Session 3

TAX COMPETITION AND TAX HARMONISATION

AN EU INTER- AND INTRANATIONAL TAX REGIME:
SOME LESSONS FROM THE GERMAN FEDERALIST EXPERIENCE

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1.   Some remarks on Germany as a federation

German federalism has for many years been the model for an efficiently functioning federal system. It has been contended that the German model in particular could supply a blueprint for the further integration of Europe.

First of all, it is surely correct to say that Europe can continue to grow together and to develop its own identity only in the form of a decidedly federal, decentralised system. Given the very significant economic and political as well as cultural and social differences, any centralising approach is doomed to failure from the outset. Quite apart from the no doubt urgent need to strengthen European parliamentary institutions, there is already probably too much centralism in Europe rather than too little. The task of achieving "unity in diversity" is already confronting us and will become even more pressing in the course of enlargement.

To be able to judge whether Germany, and in particular the German tax system, can in fact supply a model for further European integration and for a unified Europe in the long term one must take a closer look at the advantages and the drawbacks of the German system.

Germany has a short history. A unitary state existed only for some years in the middle ages, at a time when parts of today's Germany and France made up one national territory. Certainly a high point of Charlemagne's empire. After that, history diverges. Whilst a number of strong, centralised states emerged in Europe, the fragmentation of the German part of the Carolingian "empire" was a comparatively speedy process. For centuries thereafter the German language area incorporated a multitude of small medium and (later) large independent states which were forced to cooperate in one way or another – whenever they were not fighting one another.

To this extent the German-speaking area has a long and distinct tradition of federalism. We should not forget that it was only in the late 19th century that Germany was forged into a nation-state in a long and complicated process, albeit in the form of a confederation retaining the federal tradition.

Up to the first World War the principal emphasis was on the constituent states, but for the first time in centuries the post-war Weimar Republic was weighted slightly in favour of the central state, though of course retaining the basic federal concept and the sovereignty of the constituent federal states (the "Länder").

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But this was only a brief intermezzo. After the few years of centralised, National Socialist domination, the historical German tradition of a federation and subsequently of a federal state was again taken up. The Allies were instrumental after 1945 in ensuring that Germany returned to a federal regime. This affords both the Federation and the Länder their own broad areas of responsibility. But despite having some fundamental powers in the field of economic and fiscal policy, the Federation is both in law and in fact politically dependent upon the Länder level. A strong Federation – a strong central level – was not the intention of the Allies: what they wanted was a Federation whose powers were curtailed.

In this respect, Germany today differs quite substantially from, say, Austria, which in principle has the same federal structure but where central government has in fact considerably greater powers. Hence Germany is more readily comparable to Switzerland.

From this starting point a the federal system has developed up to the present in Germany. Besides the mentioned constitutive principle there is today a second very crucial, typically German federal feature: A dense and complex network of coordination mechanisms which evolved over time. Separate attention must be given to the local level in this respect.

2. The federal financial (tax) system in Germany

By stipulating that "The Federal Republic of Germany shall be a democratic and social federal state" (Article 20 paragraph 1 of the Basic Law – GG –) the constitution establishes federalism as a structural and regulatory principle.

Article 79 paragraph 3 GG declares the principle of federalism to be inviolable and unamendable. This clause "for all time" is unique among modern democratic constitutions.

There are four main aspects to the inviolability of the federal order:

(a)   Permanent division into Federation and Länder

The constitution prohibits the abolition of the Länder as such. But it does not protect the existing Länder in their specific configuration. Länder borders may be altered and existing Länder subsumed into or combined with others.

(b)   State character of the Länder

The Länder are not merely large, self-governing entities in the same way as local authorities and administrative districts but have the character of states, which may be seen, for instance, from the fact that each has its own constitution. The constitutions of the Länder are distinct from and independent of the Basic Law. In the narrower sense, state character implies that whilst the sovereign powers of the Länder are limited, they do not derive from the Federation. Neither of the two levels of government in the federal state may circumscribe the powers of the other level.

(c)   Financial independence

The Länder must have some degree of financial independence to enable them to pursue their own policies. Hence they are vested with their own powers of taxation. They are empowered to create and levy taxes, to administer the revenue thus raised and to decide how it is to be used. Conversely, the federal state must also have at its disposal financial resources sufficient to ensure its political independence from the constituent states.

(d)   Participation in legislation

The constitution gives the Länder in principle a guaranteed right to participate in legislation. This means firstly that the Länder have their own legislative powers. Secondly, it means that the Länder must be allowed to participate in the legislative process at federal level.

The Federal Republic of Germany is a two-tier federal state comprising the Federation and the Länder. Hence the communes do not form a third tier of the state, but are part of the Länder. Yet towns, local authorities and administrative districts (in the following collectively referred to as the communes) play a prominent role within the administrative structure. Their prominent position is based on the right of communal self-government set out in Article 28 paragraph 2 GG.

In a federal regime, both the federal state and the constituent states including the communes must have a financial endowment and some degree of scope for taking action on the strength of that endowment.

There are four principal issues to which the constitutional rules on public finances in Germany apply:

(a)   Which level of government must finance which functions?

In a federal regime, as in other regimes, the responsibility for a governmental function and the responsibility for financing that function must lie in one hand. The political subdivision to which the constitution assigns the performance of a function must dispose of the necessary resources for doing so (principle of coherence).

Neither the Federation nor the Länder may finance projects that do not fall within their sphere of administrative responsibility. This also implies that neither level in the federal state may impose the financing of its tasks on the other level. So there is in principle a clear cut diversification of tasks assigned to the different levels of government, but there also is a grey zone, partly nebulous, serving as a flexible political instrument on the spot, partly institutionalised in the so-called "Gemeinschaftsaufgaben" ("joint tasks") or other rules of the fiscal part of the constitution.

Nevertheless there is a principle in Germany: The Länder are autonomous in drawing up and managing their budgets and are answerable only to their parliaments.

It is clear from this that the Federation has no right whatsoever to intervene in subnational budgets. But the budgets of the Länder account for about 50 per cent of public spending by political subdivisions and are thus a highly relevant factor with reference to the Maastricht criteria.

(b)   Who passes which tax laws – the federal state or the constituent states?

Tax law is in fact largely federal law. The powers to pass tax laws are assigned as follows:

- The Federation has exclusive power to legislate only on customs duties and fiscal monopolies (Article 105 paragraph 1 GG, Customs Law, Customs Tariff Law, General Customs Regulations, Federal Spirits Monopoly). This ceased to have political relevance with the creation of the EU single market.

- The Federation has concurrent power to legislate on all other taxes (Article 105 paragraph 2 GG) where the revenue from those taxes accrues to it wholly or in part or where the conditions provided for in Article 72 paragraph 2 GG apply.

  This last provision is of major political and legal significance, as the proviso in Article 72 paragraph 2 GG that "the creation of equal living conditions throughout the country or the maintenance of legal and economic unity makes federal legislation necessary in the national interest" generally applies.

- Consequently, the Länder have scarcely any exclusive powers to legislate on taxes. They have power to legislate on local excise taxes as long and insofar as these are not identical with taxes imposed by federal legislation (Article 105 paragraph 2a GG). The first sentence of Article 106 paragraph 6 stipulates that the revenue from these taxes accrues to the communes.

Hence the constitutional rules on public finance give the Länder and communes in principle the right to create taxes, thus vesting them with fiscal sovereignty. In fact, however, they have only a few taxes of their own which bring in any revenue, such as beverage tax, entertainment tax, dog tax, hunting and fishing tax, secondary homes tax and packaging tax.

Some Länder have already dispensed with a part of these taxes because the revenue is out of proportion to the administrative effort. In such case they may assign to the communes to power to collect, say, dog tax under communal by-laws.

- But the first impression is often mistaken. The Länder are by no means excluded from fiscal sovereignty. Article 105 paragraph 3 guarantees them the right to participate through the Bundesrat, the chamber of parliament in which they are represented. Federal legislation on taxes whose revenue accrues wholly or in part to the Länder or communes requires the consent of the Bundesrat. In this way the Länder are able through a majority veto to influence tax legislation in their favour. And this veto is an absolute veto!

This is why almost any tax law amendment can turn into a trial of strength, as the revenue from the most important taxes (VAT, personal and corporate income

tax) accrues both to the Federation and the Länder and in part to the communes as well.

There must be consensus or the law cannot be passed. There are complex mediation structures but whenever there is a conflict the need for consensus means that any tax law will be watered down from a fiscal policy point of view or it will be extremely costly for federal government to "buy" some Länder for the majority, especially when the political colour of the majority differs between both houses, which is often the case in Germany, as it is at present.

(c)   How is total state revenue divided up between the different levels?

The allocation of revenue determines both the financial and the economic and fiscal policy scope available to the federal state and the constituent states as well as their interaction on fiscal policy.

One may envisage in principle separate or combined revenue allocation systems, with separate allocation systems generally affording a greater degree of autonomy and/or greater incentive to secure an adequate amount of tax revenue. Post-war Germany initially had a clearly defined separate allocation system, although this soon came to incorporate a growing number of elements of combined allocation. Hence the degree of autonomy of each level has appreciably declined, especially with regard to revenue.

The public finance reform in Germany in 1969 created a composite system of separate and combined revenue allocation with the aim of maximising the benefits and minimising the drawbacks of both systems.

Both the Federation and the Länder and communes now have a very small degree of fiscal autonomy. The share of revenue from joint taxes (in particular income tax, corporation tax and VAT) in total tax receipts amounted to about 75 per cent in 2002. About 20 per cent of tax revenue came from taxes accruing solely to the Federation (in particular mineral oil duty, tobacco duty, insurance tax, electricity duty, solidarity surcharge). Thus the fiscal autonomy of the Federation is still appreciably greater than that of the Länder and communes, which still receive almost half of total tax revenue (after supplementary federal grants and horizontal financial equalisation), though only about one tenth of this is attributable to taxes imposed by the Länder and the communes (specifically inheritance tax, real property transfer tax, motor vehicle tax and the gaming casinos levy as Länder taxes and trade tax and real property tax as communal taxes).

The shares of income tax and corporation tax revenue assigned to the Federation and the Länder are set out in the Basic Law. Federation and Länder each receive 42.5 per cent in income tax receipts and 50 per cent of corporation tax receipts. The horizontal distribution of tax revenue among the Länder is governed by the local revenue principle, with distortions being corrected by "reallocation".

The shares in VAT revenue are regulated by a federal statute which, however, requires the consent of the Bundesrat. to this extent, VAT is the most flexible instrument in the distribution of tax revenue. In 2002 the Federation received 51.4 per cent of VAT revenue with 46.5 per cent assigned to the Länder. In accordance with Article 107 of the Basic Law, at least 75 per cent of the Länder share in VAT revenue is apportioned on a per capita basis while not more than 25 per cent is apportioned as so-called supplementary shares to Länder with less than average revenue raising capacity (*i.e.* tax revenue of less than 92 per cent of the average of all Länder). The supplementary shares result in replenishment up to 92 per cent of the Länder average, so that the distribution of VAT revenue has financial equalisation effects by levelling out to some degree the differences in financial capacity between the Länder.

With regard to the apportionment of VAT revenue, Article 106 of the Basic Law stipulates that the Federation and the Länder shall have an equal claim to funds from current revenue to finance their necessary expenditure. Accordingly, the respective shares in VAT revenue are to be reapportioned whenever the ratio of revenue to expenditure differs substantially as between the Federation and the Länder, thus avoiding financial imbalances between the levels. In theory, this sounds simple and plausible, but in federal practice it is frequently the cause of differences of opinion between Federation and Länder, as the constitutional ruling leaves plenty of room for interpretation, especially in the definition of what constitutes necessary expenditure.

The powers of the communes to impose and collect taxes are not inherent but are assigned to them under the legislation of the Länder. They collect local taxes under their by-laws. However, the revenue from these taxes is not of great significance, amounting as it does to less than 5 per cent of the aggregate revenue accruing to local authorities. The communes and associations of communes are given a percentage of the share taken by the Länder of the total revenue from joint taxes. This percentage is set by Länder legislation. The communes also receive 15 per cent of the revenue from income and corporation tax and 2.2 per cent of VAT revenue for the whole of Germany. Trade tax and real property tax receipts accrue to the communes as well as the revenue from local excise taxes which, as already stated, is hardly significant. However, the Federation and the Länder receive a share of trade tax receipts through an apportionment.

(d)   The role of the financial equalisation system

Despite the offsetting or levelling effects of tax revenue allocation there are still marked differences in the financial endowment of individual Länder. This may be attributable to geographical disadvantages or to weak infrastructure just as to misdirected policy decisions by a regional government. To lessen the impact of this, Germany has a very complex system of horizontal and vertical financial equalisation.

- In the course of horizontal financial equalisation between the Länder, tax revenue that has been assigned to the individual Länder may in part be channelled off again to the benefit of financially weaker Länder. The extent to which a Land is obliged to reassign revenue or has a claim to reassigned revenue is determined by the divergence of its own financial capacity (in terms of the ratio between tax revenue and number of inhabitants and making allowance for the financial capacity and financial requirements of its communes) from the average financial capacity of all Länder. Financially weak Länder are boosted to at least 95 per cent of the average financial capacity of all Länder by offsetting 37.5 per cent of the shortfalls existing between 92 and 100 per cent. The equalisation amounts to be contributed by the financially strong Länder are determined in a three-stage levy system. In the final stage, 80 per cent of the financial resources exceeding 110 per cent of the average financial capacity of all Länder is assigned to equalisation. In the outcome, the differences in financial capacity between the Länder are broadly, though not yet fully, levelled off.

- The central element of vertical financial equalisation is the provision of supplementary federal grants to the Länder. The Federation enhances the capacity of financially weak Länder by providing from its own resources so-called shortfall complementary federal grants, while the special burdens of individual Länder can be lessened by federal complementary grants for special needs.

As this system is closely linked to aggregate state spending and revenue it is a key parameter in the federal context that plays a frequently decisive part in all coordination processes. The complex financial equalisation system, intensified by the special problems following on the unification of Germany, significantly encumbers the political and economic efficiency of the German federal regime.

Where the individual tax receipts of the communes are insufficient to enable them to discharge the functions assigned to them, the Länder are primarily responsible for ensuring communal financial resources (communal financial equalisation).

3.   From 'Modell Deutschland' to 'German disease"

The principal feature of the German federal regime is its very subsidiary or decentralised basic structure with generally clearly defined assignment of responsibilities. The expenditure powers assigned to Federation and Länder give them a high degree of autonomy on the expenditure side of the budget. On the revenue side, however, the autonomy has been steadily diminished in practice by the predomination of the combined system of revenue allocation as well as the fiscal equalisation system.

Additionally all important tax policy decisions are taken in a relatively complex, lengthy process of coordination between the institutions. Added to this is financial equalisation, which can also be carried only in common and results in a

further distribution of income. This lack of autonomy on the revenue side also has a negative impact on expenditure-side autonomy, least so for the Federation, which still has some key taxes of its own (such as mineral oil, tobacco and spirits duties), but more so for the Länder and especially for the communes, which are almost wholly dependent on what "trickles down" from the Länder.

