regressions that we will present here, the test for second order autocorrelation does not reject the validity of the procedure. The Sargan test for over-identifying restrictions does not signal over-fitting biases.

loosening in fiscal policies induced by lower interest rates, rather than a general attitude of governments to promptly and strongly react to signals of decreased creditworthiness.

4. Conclusions

The possibility of relying on market mechanisms to provide effective incentives to fiscal discipline was assessed in depth in the late Eighties when the EMU was designed.

At that time it was widely considered that the constraints imposed by market forces are either too slow and weak or too sudden and disruptive. In the end, fiscal rules were seen as a necessary supplement to market forces.

This paper aimed at reassessing the case for financial market discipline in a context in which European financial markets are much more integrated than they were 15 years ago. Our answer is again negative: financial market discipline does not provide an adequate fall-back solution in case of rule failure.

Concerning the conditions to be met for market discipline to be effective, we have argued that the evidence concerning the EU is mixed. Governments' privileged access to the market is no longer an issue. However, in spite of marked progress (mainly due to the enforcement of fiscal rules), the available information on governments' finance is still somewhat unsatisfactory. Moreover, the credibility of the no-bail-out commitment remains an open issue.

The evidence we have examined unambiguously suggests that market rewards fiscal discipline and punishes with higher risk premia fiscal imbalances. However, the same evidence also unambiguously suggests that market reactions to growing deficit and debt levels tend to be slow and small in size.

The credit rating system seems effective in signalling fiscal crisis which are well under way, but cannot be relied upon to anticipate crisis at an early stage. Determinants of creditworthiness have a relatively small impact on yield spreads across EU countries. Narrow yield spreads are observed even in correspondence of high debt-to-GDP ratios.

As to policy makers' reactions to market signals both the case studies and the panel analysis suggest that fiscal corrections tend to be significantly delayed even when the deterioration in public finance conditions is readily priced by the market.

FitchRatings (2004) observes that "15-20 basis points […] is perhaps the most that could be attributed to credit differentials between AAA and AA euro-area governments [and that] such amounts hardly seem likely to keep a German finance minister awake at night" (p. 6). This contemporary evidence seems to confirm the results obtained by Flandreau *et al.* (1998) analysing European data for the 1880-1913 period: "... the gold standard experience ... supports the view that

markets react to increases in debt by inflicting higher risk premia. On the other hand, countries had to plunge quite deep into debt before they started feeling the pain." (p. 145).

Identifying the way ahead in the current debate on EMU fiscal rules was not the aim of this paper. However, our analysis suggests some preliminary considerations.

In order to improve the effectiveness of market discipline, two different courses of action may be taken: a) remove the factors currently hampering the market's assessment of fiscal conditions; b) amplify the signals sent from the market to the policy makers.

The first option would entail, on the one hand, further reducing whatever room is currently left in regulation for governments' privileged access to the market and, on the other hand, increasing fiscal transparency, in order to provide citizens and markets with clear and comprehensive information.

By introducing the use of credit assessment by the leading rating agencies for determining risk weights to be attached to sovereign bonds in the context of the assessment of capital adequacy, the recent Basel accord moves a step in the right direction.[35] Another possibility would be the extension of the large exposure directive, which sets limits to the amount which can be lent to a single private borrower (no more than 25 per cent of capital), to governments too (Arnold and Lemmen, 2001).

Greater fiscal transparency could be achieved by providing the public with more detailed and timely statistics than those currently available (Balassone *et al.*, 2004b). The independence of statistical institutions should be guaranteed as much as that of Central Banks. Data on public assets and liabilities should cover both financial and non-financial items and should not be restricted to general government units alone, rather their coverage should extend to the broader public sector. Estimates concerning off-budget liabilities and public guarantees should be made available. As to budget data, information on cyclically adjusted balances and the extent of one-off revenues and expenditures should also be released. Moreover, reconcilable cash and accrual data should be available and the link between deficit and debt measures should be fully explained. Short and long term projections on revenue and expenditure by level of government should be carried out and released routinely. The assumptions underlying fiscal projections should be clearly spelled out. *Ex post* assessment of projections including the effects of new legislation should also become a routine exercise.

Concerning the alternative course of action (*i.e.* amplifying the signals sent from the market to the policy makers) several proposals have been put forward.

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[35] Proposals to this effect were advanced already in CEPR (1991).

Most of the proposals entail the use of the excessive deficit procedure as a sort of public rating system to supplement the market one. Arnold and Lemmen (2001) suggest that the bonds of governments in excessive deficit could be shifted to a higher risk category for the purposes of assessing banks' capital adequacy. Similarly, restrictions may be introduced to the use of public bonds of governments in excessive deficit as collateral in monetary policy operations. Another option could be the introduction of joint (*i.e.*, multi-country) issuance of public bonds from which countries in excessive deficits could be excluded.

All these proposals are problematic. They all result in making access to credit more costly for less disciplined governments, either because of technical reasons or of reputational effects. In this respect, the only way the effects of these rules may differ from rating agencies' downgrading seems to be that they are more direct and, perhaps, more visible. However, this benefit is achieved with some relevant costs in other domains.

A different suggestion is made by Bayoumi *et al.* (1995) who argue that a rules-based approach could use observed yield spreads rather than deficits as reference indicators. Linking fiscal rules to market signals makes the rules both less arbitrary and more flexible. Instead of using fixed limits on deficit and debt levels, in such an hypothetical context it is the market which decides whether a certain deficit or debt level (or a combination of the two) is unsustainable and, therefore, needs to be corrected. Of course, identifying the relevant spread and measuring it accurately becomes crucial. This solution would raise a number of problems. For instance, the direct effects of changes in spreads might be amplified by their effects on the implementation of EU procedures thereby getting a country in a vicious circle. Governments pursuing unsound policies might not be punished if also the reference issuer pursues an unsound policy. Governments pursuing sound fiscal policies might be punished if other factors determine a higher spread.

In the end, our conclusion is that for the time being it would be extremely risky to replace fiscal rules with market mechanisms. However, greater transparency in fiscal accounts would allow markets to usefully complement rules.

APPENDIX

Table 1A

Some Evidence on Determinants of Risk Premia on Government Bonds

	Measure of risk premium (dependent variable)	Sample	Coefficients on selected independent variables *(t-statistics in parentheses)*								
			Public debt (1)	Change in public debt (1)	Public debt interacted w/int. risk	GDP growth	Maturity (2)	Tax raising capability (3)	Budget surplus	Current account	Rating (4)
Alesina *et al.* (1992) (5)	Difference between public and private interest rate	12 OECD countries	1.51 (3.52)	3.33 (1.79)	–	0.03 (2.34)	–0.19 (–2.26)	–	–	–	–
		6 OECD high debt countries	1.60 (3.56)	4.34 (2.10)	–	0.03 (2.46)	–0.18 (–0.21)	–	–	–	–
		6 OECD low debt countries	0.63 (0.42)	–0.93 (–0.21)	–	0.03 (2.46)	–0.21 (–0.13)	–	–	–	–
Lemmen and Goodhart (1999)	Difference between govt. bond and swap interest rate	13 EU countries	–	0.02 (5.81)	–	–	–	–0.03 (–3.83)	–	–	–
		12 EU countries (exclud. Italy)	–	0.01 (4.96)	–	–	–	–0.00 (–0.89)	–	–	–
Lønning (2000)	Difference between DM denominated bonds and German bonds interest rate	13 national bonds issued by 11 EU countries	0.08 (1.43)	–	–	–0.47 (–0.99)	–	–	–1.51 (–3.49)	1.65 (3.08)	–18.86 (–3.75)
Codogno *et al.* (2003) (6)	Difference between government bond and swap interest rate	Austria	–0.90 (–2.21)	–	0.83 (1.95)	–	–	–	–	–	–
		Italy	Not significant	–	0.41 (2.10)	–	–	–	–	–	–
		Spain	–0.33 (–2.75)	–	0.81 (6.75)	–	–	–	–	–	–

(1) In all works, with the exception of Lønning (2000), debt is expressed as a percentage of GDP. In Codogno *et al.* (2003) each country's debt-to-GDP ratio is expressed in deviation from Germany's ratio. Therefore, the expected sign is minus. (2) Maturity is measured as the fraction of short-term debt over total privately held debt. (3) Tax raising capability is measured as the difference between the highest level of general government current receipts over the period 1960-96 less present current receipts as a percentage of GDP. (4) In order to include the rating variable in his regressions, Lønning (2000) assigns the following numerical values to "Moody's Bond Record": Aaa=3.76, AA1=3.71, AA2=3.66, AA3=3.60, Aa=3.54, A1=2.88, A=2.83, Baa=0. (5) Alesina *et al.* (1992) perform the analysis both by imposing the restriction that all countries have the same coefficients on all variables (except the intercept) and by allowing the coefficients on debt variables (size, variation and maturity) to differ across high and low debt groups. (6) Codogno *et al.* (2003) perform the analysis on a set of 10 EU countries separately. Here we report the results only for countries where fiscal fundamentals (measured either by the deviation in debt-to-GDP ratio or by the interaction term with a measure of international risk) turn out to be significant. The coefficients we report must be multiplied by a term, $1-\lambda$, where λ is estimated equal to 0.60, 0.78 and 0.61, for Austria, Italy and Spain, respectively.

Table 2A

Dependent Variable: Yield Spread

(t-statistic in parentheses)

	All countries				High-debt countries			
	1979-2003	1979-91	1992-98	1999-2003	1979-2003	1979-91	1992-98	1999-2003
Intercept	–0.19 (–1.38)	1.14 (4.69)	–1.06 (–4.33)	0.12 (5.24)	–0.83 (–2.89)	–0.15 (–0.28)	–1.68 (–3.26)	0.02 (0.52)
Credit risk differential	0.21 (25.60)	0.18 (14.65)	0.23 (15.94)	0.02 (10.22)	0.24 (15.58)	0.24 (8.73)	0.27 (11.28)	0.03 (10.96)
R^2	0.53	0.44	0.59	0.45	0.53	0.44	0.65	0.71
Number of observations	586	275	181	130	219	100	69	50

Table 3A

Dependent Variable: Sovereign Risk

(t-statistic in parentheses)

	All countries				High-debt countries			
	1980-2003 (1)	1980-91 (1)	1992-98	1999-2003	1980-2003 (1)	1980-91 (1)	1992-98	1999-2003
Intercept	19.94 (32.27)	22.48 (21.46)	20.5 (19.53)	11.98 (15.99)	23.85 (20.66)	26.5 (10.74)	25.69 (12.18)	16.12 (8.25)
Change in Debt/GDP ratio	0.83 (6.36)	0.99 (4.36)	0.33 (1.85)	-0.13 (-0.53)	0.98 (4.71)	0.72 (1.60)	0.69 (2.18)	0.51 (1.00)
R^2	0.11	0.11	0.03	0.004	0.16	0.05	0.13	0.04
Number of observations	322	154	98	70	115	55	35	25
Intercept	15.64 (22.59)	19.17 (16.38)	13.08 (8.71)	12.10 (18.63)	15.25 (9.74)	16.61 (3.96)	15.22 (5.50)	14.08 (9.98)
Net borrowing	1.45 (11.59)	1.14 (6.40)	1.81 (6.37)	0.40 (1.53)	1.64 (7.86)	1.39 (3.15)	2.12 (4.67)	1.31 (1.73)
R^2	0.31	0.20	0.3	0.03	0.34	0.15	0.40	0.12
Number of observations	336	168	98	70	120	60	35	25

(1) Data start from 1981 when the dependent variable is the change in debt/GDP ratio.

Table 4A

Dependent Variable: Yield Spread
(t-statistic in parentheses)

	All countries				High-debt countries			
	1980-2003 (1)	1980-91 (1)	1992-98	1999-2003	1980-2003 (1)	1980-91 (1)	1992-98	1999-2003
Constant	1.38	2.39	1.52	0.25	1.08	1.65	1.72	0.33
	(10.19)	(10.74)	(8.68)	(6.07)	(4.78)	(5.44)	(4.70)	(3.38)
Change in Debt/GDP ratio	0.14	0.04	0.17	0.01	0.16	0.08	0.17	0.03
differential	(5.78)	(1.03)	(6.18)	(1.50)	(4.73)	(1.33)	(3.86)	(1.86)
Inflation differential	0.56	0.44	1.09	0.02	0.85	0.72	1.22	0.03
	(18.48)	(12.73)	(15.87)	(0.94)	(14.37)	(12.96)	(12.69)	(0.52)
R^2	0.60	0.58	0.76	0.04	0.74	0.81	0.88	0.14
Number of observations	279	123	91	65	104	44	35	25
Constant	1.12	2.26	0.70	0.25	0.42	1.16	0.58	0.30
	(8.98)	(10.37)	(4.30)	(6.08)	(1.95)	(2.45)	(2.17)	(3.74)
Net borrowing differential	0.23	0.08	0.40	0.02	0.31	0.16	0.44	0.07
	(8.52)	(2.13)	(7.78)	(1.67)	(7.30)	(2.19)	(5.65)	(3.12)
Inflation differential	0.50	0.42	0.86	0.02	0.62	0.56	1.00	0.05
	(17.96)	(13.03)	(12.50)	(0.67)	(11.42)	(9.94)	(10.34)	(1.03)
R^2	0.65	0.60	0.80	0.05	0.77	0.78	0.91	0.31
Number of observations	289	133	91	65	108	48	35	25

(1) Data start from 1981 when the dependent variable is the change in debt/GDP ratio.

Table 5A

Dependent Variable: Structural Primary Budget Balance
(t-statistic in parentheses)

	All countries				High-debt countries			
	1981-2003	1981-91	1992-98	1999-2003	1981-2003	1981-91	1992-98	1999-2003
Constant	–0.05	0.03	–0.14	–0.11	–0.09	0.02	–0.55	–0.1
	(–2.29)	(0.49)	(–2.17)	(–1.04)	(–2.69)	(0.13)	(–5.17)	(–0.36)
STRUCT(–1)	0.68	0.35	0.58	0.45	0.62	0.52	–0.25	0.28
	(16.04)	(3.30)	(6.87)	(4.60)	(7.60)	(3.94)	(–1.62)	(1.40)
SPREAD(–1)	–0.17	–0.05	–0.16	–0.67	–0.14	–0.18	0.12	–0.68
	(–3.47)	(–0.57)	(–1.69)	(–3.04)	(–2.28)	(–1.12)	(1.35)	(–2.44)
DEBT(–1)	–0.04	–0.09	–0.03	–0.11	–0.05	–0.07	–0.12	–0.11
	(–5.98)	(–4.82)	(–2.15)	(–3.29)	(–4.75)	(–1.86)	(–5.60)	(–1.82)
Number of obs.	230	84	81	65	93	35	33	25

Table 6A

Dependent Variable: Structural Primary Budget Balance
(t-statistic in parentheses)

	All countries				High-debt countries			
	1981-2003	1981-91	1992-98	1999-2003	1981-2003	1981-91	1992-98	1999-2003
Constant	–0.003	0.05	–0.12	0.01	–0.09	–0.06	–0.05	–0.28
	(–0.16)	(0.93)	(–1.62)	(-0.49)	(–2.44)	(–0.30)	(–5.10)	(–0.92)
STRUCT(–1)	0.68	0.38	0.54	0.46	0.62	0.39	–0.15	0.24
	(17.74)	(3.73)	(7.88)	(4.95)	(8.63)	(3.08)	(–1.21)	(1.20)
CREDIT RISK(–1)	–0.03	–0.09	–0.02	–0.06	–0.06	–0.18	0.27	–0.17
	(–1.22)	(–1.64)	(–0.24)	(–1.51)	(–1.63)	(–1.73)	(3.31)	(–2.74)
DEBT(–1)	–0.04	–0.1	–0.03	–0.07	–0.04	–0.05	–0.17	–0.09
	(–4.67)	(–4.67)	(–1.82)	(–2.38)	(–3.36)	(–1.18)	(–6.95)	(–1.69)
Number of obs.	267	107	90	70	97	37	35	25

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THE EFFECTS OF BUDGET DEFICITS ON INTEREST RATES: A REVIEW OF EMPIRICAL RESULTS

Thomas Laubach[*]

Introduction

Economic theory yields ambiguous predictions for the effects of budget deficits on interest rates that depend on the structure of the economy. At one end of the spectrum are the small open economy and the assumptions underlying Ricardian equivalence. In the former, interest rates are exogenous and thus unaffected by any type of fiscal policy. The evidence discussed below relates mostly to the US, which is arguably too large an economy to qualify for this assumption. In a closed economy in which agents fully internalize the implications of current debt finance for the future tax burden, and in which households can freely borrow and lend, a shift in the timing of (non-distortionary) taxes to finance a given path of government spending leaves real allocations, and thus interest rates unchanged. While there is general agreement that the conditions for Ricardian equivalence do not hold exactly, whether the extent to which reality departs from these conditions implies large or negligible interest rate effects of changes in the timing of taxes is an empirical question.

Even if the necessary conditions for Ricardian equivalence do not hold, the interest rate effects of deficits remain ambiguous because observed changes in current and projected deficits are usually not the result of a pure shift in the timing of taxes. For example, the effects of a temporary change in government spending on current and future interest rates depend on the timing of the changes in government spending and, importantly, whether the government's intertemporal budget constraint will be satisfied by adjusting taxes or spending. Moreover, the manner in which the budget constraint will ultimately be satisfied is often unknown at the time of the increase in the budget deficit. Nonetheless, under plausible assumptions reviewed below an increase in the current budget deficit is predicted to raise the current interest rate.

This paper focuses on the empirical literature concerning the reduced-form relationship between interest rates and budget deficits. The main empirical problem in estimating this relationship is to control for other factors determining real interest rates, notably the response of monetary policy to the business cycle. In a setting in which the monetary authority can affect the short-term real interest rate, a monetary policy rule that responds to resource utilization combined with automatic fiscal

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stabilizers can produce a negative correlation between deficits and interest rates in the data even if an autonomous increase in the deficit through either a tax cut or a spending increase would raise interest rates. Hence the problem of endogeneity in such regressions is most likely severe (see, e.g., Bernheim, 1987) for a discussion of this issue). This paper presents a selective review of several approaches to address this problem. Gale and Orszag (2002) provide a more extensive survey of the recent literature in this area.[1] The paper's main conclusion, like Gale and Orszag's, is that studies that carefully measure expectations of both future deficits and interest rates tend to find strong evidence that increases in budget deficits raise interest rates. However, the evidence reviewed below does for the most part not permit any conclusions about the empirical relevance of the Ricardian equivalence hypothesis, as the studies do not attempt to isolate the effects of pure timing changes in taxation from the effects of changes in the path of government spending.

The following section briefly summarizes some results concerning theoretical predictions for the interest rate effects of deficits. Section 1 illustrates the point that simple regressions of current interest rates on current budget deficits yield ambiguous results, which is consistent with the view that endogeneity problems in such regressions are pervasive. The following two sections review different approaches to address this problem, primarily by using expectations measures of both deficits and interest rates, and summarize the findings. Section 5 offers conclusions.

1. Predictions from theory

In general it is difficult to obtain analytical results concerning the interest rate effects of various fiscal policies in models in which Ricardian equivalence does not hold. Two exceptions are the overlapping generations model of Diamond (1965) and Blanchard's (1985) model of perpetual youth. Diamond analyzes the effects of debt-financed government purchases, while Blanchard focuses on shifts in the timing of taxation. This section presents a simplified discrete-time version of Blanchard's model developed in Cohen and Garnier (1991) which permits the derivation of the interest rate effects of combinations of tax and spending policies. As Cohen and Garnier emphasize, this analysis shows that the effects of a current bond-financed tax cut on current and future interest rates depend on whether the government's budget constraint will be satisfied through future spending cuts or tax increases.

The key assumption in Blanchard's model is that every individual alive faces a constant probability p of dying at any point in time, regardless of his age. While this assumption excludes life-cycle behaviour, it makes the model analytically tractable in that every individual has the same marginal propensity to consume out

[1] Gale and Orszag also review the implications of several structural macro models concerning the interest rate effects of budget deficits. Barth *et al.* (1991) review the earlier reduced-form literature.

of wealth.[2] Ricardian equivalence breaks down in this model because agents perceive that with a certain probability future taxes paying for a current tax cut will no longer fall on them. In the discrete-time version of Cohen and Garnier, every period a new cohort of size p, $0 \leq p \leq 1$ is being born, while a fraction p of the existing population of size 1 dies, so that the size of the economy remains constant. Cohen and Garnier simplify further by abstracting from physical capital accumulation and by assuming that labour is supplied inelastically, so that output is constant. Interest rates must then adjust such that the market clearing condition $Y_t = C_t + G_t$ holds.

Individuals maximize

$$E_t \sum_{s=0}^{\infty} (1+\theta)^{-s} \log(c_{t+s})$$

where throughout lower-case variables denote individual decision variables and upper-case letters their aggregate counterparts. Given that the only source of uncertainty is the time of death, this is equivalent to maximizing

$$\sum_{s=0}^{\infty} \left(\frac{1-p}{1+\theta} \right)^{s} \log (c_{t+s})$$

Agents' flow budget constraint is given by:

$$a_{t+1} = (1+r_t)(a_t + y_t - \tau_t - c_t)$$

where a_{t+1} denotes financial assets held at the beginning of period $t+1$, and $y_t - \tau_t$ denotes after-tax labour income. Assets pay a net return r_t between period t and $t+1$. Combined with a transversality condition, the flow budget constraint can be integrated to give:

$$\sum_{s=0}^{\infty} \delta_{t,t+s} c_{t+s} = a_t + h_t$$

where the discount factor $\delta_{t,t+s} = (1-p)^s / \prod_{j=0}^{s} (1+r_{t+j})$ used to discount future consumption reflects the probability of death. The same discount factor is used in computing human wealth h_t as the present discounted value of current and future after-tax labour income. Optimal consumption is determined by:

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[2] Extensions of the Blanchard model that allow for lifetime earnings profiles and age-specific mortality rates are developed in Faruqee *et al.* (1997) and in Faruqee (2003), respectively.

$$c_t = \frac{\theta + p}{1+\theta}(a_t + h_t)$$

Aggregate consumption C_t is then given by:

$$C_t = \frac{\theta + p}{1+\theta}(A_t + H_t)$$

Since there is no physical capital, financial wealth A_t is equal to government debt $(1+r_{t-1})B_{t-1}$ at the beginning of period t. By the government's intertemporal budget constraint, this must equal the present discounted value of future primary surpluses:

$$(1+r_{t-1})B_{t-1} = \sum_{s=0}^{\infty} \delta^g_{t,t+s}\left(T_{t+s} - G_{t+s}\right) \tag{1}$$

where the discount factor for financial wealth $\delta^g_{t,t+s} = \prod_{j=0}^{s}(1+r_{t+j})^{-1}$ is higher than the discount factor for human wealth. Using the budget constraint (1), aggregate demand at date t can be expressed as:

$$C_t + G_t = sG_t - (1-s)\sum_{j=1}^{\infty} \delta_{t,t+j} G_{t+j} +$$
$$+ (1-s)\left[(1+r_{t-1})B_{t-1} + \sum_{j=0}^{\infty} \delta_{t,t+j} D_{t+j}\right] + (1-s)\sum_{j=0}^{\infty} \delta_{t,t+j} Y_{t+j}$$

where $1-s = (\theta + p)/(1+\theta)$ is the propensity to consume wealth, and D_t denotes primary deficits. When $p = 0$, $\delta_{t,t+s} = \delta^g_{t,t+s}$ and the expression in square brackets in the second line is 0. When $p > 0$, current aggregate demand increases with current government spending, initial debt and future primary deficits, and decreases with future government spending. Thus, the effects of current fiscal policies depend on the whole sequence of anticipated future budget deficits and government spending.

To derive results for current and future interest rates, Cohen and Garnier divide the horizon into the present ($t = 0$), the next period ($t = 1$), and a compound period thereafter, for which variables are defined as their present discounted value as of date $t = 2$, discounted by the constancy-equivalent interest rate r. The interest rate linking periods 0 and 1 is denoted r_0, and the interest rate linking period 1 and the compound future is given by r. They derive the following results for the case that $p > 0$:

- r_0 and r, whether the increase in debt is financed by a tax increase or a cut in purchases beginning at date 1.
- A current, temporary tax cut associated with a temporary increase in debt raises r_0, but leaves r unchanged if the debt increase is paid off by a temporary tax increase at date 1, and reduces r if it is paid off by a temporary spending cut at date 1.
- A permanent tax cut financed by a permanent cut in purchases at date 2 raises both r_0 and r.

Thus, even in a model without nominal rigidities in which there is no potential influence from monetary policy on real interest rates, there is no unambiguous prediction for the interest rate effects of current deficits. At the same time, in most cases deficits do raise interest rates. Only in the case in which the increase in debt caused by a current tax cut is fully repaid by future spending cuts can deficits be associated with lower interest rates, while any policy that leaves the stock of debt persistently higher leads to higher interest rates.

2. Current deficits, interest rates and the business cycle

Simple regressions of current interest rates on current budget deficits provide a natural starting point for reviewing the empirical evidence. Table 1 reports the results from four different regressions for each of the G7 countries. The dependent variable in the first regression is a measure of the *ex ante* 10-year real government bond yield, whereas in the third and fourth regressions it is the spread between the nominal 10-year government bond yield and the 3 month Treasury bill or interbank loan rate. The regressors in each of these regressions are a constant and the negative of general government net lending (on a standardized national accounts basis) as percentage of GDP (henceforth the deficit-to-GDP ratio). Because of concerns about the stationarity properties of the data, the second regression reruns the first regression in first differences. The data is quarterly, and the sample in the first three regressions is 1970:1-2002:4, except for Canada for which deficit data begin in 1981:1.[3] The sample of the fourth regression is roughly the second half of the full sample, excluding the volatile interest rate data during the first half.

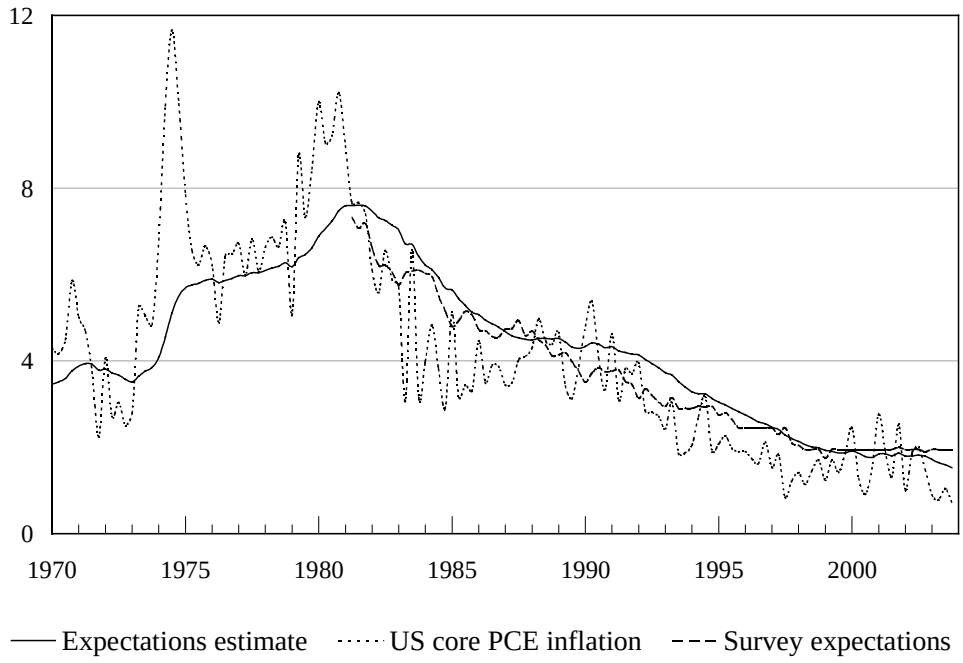
Computing *ex ante* real long-term rates requires a proxy for average inflation expectations over the life of the long bond, denoted as $\overline{\pi}_t^e$. The proxy used here is computed by setting $\overline{\pi}_t^e$ equal to actual inflation in some initial period (1965:1 for all countries except Japan, for which due to data constraints the initial period is 1970:2) and then iterating over the equation:

$$\overline{\pi}_t^e = 0.92 \cdot \overline{\pi}_{t-1}^e + 0.08 \cdot \pi_t \qquad (2)$$

[3] Except for the US and Canada, the underlying data for the deficit-to-GDP ratio are for most of the sample annual data interpolated to quarterly frequency.

Figure 1

Inflation and Inflation Expectations in the US



Source: Bureau of Economic Analysis, Federal Reserve Board, author's calculations.

where current inflation π_t is quarterly inflation expressed at annual rate. The inflation measure used for the UK, France and Canada is the personal consumption deflator, for the US the personal consumption deflator excluding food and energy, and for the remaining countries the core consumer price index.

Figure 1 shows actual inflation and $\overline{\pi}_t^e$ for the US, and Figure 2 shows the same variables for the UK. Figure 1 also shows survey measures of US long-term inflation expectations from 1981:2, based on the Hoey Survey (through 1991:2) and on the Survey of Professional Forecasters (from 1991:3 onward).[4] The coefficient 0.92 on $\overline{\pi}_{t-1}^e$ is chosen so as to produce a close fit between $\overline{\pi}_t^e$ and the survey series. An advantage of the proxy $\overline{\pi}_t^e$ compared to a trend derived from applying

[4] Since these surveys ask respondents about their expectations for CPI inflation, this series has been shifted down by 55 basis points to reflect the mean difference between CPI inflation and PCE inflation. For details see Laubach (2003).

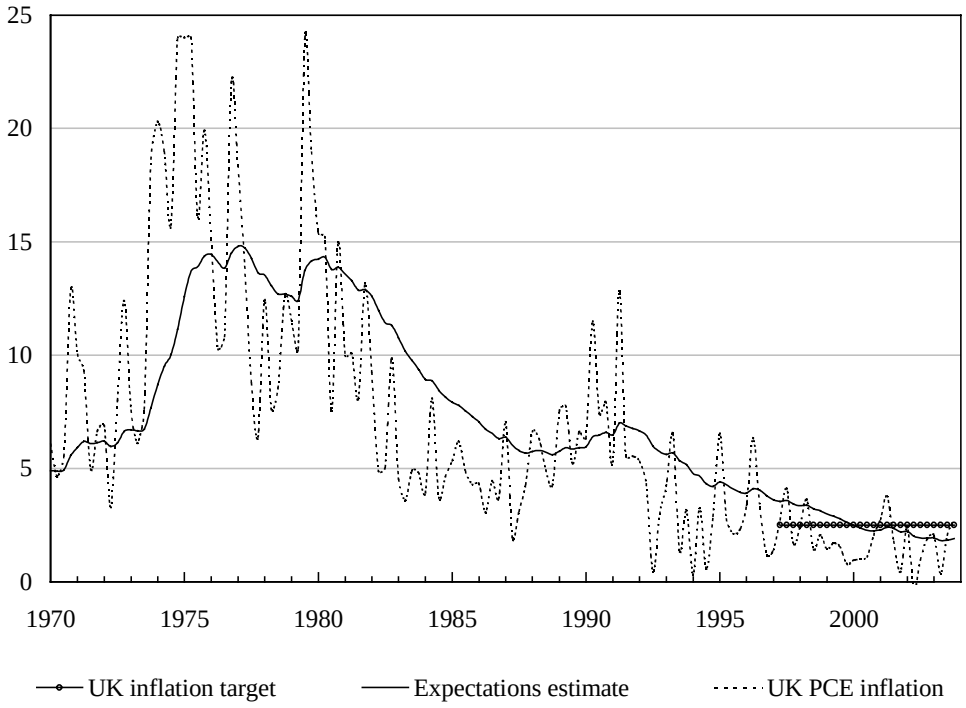
the Hodrick-Prescott filter is that the former is backward-looking, lagging behind the rise in inflation in the Seventies and the fall in inflation in the Eighties and Nineties, a feature which appears to fit the evolution of the survey expectations quite well.

One can think of equation (2) as the steady-state Kalman filter in which the public tries to discern from the observed data an unobserved inflation target that follows a random walk. Also shown in Figure 2 is the Bank of England's inflation target from the time when the Bank was granted independence from the Treasury. Inflation expectations derived from the yields on nominal and inflation-indexed UK Treasury bonds show a noticeable decline at that time. While the proxy $\overline{\pi}_t^e$ does not reproduce that fall, it nonetheless remains fairly close to the inflation target. In summary, the inflation proxies should provide a reasonably accurate measure of *ex ante* real long-term yields.

The results reported in the first column of Table 1 illustrate the problems with uncovering the relationship between deficits and interest rates. For each regression the Table reports the coefficient on the deficit-to-GDP ratio and its *t* statistic, the R^2

Figure 2

Inflation and Inflation Expectations in the UK



Source: OECD, author's calculations.

Table 1

Current Deficits and Current Interest Rates in the G7 Countries

Dependent variable	Real 10-year yield, levels	Real 10-year yield, first differences	10-year/ 3-month spread	10-year/ 3-month spread
Sample	70:1 - 02:4	70:2 - 02:4	70:1 - 02:4	85:1 - 02:4
US	.06 (.80)	–.17 (2.05)	.47 (4.04)	.31 (5.18)
	.01, .20	.05, 1.60	.26, .29	.35, .25
Japan	–.18 (2.05)	.03 (.36)	.29 (3.75)	.21 (4.89)
	.07, .08	.00, 1.84	.21, .34	.47, .37
Germany	–.18 (2.22)	–.10 (1.08)	.34 (1.79)	.07 (.43)
	.07, .15	.02, 1.30	.10, .19	.00, .11
UK	–.14 (1.70)	.02 (.46)	.25 (2.85)	.28 (3.13)
	.04, .17	.00, 1.56	.13, .29	.27, .25
France	.24 (3.24)	–.01 (.21)	–.03 (.22)	–.15 (.66)
	.15, .16	.00, 1.32	.00, .32	.02, .28
Italy	.01 (.06)	–.08 (.56)	–.11 (2.37)	–.12 (2.36)
	.00, .08	.01, 1.20	.05, .38	.16, .41
Canada	.04 (1.05)	.08 (1.02)	.07 (1.19)	.01 (.25)
	.02, .38	.01, 1.53	.02, .22	.00, .24

Notes: The first line in each cell reports the coefficient on the deficit-to-GDP ratio and in parentheses its Newey-West *t* statistic. The second line reports the R^2 and the Durbin-Watson statistic.
Source: Author's calculations.

and the Durbin-Watson statistic.[5] Except for France, the coefficients on the deficit-to-GDP ratio are either insignificant or imply (for Japan and Germany) that deficits reduce real long-term interest rates. The results in the second column are even less informative, with R^2s close to zero. The results shown in columns 3 and 4, using the 10-year-minus-3-month spread as dependent variable, appear more informative for the US, Japan, and the UK, with significant coefficients and modest R^2s, but the extremely low Durbin-Watson statistics point to misspecification of

[5] The *t* statistics need to be interpreted with caution because ADF tests for the deficit-to-GDP ratio cannot reject the hypothesis of a unit root at the 5 per cent level for all countries except Germany. By contrast, the real interest rate appears stationary for all countries except Japan, and the 10-year-3-month spread is stationary for all countries. The inability to reject a unit root for the deficit-to-GDP ratios is, however, probably a small-sample problem, as the hypothesis of a non-stationary deficit-to-GDP ratio implies that with probability 1 the government will ultimately violate its inter-temporal budget constraint.

these regressions. For the remaining countries the results continue to be uninformative. The issue of the proper definition of the dependent variable will be discussed further in section 4.

Taken at face value, the results in Table 1 do not seem to provide support for the view that budget deficits raise real long-term interest rates, and only limited support for effects on the yield spread. Apart from the issue of measuring expectations, part of the problem might be omitted variable bias. For example, Orr *et al*. (1995) perform pooled time-series regressions for 17 countries, using an error-correction framework in which the "equilibrium" long-term real interest rate is determined by the rate of return on capital, a measure of domestic bond portfolio risk, and the current account balance in addition to the deficit-to-GDP ratio. The coefficients on the long-run determinants are constrained to be identical across countries. Using quarterly data for the period 1981:2-1994:2, they find that, all other factors equal, the long-run effect of a percentage point increase in the deficit-to-GDP ratio on long-term real rates is a 15 basis point increase. Yet adjustment of actual to equilibrium real interest rates is very slow, suggesting that little of the variation in actual interest rates is explained by variations in the equilibrium rate.

3. The role of expectations of future budget deficits

Because current long-term interest rates depend on expected future short-term rates, if budget deficits raise interest rates it is not only current, but also expected future budget deficits that affect today's long-term rates (an observation going back at least to Feldstein, 1986). Moreover, as discussed above, the simultaneous response of monetary policy and automatic fiscal stabilizers can in principle mask the effect of budget deficits on interest rates. To identify the interest rate effects of budget deficits that are not caused by cyclical responses of fiscal policy, the empirical studies discussed below have pursued two alternative approaches. The first approach is event analysis, focussing on changes in asset prices on the day of the release of new information (such as official projections) about the future budget outlook. The main issue here is to correctly identify the unanticipated component of the release. The second approach is to reduce the cyclical influences on the deficit-interest rate relation by using current projections of future deficits; at a sufficiently long horizon, these projections are presumably not much influenced by events that independently affect current interest rates, thus mostly eliminating the endogeneity problem.[6]

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[6] Another alternative is to use cyclically adjusted budget balances. These balances are usually constructed by cyclically adjusting separately the components of revenues and outlays, and then aggregating up the cyclically adjusted components (see, e.g., Giorno *et al.*, 1995). However, using cyclically adjusted instead of actual balances in the analysis reported in Table 1 has very little effects on the results.

As will be discussed below, obtaining measures of expected future deficits is quite difficult. Unlike other macroeconomic variables, many fiscal variables, which are determined by a political process, do not appear to be modelled well by standard linear methods. The first subsection reviews results of studies that nonetheless rely on such methods. The second subsection discusses studies that employ publicly available budget projections based on the analysis of current and announced future fiscal policies.

3.1 VAR expectations

The studies in this area focus on the effects of unexpected innovations in fiscal variables, such as debt per capita (Plosser 1982, 1987) or the deficit-to-GDP ratio (Evans 1987a, b), on interest rates, where expectations are derived from VARs. Plosser (1982, 1987) takes as point of departure a model for the one-period nominal interest rate on a risk-free asset, such as a one-month Treasury bill:

$$R_{1,t} = a(L)X_t + \varepsilon_t \tag{3}$$

where X_t is a vector of variables that determine the one-period interest rate including measures of output, inflation, government spending, money supply and government debt, and ε_t is a white-noise error. Combining this process with the expectations hypothesis, and omitting constant term premia, the excess holding period return $H_{n,t+1}$ on an *n*-period bond held between periods t and $t+1$ over the one-period return $R_{1,t}$ can be expressed as:

$$H_{n,t+1} - R_{1,t} = \beta(X_{t+1} - E_t X_{t+1}) + e_t \tag{4}$$

Under the linear term structure model employed, the left-hand side of equation (4) is an expectational error, implying that only information orthogonal to the date t information set affects the excess return.

The key assumption for the empirical implementation of equation (4) is that the process X_t follows a VAR:

$$X_t = A(L)X_{t-1} + \eta_t$$

Regressing the excess holding period returns on the one-step-ahead prediction errors of the elements of X_t then allows to assess the effect of fiscal variables on interest rates. Using monthly data for the period 1968-85, Plosser (1987) finds that for maturities between 2 months and 10 years the one-step-ahead prediction errors for real debt per capita enter equation (4) insignificantly, and for the later subsample with a positive sign, raising excess holding period returns and thus reducing interest rates. To address Feldstein's (1986) observations that expected future deficits are likely to be more persistent and thus have larger effects on interest rates, he

computes multi-year forecasts of real debt per capita using the VAR. Again the deficit forecasts enter with a positive sign.

Evans (1987a) starts by specifying a structural equation for the short-term interest rate that includes lagged interest rates as well as lagged, current and expected future values of a number of other variables, including the real budget deficit. He then argues that standard macroeconomic theory implies that the coefficients on all leads and lags of the deficit should be positive. Using again a VAR to model expectations of the variables other than the interest rate he shows that, if all coefficients on the deficit in the structural equation are positive, so must be the sum of coefficients in the reduced form obtained from replacing the expectations by their VAR predicitions. For the nominal and *ex post* real commercial paper rate as well as a corporate bond yield, and using data spanning the period 1908-84 and various subsamples, he finds that the sum of coefficients on the deficit is almost always negative, and sometimes statistically significant.[7]

To assess whether his results are due to the fact that economic agents have a larger information set than the VAR, Evans examines the residuals from the fitted interest rate equations during the 12 months leading up to major tax changes. He argues that individuals were probably anticipating that these tax measures would be passed, information that is not contained in the VAR forecasts. If deficits raised interest rates, the residuals of the interest rate equation should be negative during the 12 months leading up to a tax increase (which is expected to reduce deficits) and positive before a tax cut. Identifying 18 tax cuts and 27 tax hikes during his sample, he finds no evidence that the residuals behave in this way. His conclusion is that deficits, whether current or expected, do not affect interest rates.

The most important criticism of this literature is that VAR expectations are probably poor measures of agents' expectations for many variables, particularly for budget deficits. These expectations can change dramatically, for example during war times, or more recently following the Reagan and Bush tax cuts. This information is not captured by VAR forecasts. Elmendorf (1993) examines the performance of VAR forecasts of several variables, including budget deficits, relative to forecasts for the same variables published by Data Resources, Inc. (DRI) since 1971. He shows that the DRI forecasts seem to be much better proxies of expectations than the VAR forecasts. In particular, VAR forecasts are by construction extrapolating the past and do not allow for learning nor for incorporating non-quantitative information which may be important for the fiscal outlook. When replacing the VAR proxies for future deficits by the DRI forecasts, he shows that the findings of the studies by Plosser (1987) and Evans (1987a) discussed above are overturned. Thus, their conclusion that budget deficits do not raise interest rates seems to be a figment of the poor measurement of expected future deficits. Elmendorf also argues that Evans' (1987a) test of the residuals of his interest rate equations prior to tax changes is uninformative because the residuals contain unmeasured expectations of many variables, and could therefore easily be uncorrelated with tax changes.

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[7] Evans (1987b) reports similar results for a set of six countries.

3.2 Published budget projections

Most of the evidence discussed in this section refers to the US only, as there are several institutions producing budget projections, some of them publicly available. Two of these, namely the projections published by the Congressional Budget Office (CBO) and the Office of Management and Budget (OMB), deserve particular mention. Since its establishment in the mid Seventies, the CBO has published projections for the federal budget deficit as well as detailed components of spending and outlays five years into the future (ten years beginning in 1992). With few exceptions, the projections have been released each year in January or February in its Budget and Economic Outlook, and mid-year updates have been released in the summer. Its baseline projection is by statute predicated on the continuation of current legislation, including specific assumptions about future discretionary spending. The OMB is responsible for publishing the President's budget in early February of each year (in April for years in which a new administration takes office), and publishes mid-session updates usually in July. While OMB projections have been available for a longer time than CBO projections, only since 1983 has OMB published projections at a five-year horizon. In contrast to the CBO's baseline, the OMB's projections reflect the policies proposed by the administration rather than current policies.[8] Many private sector analysts use either the CBO or OMB projections as the starting point for their own analyses. Thus, while market expectations do not necessarily coincide with either the CBO or the OMB projections, arguably these projections are the most important pieces of information shaping market views about future budget deficits.

One of the earliest studies using deficit projections is Wachtel and Young (1987). In the spirit of event studies, these authors focus on the change in long-term interest rates on the day of the release of CBO and OMB projections. Their results depend on correctly identifying the unanticipated component of the release, which they identify with the change in the projection for a particular period from the previous release. They consider a sample of ten OMB projections and 12 CBO projections released between 1979 and 1986, at the horizons of the current fiscal year as well as one and two years ahead. Considering interest rates at maturities between three months and 30 years, they find that a $1 billion increase in the projected deficit (at that time roughly 0.025 percent of nominal GDP) raises interest rates by between 0.15 and 0.4 basis points, depending on the maturity of the interest rate series and the source of the projections. Their estimates therefore imply an increase in interest rates on the order of 6 to 16 basis points in response to a percentage point increase in the deficit-to-GDP ratio. Not all of their estimates are statistically significant. Similarly to Wachtel and Young, Kitchen (1996) studies the

[8] Both CBO and OMB publish projections for the unified budget balance as well as its separate components, the on-budget and off-budget balances. The latter reflects mainly the balance of revenues and outlays in the Social Security trust funds. All the studies discussed here focus on the unified budget balance, which is the relevant measure of the federal government's borrowing needs in capital markets.

effects of 37 OMB releases between 1981 and 1994 on various asset prices, including Treasury securities with maturities between three months and 30 years. He finds very small effects, on the order of 1 to 5 basis points per percentage point increase in the current or projected (averaged over several years) budget deficit.

In another event study, Elmendorf (1996) examines events surrounding the passage of the Gramm-Rudman-Hollings deficit reduction act in 1985 and the Budget Enforcement Act in 1990. Although his method does not allow him to quantify the size of the effects on real interest rates, he nevertheless can reject at the 1 per cent confidence level the hypothesis that real interest rates were unaffected by changes in the outlook for budget deficits: events that made passage of either of these two laws less likely raised interest rates, and events that made passage more likely reduced them.

Cohen and Garnier (1991) and Elmendorf (1993) present results concerning the effect of deficit projections on the change in interest rates between release dates. These studies are based on the weaker assumption (in comparison to Wachtel and Young's) that the deficit projections are good proxies of private agent's expectations of future fiscal policy at the time of the release. As in Wachtel and Young, the projections used in these studies are relatively short – for the current and next calendar year in Cohen and Garnier, for up to eight quarters ahead in Elmendorf. Forecasts at this horizon are still affected by the state of the business cycle. Using the spread between 10-year and 1-year nominal Treasury yields as dependent variable and OMB projections during the period 1971-90 as regressors, Cohen and Garnier find statistically significant impact effects of a percentage point increase in the current prediction error of the deficit-to-GDP ratio on the spread on the order of 40 to 55 basis points. Using DRI forecasts published during the period 1971:4-1987:3, Elmendorf finds a statistically significant increase in interest rates at maturities up to five years of about 50 basis points, but the effects on long-term interest rates are smaller and statistically insignificant.

The studies discussed so far (except Elmendorf, 1996, who uses a different methodology) all use budget projections at short horizons, at most two years ahead. Canzoneri *et al*. (2002) extend previous work by using deficit projections from the CBO at substantially longer horizons – either five or ten years ahead. The longer projection horizon should help to identify the interest rate effects of budget deficits because, compared to current deficits, it is less likely that changes in deficit projections at long horizons are driven by events other than autonomous fiscal policy changes that jointly determine those projections and current interest rates. The dependent variables used by these authors are a constant and either the 5-year-minus-3-month or the 10-year-minus-3-month government yield spread. For semi-annual projections at the 5-year horizon published between 1984 and 2002, as for projections at the 10-year horizon over the shorter sample 1992-2002, the authors find statistically significant effects on the 5-year spread of 52 to 60 basis points, and on the 10-year spread of 41 to 45 basis points. Compared to previous studies, their estimates are considerably more precise, indicating that indeed the focus on the longer projection horizon facilitates identification of the interest rate effects.

4. The role of expectations of future interest rates

If, all else equal, budget deficits at some future date raise short-term interest rates at that date, the expectation of such future budget deficits raises long-term interest rates today. However, their effect on current long-term interest rates may be masked by movements at the short end of the yield curve driven by current and expected future monetary policy actions. Developments in the US over the past three years illustrate this point, when short-term and long-term interest rates fell to levels not seen in decades despite a dramatic deterioration in the fiscal outlook. Bernheim (1987) emphasizes that the analysis must focus on expected future interest rates in order to properly identify the effects of projected deficits. This section argues that, once interest rates are measured at the long end of the yield curve, the effects of expected future deficits become much clearer.

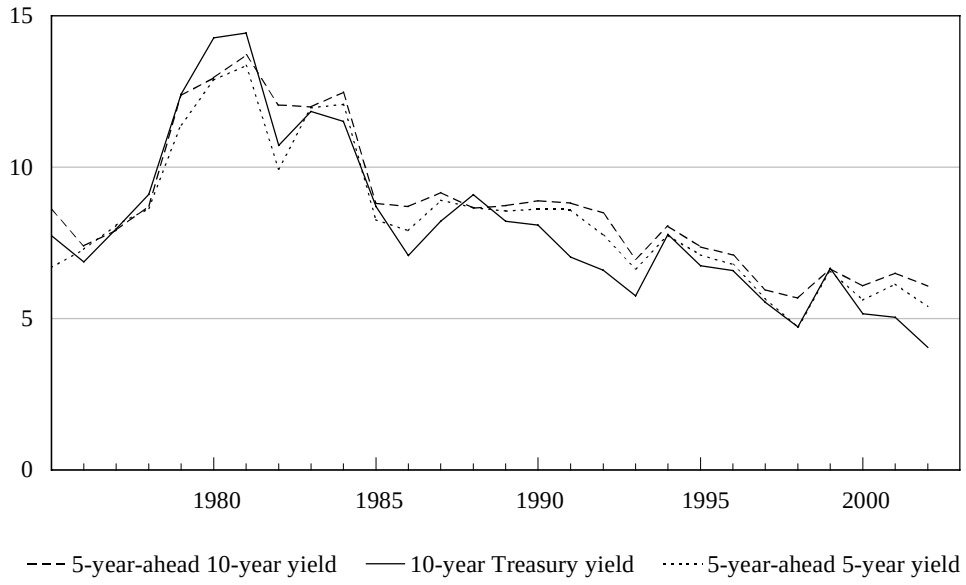
The use of a yield spread instead of the level of some long-term interest rate can be viewed as a first step in controlling for the short end of the term structure. The results by Cohen and Garnier (1991) and Canzoneri *et al.* (2002) suggest that doing so helps to identify the interest rate effects of budget deficits. This issue is taken up directly in Laubach (2003), where the dependent variable is a measure of expected future long-term interest rates rather than a spread. These expectations are derived from estimated forward rates from the zero-coupon yield curve. Figure 3 shows two of these measures: the 5-year Treasury yield expected to prevail five years into the future is obtained by averaging over 1-year-forward rates five to nine years ahead, and the 10-year Treasury yield expected to prevail five years into the future is obtained by averaging forward rates five to 14 years ahead. Observations are sampled at the end of months in which the CBO projections used in the regressions below were released. As can be seen, these expected future interest rates show considerably less of a decline during the two most recent recessions than the 10-year (constant maturity zero-coupon) Treasury yield.

Table 2 presents results from Laubach (2003) that illustrate the importance of using expected future interest rates. Compared to the studies discussed above, there are a few additional regressors included in these regressions. The dependent variable in each case is a nominal interest rate, and inflation expectations are included as a regressor with a coefficient not constrained to 1. Inflation expectations are measured by the survey expectations shown in Figure 1. The coefficient on expected inflation is always estimated to be larger than 1, possibly reflecting a demand by investors for increased risk premia on nominal assets to compensate for greater uncertainty about future inflation when the current level of inflation is elevated. Moreover, Feldstein (1976) points out that, because taxes are levied on nominal returns, nominal interest rates have to increase more than one-for-one with expected inflation.

A prediction of the neoclassical growth model is that trend growth and risk aversion should play a role in determining yields on risk-free Treasury instruments: an increase in trend growth should raise interest rates, whereas an increase in risk

Figure 3

Current and Expected US Long-term Interest Rates



Source: Federal Reserve Board, author's calculations.

aversion should lower Treasury yields because it raises the demand for safe assets.[9] Three of the regressions reported in Table 2 therefore include both CBO's 5-year-ahead projections of the growth rate of real GNP or GDP as a proxy for agents' views about the trend growth rate of the economy at a given point in time, and the equity premium as a proxy for risk aversion. The equity premium is calculated as the dividend component of national income, expressed as a percent of the market value of corporate equity held (directly and indirectly) by households, minus the real 10-year Treasury yield, plus the trend growth rate. Details of all the data used are provided in Laubach (2003).

The sample includes the 28 annual CBO releases between 1976 and 2003; the mid-year updates are omitted, but results are very similar when they are included. The first column in Table 2 shows the basic result: a percentage point increase in the deficit-to-GDP ratio projected five years ahead raises the 5-year-ahead 10-year yield by 23 basis points, and the associated *t* statistic exceeds 4. Although trend growth does not enter significantly in any of the regressions reported in Table 2, it does so in other regressions reported in Laubach (2003) and is retained for the theoretical

[9] In a closed economy, an increase in the trend growth rate implies a faster rate of decline in marginal utility, and hence a higher real return on capital as consumers demand a higher return on savings to forgo consumption today. The real interest rate therefore rises, and the desired capital-output ratio declines.

Table 2

Effects of Projected Deficits on Current and Expected Interest Rates

Dependent variable	5-year-ahead 10-year yield	5-year-ahead 10-year yield	5-year-ahead 5-year yield	Current 10-year yield
Expected inflation	1.19 (5.63)	1.23 (9.62)	1.21 (5.94)	1.62 (7.13)
Projected deficit/GDP	.23 (4.17)	.21 (3.96)	.19 (2.38)	.09 (1.40)
Trend growth	.68 (1.53)	-	.65 (1.40)	.73 (1.25)
Equity premium	–.40 (4.30)	-	–.50 (3.66)	–.72 (4.93)
R^2	.92	.89	.90	.93
Standard error	.69	.80	.79	.76
Durbin-Watson	2.05	1.57	1.50	1.47

Notes: Newey-West *t* statistics in parentheses.
Source: Laubach (2003).

reasons discussed above. A percentage point increase in the equity premium reduces expected future long-term interest rates by 40 basis points. Column 2 shows that the coefficient estimate for the deficit-to-GDP ratio and its *t* statistic are little affected by inclusion of the additional regressors. The R^2 of the regressions are high, close to 0.9, although this is partly due to including expected inflation as an unconstrained regressor. Even when the dependent variable is nominal interest minus expected inflation, the R^2 is 0.7, with a coefficient on the deficit-to-GDP ratio of 0.28 and a *t* statistic of 12.

By comparing the results across columns 1, 3 and 4, the effect of properly controlling for monetary policy's influence on the short end of the yield curve becomes evident. When using the simple 10-year Treasury yield as dependent variable, for example, the coefficient on the deficit-to-GDP ratio is only 9 basis points, and the estimate is no longer significant at conventional levels. As shown in Laubach (2003), these results become even sharper when the projected primary deficit-to-GDP ratio is used instead of the deficit-to-GDP ratio including net interest payments. Moreover, the results remain robust when the early part of the sample is omitted.

5. Conclusions

This paper argues that the diversity of the reduced-form evidence concerning the interest rate effects of budget deficits is closely linked to the issue of measurement of expectations. For the G7 countries it shows that simple regressions

of current long-term interest rates on current deficit-to-GDP ratios provide no support for a role of deficits in interest rate determination. Next, it discusses the measurement of expectations of future deficits: studies that use projections from small-scale VARs to proxy these expectations find no effects, while studies using published official or private forecasts are more successful. Finally, it is important to extend the measurement of expectations to interest rates as well so as to abstract from monetary policy's influence on long-term rates through the short end of the yield curve. Regressions of expected future long-term rates on expected future deficit-to-GDP ratios produce economically plausible and statistically significant estimates of the effects of deficits on interest rates.