However, the relatively high degree of expenditure-side autonomy on the one hand and the diminished revenue-side autonomy on the other hand give rise to serious efficiency problems. The responsibilities for expenditure and for financing expenditure are not congruent, and additionally this mismatch is aggravated by the high level of joint financing that is no longer justified by the existence and the extent of external effects. The blurring of responsibilities for financing makes it more difficult to establish accountability on the part of the responsible decision-making bodies and thus also undermines any incentive to exercise expenditure discipline.

The present financial equalisation system featuring extensive reallocation of tax revenue and transfer payments between the territorial subdivisions provides other misdirected or inadequate incentives for the Länder. Efforts undertaken by a Land to improve its financial situation, for instance by making tax collection more efficient or by pursuing an economic and fiscal policy course designed to boost growth and employment, will produce scarcely any benefit as the Land will be able to retain only a small part of the additional revenue. With the system as it now stands, it is not even certain that the Land originally having the highest tax revenue will still occupy that position after financial equalisation and federal supplementary grants; in other words, financial equalisation may even lead to shifts in the ranking of Länder in terms of financial resources.

The lack of fiscal autonomy and a financial equalisation system dedicated to the creation of equal living conditions which largely levels out and in part overcompensates for tax revenue differences, plus the obligation for the Federation and the other Länder to bail out any Land under the threat of insolvency, make German federalism into an unwieldy and ineffective arrangement. Reforms (of tax law) can generally be pushed through only after a protracted struggle to reach a compromise between federal and Länder interests. These difficulties become even more acute if, as has almost always been the case in the past few years, there are different party majorities in the Bundestag and Bundesrat. The most recent example is the ongoing procedure to pass a law cutting tax concessions.

Despite these "inbuilt" – and steadily growing – defects, Germany managed for a long time to make the system work in a manner that gained reputation both at home and abroad, particularly because it was exceptionally suited to promoting cooperation and integration – a feature seen, for instance as being of decisive significance for reconstruction after the second World War and for the process of reunification.

Although other structurally incorrect decisions were taken as late as the end of the Sixties – especially in further intensifying the links between levels of government in respect of revenue and expenditure (for what are referred to as joint

tasks) – this consensus-based cooperative federalism operated very effectively if somewhat inconsistently until well into the Eighties. For a long time, too, this federal system was generally very efficient and productive in the field of economic and fiscal policy as well. Even today the German system would still grade well in terms of closeness to the citizen, regional effectiveness and participation, though not in terms of efficiency and transparency.

In the meantime, however, this positive assessment has undergone a dramatic change. German federalism is now equated with the compulsion to achieve consensus, protracted coordination processes, the protection of vested rights, standstill and blockade. The "German model" has turned into the "German disease". Facing high unemployment, low growth and structural problems in Germany, especially on the labour market and in the social system, the institutional side is also crucial for the (lack of) implementation of bold reforms.

Effects providing economic incentives are slowly but surely forfeited, while negotiations are dominated by political strategies and tactical manoeuvring. The clearly defined assignment of factual and financial responsibilities and the monitoring of efficiency based on such assignment are rendered considerably more difficult.

This trend has already been long apparent, but for a long time the drawback was concealed by high growth. The state of affairs has now been revealed by the long run of weak growth rates and their fiscal consequences (which have had a particularly severe effect on Germany).

The central concern is to improve government structures that can enable unified policy to be pursued across all levels and generally increase the effectiveness of economic and fiscal policies. If possible, there should be no loss of participation, regionality and closeness to the citizen and a gain in transparency. Hence a centralist model has to be ruled out. The refinement of federal models incorporating less interlinking and greater autonomy coupled with clearly defined economic incentive effects could provide a solution.

4.   Reorganisation of the system of federal financial equalisation as from 2005

A fundamental reshaping of the relationship between Federation and Länder is needed if these problems are to be resolved. The benefits of federalism can be brought to bear only if the decentralisation of responsibility is allowed ultimately to lead to differences and competition among the Länder and between them and the Federation. This does not mean that the system of cooperative federalism should be completely relinquished; after all, it managed to pass an important test on the expenditure side with the creation of the national stability pact last year. But it should be supplemented by more pronounced elements of competitive federalism. Here the object must be on the one hand to strengthen the fiscal autonomy of the

individual levels. On the other hand, the system of federal financial equalisation must be so reformed as to have less of a confiscatory effect.

An important reform of the system of federal financial equalisation has already been put in place by the Law to continue the Solidarity Pact of 20 December 2001. Financial equalisation is to be reorganised as from 1 January 2005 on a basis valid for the longer term. To quote the finance ministry's monthly report for February 2002: "The system of financial equalisation has been more strongly geared than before to the aspect of incentive effects, though without calling into question the joint and several community of the Federation and the Länder." This means that narrowing the obligations to equalise will provide greater motivation for all Länder to improve their respective revenue situation by their own efforts. This will be achieved in particular by the following new provisions:

- In financial equalisation between the Länder, the equalisation schedule takes a symmetrical and in part linear-progressive course. There are no abrupt rises in the marginal burden and in marginal replenishment. Full replenishment for recipient Länder will be discontinued. The scheduled maximum marginal burden on donor Länder will be reduced from 80 to 75 per cent and will apply only at 120 per cent of the average financial capacity instead of 110 per cent as at present. Additionally, a "cap" of 72.5 per cent will be introduced for the average assignment of surpluses registered by donor Länder. Finally, there will be a novel feature in the form of a "bonus" model: "Länder registering disproportionately large per capita tax revenue increases on the year will in future be granted a part exemption from the obligation to assign the excess of such tax revenue increment."

- Standard federal complementary grants will be made only to those Länder whose post-equalisation financial capacity is less than 99.5 per cent (at present 100 per cent) of that of all other Länder. Additionally, the equalisation intensity will be reduced from 90 to 77.5 per cent.

The reorganisation of financial equalisation under the Law to continue the Solidarity Pact will apply up to 2019. By that time the process of economic reconstruction in eastern Germany is likely to have been concluded, so that further refinement of federal financial relations can be tackled taking account of the experience gained up to then with the new system. This reorganisation is at all event an important step in the right direction – on the path to a system of financial equalisation that is appreciably less levelling yet still compatible with incentives.

5.   Next step: greater fiscal autonomy

But there is more to the task than this. What further adjustments are needed to encourage this change in the state of mind? Essentially, the aim must be to increase as far as possible the autonomy of each individual level and to establish the correct patterns of economic and political incentives.

The factual and financial responsibilities of each level must be clearly demarcated and identifiable. At all events, a possible solution for Germany would be for greater emphasis to be placed on a system of separate apportionment on the revenue side.

Initially, greater fiscal autonomy for the Länder could be achieved by reinstituting the specific revenue system. But this proposal is not feasible, as both federal and Land politicians refuse to countenance it and it would probably be impossible to reach agreement on which type of tax revenue should be assigned to which level of government. A further argument against this is that each of the major types of tax at present coming under the joint revenue system (taxes on earnings on the one hand and turnover taxes on the other) has specific advantages and drawbacks which justify the revenue being assigned jointly to all levels.

For this reason the necessary broadening of fiscal autonomy should be achieved by introducing a Länder-specific addition in the tax scale to personal and corporate income tax (possibly also to VAT). A federal statute (requiring the consent of the Bundesrat) would subsequently fix the uniform basis for assessment and if required a maximum rate for the Länder-specific addition. This would ensure, firstly, that regional differences apply only within certain limits and that conversely the equality of living conditions requirement is not fully undermined. Secondly, it would avert the threat of a race for subsidies. By exercising their claim to an addition the Länder would be able to take more effective account of their priorities and objectives, though they would also have to assume the appropriate responsibility and would thus be under greater pressure to substantiate and justify their actions than they are at present. The differing financial requirements of the Länder would be reflected in differing tax charges on individuals and enterprises, which could in general be expected to exert a disciplinary effect on spending by the Länder and encourage them to make more efficient use of funds.

However, it would initially be conditional upon cuts in the income tax scale, which it would be sensible to combine with a comprehensive broadening of the tax base, since the introduction of a claim to additions must not be allowed to increase the tax burden.

There will of course still be a need for federal financial equalisation to assist financially weak Länder and the ensure that structurally weak Länder in particular are not forced to make very large additions to taxes on earnings, causing them to fall even further behind in the regional competition for business investment and jobs.

Autonomy is all well and good, but regional divergence should not be allowed to take on excessive dimensions in a unified state. This would imply both in economic and in political terms a reversion to "particularism".

A line must be drawn at some point if greater autonomy and decentralisation also means more competition. Unrestricted competition between federal states would comply neither with the principle of "subsidiarity" nor with that of "unity in diversity".

Unrestricted competition between unequal partners (unequal because of differing economic capacity and financial endowment and other general conditions) would intensify the existing imbalances. This is especially important in view of the differences still existing between the old and the new Länder. Extreme imbalances are bound to result in demands on central government, eroding its capacity to act. The positive aspects of competition between the Länder will benefit the state as a whole only if the Länder are of roughly equal capacity as well as having comparative advantages in a Ricardian sense. Thus if the modernisation debate is seriously intended, the Federation will also have to concern itself with the issue of "reorganising the Länder".

Additionally, the existing arrangements for joint financing and the performance of tasks should be reassigned as necessary with clearly defined attribution to either the Federation or the Länder. In the provision of public infrastructure, however, certain minimum standards should be jointly prescribed.

A reform along these lines, affording greater autonomy combined with basic joint standards or fiscal policy rules, could provide the breakthrough to a new federal model.

The concept would have to be applied to the communes as well, which are at present largely dependent on what "trickles down" from the Länder. This will call for more radical institutional reform. The communes would first have to be given *de facto* fiscal autonomy and would have to assume greater responsibility for the revenue and expenditure sides of the budget. Initially this implies assigning to the communes their own local tasks. At the same time, (minimum) standards are to be prescribed for the provision of goods and services at local level. Added to this are further financial management standards and rules, such as the commitment to run a balanced budget under normal conditions.

To be able to discharge these responsibilities, the local level would in future have to be less dependent on grants from the Länder, which have hitherto been subject to quite arbitrary changes, and would have to derive the bulk of their resources from revenue which they themselves determine. This could conceivably include local powers to access revenue from direct taxes as well as local tax sovereignty (power to create new taxes).

Hypothecated grants should be forthcoming for the provision of public goods and service of the Länder at local level. Direct grants by the Federation to the communes might also be conceivable in future.

But although increasing autonomy provides greater incentives for economic efficiency it must still be linked to very direct "auditing". As there is no market as such in the narrowly defined public sphere which would automatically correct misdirected action, it must be possible for undesirable trends and inefficient management to be rapidly identified and sanctioned (by the Länder). Any "bailout" can only be the exception.

If it is to ensure equality of living conditions in Germany as a whole, this system would certainly not function properly without Federation/Länder or Länder/Länder financial equalisation, and especially not without financial equalisation between Länder and communes. But the arrangements could be much less extensive and also much less complicated.

It must be remembered that interventions in the existing federal system will generally call for changes to the constitution. These require a two-thirds majority in both houses of parliament, the Bundesrat and the Bundestag. It seems likely that more extensive changes can be implemented only if there is a growing perception among the public at large that the lack of effectiveness of fiscal policy and the poor performance of "model Germany" are largely attributable to the institutional structures currently in place.

If we succeed in fully modernising Germany's federal organisation in line with these criteria we will be able to define more clearly the decision-making structures and hence the responsibilities at all political levels – in the Federation, the Länder and the communes. This would be of decisive significance for fiscal policy, as it would bring the division of responsibilities for aggregate expenditure and deficit trends more sharply into public focus and make it more readily perceptible to the public. The new incentive structures applying equally at all levels would be a further contribution towards ensuring a unified fiscal policy.

6.   Some remarks on Europe as a federation: lessons from Germany

What conclusions may now be drawn for Europe from the German system and from German experience? First: Whether Europe shares a lot of common values and traditions, the difference is still large and grows with enlargement. Second: The European approach is not a far-reaching equalization/neutralization of difference, but valuing and keeping those difference for innovation and (local, regional) participation besides any necessity for a "common sense" and a European identity.

In EU tax policy, the subsidiarity principle has become broadly established. The responsibility for tax policy is still almost exclusively a national concern, with harmonisation and efforts to achieve it being limited to areas in which distortions of competition can and should be prevented by national means – to date principally in the field of indirect taxation. A long awaited breakthrough in the fight against cross-border tax evasion was finally achieved on 21 January 2003 with the agreement on the taxation of interest income reached in the ECOFIN Council.

In the long term, I consider that a German system reorganised in accordance with the criteria already described could well serve as a model for a unified Europe. But there is still a very, very long way to go and many obstacles to be surmounted. The requirements are these:

Expenditure and financing powers must be "in a single hand" and clearly attributable in order to ensure the accountability of the responsible bodies. The trend

is clearly in favour of a specific revenue system. The unavoidable financial equalisation system must contain strong incentives.

The more pressing question at present no doubt has to do with how the revenue system of the EU as an organisation can be reformed. Around 85 per cent of the funds accruing to the EU budget currently derive from contributions from the national budgets of Member States in the form of VAT-based and GDP-based own resources. This arrangement gives rise to problems similar to those described in connection with the German system. In particular, the present funding system suffers from a lack of transparency – not only for finance ministers and parliamentary deputies but even more so for the citizens of the EU. This is doubtless one of the causes of the sceptical stance still adopted in relation to European integration and the European institutions.

For this reason Germany is definitively receptive to the proposed introduction of an EU tax in the medium to long term. In my view, preference should be given to the right to make additions to an existing tax (VAT springs to mind in this context) rather than to introducing a new tax.

But the following conditions would have to be fulfilled. An EU tax:

- must not impose an extra tax burden on individuals and enterprises;
- must not lead to extension of the financial framework;
- must be balanced as among the Member States with regard to the expected revenue;
- must be harmonised or capable of being harmonised;
- presupposes continuing political integration of the EU.

It must be understood that an EU tax could represent the first step in a transition from a community of states to a federal state, fiscal sovereignty being one of the central elements of statehood. This must be balanced by political control on the part of the citizen on every level of the state of the union.

INCOME TAX COMPETITION IN A FEDERATION:
EVIDENCE FROM A NATURAL EXPERIMENT

Paul Boothe[*]

Introduction

Questions around tax competition among neighboring jurisdictions have occupied economists for many years. Although early treatments of the issue were framed in the context of competition at the local level, it soon became clear that the analysis could be extended to tax competition among regions and even among nations with barriers to mobility and levels of economic integration becoming increasingly relevant as one moved from the local to the national level.

The operation of tax regimes in federal systems adds additional complications to the study of tax competition. Complications arise because the same citizens remit taxes to both regional and national governments and because of potential spillovers between regional and federal tax systems. A longstanding literature exists on the so-called "tax assignment" problem for dividing tax fields among national and regional governments.[1] More recently, advances have been made in our understanding of the interaction of tax systems in federations, leading to examinations of "vertical" and "horizontal" externalities in taxation (see Dahlby, 1996).

Competing considerations for designing a federal tax system include:

- minimizing vertical and horizontal fiscal imbalance,
- matching appropriate expenditure and revenue responsibilities,
- providing flexibility for regional tax structure preferences,
- contributing to the efficient running of the national economy (the economic union),
- maximizing transparency and accountability and
- minimizing administrative and compliance costs.