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ARE FISCAL AND MONETARY POLICIES REFLECTED IN REAL YIELDS? EVIDENCE FROM A PERIOD OF DISINFLATION AND DECLINING DEFICIT TARGETS

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Introduction

The present study focuses on analyzing the effect of fiscal and monetary policy and interest rates abroad on Israel's capital market. We examine whether the government deficit (current or forecast), changes in deficit targets (which were frequent in the last decade), the size of the government debt (as a share of GDP), and monetary policy influenced the yields on bonds during the Nineties. We also endeavor to ascertain whether monetary policy was directly or indirectly affected by fiscal policy, and if – and to what extent – yields abroad impacted on domestic bond yields.

This study contributes to the literature on the subject in three ways: first, it focuses directly on real yields for different terms, without having to decompose nominal yields into a real component and inflation expectations, as is required for other countries' data and has been done in many studies. This is possible because a large proportion of tradable government bonds in Israel is indexed to the CPI (Consumer Price Index). Second, this study separates the effect of policies on the forward component of the long term yields from the effect on the short end of these yields. Third, we examine the effect of fiscal and monetary policy at a time when declining deficit and inflation targets were adopted, when current policy may have a greater impact by signaling the policy makers long-term behavior.

As stated, the relation between fiscal and monetary policy and yields in the money market has been examined in many theoretical and empirical studies, as well as in various episodes worldwide when money market interest rates were high and the government deficit rose (e.g., the U.S. in the early Eighties), and vice versa (e.g., the U.S. since the mid-Nineties). There is a long-standing dispute in the theoretical and empirical literature with regard to the effect of fiscal policy on domestic interest rates. Whereas, according to the Keynesian and neo-Keynesian approach, a larger deficit will cause interest rates to rise (Modigliani, 1961; Blinder and Solow, 1973), the Ricardian Equivalence theory (Barro, 1974) contends that an increase in the government deficit, which is perceived by the public as permanent, will not affect

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interest rates (see below).[1] Furthermore, studies undertaken in the last decade have suggested that expansionary fiscal policy could even moderate aggregate demand by impacting on productivity, and hence on the demand for investment and consumption on top of the Ricardian effect (Alesina, Perotti and Tavares, 1998). In that case, fiscal expansion could even cause long-term interest rates to fall.[2] Another approach stresses the importance of international capital mobility, claiming that in an open economy fiscal policy will not affect interest rates (Mundell, 1963), except indirectly, through its influence on the risk premium. The empirical findings regarding the impact of the deficit on interest rates in general are also not unequivocal: in some countries no relation was found between the fiscal variables and market interest, *i.e.*, the Ricardian Equivalence approach was borne out, while in others or at other times a relation was found between the fiscal variables and yields, as shown below.

There is considerable empirical evidence from various countries for the effect of fiscal policy on yields but, as stated, this is not always unequivocal. Empirical studies which found no relation between fiscal policy and interest rates include those of Plosser (1982), Mehra (1994), Evans (1987), Siklos (1988), Modigliani and Jappelli (1988), and Barro and Sala-i-Martin (1990). Faini (2004) finds that fiscal balances do eaffect interest rates and that their impact is much stronger at the aggregate EMU level than at the separate national level. Other studies found a relation between fiscal variables and yields, including those of Turnovsky and Miller (1984), Kitchen (1996), Wachtel and Young (1987), Thorbecke (1993), Knot and de Haan (1995), Caporale and Williams (2002), and Hoelscher (1986). Some, such as Barro (1981) and Turnovsky (1989), make a distinction between temporary and permanent deficits, claiming that only the latter will affect yields. An extensive review of this literature presented by Gale and Orsag (2002) stresses that the failure to establish a clear-cut relation between fiscal policy and yields derives from differing definitions of current *vis-à-vis* expected policy. They assert that almost all the studies of the effect of *expected* (rather than actual) deficits indicate that a rise in the deficit has a significant effect on long-term interest rates. Laubach (2004) also stresses the importance of measuring correctly the expected future deficit. According to a selective review of empirical evidence he presents, studies that use good measures of the expected deficit tend to find strong evidence that deficits raise interest rates. Some studies examine the influence of the government debt on yields, but their theoretical conclusions are not clear, and their empirical findings do not support the existence of a positive relation between changes in the size of the public debt-to-GDP ratio and interest rates. In effect, Caporale and Williams (2002) find a negative or non-significant relation between the variables for most countries, as do Knot and de Hann (1995). In a cross-sectional international study, on the other hand,

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1 Nevertheless, other studies argue against some of the assumptions underlying this theory, concluding that a relation can be expected between fiscal policy and interest rates. For a comprehensive review of the literature on Ricardian Equivalence, see Seater (1993).

2 The article by Alesina, Perotti and Tavares (1998) contains indications that long-term interest rates have risen in the wake of significant (and credible) deficit reductions.

Lane (1993) discerns a positive relation between interest rates and the public debt-to-GDP ratio, attributing this to the country risk premium.

Many studies have tackled the question of the relation between monetary policy and interest rates as part of a wider literature dealing with the economic effects of monetary policy. The main conclusion of these studies is that monetary policy affects the economy in the short run (e.g., via the negative correlation between inflation and unemployment, in accordance with the Phillips curve), while in the long run its effect on the economy is nominal rather than real (the neutrality of money). The fact that monetary policy has an effect in the short run does not mean that it will not also find expression in long-term (e.g., 10-year) yields, especially since long-term interest rates are an average of the expected short-term ones for the remaining term of the bond (as is stressed in expectations theory regarding the yield curve). In this context, we examine whether, due to the adoption of inflation targets, changes in short-term interest rates signal to the public that the intention is to keep rates high for a long time, thereby influencing long-term yields, and especially their distant (forward) component.

The theoretical and empirical approach adopted here follows and expands the one presented by Sargent (1969), according to which yields in the money market have two components: the steady-state equilibrium interest rate, which is determined by the supply of savings and the demand for investment (in a closed economy), and the deviation from that rate, which may be the outcome of monetary policy. In our theoretical formulation we expand that approach, enabling private saving to respond to changes in public saving – in accordance with Ricardian Equivalence. Concurrently, we enable investment to react to the government deficit, in line with studies which focus on the restraining effect of expansionary fiscal policy. We also extend the model to a partly open economy in which sources of saving include capital flows, which are determined by interest rates abroad. From the formulation of a general equilibrium we derive a reduced-form equation of market yields on bonds, in which the main explanatory variables are fiscal policy, monetary policy, changes in GDP, and interest rates abroad. In addition to estimating the factors impacting on overall yields, we estimate equations in which the dependent variable is the forward yield given the various interest rates.[3] This addition is important for isolating the effect due to the short end from the long-term yields, making it possible to gain a better understanding of the transmission mechanism between the explanatory variables and long-term interest rates.

We then examine the extent – if any – to which fiscal policy affects monetary policy, thereby indirectly influencing yields in the money market. The motivation for undertaking this test arises from recent studies (Woodford, 2001; Canzoneri and Diba, 2002), according to which attaining a price-stability target, which is the target of monetary policy, requires appropriate fiscal policy.

We find that both monetary and fiscal policy affect money market yields. Monetary policy has a direct influence on long- and short-term yields. The

[3] For example, the expected interest rate for the sixth to the tenth year on 10-year bonds.

dominance of monetary policy, as is indicated by this study, may be due to the disinflationary policy implemented in Israel in the last decade and which is unique to that period. Fiscal policy impacts directly on money market yields via the expected deficit and the deficit targets, and indirectly through the effect on inflation expectations and hence on monetary policy.

The article consists of four sections. In the following section we present the theoretical framework of the research. In Part Two we describe the data and review briefly Israel's monetary and fiscal policy. The estimation and the results are presented in Part Three, and the conclusion is given in Part Four.

1. A conceptual framework for examining the factors affecting bond yields

We adopt Sargent's (1969) conceptual framework, according to which the money market yields on government bonds can be decomposed into two components: the *ex ante* equilibrium interest rate at which the saving rate is in balance with the demand for investment, according to the economy's fundamentals (defined here as "basic equilibrium"). This component cannot be observed directly, but is influenced by observable economic factors which affect the demand for investment (both domestic and abroad) as well as the supply of savings, and especially by fiscal policy. The other component of market interest is the deviation from this rate due primarily to monetary policy (the loanable funds model). This framework enables us to examine the effects of fiscal and monetary policy on money market yields.

We extend Sargent's model in several respects: we adapt it to real rather than nominal yields (in view of the large share of CPI-indexed government bonds in Israel), and adjust it to the possibility that Ricardian equivalence exists, *i.e.*, that private savings will respond to a change in the government deficit; to the possibility that fiscal policy will have a restraining effect on domestic investment, and also that interest rates abroad can exert an influence if the economy is open to capital flows.

The money market yield on government bonds ($R_{m(t)}$) can be described as follows:

$$R_{m(t)} = R_{e(t)} + [R_{m(t)} - R_{e(t)}] \qquad (1)$$

where the first element in the equation is the basic equilibrium interest rate, and the second describes the possible difference between market yields and basic equilibrium yields. The basic equilibrium interest rate is the one at which the saving rate, including government saving and capital inflow, is equal to the demand for investment (all the saving and investment variables are expressed as a percentage of GDP).

The investment demand equation can be written as an "accelerator model", in which investment I is positively dependent on a change in GDP, (Δy) (see, e.g., Mehra, 1994), and negatively on the interest rate. Investment could also depend on

the economy's demographic structure (Demog), which influences the demand for residential and nonresidential investment. In Israel, in particular, the influx of immigrants in the early Nineties had a significant impact on the extent and timing of residential and nonresidential investment. In addition, as stated, investment could be (positively) contingent on public saving (*SG*) if it affects productivity. Note that *I* is demand for investment, not actual investment (which includes involuntary inventory investment), as otherwise equation (5) below would be an identity.

$$I_{(t)} = g_0 + g_1 \Delta y_{(t)} + g_2 Demog + g_3 R_{e(t)} + g_4 SG_{(t)} \tag{2}$$

Private saving (*SP*) depends positively on the interest rate, and negatively on public saving. The extent to which public saving affects the behavior of individuals reflects their level of Ricardian behavior.

$$SP_{(t)} = s_0 + s_1 R_{e(t)} + s_2 SG_{(t)} \tag{3}$$

Capital inflows (*FF*) depend positively on the difference between the real domestic interest rate and that abroad, R_f, assuming that the economy is not completely open to capital flows, so that interest-rate differences may exist. If the economy is completely open to capital flows the domestic interest rate will be the same as that abroad, and the other variables will not affect it,

$$FF_{(t)} = f_0 + f_1 (R_{e(t)} - R_{f(t)}) \tag{4}$$

and at equilibrium, the following should obtain:

$$SP_{(t)} + SG_{(t)} + FF_{(t)} = I_{(t)} \tag{5}$$

Equality between saving and the demand for investment will determine the basic equilibrium interest rate. Solving equation (5) yields:

$$R_e = \frac{1}{(s_1 + f_1 - g_3)} \left[(g_0 - s_0 - f_0) + g_1 \Delta y + g_2 \, Demog + SG(g_4 - s_2 - 1) + f_1 \, R_f \right] \tag{6}$$

The basic equilibrium interest rate is positively influenced by a rise in GDP, which increases the demand for investment. A higher interest rate abroad will be expressed in a higher domestic rate, to the extent that the economy is open to capital flows, denoted by the coefficient f_1. A decline in government saving (a rise in the deficit *less* government investment), which increases the government's demand for sources, will influence domestic interest rates in line with the sensitivity of saving and investment to changes in the government's behavior.

The second component of market yields depends on monetary policy. Tight policy, expressed in higher short-term rates, will contribute to a rise in real market yields, and can be written as follows:

$$R_m - R_e = k_0 + k_1 R_{MON} \tag{7}$$

where R_{MON} is the monetary interest rate set by the central bank in real terms.

All in all, the reduced form of the yield equation can be written as being contingent on the following factors:

$$R_m = a_0 + a_1 \Delta y + a_2 Demog + a_3 SG + a_4 R_f + a_5 R_{MON} \tag{8}$$

where:

$$a_0 = \frac{(g_0 - s_0 - f_0)}{(s_1 + f_1 - g_3)} + k_0, \qquad a_1 = \frac{g_1}{(s_1 + f_1 - g_3)}, \qquad a_2 = \frac{g_2}{(s_1 + f_1 - g_3)},$$

$$a_3 = \frac{(g_4 - s_2 - 1)}{(s_1 + f_1 - g_3)}, \qquad a_4 = \frac{f_1}{(s_1 + f_1 - g_3)}, \qquad a_5 = k_1$$

The denominator in the a_0 to a_4 coefficients is positive as its first two components are positive, and the third (the effect of the interest rate on demand for investment) is negative. The a_1 coefficient is expected to be positive, in line with the sign of g_1. The size and sign of a_3, the coefficient of government saving, depends on the extent to which private saving and investment respond to a change in government saving. If full Ricardian Equivalence exists ($s_2 = -1$), private saving adapts, so that there is no change in total demand, and hence the interest rate is not expected to change if investment does not respond to government behavior ($g_4 = 0$). In that case a_3 is expected to be zero. If investment rises as government saving increases, because of expectations of faster growth ($g_4 > 0$), and there is full Ricardian equivalence, the coefficient is positive. In all other cases the relative intensity of the response of private savings (and investment) to the size of public savings will determine the size of the coefficient.[4] The extent to which the economy is open to capital flows is expressed by the coefficient a_4. In a completely open economy, where interest rates are determined on the basis of interest abroad (*i.e.*, f_1 tends to infinity), we will expect to obtain $a_4 = 1$ while all the other coefficients converge to zero.[5] The coefficient of monetary policy is expected to be positive, but its size will depend on the nature of the transmission mechanism between the interest rate set by the central bank and the market yield for longer term bonds.

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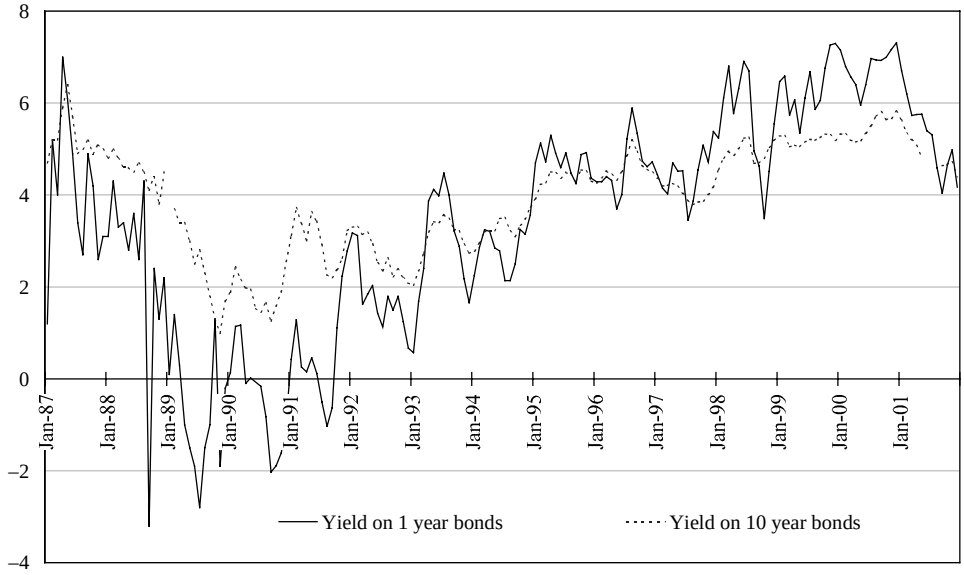
[4] The coefficient s_2 may fluctuate, thereby reflecting a risk premium that rises as public saving contracts.

[5] If the economy's risk premium depends on the other factors in the equation, their coefficient may differ from zero.

Figure 1

Real Yields on 1-Year and 10-Year CPI-indexed Bonds, 1987-September 2002



2. Policy overview and description of data

Our research focuses on the Nineties, using monthly data for the period from August 1991 to the end of 2001. Several factors characterize the sample period. The policy setting was changed to include deficit and inflation targets.[6] Furthermore, tradable bonds accounted for a relatively small proportion of total government debt (which also includes nontradable bonds) until the mid-Eighties; only in 1990, did they reach 50 per cent. Furthermore, the government used administrative measures to intervene in the capital markets. In other words, the market had not previously played a significant role in determining yields before the Nineties.

The market for CPI-indexed bonds, from which the yields examined in this study are derived, constitutes a vital component of the domestic capital market. In December 2001 the stock of tradable government bonds was about 40 per cent of GDP, with CPI-indexed bonds accounting for about 50 per cent of this.

An examination of short- and long-term yields shows that throughout most of the Nineties there was a trend rise in (real) yields on bonds for all horizons (Figure 1). This trend characterizes all horizons, although with varying intensities,

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[6] In addition, monthly reporting of government activity began only in 1990.

so that the relation between yields and horizons, which may be represented by the yield curve, changed in the course of the decade.

Table 1 gives the yield for bonds of varying terms. Two notable characteristics emerge. First, the average yield is very similar for all horizons. Second, the longer the horizon, the smaller the standard deviation over time. This result is expected if we assume that long-term yields are the weighted average of expected future short-term interest rates.

Table 1

Main Statistics on Bond Yields, 1990-June 2002

Horizon	**1**	**3**	**5**	**10**
Mean	3.74	3.86	3.87	3.96
Standard deviation	2.30	1.74	1.47	1.15
Maximum yield	7.32	6.89	6.53	5.82
Minimum yield	–2.02	–0.49	0.34	1.26

Table 2

Correlation Between Change in Yields at Different Horizons, 1990-June 2002

	1	**3**	**5**
3	0.88		
5	0.84	0.92	
10	0.67	0.75	0.84

Table 2, which gives the correlations between the change in yields at different horizons, shows that the correlation is relatively high, but declines as the difference between terms increases.[7]

[7] The correlation between the *levels* of yields for different horizons (not shown) is very close to unity.

Since we are interested in isolating the effect of policy on the long-term part of yields, we also calculated future yields for various terms. The main statistics are given in Table 3.

Table 3

Main Statistics on Future Bond Yields, 1990-June 2002

Horizon	**1**	**2-3**	**4-5**	**6-10**
Mean	3.74	3.92	3.87	4.05
Standard deviation	2.30	1.49	1.13	0.92
Maximum yield	7.32	6.87	6.01	6.41
Minimum yield	–2.03	0.30	0.98	1.93

2.1 Monetary policy

We present the effect of monetary policy by means of the real interest rate, which is obtained from the difference between the central bank's nominal interest rate – which was the central bank's principal monetary instrument in the period reviewed – and inflation expectations derived from the capital market. We also estimate the same equations using both the bank's nominal interest rate and inflation expectations instead of the real interest rate. As Figure 2 shows, from the end of 1993, and more clearly from the end of 1994, the central bank's interest rate was raised in order to reduce inflation and achieve the declining inflation targets that were announced since 1993.

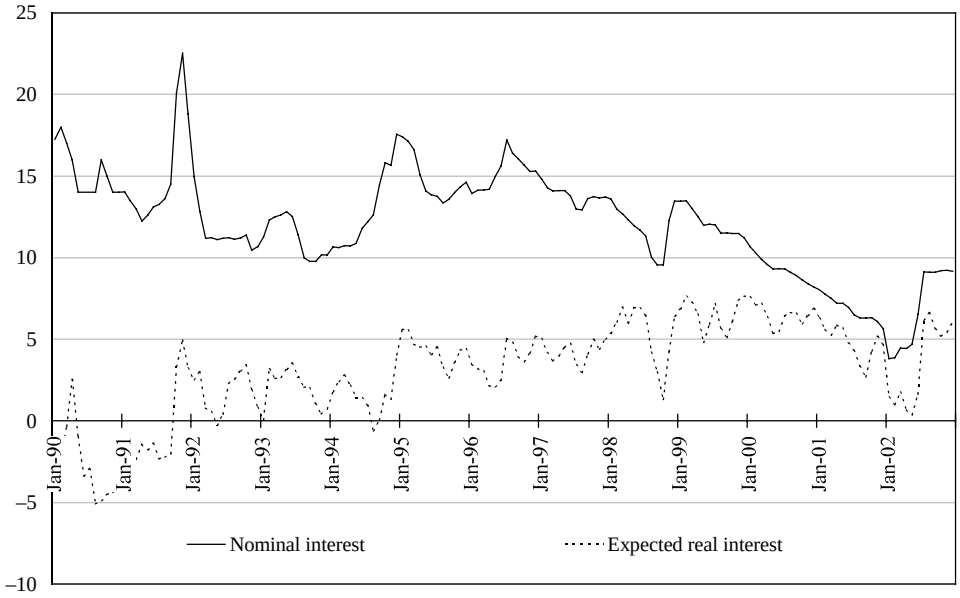
Our examination shows that the central bank interest rate and the yields on bonds of various terms affect each other, in terms of Granger causality. This relation may indicate that these yields are taken into account in the central bank's policy, apparently because they serve as an indicator of expected economic activity. A table describing the results of the tests is given in Appendix B. Our estimation refers to these relations, as described below.

2.2 Fiscal policy

To describe fiscal policy in the last ten years, we examine three main indices: the government's domestic deficit, the annual deficit targets and the change in them, and the public debt-to-GDP ratio.

Figure 2

Central Bank Interest Rate, in Nominal and Real Terms



The government's domestic deficit,[8] adjusted for the effect of the business cycle, stood at an average of 4 per cent of GDP in the Nineties, albeit with large fluctuations around this level,[9] as presented in Figure 3.

The government deficit used in our estimation is the government's domestic deficit (including credit extended),[10] adjusted for seasonal factors and the business cycle. The latter adjustment is made because it is reasonable to assume that the price of long-term bonds will be influenced more by the permanent than the current deficit (we examine this hypothesis below). Whereas adjusting for the effect of the business cycle does not make the adjusted deficit a permanent one, it removes an important component, which is perceived by the public as transitory.

Adjustment for the business cycle is made in two ways:

1. By calculating the deficit as the difference between expenditure divided by

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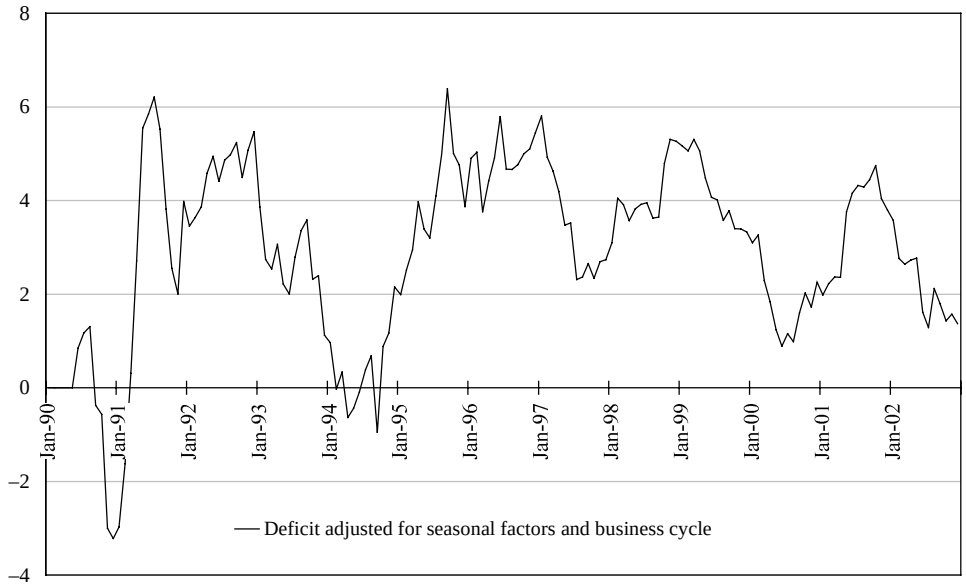
[8] The domestic deficit is used because the deficit in foreign currency was fairly stable in annual terms throughout the period and its changes reflect mainly seasonal shifts which do not always take a fixed path around a fixed level. In order to adjust for this 'noise' we have chosen to focus on the domestic deficit.

[9] Adjustment was made in two ways for the effect of the business cycle. First, it was assumed that potential GDP rises by an average of 4 per cent a year, in line with its average growth rate since 1973. Second, it was assumed that per capita potential GDP rises by an average of 1.5 per cent a year, also similar to its average growth rate since 1973. The results do not differ significantly whichever estimation is used.

[10] Monthly data for the deficit excluding credit exist only from 1997.

Figure 3

The Government Deficit/GDP Ratio Adjusted for Seasonal Factors and the Business Cycle (Moving 6-Month Average)



potential GDP, on the one hand, and non-tax revenue divided by *potential* GDP and tax receipts divided by *actual* GDP, on the other.

2. By estimating a model for forecasting the deficit which incorporates various real and financial variables. The model uses the variables included in Brender's (2001) model of tax revenue. The share of the deficit explained by cyclical variables is not expected to affect long-term yields, since this component is perceived by the public as not permanent. By contrast, the other components of the expected deficit – reflecting mainly developments on the expenditure side and structural (and statutory) changes in the composition of income – are likely to affect long-term yields if they are perceived as permanent.

The government's deficit target: in 1991 it was decided to set a declining path for the domestic deficit, against the backdrop of the influx of immigrants and rise in the government deficit. However, these targets were changed several times in the course of the decade, virtually every time a new government was formed. Determining deficit targets for several years in Israel is in line with the trend of setting long-term fiscal targets which developed at that time in the EU and other countries. Nevertheless, a comparison of the development of the actual deficit in Israel with that of those countries shows that the difference between the domestic deficits in Israel and in the EU grew.

The (net) public debt-to-GDP ratio fell sharply at the beginning of the decade, subsequently remaining stable until 2000.

3. Estimation and results

The factors affecting bond yields for various terms are estimated by a set of SUR (Seemingly Unrelated Regression) equations, which adjusts the estimation for a possible correlation between the equations' residuals for the various yields. Since we cannot reject the hypothesis that the yields on bonds for some terms Granger cause the central bank interest rate, which is an explanatory variable in the equations, we also estimate the system using instrumental variables for the central bank interest, *i.e.*, the 3SLS (Three Stage Least Squares) method. When this method is used the results of the estimation are not significantly different from those obtained using SUR (see tables in Appendices D1 and D2).

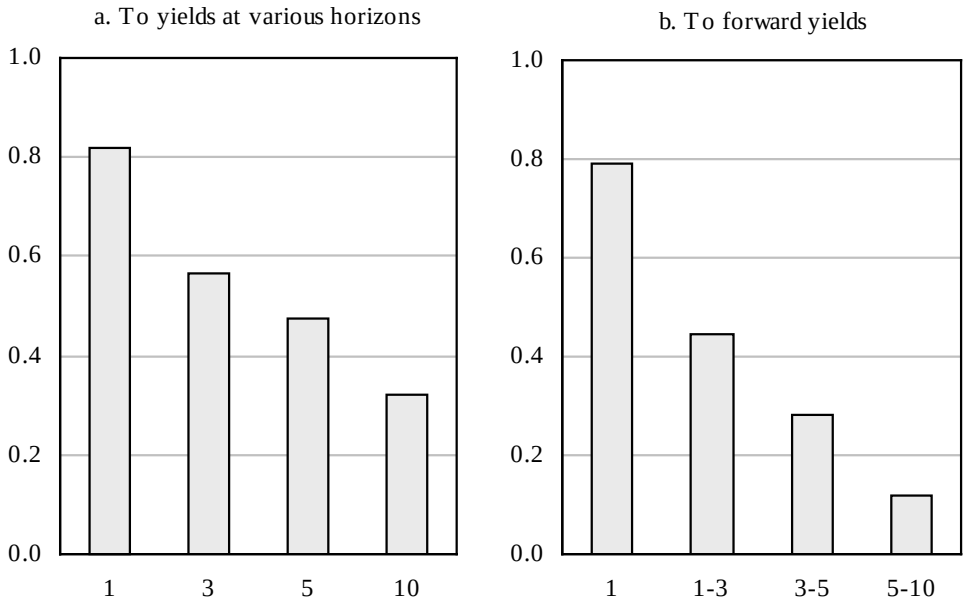
In order to reflect the different behaviors along the yield curve, we estimate a system of four equations for horizons of one, three, five, and ten years. We estimate the system for yields on bonds and for derived forward yields. Estimating the factors influencing forward yields enables us to identify and isolate the effects of the explanatory factors for sub-periods of long-term bonds.

In accordance with the theoretical framework presented in Section 1, the equations in the system include variables for monetary policy, fiscal policy, interest abroad, and the change in economic activity, as well as several demographic variables. The equations also include a lagged dependent variable to adjust for the serial correlation between yields on bonds. The results of the estimation are given in Tables 4a and 4b. The results of estimating the equations without the lagged dependent variable are similar to those described below, and the explanatory level is also very high, but the existence of the serial correlation requires an estimation that includes the lagged variable.

Monetary policy: the effect of the interest rate is found to be significant for all horizons, but the longer the horizon, the lower the intensity. A 1 percentage point rise in the real monetary interest rate gives rise to a 0.82 percentage point increase in the yield on 1-year bonds and a 0.32 percentage point rise in that on 10-year bonds (Figure 4). The estimation of forward yields shows that the impact of monetary policy on long-term yields is not only due to the fact that they incorporate short-term yields, but also because monetary policy has a direct and significant effect on the long end, *i.e.*, on expected future yield. A 1 percentage point rise in the real monetary interest rate is expected to be expressed in a 0.28 percentage point increase in the yield in the fourth and fifth years, and only a 0.1 percentage point rise (albeit statistically significant) in the expected yield in the sixth through tenth years (Figure 4B). These results attest to the fact that there is a transmission mechanism of the monetary policy that determines both short- and long-term interest rates. In addition, the results indicate that a change in the central bank interest rate, which is set each month, is also perceived as an indicator of longer-term policy, and hence affects expected future interest rates, too. This interpretation is supported by the results of a

Figure 4

The contribution of monetary policy*



* The expected change in yields (in percentage points) in response to a 1 percentage point rise in the central bank's marginal interest rates.

rolling regression[11] we estimated, which show that the relation between the central bank's short-term rate and long-term rates weakened over time. This may be explained by the fact that as the disinflation process progressed the public gradually became convinced of its chances of success, and hence also believed that the high current interest rates no longer signal high future rates.

These results run counter to the prediction of Segmented Markets theory, that the behavior of long-term investors is not influenced by short-term rates. It may reflect the public's learning curve with regard to the central bank's determination to adhere to the disinflation process, which constituted a change from previous policy.

The decomposition of the real interest rate: we also estimated the equations in a formulation which included the nominal interest rate of the central bank and inflation expectations instead of the real interest rate. The results show that the coefficients of the nominal rate and expectations are similar (with inverse signs). According to the Wald test, the hypothesis that the coefficient of the nominal

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[11] We estimated the model for a period of 6 years (72 observations), shifting the starting point by one month each time. The first regression was from August 1991 to July 1997 and the last was from January 1995 to December 2001.

interest rate is equal to that of inflation expectations, for all terms, cannot be rejected.

In order to identify the effect on yields of expected future – as well as actual – monetary policy, we tried to incorporate indicators of expected monetary policy in the equations. The first of these is the difference between yields on unindexed 1-year bonds and the central bank interest rate. A positive difference, with bond yields above the interest rate, attests to expectations that the interest rate will rise in the coming year (up to a term premium). The addition of this variable does not improve the quality of the estimation or the equation's forecasting ability. Another variable we examine is the residual of the central bank interest rate equation[12] (Taylor Rule), as this represents the unexpected element of the central bank interest rate. When the residual is positive, *i.e.*, actual interest is higher than expected, the interest rate is expected to fall in the future, so that a positive residual should contribute to lower yields for long terms. The effect of this variable is significant for terms of five to ten years, but not for shorter terms. In this instance, too, there was no substantial change in the results of the estimation of the system or any improvement in the forecasting ability of the equations. We also tried to include a variable for significant interest rate changes in the equations – interest rate squared or a dummy variable taking the value +1 or –1 for interest-rate changes greater than 1 or smaller than –1, but they were not found to be significant. An attempt to examine the effect of monetary interest separately for periods when the central bank raised the interest rate as opposed to periods when it lowered it did not produce significant results.

Fiscal policy: in the main specification of the system of equations fiscal policy is represented by three explanatory variables: the expected cyclically-adjusted domestic deficit, the deficit target, and the influx of immigrants.

The effect of the variable for the expected deficit (adjusted for seasonal factors and the business cycle) is found to be significant for all yield terms. The effect of a rise of 1 per cent of GDP in the deficit ranged from 0.15 for yields of up to a year to 0.21 for 10-year yields (Figure 5a). As expected,[13] the effect of the budget deficit on long-term yields was found to stem primarily from the contribution of the long end and not from that of the "short end". A rise of 1 per cent of GDP in the deficit is expected to increase the yield from the sixth to the tenth years by 0.26 percentage points (Figure 5b). The effect of the actual deficit, which is not adjusted for the business cycle, was not significant. Moreover, including the deficit (whether cyclically adjusted or not) for a period that includes both the future and the past – or just the past – did not produce significant results. In view of possible reservations concerning the computation of the cyclically adjusted deficit, we examined the result that only the permanent deficit affects yields by calculating the cyclically-adjusted deficit in another way. We estimated an equation for the government deficit (Appendix C1) which included cyclical variables, such as GDP and wages.

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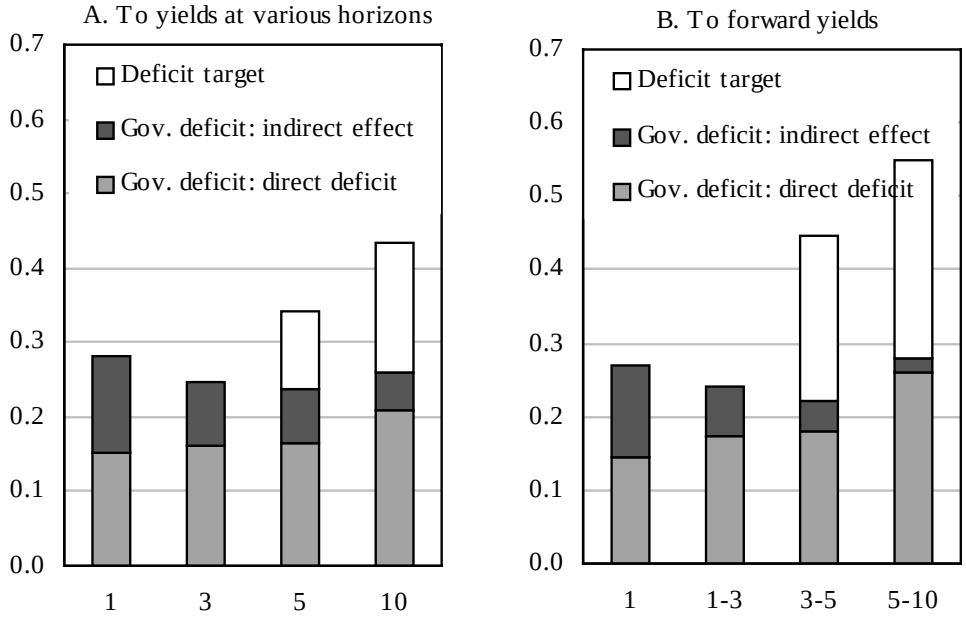
[12] The results of the estimation of the equation are presented in Appendix A1.

[13] See, for example, the findings of Wachtel and Young (1987).

Figure 5

The Effect of Fiscal Policy*



* The expected change in yields (in percentage points) in response to a 1 percent of GDP rise in the government's cyclically-adjusted domestic deficit, and in the deficit target.

We use the residuals of this equation, which represent the non-cyclical part of the deficit, as an alternative way of measuring the cyclically-adjusted deficit, and find that only that part of the deficit influences yields, while its cyclical part (the deficit explained by the equation) has no effect on them. The results also show that it is *expected* rather than actual behavior that is pertinent with regard to yields. This is particularly the case because information about the past is expected to be reflected in the lagged yield, which is also included in the equation. These findings are similar to those of Feldstein (1986) for the U.S.

Additional information on which the public can base its expectations regarding the future deficit is the government's *deficit target* for the next few years. This applies if the government's decisions are perceived as credible. With respect to 1-year yields we include the target for the coming year; for longer yields we have included the target for three years ahead. We do not incorporate targets for longer terms because their credibility seems to us to be lower and because they are not available for some of the estimation period. The effect of the target on yields is found to be significant only for long horizons – five and ten years. The coefficient for the target is not significantly different in these horizons from that for the deficit,

Table 4a

Results of Estimation for Bond Yields

	B1	**B3**	**B5**	**B10**
Intercept	0.336	0.579	0.630	0.559
	1.15	3.19	4.16	4.13
Real central bank interest	0.358	0.229	0.169	0.092
rate	13.80	14.86	13.66	9.57
Expected deficit	0.067	0.069	0.059	0.059
	2.33	3.46	3.80	4.97
Change in GDP	6.969	3.685	2.120	1.359
	2.64	2.33	1.89	2.29
U.S. interest (from 1998)	–0.02	0.055	0.046	0.034
	0.86	2.51	2.552	3.05
Deficit target for next year	–0.08			
	1.40			
Deficit target for 3 years		0.013	0.036	0.049
		0.69	2.14	3.18
Influx of immigrants	–0.012	–0.035	–0.034	–0.025
	0.47	–2.55	3.12	2.95
Influx of immigrants (–30)	0.022	0.016	0.011	0.008
	2.23	2.60	2.235	2.06
Lagged dependent variable	0.562	0.595	0.640	0.713
	17.2	19.97	23.73	26.59
R^2	0.953	0.970	0.973	0.975
DW	1.70	1.42	1.36	1.43
N	125	125	125	121

* Values in small font are *t*-values.

Note: *Bx* is the gross yield to maturity on CPI-indexed government bonds for *x* years; the real central bank interest is the nominal interest *less* 12-month inflation expectations; expected deficit is the moving average of the government deficit, adjusted for seasonal factors and the business cycle, six months ahead; the change in GDP is in log form and seasonally adjusted. In rows 1 to 3 the change in GDP is in the last three months, and in row 4 it is for the last six months; U.S. interest is the yield on U.S. government T-bonds for *x* years, adjusted for inflation for the same number of years (in the past) *times* a dummy with value 1 in 1998 and subsequently; the influx of immigrants is calculated as the moving average of the last six months.

Table 4b

Results of Estimation for Forward Yields

	F1	**F1_3**	**F3_5**	**F5_10**
Intercept	0.554	0.676	0.851	0.620
	1.66	3.26	3.57	3.25
Real central bank interest	0.352	0.163	0.092	0.029
rate	12.98	10.42	5.46	2.69
Expected deficit	0.065	0.063	0.058	0.065
	2.23	3.19	2.76	4.57
Change in GDP	8.531	3.26	0.967	1.94
	2.70	1.58	0.43	1.91
U.S. interest (from 1998)	–0.022	0.075	0.049	0.035
	0.65	2.59	1.74	2.95
Deficit target for next year	–0.158			
	1.87			
Deficit target for 3 years		0.018	0.073	0.067
		0.65	2.19	2.78
Influx of immigrants	–0.003	–0.037	–0.048	–0.030
	0.11	2.52	2.96	2.82
Influx of immigrants (–30)	0.019	0.013	0.004	0.005
	1.81	2.00	0.62	1.08
Lagged dependent	0.555	0.634	0.675	0.751
variable	14.97	15.59	14.57	18.35
R^2	0.953	0.962	0.930	0.946
DW	1.71	1.54	2.06	1.99
N	125	125	125	121

* Values in small font are *t*-values.

Fx_y is the gross future yield to maturity from year *x* to year *y* on indexed government bonds; the real central bank interest is the nominal interest *less* 12-month inflation expectations; expected deficit is the moving average of the government deficit, adjusted for seasonal factors and the business cycle, six months ahead; the change in GDP is in log form and seasonally adjusted. In rows 1 to 3 the change in GDP is in the last three months, and in row 4 it is for the last six months; U.S. interest is the yield on U.S. government T-bonds from year *x* to year *y*, adjusted for inflation for the same number of years (in the past) *times* a dummy with value 1 in 1998 and subsequently; the influx of immigrants is calculated as the moving average in the last six months.

and is significant in the equations in which it is included even when this is done in addition to the deficit; removing it does not alter the coefficient of the deficit.[14]

We also include the *influx of immigrants in the last six months*. The rise in the deficit due to the cost of absorbing immigrants is expected to have only a slight effect on long-term yields, because a deficit of this kind should be temporary and "cyclical" to some extent. The monthly rate at which new immigrants reached Israel accelerated in the early Nineties, peaking at about 20,000 in mid-1991, contracting at the beginning of 1992 to 6,000, to less than 4,000 in 2001. The influx of immigrants was found to have a negative and significant effect on yields for three, five, and ten years.

An important variable used in the literature for describing fiscal policy is the *public debt*. Although there are reasons for expecting the debt (especially net debt adjusted for government loans to the public) to influence yields, because of the risk premium and a shortage of sources for private-sector investment, our various attempts using different definitions of the debt, do not indicate a relationship of this kind. As noted above, this result is consistent with findings based on time series data for other countries. In addition to the debt-to-GDP ratio,[15] which has a downward trend, especially in the first half of the decade, we also tried to include short-term deviations of the debt from its trend.[16] These are found to be positive and significant, as expected (*i.e.*, a positive deviation from the declining trend serves to raise yields), but the variable served to crowd out the deficit target variable (and that for immigrants with a 30-month lag). This may indicate that the current deviation from the trend of the debt is perceived as being long-term, and hence replaces the expected deficit target for the next few years. Note that the debt figures we use were measured annually for most of the period, and so are less appropriate for describing the effect of the size of the debt on the interest rate.

The *indirect effect of fiscal policy via monetary policy*: fiscal policy may also have an indirect effect on yields through monetary policy, *i.e.*, when setting its interest rate, the central bank also takes the development of fiscal variables into account. This hypothesis has been posited in several recent studies, where it is claimed that monetary policy cannot attain the price-stability target without relating to fiscal policy, and that in addition to the Taylor Rule, monetary policy must also consider the targets connected with the government deficit (Woodford, 2001).

An empirical examination of the relation between fiscal shocks and monetary policy is presented in Canzoneri, Cumby and Diba (2002) by means of a SVAR system which includes fiscal variables – government expenditure and taxes, real economic activity, prices, central bank interest rates, long-term interest rates, and the banks' reserves. The correlations thus obtained indicate that even if the central

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[14] When we included the target for the next year in the equation for the yield between the first and third years, its effect was not significant.

[15] The net and gross debt (excluding government credit to the public) and the domestic debt.

[16] The deviations were derived alternatively from the trend using the HP procedure, from a linear and a squared trend.

bank's response is formulated in terms of the Taylor Rule, which includes only activity and prices, since the latter are influenced by fiscal policy (government expenditure), in the final event the government's behavior does impact on monetary policy. They also show that in the framework of the system they estimated, government behavior also has a direct effect on the central bank's interest rate and this is similar in extent to its indirect influence.[17]

To test the hypothesis that monetary policy is influenced by fiscal developments, we estimate an equation for the central bank's interest rate (see Appendix A). According to the equation, the interest rate is determined by the difference between inflation expectations and the inflation target, as well as by the level of inflation in the preceding year, economic activity, and interest rates abroad. The equation also incorporates a smoothing factor, which is the lagged interest rate. The government's expected cyclically-adjusted deficit for the next six months, as represented in the long-term yield equation, does not have a direct effect on monetary policy decisions. However, even though the central bank does not examine the development of the deficit directly, the deficit may influence the development of inflation expectations, and since these are taken into account when the central bank sets interest rates, the deficit impacts indirectly on rates. Estimating the equation for the development of inflation expectations does in fact bear out this hypothesis (Appendix A2), and we find that the expected deficit has a positive effect on the public's inflation expectations. The indirect effect of the deficit via expectations is expressed in nominal interest-rate changes, due to the central bank's response to expectations, as well as in actual expectations, which determine the real interest rate. In general, this can be written as follows:

$$\begin{aligned} R_m &= \alpha_0 + \alpha_1 R_{MON} + \alpha_2 SG = \alpha_0 + \alpha_1 (i - \pi^e) + \alpha_2 SG \\ &= \alpha_0 + \alpha_1 ((\beta_0 + \beta_1 \pi^e) - \pi^e) + \alpha_2 SG = \alpha_0 + \alpha_1 (\beta_0 + (\beta_1 - 1)(\gamma_0 + \gamma_1 SG)) + \alpha_2 SG \\ &= (\alpha_0 + \alpha_1 (\beta_0 + \gamma_0 (\beta_1 - 1)) + (\alpha_2 + \alpha_1 (\beta_1 - 1)\gamma_1) SG = \delta_0 + \delta_1 SG \end{aligned} \tag{9}$$

where R_m is the yield on bonds, R_{MON} is the central bank's real monetary interest, SG is the expected government deficit, and π^e is inflation expectations. The constant term in the equation represent all the other explanatory variables.

The magnitude of the indirect effect of the deficit on real interest rates depends on three factors: the extent to which short-term rates influence long-term ones (α_1), the extent to which the central bank adjusts the interest rate *beyond* the rise in expectations (β_1–1), and the impact of the deficit on inflation expectations (γ_1). The direct and indirect effect of the deficit on real long- and short-term interest rates[18] is shown in the table overleaf.

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[17] Examination of the effect of a change in taxes on monetary policy did not give unequivocal results.

[18] In the long run, *i.e.*, taking into account lagged effects.

Table 5

Overall Effect of Deficit on Real Interest Rates

Horizon	Direct effect of deficit	Indirect effect*	Total effect
1	0.153	0.129	0.282
3	0.170	0.088	0.258
5	0.163	0.074	0.237
10	0.206	0.050	0.256

* Multiple of the effect of the deficit on the central bank's real interest rate (0.157) in coefficient of this variable in the interest-rate equation for the appropriate term.

From Table 5 and Figure 5 it can be seen that even though the direct effect of fiscal policy grows as the interest-rate horizon gets longer, because the influence of the central bank rate is greater for shorter terms, the additional impact of the deficit via monetary policy increases in shorter terms, so that the overall impact of fiscal policy is similar for all terms – about 0.25.

Interest abroad: we include the real yield on U.S. government bonds for terms equivalent to those of domestic bonds in the equation in order to learn how interest rates abroad affect yields on domestic bonds. Since the yield on foreign bonds is nominal, it is necessary to adjust for inflation expectations in the U.S. for the relevant period. We choose to deduct actual past inflation for a period equal to the term of the bond, from its yield, assuming that inflation expectations over a longer horizon will be based on the average over a longer period in order to smooth short-term fluctuations and expectations. In an alternative specification we incorporate the one year dollar interest rate for all terms. Ten-year CPI-indexed bonds were issued for the first time in the U.S. in 1997. Since then they have been issued annually, so that a series of real yields to redemption for terms of between nine and ten years exists.[19] Hence, for the ten-year yield we used the real yields obtained on these bonds,[20] and also for calculating the forward interest rate of between five and ten years.

An attempt to include this rate for the entire period or partial periods was not successful, other than the formulation that incorporates this interest rate from 1998.[21] The liberalization of the Israeli economy was a lengthy process which took place primarily in the Nineties, and the results of the estimation attest to the fact that the alternative interest rate abroad became relevant only towards the end of the decade, and even then only partly. The coefficient of the yield on U.S. government bonds is

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19 The term to maturity grows shorter during the year until a new series is issued.

20 Since in the final event interest abroad is included in the equations only from 1998 (via a dummy variable), we could use this series.

21 The dummy variable for a year was also included in the equation separately from the interest-rate variable, but since it was not significant it was dropped from it.

statistically significant but small for terms of three, five and ten years. This could be because of the tax discrimination that still existed (in the sample period) regarding investments in assets abroad,[22] and the tendency to invest in domestic assets due to the greater accessibility of information about them ("home bias"). An attempt to enable the coefficient to change after 1998 by multiplying the time trend or adding a dummy variable for the period after 2000 did not produce significant results. We also include interest rates abroad in the central bank interest-rate equation (Appendix A1), and find that it has had a significant impact on monetary policy since 1998.[23] Consequently, the total direct and indirect effect of interest rates abroad on bond yields in relatively great and predominantly indirect.

Together with the interest rate abroad, we also tried to include an indicator of the country risk premium, using two alternative estimations. The first is an aggregate index of the risk premium of emerging markets, calculated as the difference between the yield on these countries' bonds and that on U.S. bonds.[24] The second is an index of a country's financial reputation, as published by *Institutional Investor*.[25] These variables were not significant in the estimation, despite the expectation that country risk will be expressed in domestic bond yields.

Change in GDP: an acceleration in the GDP growth rate increases demand for investment, according to the accelerator theory and is, hence, expected to raise the yield on bonds. The GDP data we use constitute a smoothing to monthly frequency of seasonally-adjusted quarterly data at constant prices. Our estimation uses a moving 3- or 6-month average of this variable. The effect of this variable is significant in both the yield equations and the estimation of forward yields. We tried to include the deviation of actual from potential GDP in the set of equations,[26] but its influence is not significant.

The effect of the rise in investment due to immigration: we also include a variable for the influx of immigrants, with a two-and-a-half-year lag (in addition to the number of immigrants with a six-month lag, reflecting the perception of the deficit at the time of the influx), in order to give expression to the effect of immigrants' demand for housing, as well as of their absorption in employment, on the demand for investment goods, and hence on yields. As expected, the results are that this variable has a positive and significant effect on yields for all terms, although at certain specifications it is not significant.

Other variables which we incorporated within the estimation and are not found to be significant include the standard deviation of the exchange rate and the

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22 Individuals were liable for tax on both CPI-indexed bonds and assets abroad, while institutional investors were liable for tax only on assets abroad, so that there was discrimination against assets abroad during the sample period.

23 The coefficient for the long-term foreign interest rate in the Bank of Israel's interest-rate equation is unity (see Appendix A).

24 This index is calculated by J.P. Morgan.

25 The index reflects the weighted average of the marks obtained in an extensive survey of about 100 banks throughout the world, and is published semi-annually.

26 This variable is I(0).

change in the exchange rate, as indices of uncertainty which could lead to a demand for a higher risk premium, namely, higher yields on indexed bonds. We also attempted to include financial variables: total monthly borrowing by the government, which could be expected to act to raise the interest rate and the relative stock of all bonds.

3.1 Stability tests

Dynamic simulation: to examine the quality of the estimation we ran a dynamic simulation of the system for bond yields for one, three, five, and ten years. In other words, we solved the values of the dependent variables while substituting their lags, as they were solved in the preceding period (and not their true value). The results are presented in Figure 6.

As the figure shows, the simulation fits the actual yields very well, and in most periods it succeeds in shadowing trend changes in yields. The results for the

Figure 6

Dynamic Simulation

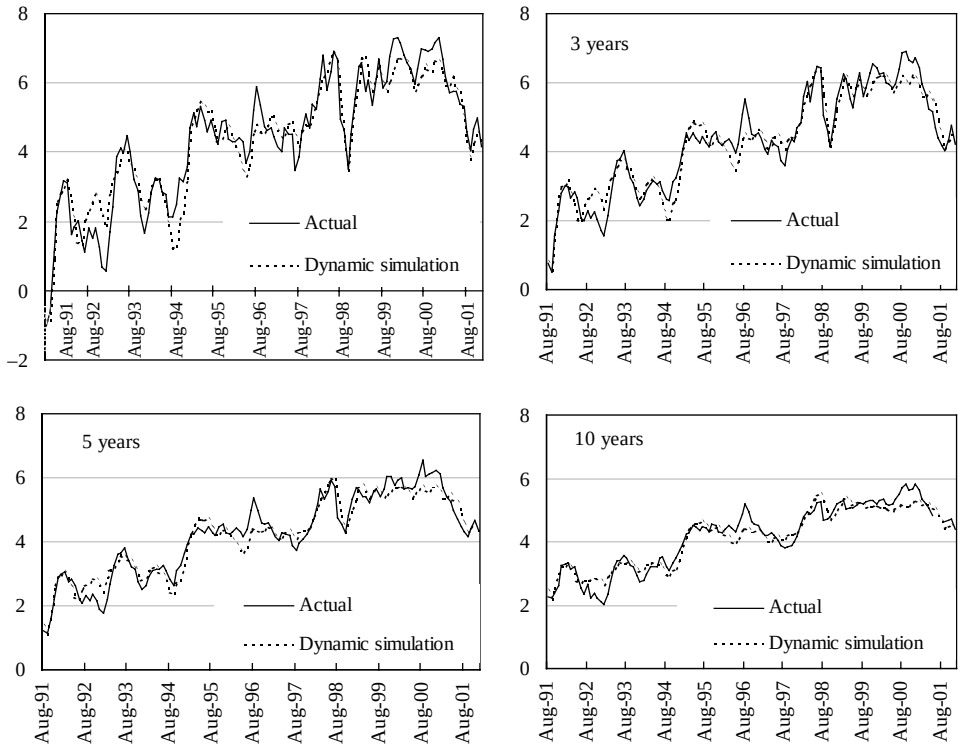

Table 6

The Contribution of Economic Factors to Explaining the Variance of the Yield on 10-Year bonds (Share of Total)*

	Monetary policy	Fiscal policy			Other variables		
	Expected real monetary interest	Expected deficit/GDP	3-year deficit target	Change in influx of immigrants in last 6 months	Change in GDP	Interest abroad	Change in influx of immigrants with two-and-a-half-year lag
1991.08-2001.12	0.69	0.09	0.02	0.10	–0.01	0.16	–0.04

* The contribution of each variable to total variance includes its covariance with the other explanatory variables. As a result, there may be negative values, as shown in the table.

yields on ten-year bonds are slightly less precise, and it appears that the simulation shadows the direction of the changes, but not their intensity.

3.2 Analysis of the contributions of fiscal and monetary policy to interest rates

The results of the equations presented above may be used to examine the relative contributions of several variables – especially monetary and fiscal policy – to explain the variance of long-term interest. The analysis was based on decomposing the explained variance of long-term interest into the variance deriving from each of the explanatory variables, adjusted for the size of its coefficient in the equation.[27]

As Table 6 shows, the variance of monetary policy, as expressed in the volatility of real monetary interest, contributes 70 per cent of the total variance of long-term yields, while the three components of fiscal policy contribute about 20 per cent in the entire period. The relatively large contribution of monetary interest rates to long-term yields stems from two factors: a relatively large coefficient and the fact that expected real interest rates soared in the course of this period, when the disinflationary policy was implemented.

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[27] The covariance of each explanatory variable with the other variables is included in the contribution of the variable in question to the explained variance.

4. Conclusion

The principal finding of this study is that both fiscal and monetary policy influence real yields. We find that the direct effect of fiscal policy is greater on long-term than on short-term yields. A rise of 1 per cent of GDP in the deficit increases the real interest rate on 10-year bonds by about 0.2 percentage points. These results apply to the share in GDP of the cyclically adjusted deficit expected in the next six months. We also find that without this adjustment the deficit does not affect bond yields, possibly because some of it (a large part, according to the results presented in Appendix C1) reflects cyclical changes – which are perceived as transitory. In addition, the deficit in the past (in the last six months at any point in time) does not affect yields significantly, *i.e.*, the public's expectations regarding the deficit can be described as rational rather than adaptive. Alongside the actual deficit, the deficit target also influences interest rates, and if it rises so do yields, particularly in the medium and long run. The coefficient of the deficit target is similar to that of the actual deficit. An examination of the effect of the debt-to-GDP ratio shows that it does not have a significant effect on yields, and this bears out the result of similar studies undertaken for other countries (Kitchen, 1996; Caporale and Williams, 2002), although deviations from the debt trend (which is negative in the ten-year-period examined) have the expected (positive) impact on yields. We also find that the deficit has an indirect effect on yields in the money market, via its impact on monetary policy (through influencing the public's inflation expectations). This attests to the relation between fiscal and monetary policy. The response of real yields to changes in government saving indicates that the public does not fully adjust its saving rate to that of the government. If changes in government saving are perceived as permanent, this result may be interpreted as evidence that Ricardian equivalence does not exist in full in Israel.