However, in an important sense, this normative literature often has little practical relevance. Economists rarely find themselves involved in the design of new federation. Indeed, the assignment of taxing powers among national and regional governments in mature federations is generally governed by historical and political

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[1] For early discussions, see Musgrave (1973) and Oates (1972).

factors and often codified in existing national constitutions and slowly evolving jurisprudence.

In this paper, we take advantage of a recent natural experiment to examine the issue of tax competition in a federation. In 2000 and 2001, nine of the ten Canadian provinces changed from levying income taxes as a percentage of federal income tax (Tax On Federal Tax – TOFT) to a system of levying taxes directly on federally-defined taxable income (Tax On Income – TONI). This change substantially increased the flexibility of provincial governments to shape their provincial income tax systems, and thus their scope for varying tax structures to meet regional objectives. Our goal is to measure and assess the impact of this change on the degree and nature of interprovincial tax competition.

The remainder of the paper is organized as follows: in the first section we provide some background information on Canada's federal and provincial tax systems; next we briefly describe some of the economic and political efficiency issues that have been discussed in the tax competition literature; the third section is devoted to describing and measuring the changes that took place followed by an assessment of the changes under the headings suggested by the theoretical literature. The paper concludes with a brief summary and discussion of the implications for other jurisdictions.

1.   Background[2]

Constitutionally, both federal and provincial governments are permitted to levy income taxes. The provincial power is explicit in provinces' powers of direct taxation. The federal power comes from its general power to tax by whatever means it deems appropriate. The province of British Columbia instituted an income tax in 1876, shortly after its entry into Confederation. Some municipalities (constitutionally, creatures of the provinces) instituted income taxes as early as the 1830s. The federal government began to collect income tax in 1917 as a "temporary" measure to help finance the first World War.

By the 1930s, federal, provincial and municipal governments all levied income taxes with almost no coordination. This lack of coordination resulted in large variations in income taxes across and even within provinces, accompanied by high administration and compliance costs. In 1940, a federal royal commission (the Rowell-Sirois Commission) described the Canadian income tax environment as a "tax jungle" and recommended that provinces withdraw from the income tax field in return for intergovernmental transfers from the federal government.

Provinces rejected the recommendation that they abandon their constitutional right to levy income tax. However, they did vacate the field temporarily in return for federal transfers to allow the federal government to finance the second World War.

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2   This section draws heavily from Sheikh and Carreau (1999).

Following the war, the federal government continued the so-called tax rental agreements with a number of provinces until 1962. At that time all provinces except Quebec signed Tax Collection Agreements (TCAs) through which the federal government agreed to collect provincial income taxes with certain conditions attached.

The TCAs stipulated that the federal government would administer provincial income taxes without charge if they met three conditions:

- they were administrable (technically feasible to collect under the federal system),

- they were levied on a common base (specifically, basic federal tax) and

- they did not negatively impact the economic union – the internal flow of labour, capital or services within Canada.

No-charge administration for provinces and reduced compliance costs for taxpayers were offered as incentives to provincial governments to give up the policy flexibility that came with collecting their own income taxes.

At various times since they signed the TCAs, provinces have expressed concern about the limits put on provincial tax policy. In particular, given their tax base was basic federal tax, they objected to fact that almost all federal tax measures were automatically passed through to provincial income taxes, unless provinces took specific measures to counteract them. For example, changes to either the base or to federal rates automatically changed provincial tax revenue. This pass-through occurred regardless of the provincial governments' preferences or fiscal requirements unless explicit (and public) action was taken by provinces to counter the effects of the federal measures. In the case of federal tax reductions, provinces were sometimes required to explicitly raise rates in order to maintain revenue levels.

On several occasions, a number of provinces studied the possibility of leaving the TCAs in order to regain tax policy flexibility.[3] However, in 1997, with the federal government committed to a program of sustained income tax reductions that some provinces could not afford to match, a federal-provincial committee recommended that the TCAs be modified to permit provinces to levy taxes directly on income rather than federal tax. This limited the potential pass-through to changes to the base. The federal government finally agreed and provinces effected the transition to TONI over the two-year period 2000-01.

2. Economic and political efficiency[4]

A substantial theoretical literature on the issue of tax competition has developed since the work of Tiebout (1956). For the purposes of this paper, we can group the relevant theoretical issues under two broad headings: economic and political efficiency. By political efficiency, we mean mechanisms that permit

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[3] See, for example, Hartle *et al.* (1994) and Boothe and Snoddon (1994).

[4] For a recent review of the theoretical literature, see Wilson (1999).

citizens to effectively satisfy their preferences regarding publicly provided goods and services and preferences regarding the corresponding revenues used to finance those goods and services.

Under the heading of economic efficiency, theoretical work has been concerned with the issue of whether centrally controlled tax regimes can be efficient when regional preferences differ. In these models, jurisdictions offer different fiscal regimes in order to attract agents with particular preferences and migration plays a key role in attaining efficient outcomes.

One of the key challenges to the Tiebout analysis has come from those who argue that differences in fiscal regimes may lead to inefficient migration of labour and capital. It is argued, this migration may have more to do with differences in regional endowments than with the preferences of agents, so that a region well endowed with natural resources may be able to generate net fiscal benefits that attract migrants and distort economic decisions so that overall efficiency is compromised.

Under the heading of political efficiency, questions regarding transparency and accountability, and administration and compliance costs are relevant. Public choice theory suggests that political efficiency is enhanced when governments are directly accountable for raising the revenue required to finance the public expenditures they make.[5] In this environment, taxpayers are best able to judge the benefits of public expenditures in relation to their costs. Centrally controlled tax systems generally provide revenue to governments through intergovernmental grants. While some intergovernmental grants are necessary to address horizontal fiscal imbalances, transfers in excess of that amount may unduly lessen transparency and accountability.

A second set of more practical issues has to do with administration and compliance costs. To the extent that all regions use similar tax systems, efficiencies may be gained by pooling collection systems. This pooling is also important when considering the compliance costs of taxation. Tax base definitions and income attribution rules that are common to both national and regional governments reduce taxpayer compliance costs substantially as well as enhancing transparency and accountability.

Thus, we see that the theoretical literature produces potentially offsetting predictions regarding economic and political efficiency. Economic efficiency may be enhanced if tax competition permits differing regional preferences to be satisfied. At the same time, differences in regional endowments may lead to efficiency-reducing migration in response to net fiscal benefits. With respect to political efficiency, regional control of taxation may enhance the accountability of governments. However, without administrative coordination, it may also reduce efficiency by leading to excess administration and compliance costs.

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[5]   See Mueller (1990).

3. Provincial tax changes

3.1 The 1999 context

In 1999, all provinces except Quebec levied income taxes as a percentage of basic federal tax.[6] Each province set its own tax rates and added various surtaxes and non-refundable credits. In practice, provincial income taxes varied substantially in terms of rates, credits, and brackets. Figure 1 shows the 1999 and 2002 levels of taxation for single taxpayers with $25,000 annual income, and families with $50,000 and $75,000 annual incomes. Effective average tax rates in 1999 varied across provinces by almost 6 per cent, or double their average value. Significant variations in average rates existed for higher-income families as well, although not of the same magnitude as for single individuals at $25,000. Figure 2 shows marginal tax rates for 1999 and 2002 based on a different data set; this time for single individuals with $25,000, $50,000 and $75,000 annual income. Once again, large variations in 1999 tax rates are evident across provinces with the largest variations concentrated at the $25,000 income level.

In addition to average and marginal tax rates, another important characteristic of personal income tax systems is the low-income threshold at which income tax becomes payable. Figure 3 shows 1999 and 2002 provincial and federal low-income thresholds for single taxpayers. Given the TOFT system in place in 1999, the threshold for a number of provinces was the same as the federal threshold. Some provinces had additional personal credits, which raised the threshold by as much as $3,250, or about 42 per cent higher than its average value.
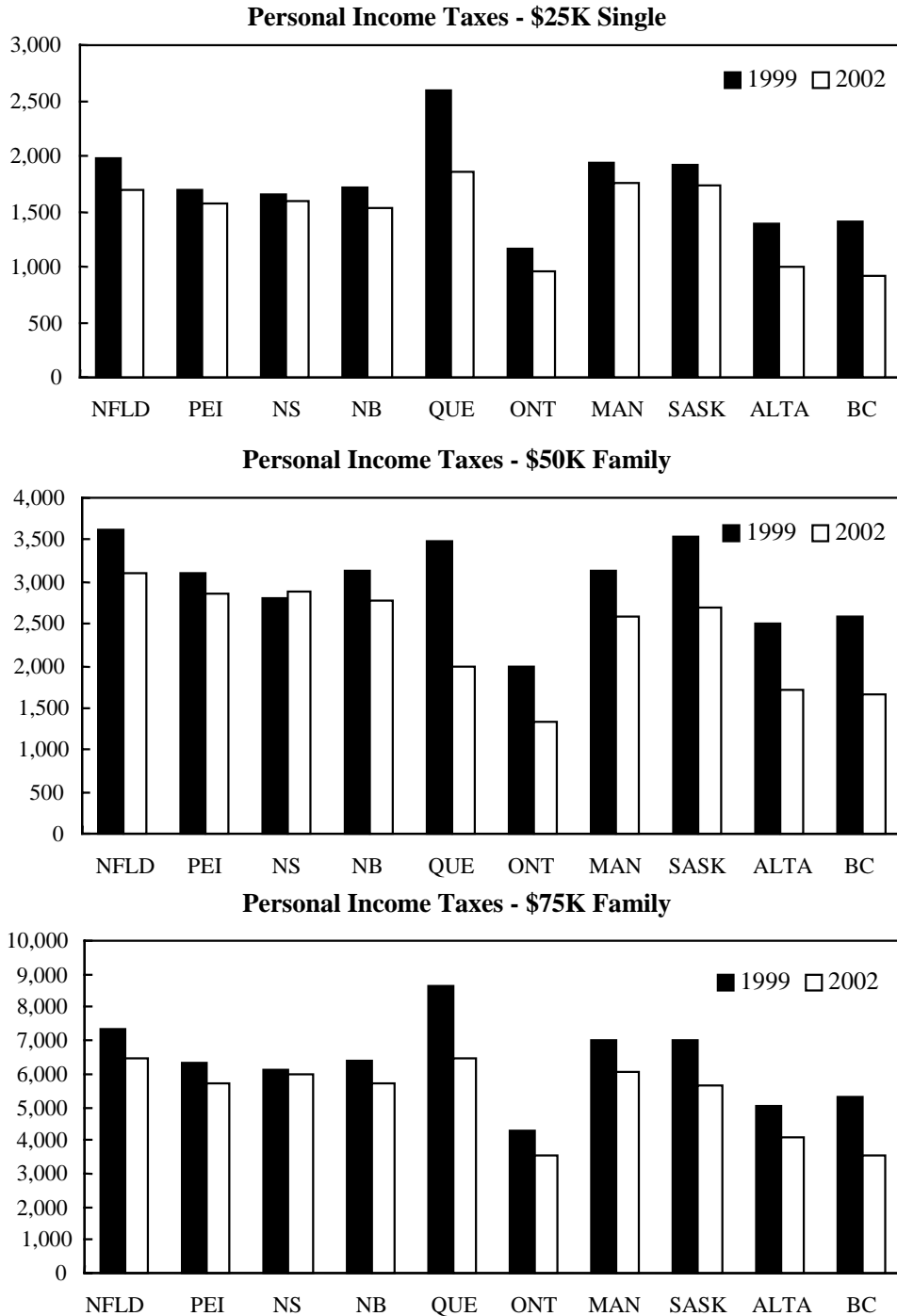
A final important characteristic of provincial tax systems in 1999 was their degree of progressivity. One indicator of progressivity, changes in average tax rates over three income ranges, is presented in Figure 4. Although the progressivity indicator for the $10,000 to $100,000 range is clustered fairly tightly around the mean (with Quebec being an obvious outlier), examination of the two intermediate ranges indicates substantial variation across provinces.

3.2 Transition to TONI

Table 1 provides a chronological account of provincial tax changes over the period 1999-2002. Five of nine provinces moved to TONI in 2000 with the remainder making the transition in 2001. As we see in Figures 5 and 6, mean average and marginal tax rates declined in every year. Average tax rates fell about 1.3 percentage points for all three family/income groupings. For marginal rates, reductions were concentrated at higher income levels with lower-income tax relief achieved primarily through enhanced personal exemptions.

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[6] Basic federal tax is federal income tax owed before the application of surtaxes and non-refundable tax credits.

Figure 1

Personal Income Taxes - $25K Single

Personal Income Taxes - $50K Family

Personal Income Taxes - $75K Family

Source: Saskatchewan Finance.

Figure 2

Marginal Tax Rates - $25K Single

Marginal Tax Rates - $50K Single

Marginal Tax Rates - $75K Single
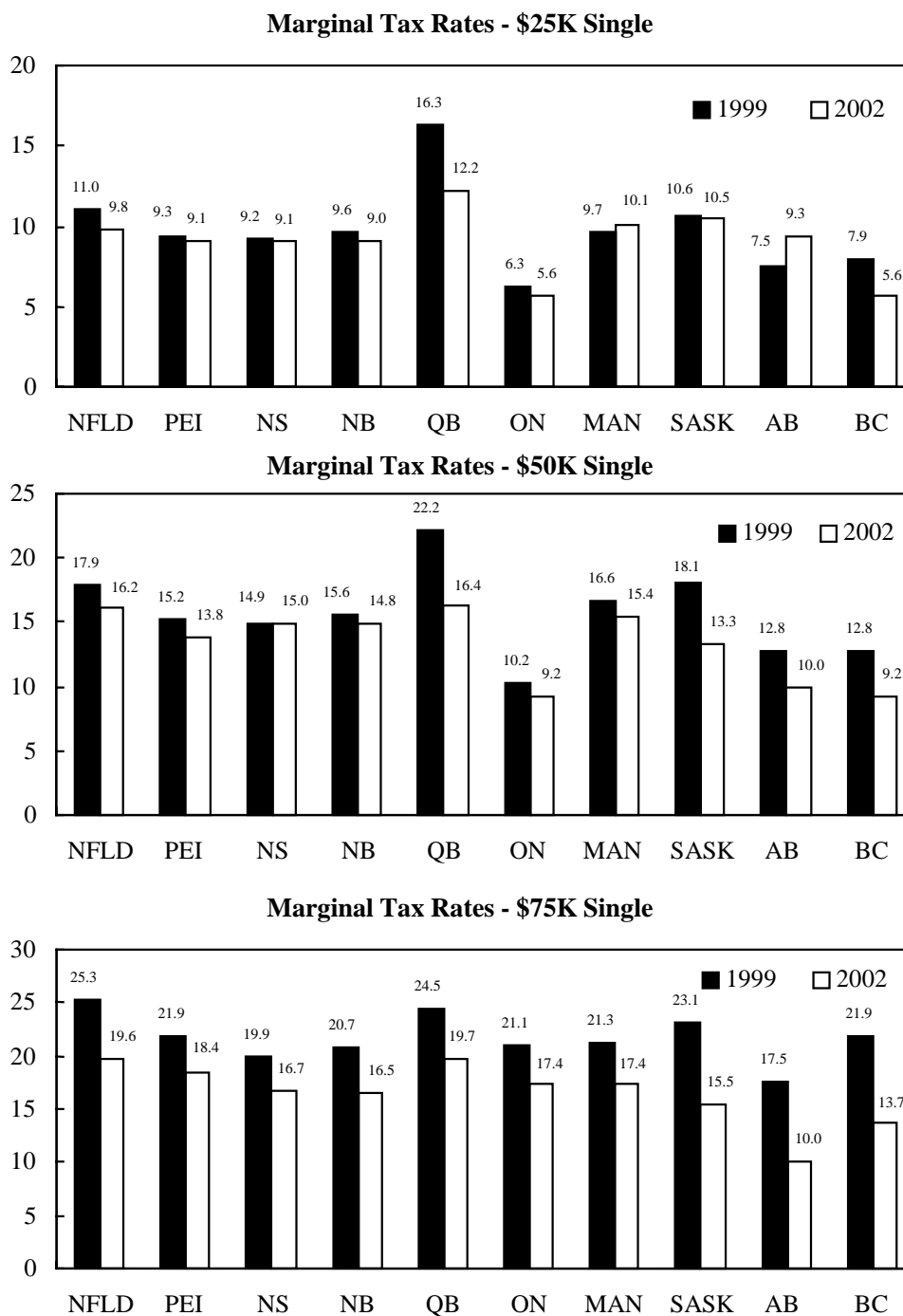
Source: Finances of the Nation.