Monetary policy has a marked impact on short-term yields but also affects long-term yields. Although the extent of its influence declines as the term of the interest rate increases, its effect on long-term yields is not inconsiderable either: a 1 percentage point rise in expected real interest (the central bank interest rate *less* inflation expectations) contributes a 0.3 percentage point to the yields on ten-year bonds. Most of the effect of the expected monetary short-term interest rate on long-term yields is because the latter reflect an average of yields for all terms, including short ones, but it is also due to the direct impact of monetary interest rates on long-term yields (*i.e.*, on the future component of the yield). This may reflect the fact that even though the monetary policy instrument – the interest rate – is a short-term one, in the context of the adoption of inflation targets at the beginning of the decade, when the inflation rate was high, and the declared central bank policy of convergence to price stability, the public assumed that this policy would be maintained in the long run, so that it also influenced long-term interest rates (beyond its effect via short-term interest).

APPENDIX A

1. The Central Bank's interest rate equation

$$i = \underset{5.66}{2.15} + \underset{8.44}{0.28}(\pi_{t-1}^{e} - \pi^*) + \underset{1.76}{0.06}\pi 12_{t-1} + \underset{2.04}{0.0663}MA((Y_{t-3} - Ypot_{t-3})/Ypot_{t-3}, 6)$$

$$+ \underset{2.74}{0.24}US1^* D97aft - \underset{3.37}{1.61}D97aft + \underset{21.6}{0.77}i_{t-1}$$

Sample: 1992.1-2001.12 $\quad R^2 = 0.96 \quad DW = 1.11$

* Values beneath coefficients are *t*-values.

i: Bank of Israel nominal marginal interest.

$(\pi_{t-1}^{e} - \pi^*)$: gap between expected inflation (derived from capital market) and inflation target.

$\pi 12$: inflation in last 12 months.

US1: Nominal 12-month yield in U.S.

$MA((Y_{t-3} - Ypot_{t-3})/Ypot_{t-3}, 6)$: moving average of gap between actual and potential GDP, with a 3-month lag.

D97aft: dummy variable = 1 from 1998.

2. Inflation expectations equation

$$\pi_t^{e} = \underset{3.97}{2.06} + \underset{1.92}{0.11}MA(GDEF\_YA_{t+6}, 6) - \underset{1.74}{0.07}MA(i_{t-2}, 2) - \underset{3.58}{1.19}D97aft + \underset{15.8}{0.85}\pi_{t-1}^{e}$$

Sample: 1992.1-2001.12 $\quad R^2 = 0.94 \quad DW = 1.51$

* Values beneath coefficients are *t*-values.

π_t^{e}: Inflation expectations derived from capital markets.

$MA(GDEF\_YA_{t+6}, 6)$: 6-month moving average of deficit adjusted for seasonal factors and business cycle, for 6 months ahead.

$MA(i_{t-2}, 2)$: 2-month moving average of Bank of Israel interest with two-period lag

D97aft: dummy variable = 1 from 1998

APPENDIX B

Test of Granger Causality Between Central Bank Interest and Yields on Bonds of Various Terms

Yield horizon	Null hypothesis (6 lags)	
	ir does not Granger cause *B*	*B* does not Granger cause *ir*
1	3.6*	1.7
3	3.9*	2.0**
5	3.2*	2.7*
10	2.8*	3.6*
1-3	3.6*	1.1
3-5	3.2*	2.7*
5-10	1.2	1.9**

* The null hypothesis can be rejected at the 5% confidence level.
** The null hypothesis can be rejected at the 10% confidence level.

ir: the monetary interest set by the central bank *less* inflation expectations

B: the yield on government bonds, in accordance with the horizon denoted

APPENDIX C1

Cyclical Factors Affecting the Government's Domestic Deficit: Estimates of the Government's Domestic Deficit Including Credit, Seasonally Adjusted
(dependent variable: expected deficit in next six months)

Explanatory variable	**Coefficient**
Intercept	73.303 8.04
GDP	–0.154 3.29
GDP with 13-month lag	–0.671 9.61
GDP with 6-month lag	0.435 6.01
Total bank foreign-currency credit	0.245 8.89
Sale of apartments in last 3 months	0.208 1.66
Sale of apartments in last 7 months, with one-year lag	–0.659 4.09
Average wage per employee post, in last 8 months	–2.485 2.87
Average wage per employee post, in last 12 months, with 15-month lag	–5.030 3.30
Consumer goods imports in last 3 months	–3.886 3.94
Real change in General Share-Price Index	–0.161 13.84
Sale of shares abroad by Israeli parties at interest	–0.588 4.32
R^2	0.812
DW	1.426
N	125

Note: All the variables are in terms of moving averages. The government's domestic deficit, including credit, as a percentage of GDP, is seasonally adjusted; gross GDP is in NIS billion at 2000 prices; total bank credit in or denominated in foreign currency is in NIS billion at 2000 prices; sales of new apartment are in thousands; the average wage per employee post is in NIS thousand at 2000 prices; consumer goods imports are in NIS billion at 2000 prices; the real change in the General Share-Price Index of the Tel Aviv Stock Exchange is in points; sales of shares abroad by Israeli parties at interest includes mergers and is in NIS billion, at 2000 prices.

APPENDIX C2

Results of Estimation of Bond Yields with Deficit Equation

	B1	B3	B5	B10
Intercept	0.825	0.833	0.838	0.642
	2.46	3.82	4.51	3.96
Real central bank interest rate	0.348	0.223	0.165	0.091
	13.14	14.03	12.87	8.93
Expected deficit (estimate)	–0.033	–0.009	–0.006	0.010
	1.00	0.41	0.33	0.70
Unexpected deficit	0.008	0.053	0.050	0.048
	0.16	1.60	1.86	2.28
Change in GDP	6.08	2.93	1.47	0.962
	2.15	1.74	1.24	1.50
U.S. interest (from 1998)	–0.046	0.040	0.031	0.023
	1.49	1.62	1.62	1.99
Deficit target for next year	–0.087			
	1.44			
Deficit target for 3 years		0.022	0.043	0.058
		0.94	2.19	3.29
Influx of immigrants	–0.006	–0.028	–0.029	–0.021
	0.20	2.02	2.58	2.31
Influx of immigrants (–30)	0.004	0.004	0.001	0.001
	0.42	0.67	0.22	0.14
Lagged dependent variable	0.569	0.615	0.662	0.748
	16.37	20.29	24.42	27.56
R^2	0.951	0.967	0.971	0.972
DW	1.59	1.33	1.27	1.30
N	125	125	125	121

* Values in small font are *t*-values.

Note: *Bx* is the gross yield to maturity on *x*-year CPI-indexed government bonds; the central bank's real interest is the 12-month nominal interest adjusted for inflation expectations; the expected deficit is estimated from the equation in Appendix C1; the unexpected deficit is the part that is not explained by the equation in Appendix C1; the change in GDP is in log terms and seasonally adjusted.
In columns 1-3 the change in GDP is in the last 3 months, and in columns 4-6 it is in the last 6 months; the U.S. interest is the yield on U.S. government bonds for *x* years, adjusted for inflation during that number of years (in the past), *times* a dummy variable that takes the value 1 from 1998; the influx of immigrants is the moving average in the last 6 months.

APPENDIX D1

Results of 3SLS Estimation for Bond Yields

	B1	**B3**	**B5**	**B10**
Intercept	0.147	0.533	0.629	0.615
	0.48	2.81	3.83	4.10
Real central bank interest rate	0.444	.271	0.221	0.139
	12.30	14.04	13.47	10.35
Expected deficit	0.076	0.068	0.062	0.064
	2.47	3.47	3.69	4.74
Change in GDP	6.19	2.99	1.48	0.894
	2.31	1.89	1.31	1.43
U.S. interest (from 1998)	–0.042	0.053	0.039	0.027
	1.38	2.33	2.02	2.12
Deficit target for next year	–0.069			
	1.16			
Deficit target for 3 years		0.014	0.039	0.057
		0.71	2.21	3.39
Influx of immigrants	–0.012	–0.032	–0.033	–0.024
	0.44	2.25	2.76	2.42
Influx of immigrants (–30)	0.031	0.020	0.015	0.010
	2.78	2.97	2.55	2.13
Lagged dependent variable	0.505	0.557	0.584	0.647
	14.04	18.47	20.60	22.30
R^2	0.947	0.967	0.968	0.967
DW	1.54	1.31	1.22	1.24
N	125	125	125	121

* Values in small font are *t*-values.

Bx is the gross yield to maturity on *x*-year CPI-indexed government bonds; the central bank's real interest is the 12-month nominal interest adjusted for inflation expectations; the expected deficit is a moving average of the government deficit, adjusted for seasonal factors and the business cycle, 6-months ahead; the change in GDP is in log terms and seasonally adjusted. In columns 1–3 the change in GDP is in the last 3 months, and in columns 4–6 it is in the last 6 months; the U.S. interest is the yield on U.S. government bonds for *x* years, adjusted for inflation during that number of years (in the past) times a dummy variable that takes the value 1 from 1998; the influx of immigrants is the moving average in the last 6 months.

The instrumental variables for the central bank interest rate are all the exogenous variables in the equation, the lagged monetary interest, the deviation of inflation expectations from the inflation target, inflation in the last year, and potential GDP.

APPENDIX D2

Results of 3SLS Estimation for Forward Yields

	F1	F1_3	F3_5	F5_10
Intercept	0.716	0.969	0.675	0.391
	3.47	14.81	3.22	1.13
Real central bank interest rate	0.435	0.183	0.168	0.080
	10.98	9.01	7.14	5.29
Expected deficit	0.078	0.066	0.065	0.074
	2.47	3.25	2.81	4.67
Change in GDP	8.415	3.058	0.656	1.24
	2.61	1.49	0.28	1.16
U.S. interest (from 1998)	–0.037	0.075	0.026	0.024
	1.06	2.56	0.88	1.84
Deficit target for next year	–0.141			
	1.70			
Deficit target for 3 years		0.016	0.077	0.077
		0.57	2.24	3.07
Influx of immigrants	–0.008	–0.036	–0.051	–0.024
	0.25	2.40	2.83	2.03
Influx of immigrants (–30)	0.027	0.015	0.007	0.006
	2.38	2.18	0.86	1.10
Lagged dependent variable	0.494	0.611	0.569	0.666
	11.74	14.81	11.24	15.49
R^2	0.948	0.961	0.915	0.933
DW	1.55	1.49	1.78	1.70
N	125	125	125	121

* Values in small font are *t*-values.

Note: *Fx_y* is the gross future yield to maturity from year x to year y on indexed government bonds; the real central bank interest is the nominal interest *less* 12-month inflation expectations; expected deficit is the moving average of the government deficit, adjusted for seasonal factors and the business cycle, six months ahead; the change in GDP is in log form and seasonally adjusted. In rows 1 to 3 the change in GDP is in the last three months, and in row 4 it is for the last six months; U.S. interest is the yield on U.S. government T-bonds from year x to year y, adjusted for inflation for the same number of years (in the past) *times* a dummy with value 1 in 1998 and subsequently; the influx of immigrants is calculated as the moving average in the last six months.

The instrumental variables for the central bank interest rate are all the exogenous variables in the equation, the lagged monetary interest, the deviation of inflation expectations from the inflation target, inflation in the last year, and potential GDP.

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FISCAL POLICY AND INTEREST RATES IN EUROPE

Riccardo Faini[*]

Introduction

The appetite for fiscal discipline has been steadily declining among most industrial countries. Even after controlling for cyclical effects, budgetary balances have been deteriorating both in the US and in Europe. In Japan, a string of large fiscal imbalances has severely undermined the sustainability of the fiscal stance.

In the past, fiscal profligacy would have been punished by markets with higher interest rates and, in some cases, also exchange rate depreciation. However, in after EMU's Europe, exchange rate markets no longer discipline the fiscal behaviour of national governments. Perhaps more crucially, even the interest rate punishment to fiscal indiscipline is highly uncertain. On the policy side, finance ministers in Europe do not seem excessively concerned that toying with the Stability and growth pact could in the end undermine its credibility and trigger higher interest rates. Similarly, the current US administration has openly and repeatedly questioned the existence of a significant link between fiscal policy and interest rates (Council of Economic advisers, 2003). Academic opinions are also quite divided. Theory does not offer a clear-cut answer as to the effects of budget deficits on interest rates. Empirical evidence is not of much help either in resolving theoretical ambiguities. In the case of Europe, existing evidence (Bernoth *et al*., 2003; Codogno *et al*., 2003; Afonso and Strauch, 2003) points to a significant but quantitatively small effect of fiscal policy, with a one per cent increase in the deficit to GDP ratio raising interest rates on government bonds by less than 10 basis points. While not negligible, this effect is substantially smaller than that estimated in the US literature (Gale and Orszag, 2002), a difference that still begs for an explanation.

The purpose of this paper is to take a close look at the link between fiscal policy and interest rates in the European context. Contrary to the US, the link between fiscal policy and interest rates has not been subject to much investigation, particularly after EMU. Lack of sufficiently long series goes some way in explaining this omission. However, the policy relevance of the interest rate fiscal policy nexus is as high in Europe as in the US. First, Europe as a whole is a large player in world capital markets. Hence, fiscal policy in the EU can have a non negligible impact on international interest rates. Second, the Stability and Growth pact notwithstanding,

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lack of fiscal rigor has been a pervasive feature in most EU countries. However, domestic interest rates do not seem to have been much affected, at least so far. Third, and perhaps more crucially, an analysis of the European case is needed to better inform the ongoing debate on the Stability and Growth pact (SGP, henceforth).

A key issue is whether domestic fiscal policies affect mainly country spreads or have a substantial effect on the average level of the Euro area interest rates. This question has a significant bearing on how to reform the SGP. Indeed, if the budgetary stance of individual countries affects mainly country spreads there will be less reasons for concerns that fiscal slippages in one EMU member will spill over into higher interest rates for the union as a whole. Hence, the case for binding fiscal at the Euro area level would be less compelling. However, if interest rates are largely determined at the European level, expansionary fiscal policy in one country will affect interest rates in other member countries. For a proper working of the currency union, this negative externality will then have to be internalized through some mechanisms such as the SGP. A related question is whether such an externality may be relatively stronger for high-debt countries, presumably reflecting market concerns about a bail-out of an insolvent government, and whether therefore high-debt countries should be treated less leniently by a reformed SGP.

The remainder of the paper is organized as follows. In the next section we briefly review the theoretical underpinning of the budgetary deficit interest rates nexus. In section 2, we take a first look at the data, while in section 3 we describe our data sources, derive our estimating equation, and report the econometric estimates. In section 4 we take a closer look at the issue of sustainability for high-debt countries. Policy implications and conclusions are presented in the final section.

1. A brief theoretical interlude

Theory does not offer a clear-cut answer as to the effects of budget deficits on interest rates. The standard text book model predicts that either a tax cut or an increase in public spending will boost aggregate demand, shift the IS curve to the right, and raise interest rates. Admittedly, even in the basic IS-LM model, fiscal policy has no effect on interest rates in a small economy which is fully open to capital flows. Extending this model to a two-country set-up yields however a number of useful insights. First, fiscal policy recovers a role in the determination of interest rates. Second, and more crucially for the purpose of this paper, a fiscal expansion in one country will be associated with higher interest rates in the other country as well.

Unfortunately, the predictions of the basic open economy model are not particularly robust. In particular, a tax cut will not affect interest rates if, for a given volume of public spending, consumers fully anticipate the future tax burden associated with the shift from tax to debt financing. Households will simply save the

increase in disposable income brought about by the tax cut, in anticipation of a higher tax burden in the future. This is known in the literature as Ricardian equivalence. Similarly, an increase in public spending will leave interest rates unchanged if consumers are forward looking and government spending is a perfect substitute for private goods. Again, households will respond to the fiscal expansion by cutting spending and increasing saving. In sum, the fall in public saving, whether brought about by an increase in spending or by lower taxes, will be simply offset by the compensating behaviour of private agents. Hence, in this set up, fiscal policy in any one country will have no spill over effects on other countries.

Fiscal policy however recovers a role in the determination of interest rates if the standard conditions for Ricardian equivalence are not met, namely if agents are liquidity constrained, have limited horizons, or taxes are distortionary. Extending the non Ricardian model to a two country set up shows that here too fiscal policy in any one country will spill over to the other country as well.

Interestingly enough, fiscal policy also recovers a role in a pure Ricardian setting if government spending is assumed to provide no utility to consumers (or, less strongly, if the marginal utility of private consumption is independent of government spending). In the appendix, we illustrate a simple two country, two period model, where consumer intertemporal utility is isoelastic, the government budget is balanced in an intertemporal sense, and there is no investment. We show that a temporary increase at time 1 in government spending in any one country will lower domestic saving and raise global interest rates. The intuition is simple. The temporary increase in public spending leads to an equivalent reduction in public saving. Private consumption falls and private saving increases, since households anticipate a future increase in the tax burden. However, private consumption will fall by less than the increase in government spending (and in future taxes) since households will typically smooth their consumption path over time. Accordingly, the increase in private saving will not fully offset the fall in public saving. Hence, aggregate saving will decline in the first period and, under standard stability conditions, interest rates will rise both in country 1 and in country 2.

This simple example illustrates two important results. First, even in a Ricardian model, a temporary increase in government spending will lead to a fall in domestic saving provided that private and publicly provided goods are not perfect substitutes.[1] Second, fiscal spillovers may be important. An expansionary fiscal policy in country 1 will raise interest rates for country 2 as well. The welfare impact will be negative if country 2 is a net borrower (its terms of trade would then deteriorate). Moreover, in a more general model where initial public debt holdings are positive and taxes are distortionary, the increase in interest rate will negatively affect the budgetary situation in country 2, possibly forcing it to raise (distortionary)

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[1] Note that, in a Ricardian setting, a tax financed temporary increase in government spending would lead to an identical fall in domestic saving and an increase in interest rates. Accordingly, budget deficits may not be a sufficient statistics of the fiscal policy stance.

taxes. The net welfare impact may then be negative even country 2 is a net lender and its terms of trade have improved.

More crucially for the purpose of this paper, the discussion so far shows that, while an expansionary fiscal policy in one country may have no impact on its spreads (in the model, absent default risk, spreads are identically equal to zero!), it will nonetheless, in a large class of models, affect the aggregate level of interest rate. As we shall see later, most of the literature, particularly in Europe, has focussed on the impact of fiscal policy on spreads, thereby neglecting a relevant channel through which the budget affects the economy.

2. A first glance at the data

Empirical evidence is not of much help in resolving theoretical ambiguities. Many studies find a significant effect of fiscal policy on (real) interest rates. Others however come to the opposite conclusion.[2]

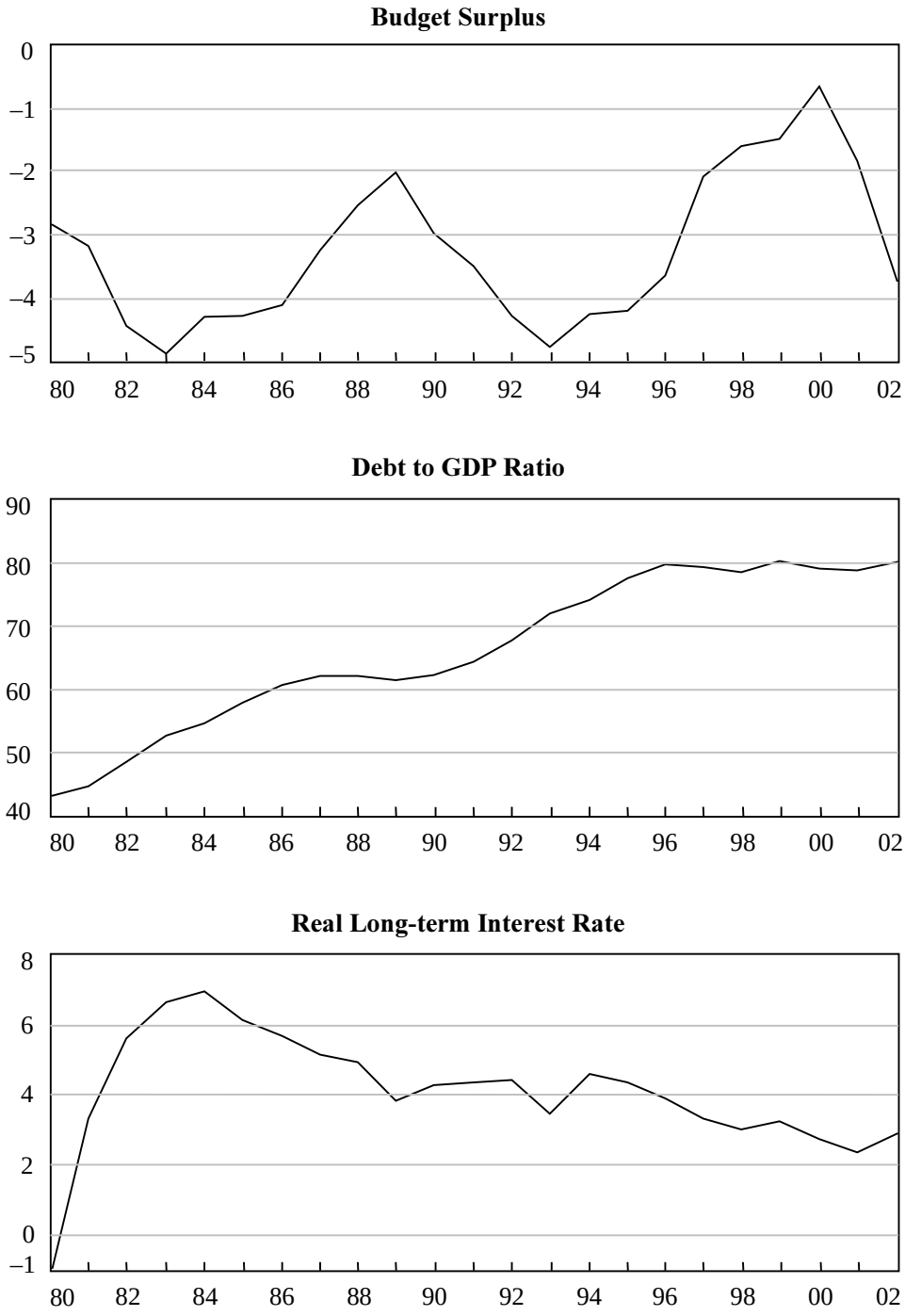
The diversity of findings is not too surprising, however, if we consider that the relationship between fiscal policy and real interest rates has not been particularly smooth. Figure 1 reports the behaviour of real interest rates since the early Eighties for the average of the G7 countries together with the ratios of public debt and the budget deficit to GDP. We see how in the early Eighties the deterioration of the debt and the deficit indicators coincided with a substantial increase in real interest rates. Indeed, between the late Seventies and the early Eighties, real interest rates rose from 0.8 per cent in 1977-79 to almost 6.5 per cent in 1982-85. During the same period, the debt to GDP ratio went from 44 to 52.5 per cent and the public sector deficit deteriorated from 2.5 to 4.5 per cent of GDP. From 1985 onwards, however, real interest rates on government debt have been on a downward trend, despite the continuing rise in the burden of debt. Presumably, the fall in real interest rates was related to the marked improvement in the budget deficit after 1983 (Figure 1). Yet, interest rates kept falling even after 1989, when the budget deficit soared again from 2 to almost 5 per cent of GDP. Most likely, financial markets were only mildly concerned by the budget deterioration during this period, as it was attributed mainly to the temporary slowdown of the economy and did not reflect a structural

---

[2] Evans (1985, 1987a, 1987b) and Barro and Sala-i-Martin (1994) do not find any significant effects of fiscal policy on interest rates. More recent evidence, however, has cast serious doubts on the absence of a link between fiscal policy and interest rates. Gale and Orsvag (2002) argue in their literature review that previous evidence about the lack of an impact of the current budgetary stance on the level of interest rates is at best misleading. In the context of forward looking financial markets, what truly matters is the medium and the long run stance of fiscal policy. Empirical evidence provides strong support to such a claim. Studies (Canzoneri *et al.*, 2002) that use projected budget deficits – using either commercial or official projections – tend to find a highly significant relationship with the level of interest rates, thereby confirming the early finding of Feldstein (1986). Moreover, as underscored by Canzoneri *et al.* (2002), it is also necessary to control for the stance of monetary policy. The main effect of fiscal policy will be felt on the spread between short and long-term rates and, more generally, on the term structure of interest rates rather than simply on the level at any point of time of such rates.

Figure 1

Fiscal Indicators and Interest Rates for G7 Countries



worsening of the fiscal position. Finally, in the second half of the Nineties the continuing decline in real interest rates was associated with a stabilization of the debt ratio and a marked improvement of the budget situation.

Figure 1 also shows the pronounced deterioration in the fiscal position of the G7 countries after 2000. Surprisingly enough, this evolution has been accompanied only by a relatively modest increase in the level of real interest rates. This evolution stands in sharp contrast with the events in the early Eighties, when the interest rate response to fiscal indiscipline was extremely pronounced. We will return to this puzzle in the concluding section of the paper.

Turning to the Euro zone, *i.e.* the main focus of this paper, the basic facts about fiscal policy and interest rates are described in Figure 2. The debt to GDP ratio rose from 35 percent in 1980 to 76 percent in 1996 and has basically stabilized since then. Real interest rates on the other hand have followed quite a different pattern. They rose quite steadily, from 1.6 percent to 6.7 percent, between 1980 and 1991 and have been on a downward path afterwards. In 2002 however, real interest rates increased again. The behaviour of interest rates closely mirrors the (cyclically adjusted) deficit. Figure 2 suggests that the steady improvement in the fiscal balances from 1990 to 2000 is likely to have played a substantial role in facilitating the decline of real interest rates during that period.

Figure 3 shows the correlation between real interest rates and public debt stocks at the country level. The relationship is not particularly strong. There is little indication that low debt to GDP ratios are associated with low real interest rates, neither before the advent of EMU (Figure 3a) nor afterward (Figure 3b). Similarly, even nominal interest rates seems to bear no clear relationships with the level of debt. In Figure 4 we focus on one single year, 2002, to avoid blurring the picture. We see that Belgium has a substantially higher debt burden that Austria, Spain, Portugal, Finland, and Ireland, but significantly lower costs of servicing its long run bonds.

Summing up so far, the link between interest rates and fiscal policy is not easy to detect. First, simply relating debt and real interest will not work. There are too many instances where rising debt ratios have coincided with falling real interest rates. Even at the cross country level, debt ratios and real interest rates show little correlation. This does not mean of course that debt stocks have no effect on real interest rates. There may be many confounding factors that blur the simple correlation between debt and interest rates. Moreover, markets may be concerned about future levels of debt and will, as a result, focus mainly on current and expected deficits. Finally, current deficits may have a different impact depending on the initial level of debt. A fiscal expansion will be more of a concern in a high-debt country like Italy, where public debt is well above 100 per cent of GDP than say in the Netherlands where the debt to GDP ratio is still below the 60 per cent mark.