Figure 3

Low-Income Thresholds
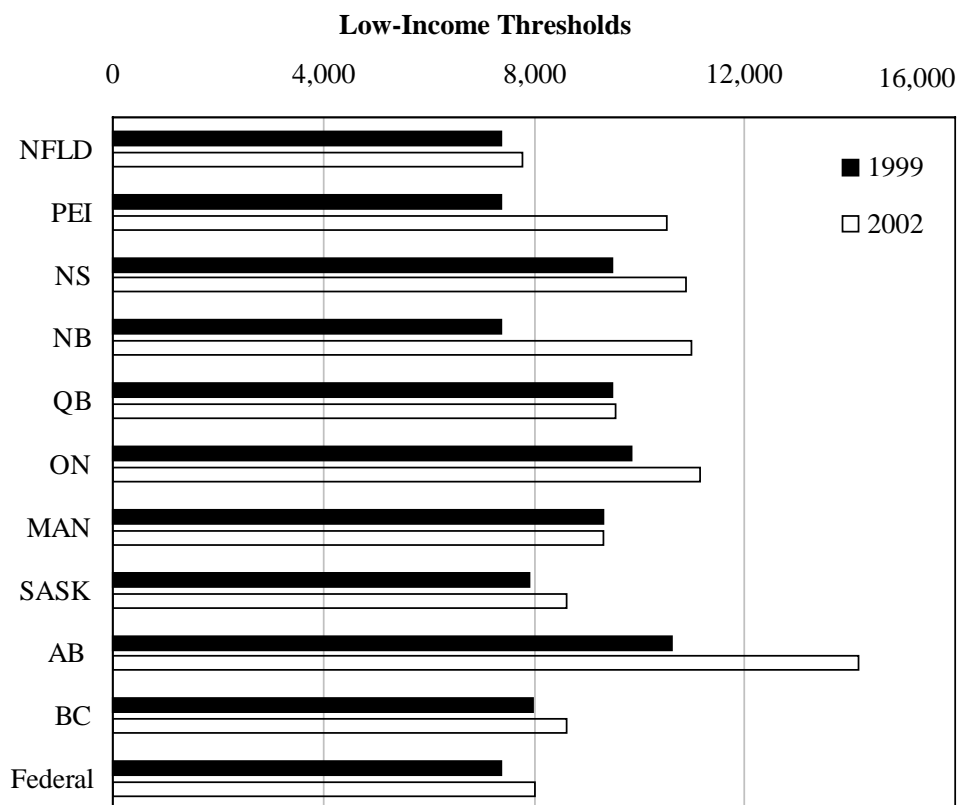
Source: Finances of the Nation.

Several provinces reduced the number of tax brackets over the period both through the elimination of surtaxes and direct bracket elimination (Figure 7).[7] The low-income threshold (Figure 3) increased in all provinces (as well as for the federal government) over the four-year period. The average value for provinces increased by $520, almost 7 per cent of its 1999 value.

Over the four year period, taxes over the $10,000 to $100,00 range became more progressive (Figure 4) in the three maritime provinces (Nova Scotia, New Brunswick and Prince Edward Island) and somewhat less progressive in the rest of the country. The same pattern is evident when examining the two intermediate ranges although magnitudes differ substantially across provinces.

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[7]   Indeed, one province, Alberta, adopted a single rate tax system with a large personal exemption to add progressivity to the system.

Figure 4
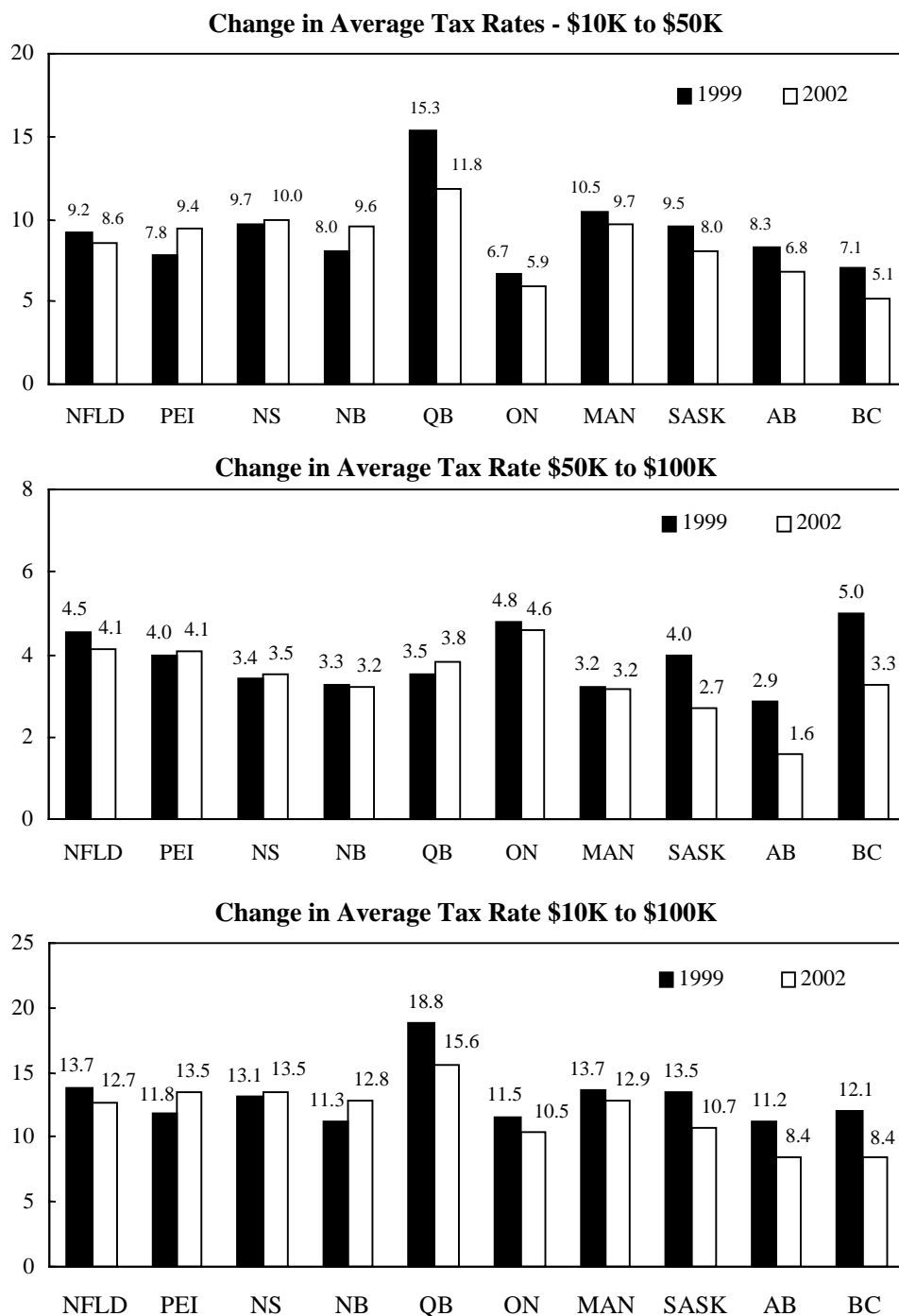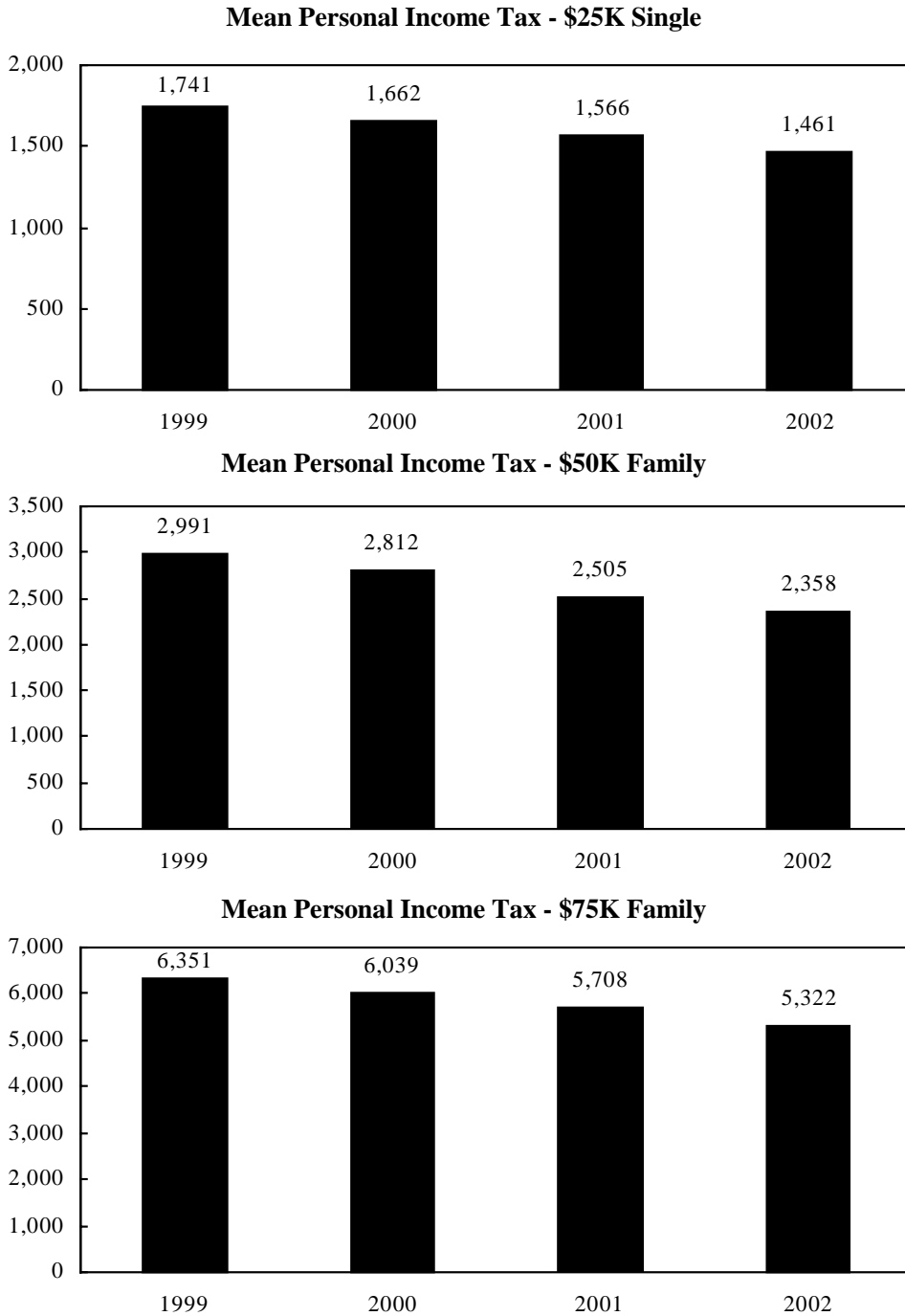
Change in Average Tax Rates - $10K to $50K

Change in Average Tax Rate $50K to $100K

Change in Average Tax Rate $10K to $100K

Source: Finances of the Nation.

Figure 5

Mean Personal Income Tax - $25K Single

1,741	1,662	1,566	1,461
1999	2000	2001	2002

Mean Personal Income Tax - $50K Family

2,991	2,812	2,505	2,358
1999	2000	2001	2002

Mean Personal Income Tax - $75K Family

6,351	6,039	5,708	5,322
1999	2000	2001	2002

Source: Saskatchewan Finance.

Figure 6

Mean Marginal Tax Rate - $25K Single

Mean Marginal Tax Rate - $50K Single

Mean Marginal Tax Rate - $75K Single

Source: Finances of the Nation.