Figure 2

Real Interest Rates, Debt and Primary Surplus in the Euro zone

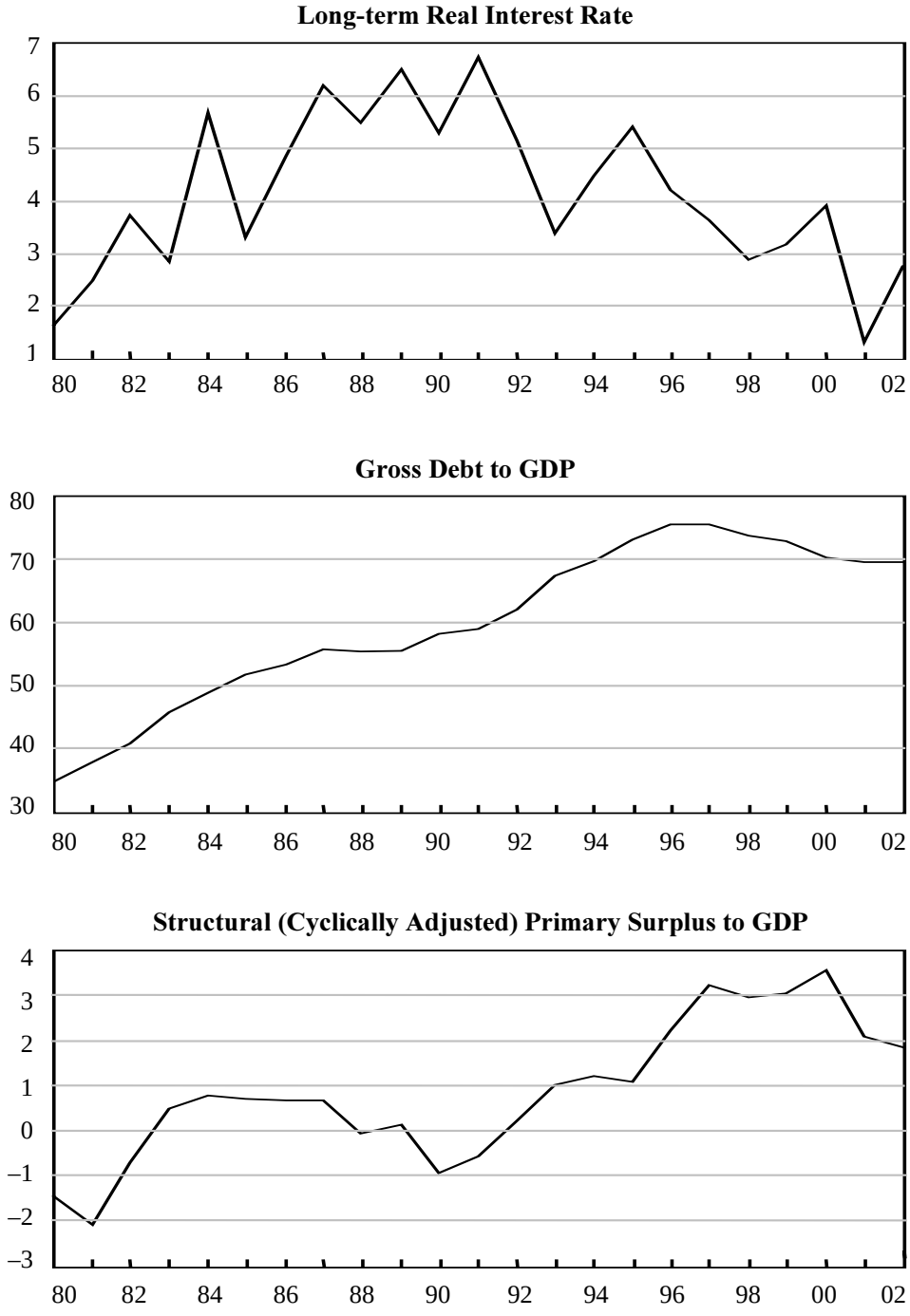
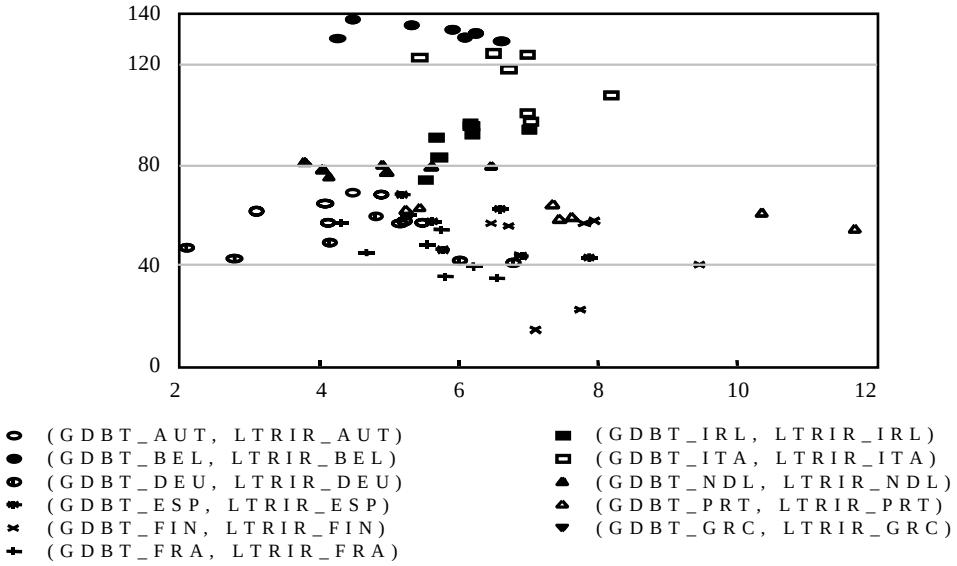


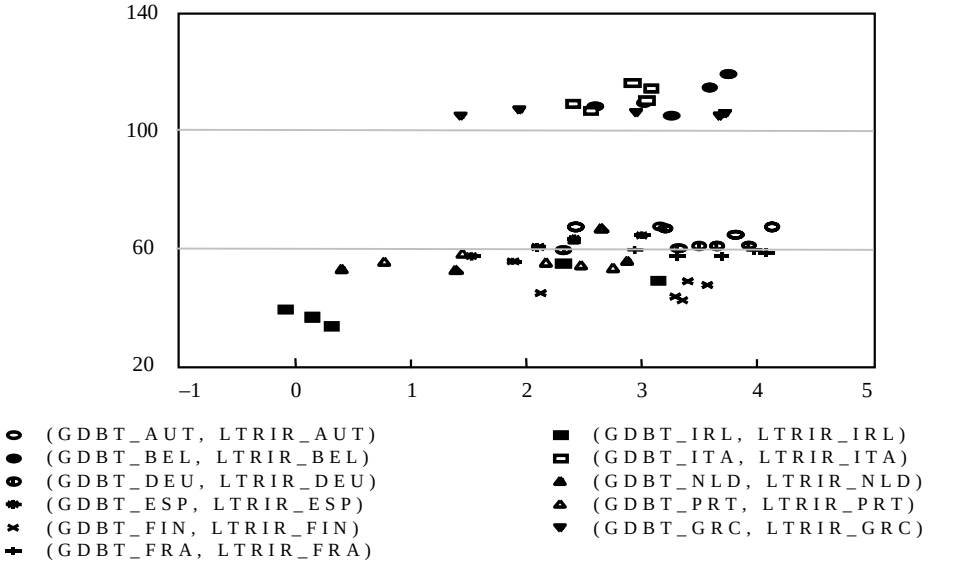
Figure 3

Debt and Real Interest Rates for EMU Members

a) 1990-1996



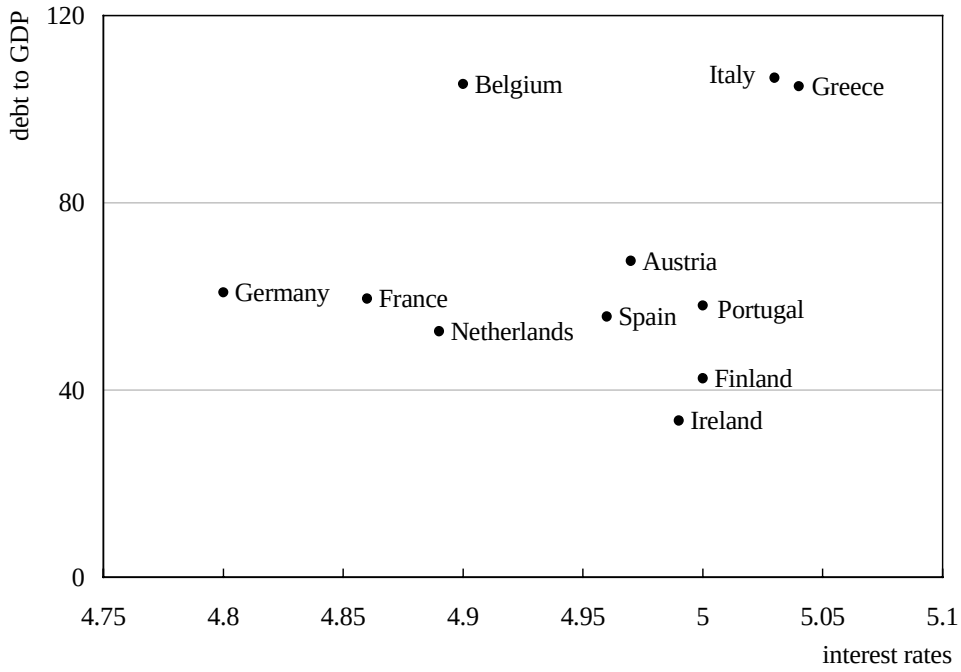
b) 1998-2002



Legend:
GDBT_i: Gross debt to GDT in country i
LTRIR_i: Long-term real interest rate in country i

Figure 4

Interest Rates and Public Debt



Hence, empirical analysis should control for both types of indicators[3] and perhaps also their interaction. Second, the cursory overview of the data show that focussing on unadjusted deficits is bound to be inadequate. We have seen how between 1989 and 1992 the average deficit in the G7 countries rose quite markedly while interest rates continued their downward course. Most likely, markets attributed the worsening of the fiscal situation to the (temporary) effect of the economic slowdown. Similarly, in the Euro zone interest rates started falling in 1990 despite a substantial deterioration in the fiscal balance. The link between interest rates and fiscal deficits reappears when one controls for the cyclical position of the economy (Figure 2).

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[3] The conclusions of the literature remain indeed quite diverse as to which fiscal variable truly matters. While Barro and Sala-i-Martin (1994) fail to find any significant effect of either debt or deficits on world interest rates, Tanzi and Lutz (1993) conclude that either one, but not both, play a significant role in the determination of global interest rates. Focussing on the US, Feldstein (1986) concludes that (expected) deficits are all that matters, with public debt having no explanatory power. More recent evidence (Muhleisen and Towe, 2004) comes to the opposite conclusion. They show that the key fiscal variable in the determination of US and global interest rates is (net) debt. This finding is somewhat surprising given that debt has kept rising during most of the Nineties while interest rates, and deficits, have started falling since at least the mid-Eighties (Figure 1). However, Muhleisen and Towe (2004) do not assess the relative contribution of these two fiscal indicators.

3. Fiscal policy and interest rates in EMU

The empirical literature on the link between interest rates and fiscal policy in Europe is not as developed as that in the US. Moreover, most (recent) contributions have focussed on micro analyses of the behaviour of spreads (Bernoth *et al.*, 2003; Codogno *et al*., 2003) or on event analyses (Afonso and Strauch, 2003). The main conclusion that emerges from such literature is that fiscal policy, however measured, matters but its effects are quite small, namely a one per cent increase in the deficit to GDP ratio would raise interest rates on government bonds by around 10 basis points. While not negligible, this effect is substantially smaller than that estimated in the US literature. However, as noticed in the previous section, it only focuses on spreads (most of these papers rely on the interest rate swap spreads) and overlook therefore the aggregate impact that higher deficits in one country may have on the *level* of interest rates, both nationally and for the currency union as a whole.

These are key questions for policy purpose. If for instance Gale and Orszag (2002) findings for the US – according to which a one per cent increase in the budget deficit is associated with an interest rate hike of 50-70 basis points – applied to Belgium or to Italy (where the debt GDP ratio is basically double the US), then a one percent increase in the primary deficit would be associated with an almost equally large rise in the interest bill. Under this scenario, fiscal profligacy would obviously become a much less palatable option. If, on the other hand, most of the interest rate impact of fiscal policy was felt at Euro area level, then markets would be quite ineffective in inducing budgetary discipline. More generally, whether expansionary fiscal policies in one (large) EMU country would result either in higher interest rates for the area as a whole or in a higher country spread has an obvious bearing on the much debated need for fiscal coordination in Europe.

a) The estimating equation

We follow much of the literature in assuming that real interest rates are determined by the interaction of aggregate saving and investment. In a closed economy context, for instance, private investment (I^{pr}) is identically equal to the sum of private (S^{pr}) and the excess of public saving over public investment, *i.e.* the budget surplus (B):

$$I^{pr} = S = S^{pr} + B \tag{1}$$

In what follows we normalize both saving and investment by GDP and assume that investment and saving are both a function of (real) interest rates. An increase in the level of real interest rates is associated with a fall in investment and, possibly, a rise in saving (Figure 5). The equilibrium is at point A where real interest rates have adjusted to ensure the equality of investment and total saving. A fiscal expansion will be associated with a fall in B, an upward shift in the saving schedule and a consequent rise in the level of real interest rates.

Figure 5

The Saving Investment Determination of Real Interest Rates

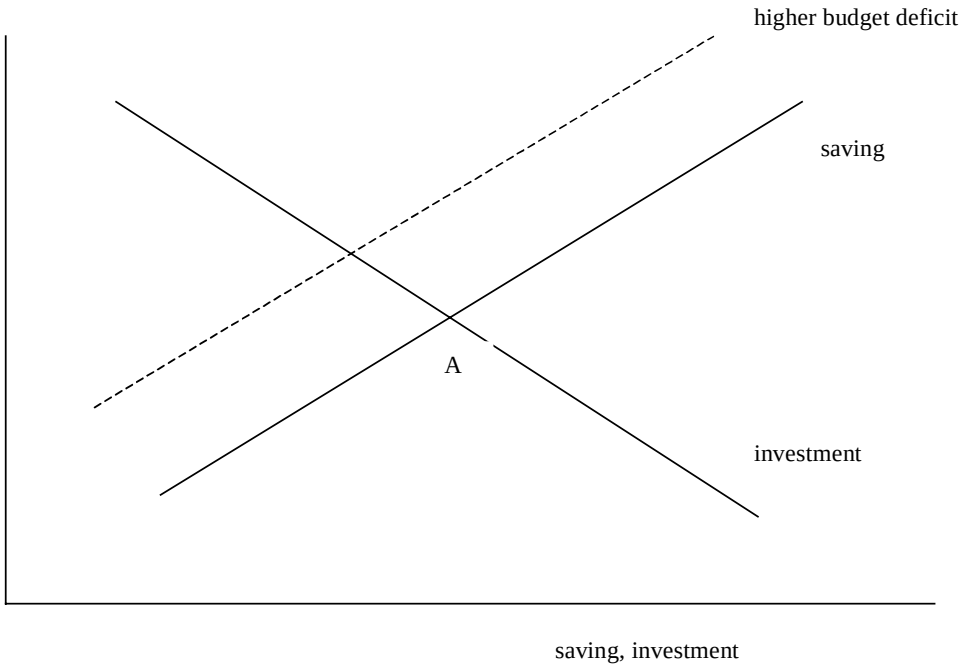

Figure 5 establishes a neat link between fiscal policy and real interest rates. However, as noticed before, it is essential to allow for the fact that such a relationship is sometimes obscured by a number of confounding effects. First, changes in productivity and, more generally in investment profitability may result in an outward shift of the investment schedule, thereby leading to higher interest rates, independently of any change in the fiscal stance. Looking at the Eighties, Blanchard and Summers (1984) conjectured that high interest rates in that period were mainly due to a significant increase in future investment profitability. Their conjecture was subsequently supported by Barro and Sala i Martin (1990) who identified a strong role for stock market prices – a proxy of anticipated investment profitability – in affecting world interest rates. Second, changes in interest rates may also reflect shifts in factors other than fiscal policy affecting private saving, such as demography, cyclical conditions and expected growth rates.[4] Third, fiscal policy

[4] The impact of higher profitability and growth on real interest rates is *a priori* ambiguous. In the standard setting of Figure 5, an increase in expected profitability would shift the investment schedule to the right and result in higher interest rates. However, if sustainability considerations (see section 5) are paramount, faster growth would lead to lower real interest rates.

may have an indirect effect on interest rates by affecting growth rates. As shown by Kneller *et al.* (1999) the growth impact of fiscal policy will typically be a function of the composition of both tax and expenditure variables. Finally, as just noticed, cyclical conditions affect both saving decisions and the link between interest rates and the budget. A cyclical downturn may result both in a deterioration of the budget balance and, through a monetary policy response, a fall in interest rates, thereby producing a negative correlation between budget deficits and interest rates (Laubach, 2004).

We therefore extend the simple model where investment and saving decisions respond only to interest rates in several directions.

First, we assume that investment depends on profitability (ρ), the output gap (*i.e.* the difference between actual, y, and potential output, y^*), expected inflation (π^E), and the real interest rate ($i - \pi^E$), where i, the nominal interest rate has been deflated by expected inflation (π^E). An increase in profitability and a rise in the output gap are expected to increase investment. For a given level of the real interest rate, the effect of π^E on investment is however ambiguous, since a rise in expected inflation should boost the value of tax deductions, but also erode the real value of depreciation allowances (Feldstein, 1986).

Second, private saving is assumed to be a function of the output gap, the real interest rate, expected inflation, net public saving (*i.e.* the budgetary balance), and possibly other variables that reflect the fiscal policy stance (D). The ratio of private saving to GDP is expected to be a positive function of the output gap (households will largely save a temporary rise of income) and, under standard conditions, a positive function of the real interest rate. The impact of expected inflation is instead unclear. In general, higher inflation discourages saving, since tax liabilities are typically a function of nominal interest income. However, higher inflation could be associated with an increase in precautionary saving. In addition, households may be prompted to increase their (measured) saving simply to restore the real value of their financial assets following a rise in inflation. By and large, therefore, the impact of expected inflation on private saving remains ambiguous.

Combining and solving the saving and investment equations yields the reduced form solution for the real interest rate:

$$i - \pi E = f(y - y^*, \pi E, B, D, \rho, MC) \qquad (2)$$

Equation (2) is the basis for our empirical work. An increase in the output gap should boost both saving and investment. Its effects on the real interest rate is therefore *a priori* ambiguous. Similarly, the impact of an increase in expected inflation on either saving or investment and hence on the real interest rate cannot be signed *a priori*. Also, an increase in profitability should be associated with a rise in real interest rates, unless as noticed earlier, the resulting acceleration in growth improves the long run sustainability of the budget. Finally, a fiscal policy expansion, as measured by B and D, should lead to higher interest rates.

The choice of fiscal policy indicators (*D* and *B*) is key. As noticed earlier, empirical analysis so far has been unable to cast much light on the issue. What is clear however is that, *a priori*, both stock (*i.e.* the level of public debt) and flow variables (*i.e.* the deficit) should matter. Why public debt should matter is easy to see. In a non Ricardian world, a large stock of public debt may be seen as adding to households wealth and would therefore depress saving and raise interest rates. The introduction of a flow variable is more controversial theoretically, but can be defended on several grounds. First, quite trivially, deficits, when properly measured, provide a link between debt stocks at different points of time. Second, and more crucially, expected future deficits are key in determining debt dynamics. Forward looking households are therefore likely to change their saving behaviour in anticipation of the future tax liabilities associated with a higher stock of debt. Third, debt dynamics is obviously linked to long run sustainability. If current deficits indicate that fiscal conditions are unsustainable, households will most likely adjust their saving and spending behaviour in response. Notice that even allowing for both debt and deficit effects may not be sufficient to fully describe the stance of fiscal policies. Indeed, as noticed before, a tax financed temporary increase in government spending, with no effect therefore on the budget balance, may nonetheless affect private saving[5] and the level of interest rates. Households may indeed respond to higher taxes today by decreasing saving so as to smooth consumption intertemporally. For this reason, in the empirical analysis below, we add to the list of fiscal indicators also the level of government consumption.[6]

We have also added to equation 2 an additional variable (*MC*) to capture monetary conditions. While monetary policy is the key determining factor of short run interest rates, fiscal policy will mainly affect the spreads between long and short term rates (Canzoneri *et al.*, 2002).

Equation 2 will be estimated on a panel of 11 EMU members (excluding Luxembourg, but including Greece) from 1979 to 2002. However, when applied to the case of EMU, it needs to be modified in some important respects. Indeed, in a currency or, more generally, in a financially integrated area, real interest rates will be a function not only of domestic variables but also of financial conditions for the area as a whole. To capture this factor, we add to equation (2) a measure of the average (GDP-weighted) real interest rate for the currency area as a whole, with the average EMU interest rate being defined so as to exclude the country concerned.[7] We must also allow for the fact that the average EMU interest rate is an endogenous variable as well, whose determination should follow closely the specification of

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5 Under the usual assumption that government spending is not a perfect substitute for private consumption.

6 A higher level of unproductive government consumption and distortionary taxation may however depress growth. If this effect is strong enough, interest rates may fall rather than rise.

7 An alternative approach would simply add to equation 2 the difference between each country's regressor and the corresponding variable at the EU level. Given that the two approaches are bound to be equivalent, in what follows we only take the first route.

equation 2. Accordingly, in this specification, we end up estimating a system of 12 equations, one for each EMU member[8] and one at the Euro zone level.

$$(i - \pi E)i = fi[yi - yi^*, \pi iE, Bi, Di, \rho i, MCi, (i - \pi E)\text{emu} - i] \qquad i=1,\ldots,11 \qquad (3)$$

$$(i - \pi E)\text{emu} = \text{femu}[y\text{emu} - y\text{emu}^*, \pi\text{emu}E, B\text{emu}, D\text{emu}, \rho\text{emu}, MC\text{emu}, (i - \pi E)\text{us}] \qquad (4)$$

Note that in equation 4 we allow for the fact that EMU is not a financially closed area by introducing a variable representing international financial conditions. To this effect, we add the level of US real interest rates ($i_{us} - \pi^{E}_{us)}$ to the list of explanatory variables in equation 4.

In this set-up, domestic fiscal policies affect interest rates through two channels. First, there is a direct impact on spreads. Expansionary fiscal policy should raise domestic spreads with respect to the prevailing rates in the remainder of the area. This effect is captured in equation 3, through the coefficients on B_i and D_i. Second, a fiscal expansion in one country will affect both the deficit and the debt stock for the Euro zone as a whole and hence the area level of interest rates. This is the spillover effect, that was described in section 2. The size of this effect will largely be a function of the relative size of the country. It is captured in equation 4 by the coefficient of B_{emu} and D_{emu}.

b) The data

Most of the data come from the OECD. As a measure of the interest rate on the stock of public debt, we use the yield to residual maturity on 10 years government bonds. The output gap also comes from the OECD. Expected inflation is computed separately for each country, and for the EMU as a whole, from a simple ARIMA process. For most countries, an ARMA (1, 1) process described the inflationary process quite well. Profitability is measured by the real (*i.e.* deflated by expected inflation) return on the stock market.

We have added to equations 3-4 a variable to capture the monetary policy stance. Under the assumption that Central Banks control short term interest rates, we have used the three month real money market rate as an indicator of monetary conditions.

The selection of fiscal policy indicators was relatively harder. As noticed earlier, there are good reasons in favour of having both a stock and a flow indicator. However, we still need some guidance as to which indicator to select. Concerning debt, one would in principle favour a net measure, that deducts government assets from government liabilities. Muhleisen and Towe (2004) and Orr and Conway (2002) use such an indicator. Unfortunately, existing measures of government assets are not easily comparable among countries and their availability

[8] In the actual estimation, we drop one country equation (Austria) to allow for the fact that the aggregate EMU equation is a combination of the individual countries' equations.

is relatively restricted. There are in addition unresolved conceptual and definitional issues (Elmendorf and Mankiw, 1999). For these reasons, in what follows, we rely on a more standard gross debt indicator. The choice of the deficit variable also raises a set of thorny issues. Just using current deficits is likely to be inappropriate for at least two reasons. First, measured deficits reflect not only the fiscal policy stance, but also factors such as the business cycle. As noticed earlier, relying on cyclically unadjusted fiscal indicators may introduce a spuriously negative correlation between budget deficits and interest rates. Second, measured deficits depend on the level of the interest rate and, hence, suffer from an endogeneity problem. To address the latter problem, we focus on the primary surplus, thereby excluding interest payments. To cope with the former issue, we rely on a cyclically adjusted measure of the deficit, that corrects actual deficits for the effects of cyclical fluctuations. In the end, therefore, we rely on the cyclically adjusted primary surplus.[9] We use the OECD indicator of the output gap as a measure of cyclical conditions and European Commission estimates of the elasticity of budgetary conditions to the cycle. Figure 6 shows how the cyclically adjusted deficit compared to the unadjusted measure.

c) Estimation results

Estimation results are presented in Table 1. The sample covers the period 1979-2002. All current EMU countries, with the exception of Luxembourg, are included. Incomplete data availability, particularly at the beginning of the sample, means that the panel is unbalanced. For the purpose of estimation, we define a system of 11 equations (one for each of the 10 EMU country[10] and one for EMU as a whole) and impose the equality of the slope coefficients, while allowing intercepts to differ across countries.[11] The system is then estimated through three stage least square. This procedure is designed to allow for the contemporaneous correlation of the error terms among the 11 equations. It is therefore more efficient than a standard fixed effect procedure (Arellano, 1987). It also controls for the possible endogeneity of most regressors in equations 3-4 (such as the EMU real interest rate, the real return on the stock market, the real short term interest rate, inflation, and the output gap).[12]

We first present the estimates for the 1979-98 period, *i.e.* before the advent of EMU, with a view to assessing the behaviour of interest rates before the introduction of the common European currency. The results are presented in

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[9] We use actual fiscal balances, but plan to extend the empirical analysis to assess the role of expected future deficits.

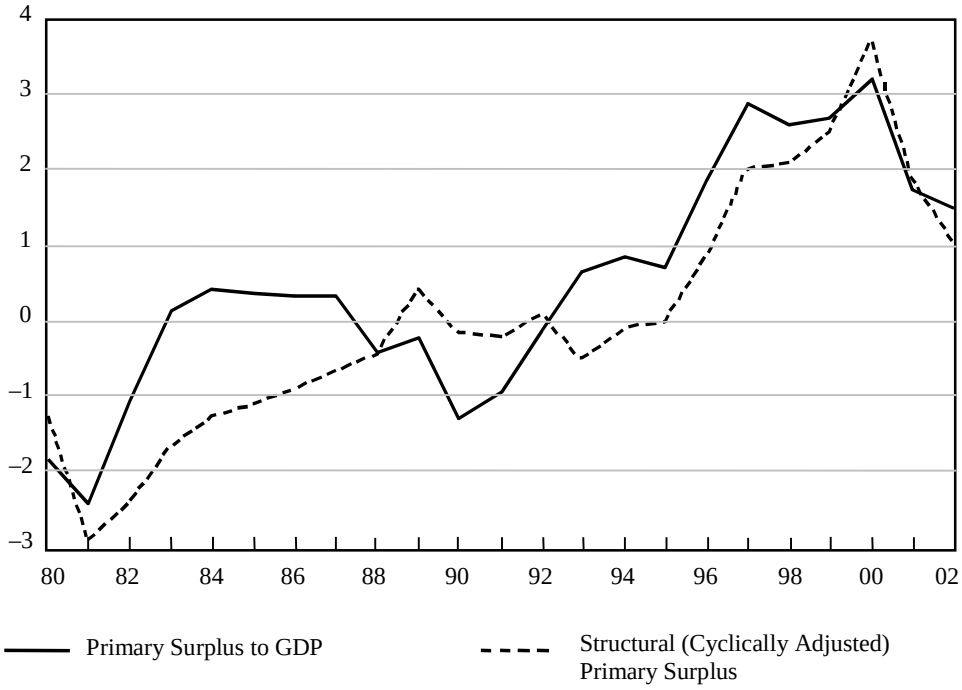
[10] Recall that we have excluded one country (Austria) from the system.