Figure 7

Number of Income Tax Brackets
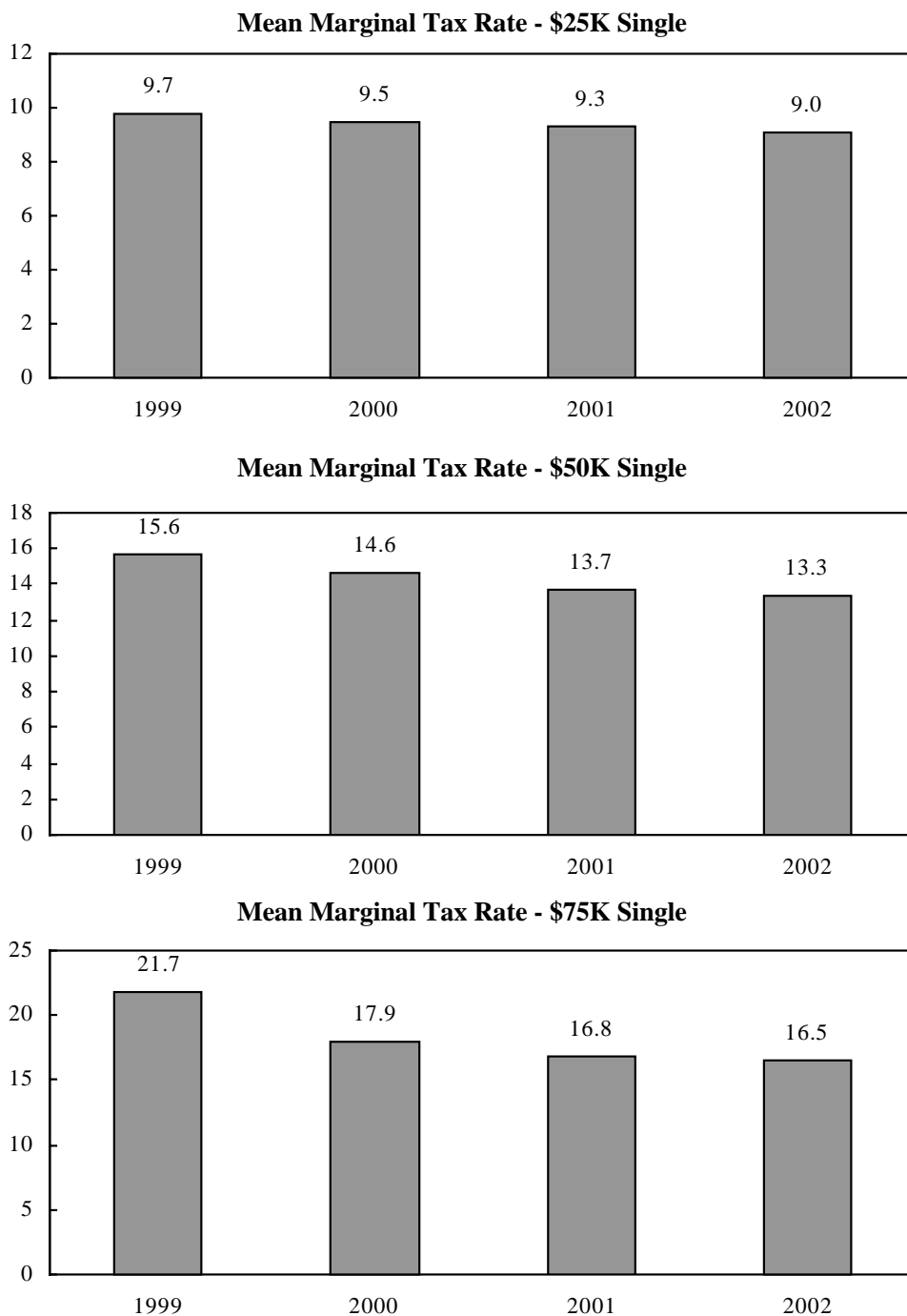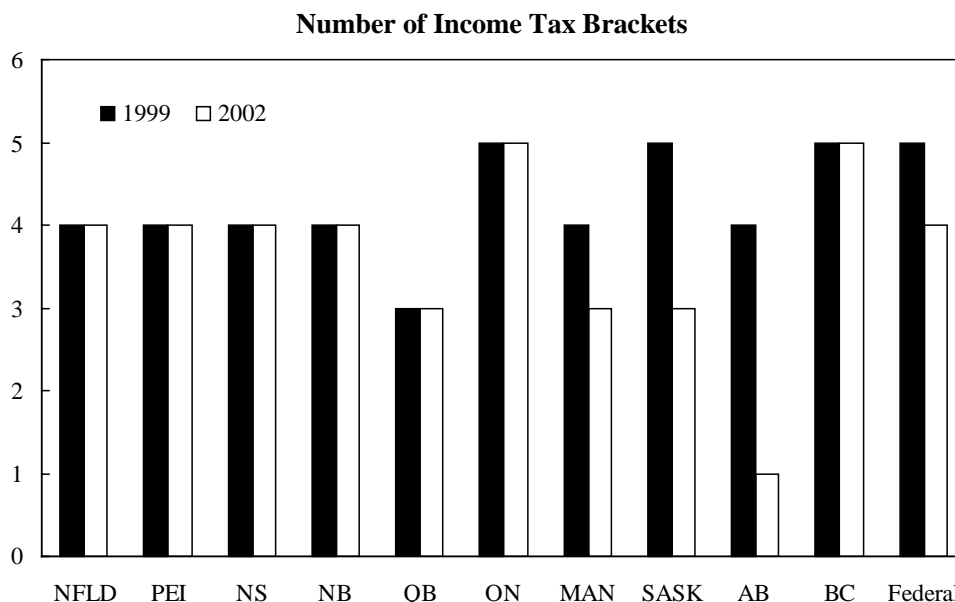
Source: Finances of the Nation.

4.   Evaluation

As we saw in the previous section, all provinces moved to lower average tax rates over the period 1999 to 2002. Given this trend, and the greater opportunity to tailor provincial tax regimes to regional preferences, it is interesting to consider whether variations in provincial tax systems have actually increased and the implications for economic and political efficiency.

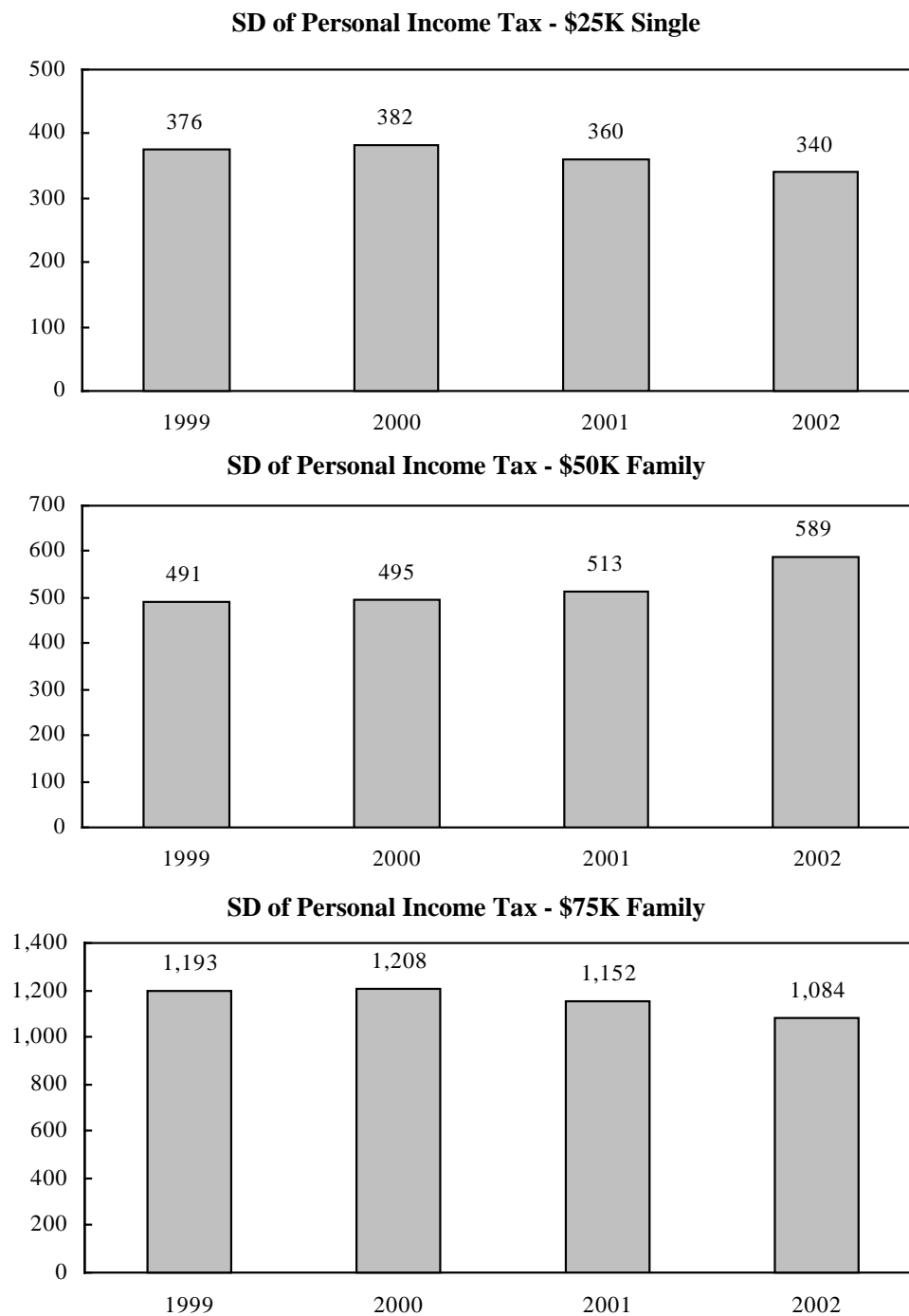Given that tax systems have a number of distinct characteristics, the answer to these questions may not be clear-cut. Probably the best overall measure of variation to employ is the average level of taxation by income/family group. In Figure 8 we show the standard deviation of taxes for three income/family groups. For the $25,000 single taxpayer, we see that dispersion of provincial taxes actually declined over the period. The same results obtain for the $75,000 family, while the dispersion of provincial taxes increased for the $50,000 family.

These summary results obtain despite substantial variation across different characteristics of provincial tax systems. For example, the pattern of marginal tax rate dispersion across income groups (Figure 9) is slightly different than the summary measure. For these rates, dispersion declines for $25,000 and $50,000 single taxpayers and increased for $75,000 single taxpayers largely as result of one province adopting a single rate tax.

Figure 8

SD of Personal Income Tax - $25K Single

Year	Value
1999	376
2000	382
2001	360
2002	340

SD of Personal Income Tax - $50K Family

Year	Value
1999	491
2000	495
2001	513
2002	589

SD of Personal Income Tax - $75K Family

Year	Value
1999	1,193
2000	1,208
2001	1,152
2002	1,084

Source: Saskatchewan Finance.

Figure 9

SD Marginal Tax Rate - $25K Single

Year	Rate
1999	2.6
2000	2.3
2001	1.9
2002	1.9

SD Marginal Tax Rate - $50K Single

Year	Rate
1999	3.2
2000	2.6
2001	2.7
2002	2.7

SD Marginal Tax Rate - $75K Single

Year	Rate
1999	2.1
2000	2.0
2001	2.7
2002	2.8

Source: Finances of the Nation.

In addition, the dispersion of low-income thresholds as measured by the range, increased by about $2,500 from its 1999 value of $3,250 (Figure 3). By 2002, there was more variation in the number of brackets and greater dispersion in our progressivity indicator (Figure 4) over the $ 10,000-100,000 range, although dispersion actually declined for the $10,000-50,000 range.

Thus, provinces used the move to TONI to tailor their tax systems to preferences that appear to differ across regions. However, it seems that tax competition in an environment of high capital and labour mobility prevented actual levels of taxation at different income levels from becoming significantly more diverse.

Have changes to provincial tax systems since the move to TONI served to fragment the Canadian economic union? Beyond general competition on average tax rates, the answer is a qualified no. Inspection of Table 1 shows that with the exception of Quebec (the only province that used TONI prior to 2000), few provinces introduced measures designed specifically to attract targeted groups of taxpayers. Quebec continued its reliance on tax measures to attract specific kinds of human capital.

Finally, all nine provinces adhered to the common definition of taxable income and income allocation rule proposed by the federal government as they moved to TONI. Thus, compliance and administration costs did not increase significantly. The move to TONI was accompanied by measures designed, in part, to simplify provincial tax systems, for example, the reduction in the number of tax brackets. Both the move to TONI and the accompanying simplification have improved the transparency and accountability of provincial and federal income tax systems.

5.   Summary

In this paper, we have taken advantage of a natural experiment to examine the impact of increased tax competition on the economic and political efficiency of the tax system in a federal state. In 2000 and 2001, nine of ten Canadian provinces moved from an income tax levied as a share of basic federal tax to one levied directly on federally-defined taxable income. While provinces used this opportunity to tailor their tax systems to more closely match regional preferences, the forces of competition prevented an increase in the dispersion of overall levels of taxation. Beyond competing on overall tax levels, provinces have not generally introduced measures that would distort the location decisions of individuals. The exception to this finding is Quebec, a province that has historically maintained a distinctly different tax system from the other provinces.

Further, the move to TONI has been accompanied by a trend toward simplification of provincial tax systems. Both of these developments have contributed to better transparency and accountability in the collection of personal income taxes in Canada.

Table 1

Selected Provincial Tax Measures, 1999-2002

1999

PEI
• cuts PIT

NB
• cuts PIT

QUE
• new measures for self-employed, disabled, children
• modified Alternative Minimum Tax (AMT)
• tax holiday for non-residents working in R&D and Intl Fin

ONT
• cuts PIT
• tax credit for R&D employees buying stock

MAN
• cuts PIT

2000 (Five Provinces Move to TONI)

NFLD
• cuts PIT

PEI
• cuts PIT
• special reduction for low income
• 2001 move to TONI
• 2001 adopt federal brackets

NS
• moves to TONI
• adopts federal brackets

NB
• cuts PIT, moves to TONI

QUE
• changes brackets and rates, cuts PIT
• new tax credits: infertility, elite athletes, adoption expenses, corporate directors, charitable donations
• harmonizes capital gains inclusion rate

ONT
• moves to TONI, adopts federal brackets, cuts PIT
• change in charitable donation tax credits
• harmonize capital gains

MAN
• moves to TONI, adopts federal brackets

SASK
• cuts flat tax
• PSE grad credit

BC
• moves to TONI, adopts federal rates and brackets

2001 (Federal Tax Moves to a Five Bracket/Surtax System, Four Provinces Move to TONI)

NFLD
• moves to TONI with 3 brackets
• higher credit for low-income seniors

PEI
• moves to TONI with 3 brackets

NB
• eliminates surtax and moves to 4 brackets
• increases and indexes personal credits
• adopts federal capital gains inclusion rate

QUE
• cuts PIT
• enhanced credits – sales tax, northern villages, disability, infertility, people living alone, artists, political contributions, scholarships, and bursaries

ONT
• changes to credits – disability, caregiver, education, medical expenses, AMT, parents with children in private schools

MAN
• cuts surtax, enhances all credits
• matches federal capital inclusion rate

SASK
• moves to TONI
• major tax reduction, substantially increased credits
• 3 brackets that differ from federal brackets
• political contribution tax credit
• reduced capital gains tax on disposition of farms and small business

AB
• Moves to TONI and single rate
• large personal credits

BC
• eliminates surtaxes, moves to 5 bracket system
• major reductions to PIT

2002 (Federal Surtax Eliminated)

NFLD
• enhanced dividend tax credit

NB
• enhanced dividend tax credit

ONT
• enhanced dividend tax credit

MAN
• Enhanced political contribution tax credit
• some investment tax credits enhanced

SASK
• cuts PIT

BC
• cuts PIT

What lessons for other jurisdictions can be drawn from the results of this natural experiment? Despite the political fact of having ten strong and relatively autonomous provinces, Canada is an integrated economy with a high degree of factor mobility. As might be expected, it is in environments such as these that tax competition is likely to have its greatest effect. If these results can be generalized to Europe, for example, they suggest that as economic integration proceeds, overall levels of taxation may become more harmonized. However, these findings do not support the view that European Union members will be unable to tailor their national tax systems to satisfy regional preferences.

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TO WHICH TAX RATE DOES INVESTMENT RESPOND? A SYNTHESIS OF EMPIRICAL RESEARCH ON TAXATION AND FOREIGN DIRECT INVESTMENT

Sjef Ederveen[*] and Ruud de Mooij[*]

Introduction

Differences in corporate taxation can affect the allocation of foreign direct investment (FDI) by driving a wedge between the post- and pre-tax rates of return. Tax authorities can therefore try to attract internationally footloose business activity by lowering the tax rate. In discussions about tax harmonisation in Europe, Ireland is often cited as an example of the effectiveness of such a strategy. Whereas corporate tax rates in Ireland have been lowered from 43 per cent in 1990 to 24 per cent in 2000 and even substantially less for manufacturing corporations, the inflow of FDI into Ireland has increased a hundredfold (OECD, 2002). Although this example suggests a strong impact of taxation on FDI, the increase may also be due to different factors. Since the mid-Eighties, a number of papers have attempted to estimate the actual strength of the response. A review of this literature by Hines (1997 and 1999) suggests a consensus estimate of about –0.5, that is a one per cent higher tax rate on companies leads to a reduction in inward FDI by 0.5 per cent.