[11] We allow however the slope coefficients on fiscal variables to differ between the EMU as a whole and the rest of the system. By allowing the coefficients on B_i (D_i) to differ from that of B_{emu} (D_{emu}) we can indeed compare the effects of fiscal policy on country's spreads versus those on the Euro zone level of interest rates.

[12] As instruments, we use the price of oil, its lagged value, the cyclically adjusted primary surplus and the lagged values of the explanatory variables.

Figure 6

Actual and Cyclically Adjusted Primary Surplus for the Euro Zone



column 1. Let focus first on the impact of fiscal variables. Three facts stand out. First, fiscal balances (as measured by the cyclically adjusted primary surplus) matter. The coefficient on individual country and the EMU primary surplus are both negative (a higher primary surplus is associated with a lower real interest rate) and statistically significant. Second, the quantitative impact of deficits is much stronger at the EMU than at the national level. The coefficient on the EMU fiscal balance suggests that a one percent fall in the primary surplus boosts real interest rates by 41 basis points. The effect of an analogous change at the country level is substantially smaller, less than 5 basis points. Accordingly, the impact of expansionary fiscal policy in one country will not be seen much in the level of its spreads (our estimates in this regards do not differ substantially from those in Codogno *et al.,* 2003, or in Bernoth *et al*., 2003), but will have a definite and more substantial impact on the aggregate level of interest rates. Interestingly enough, here too our estimates are not far off the mark from those of the US literature (Gale and Orswag, 2002). Third, the debt stock plays no role at the country level, but once again is quite significant for EMU as a whole.

Table 1

The Determinants of Real Interest Rates in the Euro Zone

	(1)	(2)	(3)	(4)	(5)
	3SLS	3SLS	3SLS	2SLS	3SLS
Short term real rate	0.54 (17.0)	0.56 (16.6)	0.54 (18.5)	0.51 (10.9)	0.56 (25.3)
$(i - \pi^E)_{EMU-i}$	0.24 (5.06)	0.23 (4.6)	0.25 (5.7)	0.31 (4.04)	0.27 (7.27)
$PSSTR_i$	–0.043 (2.8)	–0.045 (2.75)	–0.046 (3.01)	–0.043 (1.16)	–0.034 (3.32)
$GDBT_i$	0.003 (0.74)	0.003 (0.72)	-	0.007 (0.95)	0.002 (0.67)
$GDBT\ D_{\text{high debt}}$	-	-	0.002 (1.73)	-	-
π^E_i	–0.08 (2.9)	–0.08 (2.9)	–0.08 (3.44)	–0.076 (1.70)	–0.08 (3.78)
$(y - y^*)_i$	–0.13 (4.9)	–0.15 (4.86)	–0.12 (4.36)	–0.10 (2.61)	–0.12 (5.34)
ρ_i	0.01 (0.7)	–0.002 (1.04)	0.000 (0.35)	0.002 (0.84)	–0.001 (0.85)
$PSSTR_{EMU}$	–0.41 (4.7)	–0.36 (3.72)	–0.40 (4.90)	–0.49 (1.76)	–0.35 (4.07)
$GDBT_{EMU}$	0.058 (5.5)	0.056 (4.79)	0.058 (5.52)	0.07 (2.02)	0.050 (4.38)
$(i - \pi^E)_{US}$	0.25 (6.4)	0.24 (5.69)	0.24 (6.21)	0.31 (2.38)	0.22 (5.46)
GCON	-	–0.07 (1.41)	-	-	-
sample	1979-1998	1979-1998	1979-1998	1979-1998	1979-2002

Legend:
i: nominal interest rate
π^E: expected inflation
PSSTR: cyclically adjusted primary surplus/GDP
GDBT: gross domestic public debt/GDP
$y - y^*$: output gap
ρ: stock market real return
*D*1999: dummy variable (1 from 1999, 0 otherwise)
$D_{\text{high debt}}$: dummy variable for high-debt countries

Overall, these results suggest that spillovers are paramount in transmitting the effects of national fiscal policies. The impact on country spreads of high deficits and of debt is either quantitatively small or not significantly different from zero. The impact of fiscal policies is much more pronounced at the level of EMU, as ought to be expected in a financially integrate area. One simple interpretation is that fiscal policies affect the aggregate saving investment balance for the EMU as a whole.

Concerning the other variables, we find that short term interest rates have, as expected, a positive impact on long-term rates. Hence, at least in the short run, the impact of expansionary fiscal policies on long-term rates may be muted if meanwhile the Central Bank pursues expansionary monetary policies. Both higher (expected) inflation and a larger output gap have a negative impact on long-term real interest rates. The latter result suggests that the impact on saving of cyclical conditions is more pronounced than that on investment. The former can be interpreted as saying that tax considerations are not paramount in determining the impact of expected inflation on real interest rates. Otherwise, the coefficient would have been most likely positive (Feldstein, 1986) to the extent that the interactions between the tax system and inflation penalize saving. The main effect of high inflation is probably to boost precautionary saving and hence to lower interest rates. Saving may also rise, as noticed before, if inflation erodes the real value of financial assets. Finally, the real return on the stock market has no influence on long-term real interest rates. High profitability should shift the investment curve and lead to higher interest rates. At the same time, it may improve the growth prospects and alleviate market concerns about debt sustainability. Alternatively, the high volatility of the stock market may explain our finding that profitability has no statistically significant impact on real interest rates. As shown by Galeotti and Schiantarelli (1994), investment reacts quite strongly to fundamental changes in stock market valuations, but is not significantly affected by fads. In addition, the high correlation among the US and the EU stock markets means that most of the effect of stock market valuations is already captured by the real interest rate in the US which in turn significantly affects that in the EU.

In columns 2 and 3, we extend the model in two different directions. First, we check whether the composition of government spending matters after controlling for the budget balance. We add therefore government consumption to the list of explanatory variables. We find no significant effect neither at the country nor at the EMU level (column 2). Second, we check whether debt stocks matter only for high-debt countries (Belgium, Greece and Italy in the Nineties, where the debt to GDP ratio was steadily above the 100 percent mark). The effect is small, but close to statistical significance (column 3). We shall return to the issue of high-debt countries in the following section of the paper.

Finally, in column 4 we estimate equations 3-4 using this time a two stage least squares procedures. This is because the three stage least square procedure, while more efficient, will spread any specification errors in a single equation to the whole system. The two stage least square procedure, while less efficient, is less vulnerable to this kind of problems. By and large, the econometric estimates do not

differ substantially (column 4). Interestingly enough, fiscal variables at the Euro zone level have now higher coefficients compared to column 1.

A key issue is whether the behaviour of interest rates has changed since the onset of EMU.[13] The number of sample observations since 1999 is clearly inadequate to provide a fully satisfactory test of such an hypothesis. As an alternative, we estimate our system from 1979 until 2002, to include the EMU period (column 5). The results do not differ in any substantial way from those for the shorter sample, suggesting that the effects of EMU, if any, were not paramount, confirming the finding of Bernoth *et al.* (2003). Of course, it could well be that the estimates over the full sample, from 1979 to 2002, resent disproportionately from the early pre-EMU period. We test, therefore, for a structural break in the equations, by adding time dummies for each year after 1998. The Wald test provides no evidence of a structural break. We also test for a break in some of the coefficients, particularly those associated with fiscal policies. We first check whether the coefficients on the primary surplus at the country level ($PSSTR_i$) exhibits a break after 1998. We interact $PSSTR_i$ with a dummy variable (D1999) that takes a value of 1 after 1998 and zero otherwise. The estimates provide no support for this hypothesis.[14] We also test whether the debt and the deficit variables at the EMU level ($GDBT_{EMU}$ and $PSSTR_{EMU}$) should be included in the list of potentially unstable coefficients. Again, the estimates offer little or no support to the hypothesis of a structural break after the onset of EMU.[15]

4. Are high-debt countries different?

The estimates in Table 1 suggest that, at least in some respects, high-debt countries behave differently. This is not totally surprising, once we consider that concerns about long run sustainability are likely to be disproportionately larger for countries with an initially high stock of debt. Furthermore, if considerations about sustainability are pervasive, then also the effect of flow variable should be more

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[13] In deriving equation 2 (the reduced form solution for real interest rates), we assumed the economy to be financially closed. The estimating equations (eqs. 3-4) are however consistent also with an open economy set up where real interest rates are determined by the combination of uncovered interest parity, purchasing power parity, and a risk premium. Indeed, combining uncovered interest parity, dynamic PPP and a risk premium (φ) yields:

$$(i - \pi^E) = (i^* - \pi^{E*}) + (e^E - \pi^E + \pi^{E*}) + \varphi$$

where the second term is the expected real depreciation. Fiscal indicators (B, D) are assumed to affect both the risk premium and the expected real depreciation, while other variables (the output gap, expected inflation, the profitability of investment) influence mainly ($e^E - \pi^E + \pi^{E*}$). The same set of factors should be at work, albeit at a different degree, both before and after EMU. Our econometric strategy is as follows. First, we estimate eqs.3-4 from 1979 to 1998. Second, we assess whether the estimates are stable after the onset of EMU, namely when the system is estimated over the full period 1979-2002. We expect to find substantive changes in the behaviour of the risk premium, in particular for high-debt countries. However, EMU may also have affected the behaviour of the term premium, and this would be reflected in a change in the coefficient of short term (real) interest rates.

[14] The p-value of the coefficient on $D1999 \times PSSTR_i$ is equal to 0.58.

[15] The p-values are equal to 0.29 and 0.91 for the two coefficients, respectively.

pronounced. Indeed, while an increase in deficit in a low debt economy may not raise excessive concerns, the same will not apply to a country where the debt to GDP ratio is say above the 100 percent mark (Drudi and Prati, 2000).

For the purpose of illustration, let consider the following simple model. Consider a stationary economy where both inflation and the output growth rate are equal to zero.[16] The rate of change in the level of debt is by definition equal to the budget deficit, which is in turn equal to sum of the primary deficit (*i.e.* the budget deficit net of interest payments) and total interest payments. The debt stock will then be unchanged if the primary surplus is equal to the interest bill. We define the debt stabilizing primary surplus (ps^*) as the level of the primary surplus that is consistent with a constant stock of debt. Clearly, the debt stabilizing primary surplus is equal to the value of interest payments, which is in turn identically equal to the nominal interest rate times the stock of debt. The difference between ps^* and the actual value of the primary surplus (ps) measures the fiscal adjustment required to stabilize the stock of debt. If ps^* is greater than ps then the stock of debt is on a rising path. The larger the difference between ps^* and ps the more demanding is the fiscal adjustment required to stabilize the stock of debt.

To determine the level of the interest rate, we proceed as follows. We assume that investors believe that if the adjustment required to stabilize the debt (namely $ps^* - ps$) is too large (*i.e.* greater than an exogenous threshold k) the risk of default will rise. They will then charge a relatively high interest rate on the government's debt.

The model leads to an obvious circularity between the debt stabilizing primary surplus and the interest rate. If interest rates are high, so will the debt stabilizing primary surplus. Conversely, if the debt stabilizing primary surplus is large, then the default risk and the interest rate will also be high. There may multiple equilibria where both the interest rate and the debt stabilizing primary surplus are either high or low.

For the purpose of this paper, the crucial observation is that changes in the primary surplus (ps), may have a different impact on interest rates depending on the initial level of the debt. Consider Figure 7. The r_1r_2 schedule paints the relationship between the interest rate and the primary surplus. If the difference between the debt stabilizing primary surplus (ps^*) and the actual surplus (ps) is larger than a critical threshold (k, in the figure), interest rates will rise from r_1 to r_2. The other two schedules (labeled the low and the high b, respectively) show how the debt stabilizing primary surplus rises with the interest rate. The slope of the schedule is a function of the debt to GDP ratio, with a higher debt stock being associated with a flatter schedule.[17]

We can now examine the effect of a fall in the primary surplus, ps. As ps declines, the discontinuity point in the r_1r_2 schedule shits to the left. For a high-debt

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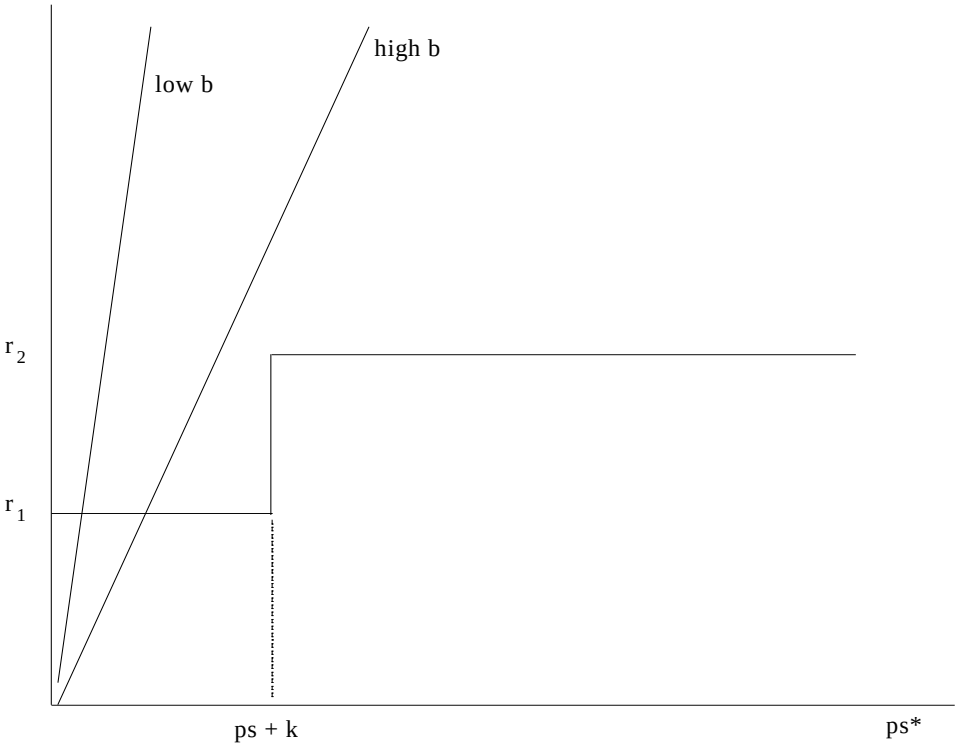
[16] In appendix C we consider the more general case where both inflation and output growth are positive.

[17] For simplicity, figure 7 is drawn for the case where $n = 0$.

Figure 7

A Framework for Debt Sustainability



country, this means that the interest rate may well rise from r_1 to r_2. For a low debt country, the fall in the primary surplus will have to be proportionately larger for the interest rate to increase. In general, a given change in the primary surplus will have no impact on the interest rate for low debt countries if it does not also affect the interest rate of a high-debt country.

Of course, the model is too simple. For instance, interest rates may rise continuously in response to the imbalance between the actual and the debt stabilizing primary surplus. However, it conveys a simple message, namely that the effect of fiscal policies may be non linear (Giavazzi, Jappelli and Pagano, 2000, and Drudi and Prati, 2000). One simple way to capture this non linearity, which is fully consistent with our model, is to add to the list of explanatory variables the following term:[18]

[18] See Blanchard (1993) for an in-depth discussion of forward looking indicators of fiscal policy.

$$\Psi = (ps^* - ps)\, b \tag{13}$$

Even if debt stabilizing primary surplus (ps^*) is greater than the actual primary surplus (ps), and the associated debt dynamics is at least locally explosive, the effects on interest rates will be muted provided that the debt to GDP ratio (b) is close to zero. Conversely, if ps^* rises above ps even by a small margin, the impact on interest rate will be disproportionately large if the initial debt to GDP ratio is high. In other words, a tendency for the debt to GDP ratio to increase will be of much greater concern to financial markets if the initial debt ratio is already relatively high.

Figure 8 shows the empirical relationship between real interest rates and the Ψ variable for EMU countries. In contrast to figure 3, there seems to be now a positive correlation between real interest rates and this new indicator of fiscal sustainability. As expected, the relationship is substantially stronger for high-debt countries (Figure 8b). To assess more formally the role of fiscal sustainability we need to turn to econometric analysis.

In Table 2, we report the estimates of equations 3-4 with the addition of the interaction term, Ψ. Given that the stock of debt had no impact for low debt countries, we add this new term only to the equation for high-debt countries. We define as high-debt countries all the cases where the debt to GDP ratio is higher than 100 percent for more than 3 years. Given this definition, the high-debt country sample includes Belgium, Greece, and Italy for most of the Nineties.

In column 1 we report the results for the pre-EMU from 1979 to 1998. The results mirror those in Table 1, except for the fact that the Ψ variable is included and is statistically different from zero. Its coefficient is positive, as expected. Ceteris paribus, an increase in the debt stabilizing primary surplus or a fall in the actual primary surplus should, for a given stock of debt, boost interest rates. We find again that standard fiscal indicators, such as the debt to the GDP ratio or the cyclically adjusted primary surplus, work their way on interest rates mainly at the level of the Euro zone. The effect on domestic spreads remain quite limited, confirming the findings of Table 1.

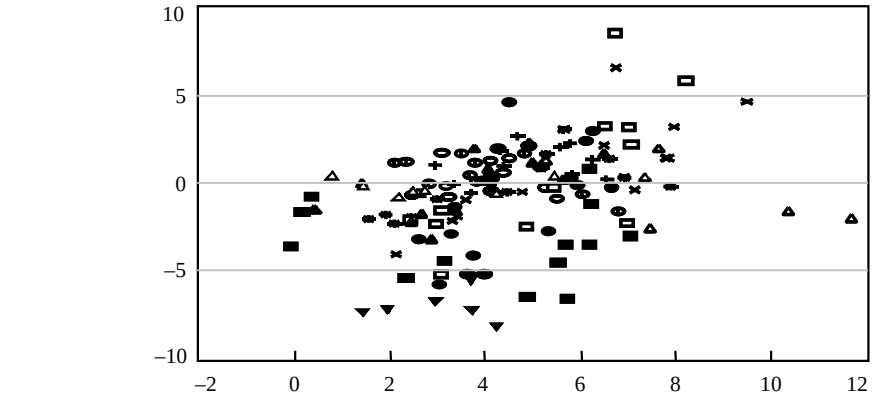
In column 2 we report the two stage least squares estimates. Again, the main difference with the three stage least squares procedure is that most of the coefficients lose some of their statistical significance. In column 3, we test whether sustainability considerations, as measured by the variable Ψ (properly redefined at the Euro area level by aggregating all high-debt countries), has an additional impact on the Euro zone level of interest rates. The results provide no support to this notion, suggesting therefore that sustainability considerations matters only, or mainly, for domestic spreads in high-debt countries.

In column 4 we extend the sample to the post-EMU period, until 2002. As in Table 1, there is little evidence of a structural break after the onset of EMU, except however for the coefficient on Ψ which is now much smaller and statistically insignificant. We have therefore reestimated the model, allowing the coefficient on

Figure 8

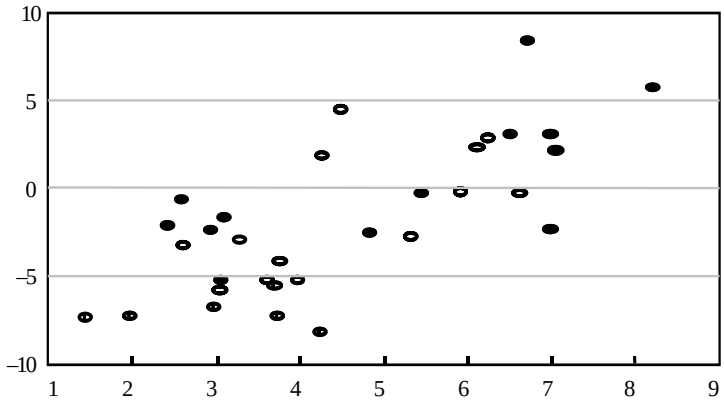
Debt Sustainability and Real Interest Rates for EMU Members

a) Full Sample



(PSVAR_AUT, LTRIR_AUT)
(PSVAR_BEL, LTRIR_BEL)
(PSVAR_DEU, LTRIR_DEU)
(PSVAR_ESP,LTRIR_ESP)
(PSVAR_FIN, LTRIR_FIN)
(PSVAR_FRA, LTRIR_FRA)
(PSVAR_IRL, LTRIR_IRL)
(PSVAR_ITA, LTRIR_ITA)
(PSVAR_NLD, LTRIR_NLD)
(PSVAR_PRT, LTRIR_PRT)
(PSVAR_GRC, LTRIR_GRC)

b) High-debt Countries



(PSVAR_BEL, LTRIR_BEL)
(PSVAR_ITA, LTRIR_ITA)
(PSVAR_GRC, LTRIR_GRC)

Legend:
PSVAR: (ps* – ps) x debt to GDP ratio
ps*: debt stabilizing primary surplus
ps: current primary surplus
LTRIR: long-term real interest rate

Table 2

Debt Sustainability and Real Interest Rates in the Euro Zone

	(1)	(2)	(3)	(4)	(5)	(6)
	3SLS	2SLS	3SLS	3SLS	3SLS	3SLS
Short term real rate	0.51 (22.7)	0.50 (10.8)	0.51 (17.0)	0.56 (23.6)	0.57 (24.2)	0.57 (24.3)
$(i - \pi^E)_{\text{EMU}-i}$	0.24 (4.77)	0.32 (4.18)	0.25 (4.81)	0.25 (6.14)	0.26 (6.32)	0.27 (6.58)
$PSVAR_i\ D_{\text{high debt}}$	0.12 (4.82)	0.13 (2.09)	0.13 (4.91)	0.03 (1.03)	-	-
$PSVAR_i\ D_{\text{high debt}}\ D_{99}$	-	-	-	-	0.06 (1.98)	0.06 (1.94)
$PSSTR_i$	–0.037 (2.16)	–0.039 (1.05)	–0.038 (2.19)	–0.034 (2.31)	–0.032 (2.25)	–0.036 (2.50)
$GDBT_i$	0.001 (0.25)	–0.005 (0.61)	0.001 (0.24)	–0.002 (0.59)	0.001 (0.54)	0.002 (0.64)
π^E_i	–0.076 (2.75)	–0.077 (1.76)	–0.075 (2.71)	–0.76 (3.52)	–0.69 (3.22)	–0.07 (3.30)
$(y - y^*)_i$	–0.11 (3.96)	–0.10 (2.43)	–0.11 (3.81)	–0.11 (4.76)	–0.12 (4.95)	–0.12 (5.00)
ρ_i	–0.005 (1.94)	–0.002 (0.61)	–0.003 (1.76)	–0.002 (1.28)	–0.001 (1.19)	–0.001 (1.18)
$PSVAR_{\text{EMU}}\ D_{\text{high debt}}$	-	-	–0.02 (0.55)	-	-	0.12 (2.16)
$PSSTR_{\text{EMU}}$	–0.40 (4.50)	–0.50 (1.78)	–0.39 (4.23)	–0.33 (3.70)	–0.33 (3.76)	–0.26 (3.20)
$GDBT_{\text{EMU}}$	0.06 (5.38)	0.07 (2.04)	0.06 5.23)	0.049 (4.09)	0.049 (4.25)	0.046 (4.41)
$(i - \pi^E)_{\text{US}}$	0.25 (6.41)	0.31 (2.44)	0.25 (6.02)	0.22 (5.13)	0.22 (5.32)	0.19 (4.93)
Sample	1979-1998	1979-1998	1979-1998	1979-2002	1979-2002	1979-2002

Legend: see Table 1.
PSVAR: (ps^* – ps)* debt/GDP.

Ψ to differ between the pre and the post-EMU period. We find that the coefficient on the sustainability indicator, Ψ, is statistically different from zero only in the pre-EMU period. In column 5, we present therefore the new estimates where the coefficient on Ψ is different from zero only in the pre-EMU period. In line with Table 1, the stability test yields no further indications of a structural break after the onset of EMU.

Finally, in column 6, we test whether sustainability considerations, as measured by the variable Ψ (properly redefined at the Euro zone level by aggregating all high-debt countries), have an additional impact on the area wide level of interest rates after the onset of EMU (recall that in column 3 we found no effect of Ψ on real interest rates before 1999). The results provide considerable support to this conjecture, suggesting therefore that sustainability considerations matters both for domestic spreads in high-debt countries and for the Euro area level of interest rates after the introduction of the common currency. We have also tested whether the results reflect the impact of the level of gross debt at the Euro zone level rather than of sustainability considerations. However, replacing the variable Ψ with the debt to GDP ratio for high-debt countries yields a statistically insignificant coefficient.

Overall, these results show that the interest rate spillover effects of fiscal policies slippages in high-debt countries are relatively larger than the average. Fiscal indiscipline in high-debt countries has a stronger impact on interest rates, which is reflected not only in higher domestic spreads but also, after the onset of EMU, spill over to the area wide level of interest rates. At the same time, however, there is no evidence that high-debt countries *per se* have negative spillovers on the Euro zone level of interest rates. Actually, high-debt countries with sustainable fiscal policies – as defined by a steady reduction in their debt ratios – may have a disproportionate impact in reducing the area wide level of interest rates. If these results are confirmed by further research, the case for treating *all* high-debt countries differently in a rejuvenated version of the Stability and Growth Pact would not seem particularly strong. What is needed is that high-debt countries follow sustainable fiscal policies that ensure a steady decline in their debt to GDP ratio. In other words, most of the attention should be devoted to the dynamics of the debt stock rather than to its level.

5. Conclusions

Peer punishment among EMU members has lost much of its effectiveness since the disparagement of the SGP at the Ecofin meeting in November 2003. Attempts by the Commission to bring new life into the SGP have so far met with little success. Whether fiscal misbehaviour is subject to market punishment is therefore a key issue in the design of the new fiscal architecture that needs to uphold the common currency.

Unfortunately, empirical evidence on the link between interest rates and fiscal policy is rather inconclusive and sometimes even puzzling. Most papers show that

fiscal indiscipline among EMU members is only subject to a relatively mild punishment. A one per cent increase in the deficit to GDP ratio leads to a rise in interest rates of not more than 10 basis points. By contrast, the US literature suggests a much larger impact, a difference that still begs for an explanation.

What this paper shows is that the findings for the US and EMU can, at least partly, be reconciled when one recognizes that an expansionary fiscal policy in one EMU member will have a twofold effect, first on its spreads, and second on the overall level of interest rates for the currency union as a whole. What our results suggest is that the latter effect is much more significant, indicating that there are indeed substantial spillovers, through the interest rate channel, among member countries fiscal policies. A further finding is that for high-debt countries sustainability is a relevant issue. Both the level and the dynamics of public debt stock have a strong influence on their domestic spreads. Moreover, we find some evidence that, after EMU, interest rate spillovers are larger for high-debt countries with unsustainable fiscal policies.

These results underscore the need to revive the Stability and Growth Pact. They also provide some indications as to the desirable avenues of change. The need for both fiscal coordination and fiscal rigour does not arise solely from the desire to allow fiscal policy to play an autonomous role in macroeconomic stabilization, but more fundamentally from the existence of unfavourable interest spillovers among EMU members. At the same time, we find some evidence that the spillover effects are stronger for high-debt countries with unsustainable fiscal policies and, hence, a growing debt burden. Fiscal slippages in such countries are reflected not only in higher spreads on their domestic debt but also on the area wide level of interest rates. Overall, therefore, the suggestion (Sapir *et al.*, 2003) that the "new" stability and growth pact should treat high-debt countries more severely should be amended to apply only to those high-debt countries where lack of fiscal discipline leads to a further increase in their debt ratio. The need for a different treatment for high-debt countries would also arise if concerns about the costs of a bail out of an insolvent government become paramount.

APPENDIX A
INTEREST RATE SPILLOVERS IN A RICARDIAN MODEL

Suppose that government spending provides no utility to consumers (or, less strongly, that the marginal utility of private consumption is independent of government spending). Consider a simple two country, two period model, where consumer intertemporal utility is isoelastic, the government budget is balanced in an intertemporal sense, and there is no investment. We show that a temporary increase at time 1 in government spending in any one country will lower domestic saving and raise global interest rates.