Such a literature survey, albeit very useful to get an impression of the empirical literature, has some important limitations. First of all, a direct comparison of the values in the literature is virtually impossible because the underlying studies report different types of elasticities. And second, different studies also use different specifications and different data. In particular, a plethora of tax rates is used. Although it is clear that the relevant tax rate is the one effectively experienced by firms, it is not at all clear how to calculate it. Many different variants exist and they are all used in econometric analyses. But how can we compare the results obtained with statutory rates, average tax rates and effective tax rates? These qualifications form the motivation for this paper. In particular, in addition to reviewing the empirical literature, its main contribution is the meta-analysis that is performed. This meta-analysis copes with both limitations of ordinary literature surveys.[1]

First, we translate the findings of 25 empirical studies into comparable elasticities.[2] With meta-analysis, the selection process is explicit and verifiable. Selection is justified to the extent that the quality of studies differs, but it is also unavoidable to the extent that it originates from publication bias. In many surveys the selection process remains implicit.

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[1]   See Stanley (2001) for a more extensive discussion of the potential of meta-analysis in economics.

[2]   Annex 5A of the Ruding report (CEC, 1992) does a similar exercise, but they had only three studies available at that time.

A second contribution of the meta-analysis is that it yields useful information for future research. In particular, we explore whether there are systematic differences between studies that use different types of effective tax rates on capital income. In a sense, the meta-analysis is used to rethink the current state of the art in the literature, and to explore fruitful directions for future research. In this respect, meta-analysis is more rigorous than an ordinary survey of the literature because of the multivariate character of the analysis. For instance, as this paper reveals, simple pair wise comparisons of study characteristics and effect size can yield misleading conclusions.

The rest of this paper is organized as follows. We start in section 1 with a discussion of different approaches to measure the effective tax rate. Section 2 gives a review of the empirical literature and provides a summary table with the main characteristics of the 25 studies that form our meta sample. Section 3 presents the meta-analysis, starting with a simple univariate analysis of variation, followed by a number of regressions. Finally, section 4 concludes.

1.   Taxation and FDI: which tax matters?

During the last decade, European countries have reduced company tax rates. Indeed, the mean corporate income tax rate in the EU has dropped from 38 per cent in 1990 to 33 per cent in 2000 (Gorter and de Mooij, 2001). Although the average tax burden on companies has been rather stable during this period, some EU governments have recently launched proposals to also reduce it. To illustrate, Germany, Ireland and Portugal have recently reduced their taxes while the Netherlands, Italy and France are discussing proposals for tax reform and relief. These proposals are motivated by the growing internationalisation of businesses and the increasing mobility of capital. By reducing tax rates, European countries aim to improve their investment climate for foreign companies. However, the tax rates effectively experienced by firms are not necessarily the same as the statutory tax rates. In this section, we discuss the impact of company taxes on investment behaviour of multinational enterprises and elaborate on different methods of measuring the effective tax rate.

1.1   Theory

Economic theory suggests that, when capital is perfectly mobile across borders, the after-tax rate of return to capital should be equal across countries in equilibrium. According to this arbitrage condition, differences in tax rates across two countries should be matched by differences in the before-tax rates of return. With decreasing returns to scale with respect to capital in production, equality is accomplished through changes in the capital stock. For instance, if The Netherlands and Belgium start from an equal tax rate and Belgium increases its tax above that of The Netherlands, equality can be maintained by a reallocation of real capital from Belgium to The Netherlands. The speed with which the before-tax returns to capital

in both countries respond to changes in the capital stock determines the sensitivity of international capital allocation to source-based taxes. Note that it is the marginal effective tax rate that matters. Indeed, not only the statutory rates but also parameters that influence the tax base determine the after-tax rate of return on real investment.

Studies that analyse the impact of taxation on investment should therefore focus on the tax rate effectively experienced by firms. It is impossible, however, to capture all the complex details of the tax system that potentially affect foreign investment in an empirical analysis. Some studies therefore abstract from these problems and simply use the statutory corporate income tax to measure the tax effects on FDI. Although the statutory tax rate is important for profit shifting by multinational corporations, it does not necessarily influence the allocation of real capital. Using the statutory tax rate can therefore be misleading.

Next to differences in statutory rates, differences between capital income tax bases also impact upon the behaviour of capital owners. In particular, international differences between depreciation allowances for machinery and buildings, valuation of inventories, general investment relief, the treatment of reserves and provisions, and the tax treatment of capital gains at the company level cause differences between the taxable corporate income of two otherwise equivalent corporations (see OECD, 1991, for a review). Similarly, international differences between the treatment of health insurance premiums, social security contributions, pension savings, and education expenses cause differences between the taxable personal income of two otherwise equivalent persons. Therefore, tax payments differ, even if tax rates would be the same. This calls for information about tax codes that supplements statutory tax rates. It is provided by so-called effective tax rates, which usually, but not always, refer to tax payment divided by a measure of taxable income. They capture the entire capital or corporate income tax system in one single number. Although in many instances this figure provides a highly desirable summary of the capital income tax system, it may not do justice to underlying aspects that are important economically.

Effective tax rates can be computed in alternative ways. Each method of computation has its merits and demerits; there is not a single preferred methodology (OECD, 2000). To illustrate, Gordon, Kalambokidis and Slemrod (2003) recently defined a new effective tax rate measure and claim that it should be added to "the pantheon of existing measures". Different effective tax rates simply measure different things. Hence, there is no such thing as the effective tax rate. The various methods differ in at least three important ways:

- Forward looking versus backward looking methods.

  Forward looking effective tax rates are usually based on tax codes. Their advantage is that they measure the impact of taxes on new investment projects. Instead, backward looking methods refer to existing capital. The effective tax rates on existing and new capital differ because the mix of new investment can differ from that of existing assets. Moreover, the tax burden on existing capital

can be distorted by the carry forward of losses or tax credits. Compared to the forward looking methods, the backward looking methods have the advantage that they take account of tax planning activities, complex tax provisions and discretionary administrative practices of tax authorities.

- Average versus marginal tax rates

  Marginal effective tax rates measure the wedge between the pre- and post tax return on a marginal investment project that does not yield an economic rent. Hence, they measures the incentive effects of taxes on marginal investment and/or savings decisions. In contrast, average tax rates measure the overall tax burden on a typical investment. This can be important for decisions regarding lumpy investment, investment in the presence of imperfect competition, or for locational decisions of firms. Further, the average effective tax rates give an indication of the tax that bears on companies which may be important for distributional reasons.

- Corporate versus capital income tax

  Effective tax rates can either refer to the tax burden on corporations or on the overall tax burden on capital income that is levied on the corporate and the personal level.

1.2   *Effective tax rates*

We distinguish four methods to compute effective tax rates. Each has its own properties, with corresponding merits and problems. We will discuss these methods in turn.

1.2.1 *Effective tax rates on the basis of macro data*

Measures for the tax burden using aggregate economic data from national accounts are computed as a percentage of domestic corporate taxes (in general only corporate income tax) relative to various income measures, such as aggregated domestic corporate profits or the corporate operating surplus. It is therefore a backward-looking method.

Mendoza *et al.* (1994) provide a well-known example of this methodology. They divide the sum of the corporate income tax and personal capital income tax by the total operating surplus of the economy. Thus, these effective capital income tax rates correspond to the weighted mean of the total capital income tax rate that actually applies, where the weights are the proportions of dividend, retained profit, and interest in capital income.

Mendoza's method of calculating effective capital income tax rates is, although widely used, not undisputed. A fundamental problem is that tax revenue statistics do not attribute tax revenue to capital income per se, but to corporate and personal income. Similarly, national accounts do not list capital income per se, but

operating surplus of corporate and unincorporated enterprises and property and entrepreneurial income of households. Therefore, the effective capital income tax rate – capital income tax divided by capital income – can only be calculated with some ingenuity in extracting the required information from the available data. For this reason, a number of authors have sought to refine Mendoza's method. For example, Volkerink and de Haan (1999) exploit additional data sources in calculating their effective capital income tax rates.

1.2.2 Effective tax rates on the basis of micro data

An alternative backward-looking method of calculating effective tax rates is based upon micro data from the financial accounts of individual firms. The corporate income tax paid by the firm is divided by its pre-tax corporate income. Data can either be taken from individual financial statements or consolidated returns. The effective tax rate for a specific country is then defined as the median ratio, because the mean is too sensitive for outliers if there is a limited number of firms.

The effective tax rates on the basis of micro data suffer from the practice of consolidating the financial accounts of parents and their foreign controlled corporations. For instance, the Dutch effective tax rate is contaminated by German taxes because multinational Philips consolidates the accounts of the Dutch parent with its German affiliates, subsidiaries, and branches. However, one can eliminate this contamination in several ways. Collins and Shackelford (1995) show that these adjustments hardly change the results. This is consistent with MARC (1999) who show that firm characteristics do not have a significant impact on the average tax rate of firms.

1.2.3 Marginal effective tax rates on the basis of tax codes

A third class of effective tax rates is calculated on the basis the tax code, not on the basis of tax data. This method is originally due to Hall and Jorgenson (1967), and updated by King and Fullerton (1984), who derive the "marginal effective tax rate", the percentage wedge that a tax code drives between the pre and post tax required rates of return on marginal investment projects. The King-Fullerton effective tax rate can explicitly take into account the fiscal details such as depreciation allowance, inventory valuation, investment incentives, and preferential savings provisions. Hence, the King-Fullerton tax rate intends to capture the main tenets of the tax code that impact upon investment decisions in a single number.

However, one disadvantage of the King-Fullerton rate is that it is difficult to calculate and interpret, another that it is sensitive to minor changes in the assumptions underlying its calculation. For instance, the marginal effective tax rate is sensitive to the assumed interest rate or the inflation rate. Furthermore, it is derived under strong assumptions regarding optimal investment behaviour, perfect competition, a small open economy that cannot exert market power, infinitely

divisible investment and decreasing returns to scale with respect to capital in production (OECD, 2000). For these reasons, the absolute figures of the King-Fullerton rates are not so informative. However, they can be informative to compare the tax burdens across countries and over time.

1.2.4 *Average effective tax rates from tax codes*

Instead of focussing on marginal investment decisions, it is also possible to calculate the effective tax rate for investment projects that are more profitable. Indeed, a company often has to choose between two mutually exclusive locations for its investment. In such a case, it is the average tax rate that counts, and not the marginal rate.

Devereux and Griffith (1998a) therefore adjust the King-Fullerton approach in order to calculate the "average effective tax rate", that is the average percentage wedge on a range of inframarginal investment projects on which firms earn an economic rent. In the same tradition, Jacobs and Spengel (1999) use the "European Tax Analyzer", a computer simulation program containing a lot of institutional detail, to calculate the wedge between the pre- and post-tax wealth of hypothetical firms. The latter methodology is usually referred to as "project-based" analysis of effective tax rates.

The average effective tax rate based on tax codes is usually higher than the marginal effective tax rate. The reason is that many tax deductions apply to the cost of investment projects (which, for the marginal investment project, are equal to the rate of return) but are irrelevant for economic rent.

1.2.5 *Which effective tax rate?*

In arguments about tax competition one often refers to *the* effective tax rate. However, there are many different variants. Which one does one mean? There exist substantial differences between the values of the effective tax rates according to the different methods. Even worse, these differences differ also across countries. To bring this point home, consider Table 1, which is taken from Gorter and de Mooij (2001) and lists different effective tax rates for the three largest EU countries for 1994.

It may be noted that the ranking of the countries changes radically. Germany tops the list according to the King-Fullerton effective tax rate, France according to the Jacobs-Spengel effective tax rates, and Great Britain according to the Mendoza effective tax rate. This does not necessarily mean that one effective tax rate is "false" and another "true". They simply measure different things.

So, which is the appropriate measure for the tax rate to be included in regressions that investigate the responsiveness of foreign direct investment to taxation? Most authors (see, e.g., Devereux and Griffith, 1998b, and Jacobs and

Table 1

Effective Tax Rates, 1994
(rankings in parentheses)

	King-Fullerton (METR)	Jacobs-Spengel (AETR)	Mendoza (Average Macro)	Worldscope (Average Micro)
France	9 (3)	41 (1)	25 (2)	33 (2)
Germany	19 (1)	37 (2)	25 (2)	41 (1)
Great Britain	17 (2)	20 (3)	42 (1)	30 (3)

Source: Gorter and de Mooij (2001).

Spengel, 1999) claim that the *ex ante* effective tax rates are superior to *ex post* average tax rates for econometric analyses because using the latter may cause severe endogeneity problems. In particular, the tax measure may well reflect the underlying profitability of the location. Fullerton (1984) even lists eleven reasons why the average tax rates would be poor proxies for the marginal effective tax rates on new investment.

This is not undisputed, however. For instance, Swenson (1994) argues that average tax rates based on data are more informative than are effective tax rates based on tax codes as the latter usually do not pick up all elements of the tax code (including non-linearities) and are extremely sensitive to assumptions regarding interest rates, financing mix, and so on. In our meta-analysis, we explore this issue further. In particular, we investigate whether the responsiveness of FDI on taxation that is reported by studies systematically differs with the tax rate that is used.

2.   A review of empirical studies

This section starts with a review of empirical studies on taxation and foreign direct investment. In particular, all empirical studies that include foreign capital on the left hand side of the equation and a measure for the tax rate on the right hand side have been considered, including working papers and unpublished articles. Only if we were unable to derive the appropriate elasticity values, we removed a study from our sample. In subsection 2.2, we make the outcomes of the studies comparable by deriving uniformly defined elasticities. These form the basis for our meta-analysis of the next section.

2.1   A review of the literature

The literature on taxation and FDI starts with Hartman (1984). He explains the aggregate inflow of direct investment in the United States as a ratio of GNP (K/Y) between 1965 and 1979 by the rate of return on US investment and taxes, measured as averages on the basis of macro data. The focus of Hartman's paper is on the distinction between FDI financed out of retained earnings and transfer of funds. Hartman claims that retained earnings should be more sensitive to US taxes because mature firms will use retained earnings as the marginal source of finance (which is cheaper than transfer of new funds). Hartman's results imply that, indeed, the tax rate elasticity for retained earnings is significant while for transfers the results are insignificant.

A number of subsequent papers have extended, modified or criticized Hartman's paper. Boskin and Gale (1987) extend the Hartman analysis by using a longer time series (from 1956 to 1984) and alternative data for the rate of return. They also experiment with a linear instead of a log specification. The results of Boskin and Gale more or less confirm the main findings of Hartman, that is the impact of US taxes on retained earnings is more robust than the impact on transfer of funds. Young (1988) also extends the Hartman analysis by means of a somewhat longer sample period (from 1953 to 1984), a slightly different specification with a lagged investment term, and revised investment data. He also confirms Hartman's original conclusions and even reports positive rather than negative semi-elasticities for transfer of funds. Murthy (1989) reestimates Young's result by maximum likelihood estimation, rather than OLS, in order to adjust for the presence of autocorrelation. His elasticities are somewhat larger than those in Young (1988) while the significance of the parameters improves. The qualitative conclusions, however, remain the same.

Newlon (1987) casts doubts on the studies in the realm of Hartman. First, Newlon shows that these studies have not used the appropriate data for the rate of return on FDI for the period 1965-73. Second, he notes that there is a problem of spurious correlation. In particular, the after-tax rate of return on FDI is constructed as the total earnings by foreign controlled companies, divided by invested capital. Since total earnings comprise reinvested earnings and repatriations, the rate of return variable contains the same component (and is almost equivalent if repatriations are low) as the dependent variable. To deal with these problems, Newlon (1987) uses alternative data. His conclusions are nevertheless in line with the previous findings of Hartman and others.[3]

Another contribution of Slemrod is that he controls for the tax system in the home country of the parent. The picture that emerges from this exercise is not clear, though. In fact, the country-specific evidence yields mixed results on the tax effect on FDI, including many insignificant coefficients. Moreover, Slemrod finds that the

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[3]   We rely on the paper by Slemrod (1990) to include Newlon's (1987) elasticities since we were unable to get the original PhD thesis of Newlon.

level of the home country tax rate and the difference in statutory tax rates between the investing country and the US do not change the results much.

These earlier studies all rely on average tax rates based on macro data. Slemrod (1990) is the first to use an alternative measure for the tax rate, namely the marginal effective tax rate derived by Auerbach and Hines (1988). He also criticizes the earlier studies in a number of other ways. First, he argues that the focus of the literature on the Hartman specification is unjustified since it lacks a perfectly specified model. In such a situation, one should investigate different specifications. Second, Slemrod raises doubts on the FDI data which are constructed from periodic benchmark surveys. He includes dummies to correct for this. Third, Slemrod controls for other variables that affect FDI (and which are potentially correlated with the tax term). With these modifications, Slemrod re-estimates the tax rate elasticities in several ways. He finds that retained earnings are not responsive to US taxes, while for transfers a significant elasticity is found. This result is opposite to that of Hartman and others. Slemrod also explores the response of aggregate FDI, which is equal to the sum of retained earnings and transfers. The results suggest that taxes exert a significant negative effect on this aggregate FDI variable.

Slemrod's qualifications to the earlier literature have made researchers reluctant to continue using aggregate time series data along the lines of Hartman. Indeed, aggregate time series have been rarely used in subsequent contributions. Only recently, Billington (1999) and Broekman and van Vliet (2000) have used aggregate FDI flows to estimate the tax elasticity. Billington uses a panel of 7 OECD countries between 1986 and 1993 with aggregate FDI inflows. He regresses the log of FDI to the square of the country statutory tax rates and reports significant but small elasticities. Broekman and van Vliet focus on aggregate FDI inflows in 15 EU countries using data spanning from 1989 to 1998 and average tax rates based on micro data. Using a simple linear specification, they report elasticities in the order of –2.

Swenson (1994) uses aggregate FDI inflows into the US between 1979 and 1991, but distinguishes 18 different industries. She regresses the log of FDI in the entire panel to the average micro tax rates, distinguished for the respective industries. For FDI, she uses different data than previous studies. In particular, instead of financial flows, she uses data that better correspond to foreign investment.[4] Swenson reports a positive elasticity for alternative specifications and alternative tax measures. She thus confirms the Scholes and Wolfson (1990) hypothesis, suggesting that higher effective tax rates in the US will raise FDI from investors in tax credit countries.

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[4] Swenson (1994) refers to Auerbach and Hassett (1993) to motivate her choice of data. They distinguish three alternatives, namely affiliate data on new plant and equipment, acquisitions of existing US companies, and the establishment of new companies by foreign investors. It is not clear which series is used by Swenson (1994). She might also have used the sum of the three series as was done by Auerbach and Hassett. In our analysis, we have assumed that her capital data are similar to data on property, plant and equipment.

Some studies during the Nineties have taken up Slemrod's idea to exploit bilateral FDI flows. Cassou (1997) repeats Slemrod's analysis for individual countries investing in the US, thereby using average tax rates based on aggregate data between 1970 and 1989. He reports primarily insignificant results, especially for retained earnings.

Other studies have pooled bilateral FDI flows in order to construct a panel. First of all, Jun (1994) constructs a panel of FDI flows from 10 OECD countries into the US. He uses both average tax rates based on micro data as marginal effective tax rates to explore the responsiveness of FDI using a linear specification. His results are mainly insignificant. Devereux and Freeman (1995) use a panel of bilateral FDI flows between 7 OECD countries within the 1985-89 timeframe. Using a linear specification, they regress FDI flows to the user cost of capital, derived from Devereux and Pearson (1995). Devereux and Freeman find small and, mostly insignificant, negative elasticity values. Pain and Young (1996) focus on FDI from Germany and the UK into 11 locations during the period 1977-92. They use simply the statutory rates of the country and stress the importance of the home country tax for the responsiveness of FDI to host country tax rates. The long-run elasticity in Pain and Young's study is significantly negative and large for the UK, but insignificant and small for Germany. Using a similar specification, but with average tax rates based on firm data, and with bilateral FDI from 11 investing countries into 46 locations in 1991, Shang-Jin (1997) finds significant negative elasticities.

Studies using data on financial FDI flows or stocks have some serious limitations. As illustrated by Auerbach and Hassett (1993), FDI comprises a number of different components that can respond very differently to tax rates. Therefore, studies using aggregate FDI flows are difficult to interpret and strongly influenced by the composition of the FDI aggregate. A number of cross section studies in the US have therefore used data on property, plant and equipment which is believed to be more closely related to real investment. Grubert and Mutti (1991) explore the sensitivity of US investors in 33 countries with respect to foreign effective tax rates. They find a significant semi-elasticity of investment of around –0.7. Using the same method, Hines and Rice (1994) find a higher semi-elasticity between –3.3 and –6.6. Both studies base their tax rates on micro data. However, Hines and Rice use data for more countries, including a number of tax havens. Furthermore, they use data on all nonbank companies while Grubert and Mutti concentrate on manufacturing firms alone. The higher elasticity reported by Hines and Rice suggests that capital flows to tax havens and by non-manufacturing firms (which may contain much more financial capital) are more responsive to taxes than is real capital.

Grubert and Mutti (2000) exploit micro data of more than 500 US tax returns to construct an aggregated data set on average tax rates and investment in plant and equipment by US multinationals in 60 locations. Using different specifications and different concepts of the average tax rate, Grubert and Mutti report significantly negative elasticities. Altshuler *et al.* (2001) have exploited similar data as Grubert and Mutti and use a similar specification. They focus on the distinction in elasticities between 1984 and 1992. For 1984, they find an elasticity that is smaller than for

1992. This suggests that capital has become more responsive to taxes during the 1980s.

Hines (1996) builds on Slemrod's idea to use information on individual countries' direct investment into the US. He uses data on property, plant and equipment from seven investing countries into 50 different US states and explores the impact of corporate income taxes, measured by the state statutory rates, on the allocation of FDI. Hines uses a different specification than Slemrod: he explains the share of FDI by an investing country in each of the 50 US states in terms of total investment in the US. Hines assumes that countries using the tax credit system will not respond to US tax rates since investors in these countries will be compensated by means for foreign tax credits. Hence, the elasticity for territorial countries is derived conditional on a zero elasticity for worldwide investors. Hines reports significantly negative elasticities that are larger than found in most previous studies. The approach of Hines was later used by Gorter and Parikh (2000) and Benassy-Quere *et al.* (2001), who both use a panel of bilateral FDI flows between OECD countries. Both studies use an average tax rate; but Gorter-Parikh's tax rate is based on firm-specific data, whereas Benassy-Quere *et al.* rely on aggregate data. They both report significant tax effects on FDI by exemption countries.

Swenson (2001) takes up the qualifications by Auerbach and Hassett (1993) and distinguishes six different components of FDI: new plants, plant expansions, mergers and acquisitions, joint ventures, equity increases, and other FDI. The data refer to the number of investment projects, rather than the total amount of investment and comprise 46 countries investing in 50 US states, with the statutory corporate tax rates of the states as a proxy for the effective tax rate. The tax elasticity of new plants and plant expansions appear to be significantly negative for most investing countries. However, the effect of mergers and acquisitions is significantly positive in all cases. This suggests that, if mergers and acquisitions take up a larger share of aggregate FDI, it becomes less likely that the tax effect on aggregate FDI will be significantly negative.

A different strand of literature on taxation and foreign investment analyses the impact of host country taxes on the probability that a multinational chooses a location for an investment. In particular, Bartik (1985) explains the probability of location for new plants into each of the 50 US states by, among others, the state statutory corporate income tax. He reports a significantly negative elasticity. In the same spirit, Papke (1991) explains the location of plant births in 50 US states by the marginal effective tax rates on specific industries. He reports very different elasticity values for the various industries. Devereux and Griffith (1998b) also find a significant adverse impact of the average effective tax rate on the probability of US firms locating in either France, Germany or the UK.

2.2 Constructing a database

The studies discussed above use different specifications, thus producing coefficients with different interpretations. Moreover, authors either do not report the

corresponding elasticity values or adopt different definitions of elasticities. To make the outcomes of various studies comparable, we transformed the coefficients of each of the studies into a uniformly defined elasticity, namely, the semi-elasticity (or tax rate elasticity). Its interpretation is easy: it measures the percentage change in FDI in response to a one percentage point change in the tax rate, for example a decline from 35 to 34 per cent. Hence, the level of the tax rate is irrelevant for the size of the semi-elasticity. More formally, the semi-elasticity is defined as:

$$\text{Semi-elasticity} = \frac{\partial \ln FDI}{\partial t}$$

Table 2 lists the 25 studies that we reported above and shows some characteristics of the semi-elasticities that we obtained from them. Overall, we have obtained 371 semi-elasticities that, together, form our meta sample.[5]

Table 2 reveals a great variation among the 25 studies. First of all, the number of semi-elasticities derived from each study differs: it ranges from 2 (Newlon, Papke and Billington) to 95 (Swenson, 2001). Secondly, there is great variation in the mean value of the semi-elasticity, ranging from –10.9 (Hines) to +1.3 (Swenson, 1994). As shown by the maxima in Table 2, ten of the 25 studies report at least one positive semi-elasticity. The majority of semi-elasticities, however, is negative. A third observation from Table 2 involves the standard deviation of the reported semi-elasticities. In some studies, the elasticities feature a large dispersion with standard deviations exceeding ten (Slemrod, Hines and Rice and Cassou), while others show more moderate dispersions. A final source of heterogeneity among the studies concerns the use of different measures for the tax rate.

The distribution of the entire meta sample of 371 semi-elasticities is depicted in Figure 1. The mean value in the meta sample is –4.8 and the standard deviation equals 9. More than 80 per cent of all observations (300 out of 371) has a negative sign. The most extreme observations have values of –84.5 and +17.8, both obtained from Slemrod's study. Because of some extreme values left from the mean, the median semi-elasticity in the sample is smaller than the mean, namely –3.2. The extreme values thus seem to have an important impact on the characteristics of the distribution of semi-elasticities.

In Figure 2, we have eliminated some extreme values from the sample. In particular, the figure excludes semi-elasticities that are two standard deviations larger or smaller than the mean. Thus, it includes only semi-elasticities between –22.8 and +13.2. This comprises 95 per cent of the observations, that is the sample size drops from 371 to 351. The mean value of the semi-elasticity in Figure 2 is –3.3, *i.e.* 1.5 smaller in absolute terms than the mean value in Figure 1. Also the median drops slightly. Apparently, the number of extreme negative semi-elasticities is larger than the number of extreme positive semi-elasticities. As

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[5]   The procedure to derive semi-elasticities from each of the original studies is described in more detail in de Mooij and Ederveen (2001). The sample can be downloaded from http://www.cpb.nl/goto/taxcompetition.

Table 2

Summary Statistics of the Studies in Our Meta Sample

		Number	Mean	Median	Max	Min	Std Dev	Tax rate
1	Hartman, 1984	6	–2.6	–3.5	2.0	–4.0	2.3	Macro ATR
2	Bartik, 1985	3	–6.9	–6.6	–5.7	–8.5	1.4	State STR
3	Boskin and Gale, 1987	12	–5.8	–2.7	0.3	–21.2	7.6	Macro ATR
4	Newlon, 1987	2	–0.4	–0.4	3.5	–4.3	5.5	Macro ATR
5	Young, 1988	12	–1.1	–2.1	5.3	–9.2	4.2	Macro ATR
6	Murthy, 1989	4	–0.6	–0.7	0.5	–1.6	1.0	Macro ATR
7	Slemrod, 1990	58	–5.5	–3.5	17.8	–84.5	14.4	METR
8	Grubert and Mutti, 1991	6	–1.7	–1.6	–0.6	–3.3	1.2	Micro ATR
9	Papke, 1991	2	–4.9	–4.9	–0.9	–8.8	5.6	METR
10	Hines and Rice, 1994	4	–10.7	–5.0	–1.2	–31.7	14.1	Micro ATR
11	Jun, 1994	10	–0.5	–1.3	5.9	–5.4	3.2	Micro ATR
12	Swenson, 1994	10	1.3	2.7	5.1	–8.1	4.3	Micro ATR
13	Devereux and Freeman, 1995	4	–1.6	–1.6	–1.4	–1.7	0.1	METR
14	Hines, 1996	46	–10.9	–10.2	–1.1	–36.7	8.2	State STR
15	Pain and Young, 1996	6	–1.5	–1.4	–0.4	–2.8	1.2	Country STR
16	Cassou, 1997	17	–7.5	–2.8	3.1	–44.7	13.5	Macro ATR
17	Shang-Jin, 1997	5	–5.2	–5.0	–4.7	–6.2	0.6	Micro ATR
18	Devereux and Griffith, 1998	10	–0.8	–0.9	0.0	–1.2	0.4	AETR
19	Billington, 1999	2	–0.1	–0.1	–0.1	–0.1	0.0	Country STR
20	Broekman and Vliet, 2000	3	–3.3	–3.5	–2.5	–4.0	0.8	Micro ATR
21	Gorter and Parikh, 2000	15	–4.6	–4.6	4.3	–14.3	4.3	Micro ATR
22	Grubert and Mutti, 2000	15	–4.0	–4.2	–1.7	–5.8	1.2	Micro ATR
23	Altshuler *et al.*, 2001	20	–2.7	–2.6	–1.4	–4.0	0.8	Micro ATR
24	Benassy *et al.*, 2001	4	–5.0	–5.0	–2.2	–7.9	3.0	Macro ATR
25	Swenson, 2001	95	–4.0	–3.2	8.0	–29.9	8.4	State STR
		371	–4.8	–3.2	17.8	–84.5	9.0	