Under the stated assumptions, private consumption at time 1 is simply equal to:

$$C_1 = 1/(1 + (1 + r)^{\sigma-1}\,\beta^{\sigma})\,[Y_1 - T_1 + (Y_2 - T_2)/(1 + r)] \tag{A1}$$

where C_i, Y_i, and T_i denote respectively private consumption, output, and taxes at time i (i = 1, 2), β and σ are the consumer's rate of time preference and the intertemporal elasticity of substitution and r is the real interest rate. Given the government's intertemporal budget constraint:

$$G_1 - T_1 + (G_2 - T_2)/(1 + r) = 0 \tag{A2}$$

we have that:

$$\Delta C_1 = -1/(1 + (1 + r)\,\sigma - 1\,\beta\sigma)\,\Delta G_1 \tag{A3}$$

The change in total domestic saving at time 1 ($S_1 = Y_1 - C_1 - G_1$) will then be equal to:

$$\Delta S_1 = (1/(1 + (1 + r)\,\sigma - 1\,\beta\sigma) - 1)\,\Delta G_1 < 0 \tag{A4}$$

Under the assumption that income effects are not too strong and the equilibrium is well behaved, the fall in country's 1 saving will lead to a higher global interest rate, thereby affecting also country 2.

APPENDIX B
THE DETERMINATION OF THE REAL INTEREST RATE

We assume that real interest rates are determined by the interaction of aggregate saving and investment. In a closed economy context, private investment (I^{pr}) is identically equal to the sum of private (S^{pr}) and the excess of public saving over public investment, *i.e.* the budget surplus (B):

$$I^{pr} = S = S^{pr} + B \tag{B1}$$

In what follows we normalize both saving and investment by GDP. Investment depends on profitability (ρ), the output gap ($y - y^*$), expected inflation (π^E), and the real interest rate ($i - \pi^E$):decisions are specified as follows:

$$I^{pr}/Y = I(\rho, y - y^*, \pi^E, i - \pi^E) \tag{B2}$$

where the nominal interest rate (i) has been deflated by expected inflation (π^E).

Private saving is assumed to be a function of the output gap, the real interest rate, expected inflation, net public saving (*i.e.* the budgetary balance), and possibly other variables that reflect the fiscal policy stance (D):

$$S^{pr}/Y = S(y - y^*, i - \pi^E, \pi^E, B, D) \tag{B3}$$

Substituting equations B2 and B3 into B1 and solving for $i - \pi^E$ yields the reduced form equation for the real interest rate:

$$i - \pi^E = f(y - y^*, \pi^E, B, D, \rho) \tag{B4}$$

Equation (B4) is the basis for our empirical work.

APPENDIX C
DEBT SUSTAINABILITY AND FISCAL POLICY

In a growing economy, the rate of change in the debt to GDP ratio (b') is a function of the real interest rate (r), the rate of growth of the economy (n) and the ratio of the primary surplus to GDP (ps):

$$b' = (r - n)\, b - ps \tag{C1}$$

From equation C1, we see that the debt stabilizing ($b' = 0$) primary surplus is simply $ps^* = (r - n)\, b$. Let also assume that the real interest rate, r, is a function of the risk free rate, r^*, and a default probability, p. With risk neutral investors, we have that:

$$r\,(1 - p) = r^* \tag{C2}$$

The key assumption is about the default probability:

$$p = p_1 \qquad \text{if } ps^* - ps < k \tag{C3}$$

$$p = p_2 \qquad \text{if } ps^* - ps > k$$

and $p_1 < p_2$. In words, if the adjustment required to stabilize the debt ($ps^* - ps$) is too large (*i.e.* greater than an exogenous threshold k) the risk of default will be larger ($p_2 > p_1$) and the interest rate will be higher.

The model leads to an obvious circularity between ps^* and r. If r is high, so will the debt stabilizing primary surplus, ps^*. However, if ps^* is large, then the default risk and the interest rate will also be high. There may be multiple equilibria where both r and ps^* are either high or low.

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COMMENTS ON SESSION II: PUBLIC DEBT AND FISCAL RULES

Sandro Momigliano[*]

The extremely insightful papers included in this session cover a wide range of important issues. For the sake of both concision and effectiveness, I will discuss only a few of them. Moreover, a large part of my comments will deal with a single theme, present in the majority of the papers: the relationship between fiscal policies and interest rates.

The Mink and Rodriguez-Vives paper is mainly concerned with methodological aspects in the measurement of government debt, but also provides very useful quantitative data on different definitions of debt for the euro area. I found of particular interest the information on the net government debt for the recent years, derived by subtracting government holdings of financial assets from gross debt. When assessing the state and developments of public finances, net debt seems a more appropriate aggregate, as it is also pointed out in the Wood contribution. I would welcome a more extensive use of this information in the context of the European multilateral surveillance.

The Boothe and Woods papers discuss, among many other issues, the rationale of having debt in a fiscal rule. Both papers take advantage of the experience gained, respectively, in Canada and the UK.

The Booth paper analyses the relationship between accounting regimes and fiscal rules, an issue relatively new in the literature, drawing a number of important normative suggestions. In particular, it indicates that, when moving from a cash to an accrual accounting regime, a greater focus on net debt may be appropriate, with a view to the transparency of budgetary decisions and to the accountability of policy makers. The indication has immediate relevance, as Canadian provincial governments are moving to accrual accounting for capital but do not plan to change their fiscal rules. I find the analysis in the paper extremely useful but I wonder whether focusing on the different treatment of public investment does fully capture the implications of switching from a cash to an accrual regime of accounting. In the European context, for example, the switch from the 1979 European Standard of Accounts (ESA79) to ESA95, which represented a partial movement in the direction of accrual accounting, did not imply a change in the treatment of investment expenditure, but nevertheless significantly affected budgetary decisions.

The paper by Wood describes the fiscal rules currently followed by the UK Government, focusing on that concerning the debt. The paper is comprehensive and extremely informative, providing historical statistics and analyses on public debt

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developments in UK, as well as the theoretical background and motivations for the decision concerning the UK debt rule, which requires the Government to hold public sector net debt stable at 40 per cent of GDP over the economic cycle. The author makes the point that economic research has not lead to a precise analytical answer to what the optimal debt level is, but for long-term fiscal sustainability this may matter less than having a clear and credible target for the debt ratio. In two respects the concept of debt used in the UK system appears more adequate than that adopted in the EU fiscal context: the debt is netted by liquid financial assets (to better reflect the government's immediate solvency) and includes the liabilities of public corporations. The transparency of the reporting on public finances in UK is further enhanced by legislation requiring public bodies to publish extensive information on their activities, among which are contingent liabilities, which are not included in national accounts' measures of debt.

As for the other papers in the session, they are all concerned with the question whether developments in budgetary balances and public debt affect interest rates. This is a very important issue but one extremely difficult to answer by means of the empirical analysis. In particular, as mentioned in the paper by Laubach, "endogeneity problem in such regressions is most likely severe".

Cyclical conditions tend to affect both the budget balance, via the automatic stabilizers and the reactions of discretionary policy and interest rates, via market mechanisms and monetary policy. When interest rates are regressed on fiscal balances, this causal effects determine a bias (usually positive) on the value of the coefficient of the latter (the bias is usually negative if the balance is defined in terms of net borrowing or the debt ratio is used as regressor). This problem will be the main focus of the remaining part of my comments, as I review the empirical analyses included in these papers.

Both the paper by Balassone, Franco and Giordano and that by Faini examine the impact of fiscal developments on interest rates (or credit ratings) in order to draw conclusions relevant for the current debate concerning the Stability and Growth Pact.

The first paper aims at assessing whether financial market mechanisms may substitute fiscal policy rule in the current European context. As pointed out by the authors, a positive answer to this question not only requires that the impact of deficit deterioration on rates be significant (and of the correct sign) but also that governments be sensitive to market signals and change their stance accordingly. Overall, the authors conclude that financial markets discipline does not provide an adequate alternative to rules. The negative answer is mainly determined by the analysis on the second requisite. In this respect, I wonder whether the evidence that the authors present is indeed conclusive. Since ratings are, at least in principle, forward looking, they may react to an expected worsening in the future; therefore the evidence that there is no change in the deficit in the period following a change in the ratings does not necessarily imply that governments have not acted.

The first requisite is instead barely attained. The authors point out that the examined evidence unambiguously suggests that markets reward fiscal discipline and punishes fiscal imbalances with higher risk premia, though these reactions tend to be slow and small in size. They review the results of other studies and also carry out a little empirical analysis. This includes two regressions with bond yields as the dependent variable, which is regressed, alternatively, on changes in the debt to GDP ratio and changes in the net borrowing ratio. The variables are all measured in terms of deviation with respect to the German ones. The results show a positive – but not particularly sizable – reaction of yield spreads. However, these results are subject to the possible distortion arising from asymmetric shocks (*i.e.*, shocks specific to an individual country) influencing both the yield and the deficit spreads. The regressions which include credit ratings as a dependent variable may suffer of the same shortcoming, as ratings also tend to be influenced by cyclical conditions.

The paper by Faini points out, in particular, that an expansionary fiscal policy in one EMU country has an impact not only on the interest rate spreads but also on the overall level of interest rates for the currency union as a whole. The evidence presented in the paper indicates the existence of substantial spillovers through the interest rate channel among the member countries. This leads to the conclusion, in line with that of the previous study, that it is important to revive if not to strengthen the Stability and Growth Pact. Coming on the empirical part of the paper, I have two comments. It is not clear to me whether the problem of endogeneity I mentioned before is entirely solved by introducing the output gap among the regressors, as this indicator may not fully capture the actual cyclical conditions. Secondly, I am not sure that expected inflation measured by an ARIMA process is fully adequate in this context, as budgetary developments may have an impact on actual expectations. If this were the case, real interest rates would be measured with an error correlated to the regressor.

The paper by Ber, Brender and Ribon assesses the effects of fiscal and monetary policy on bond yields, on the basis of data for Israel in the Nineties. The paper is particularly interesting because the existence of a sizable market for indexed bonds allows the authors to focus on real yields, without having to decompose nominal yields into a real component and inflation expectations. The effects of the expected deficit, netted by cyclical influences, is found in the study to be significant for all yield terms, ranging from 0.15 for yields of up to one year to 0.21 for the 10-year yields in the case of a 1 percent change of GDP in the balance. The effects of the current deficit (cyclically adjusted or not) were instead not significant. The authors define the expected deficit as the actual deficit in the following 6 months. I find these results surprising. I am a bit skeptical that financial markets are indeed able to predict deficits with sufficient precision, so that future deficits can be a good proxy for expected ones. If I am right we are left with the question of how it is possible that a largely unexpected event in the future can influence yields now.

Finally, the paper by Laubach examines the issue of the effects of budget deficits on interest rates by considering the indications provided by economic theory

as well as the available empirical evidence. The authors note that theory does not provide unambiguous prediction for the interest rate effects of current deficits but, nonetheless, it can be shown that under plausible assumptions these effects are positive. As for the empirical side, the author discusses extensively the problems connected with the endogeneity of fiscal balances and the solutions proposed in the literature. I agree with the author's view that a satisfactory way to tackle the problem is to regress expected future long-term interest rates on expected future deficits (measured by the Congressional Budget Office projections), as Laubach did in a previous study. In that study he finds a relatively strong evidence that increases in budget deficits raise interest rates.

A possible extension of Laubach's analysis, as well as that included in the last papers I commented on, would be to take into account whether the changes in the balance come from revenue or from expenditure developments. A number of empirical studies have recently shown that the composition of adjustment may affect the success and sustainability of fiscal policies; this suggests that, for a given change in the deficit, financial markets should react differently, depending on its composition.

COMMENTS ON SESSION II: PUBLIC DEBT AND FISCAL RULES

Jorge Onrubia[*]

1. An overview

First of all, I would like to thank Daniele Franco for the invitation to this workshop. All the papers included in this session provide a rich and stimulating overview of many of the topics concerning the relationship between public debt and fiscal rules. I would like to congratulate the contributors for their excellent papers. Because of the time constraints, I cannot claim to comment in great detail on all the papers presented. I want to apologize to the authors of the second session whose papers I have not discussed.

In my opinion, this session has included three different sorts of papers. On the one hand, I find two papers focussing on the issue of the effectiveness of the fiscal rules for controlling public debt. I'm referring to the paper by Balassone, Franco and Giordano and to the one by Woods. The first of these contributions tackles a very appropriate question for the fiscal discipline in European Union countries right now: can the financial market mechanisms be an effective alternative to fiscal rules when they have not operated satisfactorily? Later on, I will set my point of view about the implications of this question. In the second paper, Woods introduces an interesting perspective with regard to the debt rules in general and the debt rule in the United Kingdom fiscal framework in particular: their ability to assess the long-term sustainability of the UK's public finances.

On the other hand, two other papers focus on the measurement of public debt and balance on public accounts. Both papers intelligently relate accounting rules with fiscal rules. In their paper, Mink and Rodríguez-Vives provide and compare two measures of government debt in the European Monetary Union from the national accounting framework: ESA95 debt and EDP debt, whereas Boothe analyses in his paper the relationship between the fiscal rules adoption and the choice cash versus accrual accounting regimes.

The last group is made up by three papers. These contributions have got as a common objective to offer econometric analysis aimed at testing different relationships between public debt, budget deficits, interest rates and inflation. In connection with the effects of budget deficits on interest rates, Laubach presents an excellent review of empirical results. The Ber, Brender and Ribon paper analyses how both fiscal and monetary policies can influence short and long-term real yield using data for Israel. Lastly, Faini assesses how fiscal indiscipline among European

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Monetary Union members affects the interest rate on the stock of public debt, emphasizing the relevance of public debt levels and sustainability as explanatory variables.

2. Comments and suggestions

I have read these very interesting and different papers. All of them have given me many suggestions. But it is not easy task to make, at the same time, specific and related comments. I will focus only on some of the most relevant questions. Really, the invisible hand has worked. I have concentrated my comments on the two groups not commented by the other discussant, Sandro Momigliano.

I enjoyed the paper by Balassone, Franco and Giordano. They conjecture whether financial market discipline can provide a fallback solution in case of rule-failure. After ten years of monetary union, everything seems to indicate that the conditions in European financial markets have not changed enough to increase the power of market incentives. However, I agree that the key issue for fiscal discipline is fiscal transparency. Both financial market mechanisms and fiscal rules need to complement each other. Without transparency, I think it is difficult that incentives involved in fiscal rules can become effective. We can see the transparency principle from a double perspective. On the one hand, we advocate transparency in public accounting (debated in Boothe's paper) or in measurement of public debt (debated in Mink and Rodríguez-Vives' paper). On the other hand, we can also claim transparency in financial markets.

But here we find the classical discussion: can the financial market improve itself transparency? My opinion is negative. I think that the fiscal rules should design suitable institutions for enhancing transparency. Here lies their complementary. For instance, the Spanish internal budgetary stability rule has tried to improve transparency through two initiatives: first, creating a new information central agency on regional and local public debt (at the moment, similar functions are carried out by Banco de España); second, redesigning the coordination process for sharing regional and local deficit levels. In both cases, financial market signals seem to have improved, so that the Autonomous Communities with bad public debt indicators have to pay higher interest rates. The question could be: what must the content of fiscal rules be? Numeric rules only or new fiscal institutions as well? My opinion is that to institute fiscal rules is equivalent to design and to put into practice new institutions with their incentives and check and balance mechanisms. Numeric rules are important, but they are only instruments for these institutions, which usually incorporate them as informative signals for fiscal policy management.

Lastly, this paper states explicitly that fiscal discipline can be considered as a public good in federations, with all its allocation problems. I agree with this statement. But this approach gave me an idea. It can be interpreted in a fiscal externalities framework, where the information costs are a determining factor. I think that fiscal federalism literature on vertical and horizontal externalities could

provide more arguments (even in an analytical approach) for strengthening the relationship between market mechanisms and fiscal rules. I would like your opinion about this suggestion.

Wood's paper shows an interesting discussion about the UK's fiscal rules used in the implementation of fiscal policy. In particular, he analyses in detail the golden rule and the sustainable investment rule, both considered over the economic cycle. I especially like the section titled "Fiscal sustainability under uncertainty". I think that uncertainty is a crucial matter when we consider fiscal sustainability in a long-term perspective. If I have understood correctly, your risk scenario analysis does not include stochastic and Bayesian considerations. I admit the degree of difficulty to introduce them, but I think that an option could be to include an endogenous indicator of risk. This indicator could be designed estimating a relationship between variability of output gap, variability of real interest rates, and variability of public debt stock.

Finally, I would like to make two comments. The first refers to Boothe's paper. Its content appears to be very clever. We are not faced with a conventional paper on accounting methodology, but with a paper on fiscal institutions performance. Its results can allow us to analyze the fiscal behaviour of EMU members with regard to the Stability and Growth Pact implementation. Since the strategies have adequately been established, I think that an interesting way to develop this paper could be to apply a game theory model. My second comment is about Mink and Rodríguez-Vives' paper. I would like to know how some creative accounting methods applied to public investments (for instance, private financing of motorways or high-speed railways under PPP's methods of payment) could influence public debt measurement.

COMMENTS ON SESSION II: PUBLIC DEBT AND FISCAL RULES

Jean-Luc Schneider[*]

These eight papers are both enlightening and very stimulating. Together, they enrich one another, by providing various viewpoints on the difficult subject of the market and non-market responses to government's debt and deficit.

Even if this session comes three years after a whole Bank of Italy seminar has been dedicated to fiscal rules and their respective efficiency, and in spite of now many years of theoretical and empirical research, the topic remains a controversial one, partly due to the political heat that sometimes surrounds it, but mostly to the difficulties faced by anyone who tries to disentangle the various implications of fiscal policy. Credit must be given to all papers presented here, for bringing some objective light to this intricate debate.

Rather than trying to comment every paper in turn, I would like to provide some general impressions and interrogations after this session.

1. Three possible analytical frameworks

My first observation relates to the analytical framework, which is more or less implicitly assumed by most papers, which is a mixed one, in the sense that we cannot refer to the simplest models.

For example, as stated by Laubach's paper and by the Bank of Israel paper, if we assume that the households are 100 per cent Ricardian, most of the issue disappears. Additional deficit is taken care of through additional private saving providing for forthcoming additional taxes. In this pure Ricardian framework, the deficit does not have any effect at all on activity, and no effect either on interest rates and risk premiums, if adequate provisions are made for additional liabilities. In other words, in the Ricardian world, deficits are useless, and so are fiscal rules, and the market does not care anyway.

Of course, even this Ricardian world becomes more sophisticated as soon as taxes have some distortionary effects. But still, the market response to deficit is likely to remain of a second order magnitude, and the need for fiscal rules not to become overwhelming.

At the other end of the too simple theories, you can imagine a totally non-Ricardian world, let us call it a Keynesian world to simplify, in which public

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The views expressed in the paper are strictly personal and do not reflect those of the French Ministry of Finance.

spending is not directly compensated by private savings, then putting future tax increases and debt repayment at risk. If the market worked perfectly, interest premiums should reflect the additional risk, in which case in theory you do not need fiscal rules either. Conversely, if the market does not work at all, the risk is not priced at all in bonds premiums, and additional appropriate non-market interventions, such as fiscal rules, are needed to protect investors and taxpayers from government's profligacy.

To summarize, we are somewhere in the middle of three extreme worlds:

- World #1 is a Ricardian world, featuring little or no market response to deficit, and little need for fiscal rules.
- World #2 a Keynesian world with perfect markets, featuring high market response to deficit, but little need for fiscal rules.
- World #3 is a Keynesian world with very imperfect markets, featuring little or no market response to deficit, but high need for fiscal rules.

While the description of each world is simplistic, it may still be useful to try to position each paper on this simplistic map. So, after reading these eight papers, the question is: in which of these worlds are we? Since all papers seem to agree with the need for fiscal rules, the answer would simply be that they assume to be in World #3, or not very far from it. Then the next question is: are the findings of the papers about the market response to deficit consistent with this rather Keynesian model with very imperfect markets?

2. The market response to fiscal deficit

All papers are of the opinion that fiscal deficit matters, but none is really sure whether financial markets agree much with that opinion. Actually, most empirical papers find that the markets do agree that deficit matters, but only feebly, in the sense that a 1 per cent of GDP deterioration in the fiscal position does not seem to trigger much more than a quarter percentage point increase in the spreads on bond yields. This quarter point order of magnitude can be found in three central banks papers (of the Federal Reserve, of the Bank of Israel and of the Bank of Italy), as well as in Faini's paper for the Eurozone. Other papers also mention possible higher responses of about 50 basis points.

The striking fact is that all papers also seem to find that this is a rather low response of the markets to fiscal laxity. Is this the case? Putting together figures from the various papers allows us to do some back of the envelope calculations.

Assume 1 percentage point of GDP deterioration in the fiscal deficit. Let say that this involves a 25 basis point increase in the 5 years bonds yield. According to the ECB paper, 5 years is more or less the median maturity of the public debt in EU, the US or Japan, which means that the 25 basis point increase in the yield translate into an immediate increase in the annual cost of total public debt of about 5 basis points. For example, with a debt equal to 40 per cent of GDP, an additional 1 per

cent of deficit-to-GDP involves 5 base point times 40 per cent, that is an additional cost of 0,02 per cent of GDP. In other words, the market levies a kind of fine on the additional public deficit: 100 euros more deficit involve an immediate additional cost of 2 euro in that country.

Note that this cost is going to last for a while: as long as the debt issued during the deficit year. Still assume a 5-year duration, and you get 5 times 2 euro, that is 10 euro. Allow for some discounting over time and you remain with about 9 euro. That is the present value of the total cost inflicted by the market to a 100-euro increase in the fiscal deficit during one year. In other words, the market penalty for deficit is about 9 per cent.

The nice thing is that, even with this very rough assumption about a flat response of bond yields to the current deficit, the market pricing of deficit is indeed increasing with the initial level of public debt. The implicit rate for the market pricing of deficit is proportional to the level of public debt, going from 9 per cent for a 40 per cent debt-to-GDP ratio, to 22 per cent for a 100 per cent debt-to-GDP ratio, for example.

Is such an order of magnitude high or low? It is difficult to say, but it does not strike me as particularly low for at least two reasons. First, the way the market response is measured may exhibit a downward bias. Second, this 9 to 22 per cent penalty that the market put on public deficit does not look completely out of proportion with what we know or what we usually assume about the level of negative externalities. Both reasons have to do with cross-border effects.

3. The downward bias in measuring the market response

The papers by Faini and by the Bank of Italy are the only ones to address explicitly the Stability and Growth Pact, but international spillovers of fiscal deficits are also mentioned in others. However, all consequences may not have been drawn from the recognition of such spillovers, except maybe in Faini's paper.

First, the possibility of international spillovers is well debated in a monetary union, but the channels through which they are conveyed does not seem to be limited to the existence of a common central bank. For example, according to the ECB paper, foreigners now typically hold more than one third of the public debt in big developed countries, including Europe, which is not very surprising given the high level of integration of the financial markets. This means that, even without a common currency, an increase in default risk in any country will be felt on the stock of debt held by foreign financial institutions. Propagation of debt crises in developing countries often followed this pattern, and there is no way to discard it altogether in developed countries, where the financial markets are more intertwined.

Second, of course, in a single currency area, the spillovers are amplified by the common monetary response to fiscal deficits. It dampens activity in all countries outside the culprit country, and may make their raising taxes more costly. In other

words, a general raise in interest rates, both short and long term, can be expected everywhere in the monetary union. A lower increase may also be expected outside the monetary union to reflect higher risk taken by financial institutions, if bailing-out cannot be excluded.

Put together, this means that it is difficult to find an exogenous benchmark against which you would measure the increasing spread of the deficit-making country, since other countries' spreads are likely to be affected too. So, when you measure the spread, as it is measured in most papers, you are likely to underestimate the market response to the initial increase in the deficit.

Actually, it is probably underestimated twice. First, the difference in spreads is underestimated because the benchmark has increased too. Second, part of the market reaction takes place outside the country that is responsible for the deficit (and possibly outside the benchmark zone), and this part is neglected in most papers, which compare only the deficit-making country and the benchmark.

Only Faini's paper takes those effects into account in the Eurozone, to find out that they are huge: the apparent market response is multiplied by a factor of 5 to 7, compared to the country-specific estimates.

4. The adequacy of the market response

Assume there were no downward bias in the measurement of the market response, so that the market pricing of deficit is actually 9 to 22 per cent. The question is: is it inappropriately low? To answer you need a benchmark against which the 9 to 22 per cent figure is to be assessed?

One possibility is to look at what is embodied in common macro-econometric models. Most of these macro-econometric models are of Keynesian inspiration, at least in the short term, and they also assume international spillover effects of fiscal policy in the euro area. So, to get an idea about the importance of the spillovers, in the French Ministry of Finance, we ran the Nigem model of NIESR.

Without surprise, this model tells us that an additional 1 billion euro of fiscal deficit somewhere in the euro zone is to trigger an additional raise in short-term interest rates by the European Central Bank. This, in turn, would reduce the total GDP of the euro area by 50 to 200 millions euro, compared to the situation without monetary tightening. The latter figure depends upon the country where the additional deficit took place and upon how this deficit is expected to be compensated for in the future.

This provides a tentative order of magnitude for what is implicitly put as negative externalities of the fiscal deficit in a standard macro-econometric model. This order of magnitude is 5 to 20 per cent of the initial additional deficit.

Imagine for a moment that, instead of the Growth and Stability Pact, we had decided not to forbid the excess deficit, but just to tax them, with a dissuasive

Pigovian tax, to be used as a disciplinary signal. Then, the level of this Pigovian tax should have been set at the level of the negative externalities of fiscal deficits. If you believe the previous simulations by the model, the tax rate should have been set between 5 and 20 per cent.

This imaginary Pigovian tax level can now be compared with the penalty inflicted to government by the national market response, that is the 9 to 22 per cent inferred from the papers presented in this session. The interval for the market response is strikingly similar to the interval for the adequate disciplinary signal.

Keeping in mind that the national market response may also have been underestimated because of the lack of a proper benchmark, the bottom line is that the market response to fiscal probably plays a significant role as disciplinary signal. This role may even be more than enough to internalise cross-border externalities of deficits.

5. The rationale for fiscal rules

To conclude, we can go back to the three stylised worlds. At first glance, most papers seemed to point at World #3, that is a Keynesian world with markets that were not very good at pricing deficits. But this view is not supported by the empirical work presented in those same papers. Since the market response does exist, World #1, that is the Ricardian world, must be rejected. And since the market response does not seem so inappropriate, the world we are the closest seems to be World #2, that is the Keynesian world with well functioning markets.

In this world, the need for fiscal rules is much less pressing than in World #3. Still, even with a market response in line with the notional Pigovian punishment on deficits, there are a number of reasons why fiscal rules may be useful. Here is a tentative list inspired by the papers:

- Because of international spillovers, not only the culprit is punished by the market. Well-designed rules are certainly needed in a common currency area, and even in a common financial market area.
- Since it goes through interest payments on new debt issuances, the full market response takes time to be perceived. If the duration of new debt is longer than the political cycle, an additional disciplinary device is needed.
- If the market response goes only through the cost of new debt, less indebted countries would receive too low a signal. But the eviction effects and some of the spillover effects do not depend upon which country is running a fiscal deficit. Contrary to the intuition, that involves that fiscal rules may be more needed to discipline lower debt countries than for highly indebted ones.
- The econometrics in the various papers does not come out easily. That means that, even if the market punishment is right in average, it may well be badly wrong most of the times. If so, a good fiscal rule will be better than too shaky a market response.

- Most crises are launched by shifts in expectation. That is a thoroughly non-linear phenomenon, which may or may not be well priced by the market, but which is certainly poorly captured by standard econometric tools. Fiscal rules help anchor expectations and prevent such sudden shifts.