Figure 1

Distribution of Semi-Elasticities

Figure 2

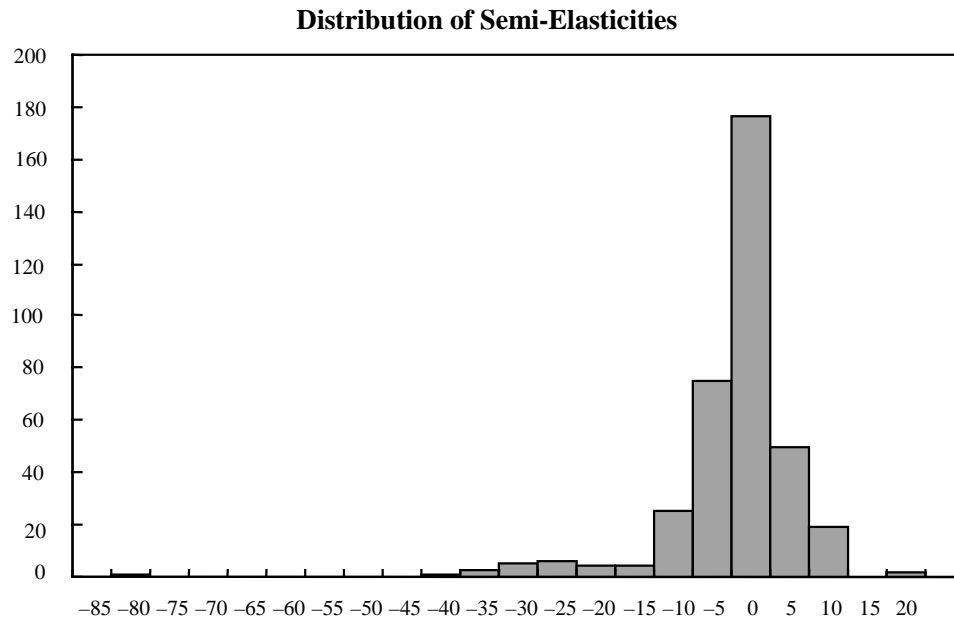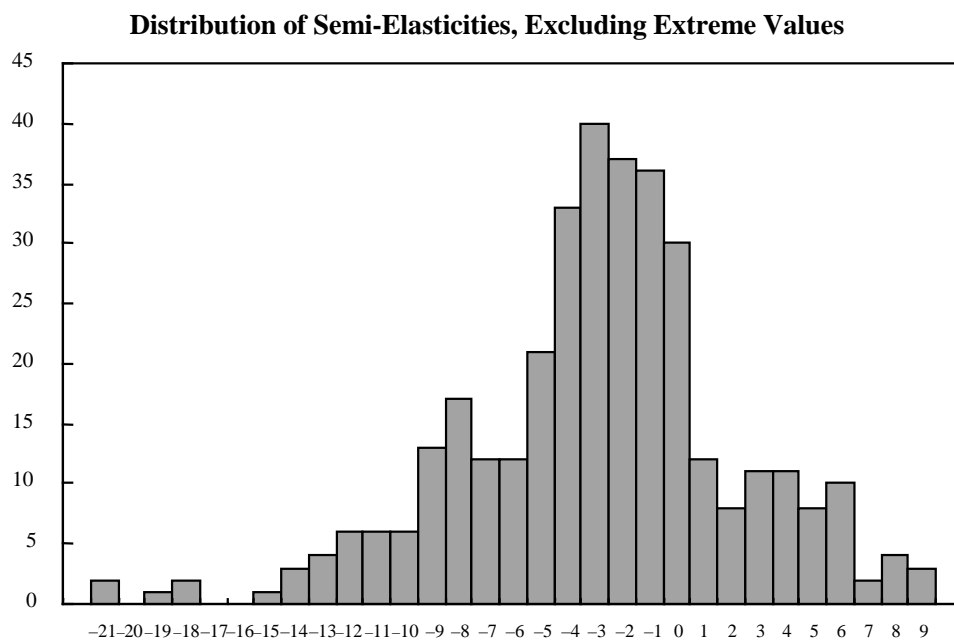**Distribution of Semi-Elasticities, Excluding Extreme Values**

we can see from Figure 2, the majority of observations lies between minus five and zero.

3. Meta-analysis of the tax-rate elasticities

This section presents the meta-analysis of the semi-elasticities. Meta-analysis refers to the statistical analysis of results from individual studies. Next to summarizing results found by previous studies, it aims to add knowledge by relating the variation in estimates of elasticities to the underlying differences in study characteristics. In doing so, meta-analysis goes beyond an ordinary survey of the literature. Moreover, the statistical analysis forces one to be explicit in the selection process of the original studies. This is not to say that meta-analysis is without problems. Especially, sample selection and publication bias, heterogeneity, and dependence of observations may cause problems.

First of all, an important methodological problem of meta-analysis is the possibility of "publication bias". This occurs if only statistically significant results with the "correct" size are being published. One reason might be that editors of journals prefer to publish these "correct" results. In our sample, we included several unpublished studies. In this way, we gain some insight in the importance of this aspect of publication bias. It should be noted, however, that some of these papers may be published in a journal in the future. An example is the paper of Gorter and Parikh (2000), that will be published in *De Economist* later this year. When performing our meta-analysis, we still considered it unpublished. Another aspect of publication bias is that researchers do not write up their "unsatisfactory" results. It is therefore impossible to include these results in the meta-analysis.[6] Incidentally, about half of the semi-elasticities in our sample is statistically insignificant at the five per cent level.

A closely related concept is sample selection bias (or "retrieval bias"). This occurs when only studies are collected that use the same theoretical perspective, or studies that are published in the same journal. This can be harmful when there is a systematic relationship between the characteristics of the sampling process and the significance of the effect size.

Heterogeneity is almost inherent to meta-analysis as studies differ in numerous dimensions. In particular, different studies use different variables, different samples, and different estimation techniques. In our meta sample, the estimated elasticities are obtained from 25 studies, each with its own characteristics. Indeed, the studies show considerable heterogeneity, not only in terms of the type of tax rate used, but also in the kind of foreign capital data that is explored, and the countries that are considered. This heterogeneity renders a direct comparison of studies difficult. At the same time, however, the diversity in study characteristics

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[6] Florax (2001) discusses several techniques to identify and remedy this type of publication bias.

makes it possible to examine their effect on the magnitude and significance of the elasticity.

Related to heterogeneity is the problem of dependence. Because multiple elasticities are used from each study, the observations in our meta sample are mutually dependent. For instance, we draw no less than 95 elasticities from the Swenson (2001) study. Bijmolt and Pieters (2001) show, however, that taking all elasticities from the underlying studies in a meta-analysis is preferable to representing each study by a single value only.[7]

These problems of meta-analysis imply that the results should be interpreted with caution. However, the same problems apply to ordinary literature surveys. As illustrated before, meta-analysis may still yield additional insights as compared to surveys.

Literature surveys usually implicitly assign more value to one study over the other because quality typically differs among papers. In fact, this selection process might be seen as the main value added of the author of a literature review. Such a selection is also possible in meta-analysis. What is more, meta-analysis seems even more appropriate since it can assign explicit values to each of the primary studies. Hence, the reviewer is forced to be explicit on how he weights one study compared to the other. It is less straightforward, however, to find an objective measure for these weights. Therefore, people often assign an equal value to each of the underlying studies.[8] This is also done in this study, albeit that some problematic results from the literature have been eliminated from the sample (thus assigned a zero weight).[9]

Below, we start with a simple analysis of variation in subsection 3.1. Subsection 3.2 presents the meta regressions.

3.1   Univariate analysis of variation

This section performs an univariate ANalysis Of VAriation (ANOVA) which refers to the pair wise correlations between the elasticities and their underlying study characteristics. This gives a first indication of how the variation in elasticities is correlated with the variation in the tax data used. The ANOVA does not yet justify firm conclusions on the systematic impact of these study characteristics on the elasticities, however. Indeed, this would require a multivariate analysis which is

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[7] Bijmolt and Pieters (2001) also discuss different approaches to deal with multiple measurements and show that the optimal procedure explicitly deals with the nested error structure.

[8] Natural candidates as weights are the standard error of the elasticity, the number of observations that are used to estimate the elasticity, or the journal impact factor.

[9] Originally, we had over 400 elasticity values. For thirty of these we were unable to derive reliable elasticities.

Table 3

Analysis Of Variation

Semi-elasticity[a]	Base sample		Including Extremes	
Number of observations	351		371	
Type of tax data				
State statutory rate (CSTR[b])	2.81	*	4.56	*
Marginal effective tax rate (CSTR[b])	1.08		3.60	
Average effective tax rate (CSTR[b])	–0.76		–0.76	
Micro average tax rate (CSTR[b])	0.92		1.28	
Macro average tax rate (CSTR[b])	1.25		2.54	

* Variable significant at 10 per cent confidence level.
[a] All semi-elasticities are pre-multiplied by a minus sign.
[b] CSTR = Country Statutory Tax Rate (benchmark choice).

presented in section 3.2. The ANOVA is only a first step in analysing the variation in elasticities.[10]

We perform the ANOVA for two different samples. First, we look at the meta sample that excludes extreme values, that is semi-elasticities that lie outside the range of plus and minus two times the standard deviation from the mean. This so-called base sample contains 351 observations. Second, we analyse the meta sample when these extreme observations are included as well. This sample contains 371 observations.

In Table 3 we present the ANOVA results for both samples. The correlations are shown relative to the country statutory tax rate. For visual convenience, we have put a minus sign for all semi-elasticities before doing the ANOVA analysis and the regression analysis. Thus, we transformed the majority of semi-elasticities into positive figures. A value of 1.08 for the marginal effective tax rate therefore means that results obtained with the marginal effective tax rate are on average 1.08 percentage points higher (more responsive) than results obtained by studies that use the country statutory rate.

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[10] In a sense, the ANOVA reflects what might be implicitly done in ordinary literature surveys. The advantage of the ANOVA is that it makes the procedure explicit and reproducable.

Table 3 reveals that studies using marginal effective tax rates or average tax rates based on either micro or macro data, yield higher semi-elasticities than studies adopting the country statutory rates. This is consistent with the view that effective or average tax rates are better approximations of the tax burden on foreign investment. However, Table 3 shows that the differences are typically insignificant, so it does not provide strong support for this hypothesis. Furthermore, the average effective tax rates exert an unexpected opposite effect.

From Table 3 we also learn that studies using state statutory tax rates in the US (Hines; Swenson, 2001) yield significantly larger elasticities. This may be because these rates are proportional to the marginal effective tax rate as the tax base of US states is, to a large extent, uniformly determined at the federal level.

Overall, the results from the ANOVA do not seem very informative. The coefficients are mostly insignificant. A possible reason could be that the results are contaminated by differences in other characteristics. That is what we will explore in the meta-regressions in the next section.

3.2 Meta-regressions

This section presents the meta-regressions. That is, we estimate $y = \exists X + \mathcal{C}$, where y represents the vector of elasticities and X is a matrix of dummy variables that reflect various study characteristics. The parameters in the vector $\exists$ thus measure the impact of each of the study characteristics (relative to some benchmark) on the effect size.

Next to different tax rates, we included a number of other variables in the regressions. In particular, we felt that the distinction between retained earnings and transfers, the relief system to avoid double taxation (exemption or credit), and the type of capital data (FDI, New plants, Mergers and Acquisitions etc.) could systematically influence the results. Therefore we controlled for these characteristics in the regressions. A footnote to Table 4 lists all the variables that were included in the regressions.[11]

Just as in the ANOVA, we have put a minus sign for all semi-elasticities before doing the regression analysis. This simplifies the interpretation of the regression results, which are presented in Table 4. The coefficients in the table show the estimated differential impact of the use of a different type of tax data, relative to the use of the country statutory rate. For example, a value of 3.08 for the marginal effective tax rate indicates that semi-elasticities estimated with the marginal effective tax rate are 3.08 higher (in absolute terms) than similar elasticities estimated with the country statutory rate. The other results can be interpreted similarly.

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[11]   The results for the whole set of variables are available from the authors upon request.

Table 4

Meta Regressions With Different Samples

	Base regression	(351 observations) [a]	With extremes	(371 observations) [a]
State statutory rate	7.87 (1.30)	**	6.94 (2.22)	**
Marginal effective tax rate	3.08 (1.07)	**	3.89 (1.44)	**
Average effective tax rate	8.09 (2.21)	**	3.27 (4.16)	
Micro tax rate	1.27 (0.62)	**	0.46 (1.15)	
Macro average tax rate	2.64 (1.26)	**	2.98 (2.61)	

[a] In addition, the regression includes a constant, the average sample year and dummies for the source of finance (retained earnings, transfers), the taxation of foreign source income (exempt, credit), the type of foreign capital data (number of locations; property, plant and equipment; plants; mergers and acquisitions), the distinction between manufacturing firms and all firms, an indication whether there is controlled for home taxes and a dummy for Belgium.
White heteroskedasticity-consistent standard errors are shown between parentheses.
** Variable significant at 5 per cent confidence level.

We have explored two samples in our regressions. The first column of Table 4 shows the regressions with the sample of 351 observations and excludes the extreme values. The second column of Table 4 includes the 20 extreme observations and contains all 371 semi-elasticities. It turns out that the extreme values have a substantial impact on the results, especially with respect to the average effective tax rate. This does not come as a surprise, as we saw in section 2 that the extreme values also had a significant effect on the characteristics of the sample. Still, our main conclusions are supported in both cases. We have explored the robustness of the results by including additional study characteristics in the benchmark regression. The results of this sensitivity analysis can be found in the Appendix. They support the general notion that arises from the regression results in Table 4 and that we will discuss below.

A result that holds in all the regressions is that the responsiveness of foreign direct investment to state statutory rates is higher than the sensitivity to country statutory rates. This finding is in line with the results of the ANOVA. There we already mentioned that because of similar tax bases across US states, the state statutory rate probably bears a similar interpretation as the marginal effective tax rate.

Another clear conclusion that arises from the results of our meta-regressions is that both average tax rates (based on either micro or macro data) and effective tax rates (marginal or average) exert a larger effect on foreign direct investment than country statutory rates do. Indeed, the coefficients for the former categories of tax rates are always positive and usually significant.

Compared to the micro and macro average tax rates, the marginal effective tax rate (METR) yields bigger elasticities. The coefficient for the METR is significant at the 5 per cent level in all regressions. Its difference with the average tax rates is not statistically significant, however.

Important to note is that the average effective tax rate (AETR) appears in both the base regression as in the results in the Appendix with a positive, high and mostly significant coefficient. This contrasts with the findings from the ANOVA. Hence, the pair wise comparisons tend to be misleading. In particular, the AETR is used only by the study of Devereux and Griffith. Their relatively small semi-elasticities are not due to the AETR, but because of other characteristics. For instance, the Devereux and Griffith study uses data on the number of locations which exerts a negative impact on the value of the semi-elasticity. By including the variation in other dimensions, the regressions in Table 4 and in the Appendix suggest that the AETR yields a positive, rather than a negative, impact on the size of the semi-elasticity.

3.3   Typical elasticities

The meta-regressions can be used to compute the typical semi-elasticity for a study with particular study characteristics. These calculations serve to illustrate the quantitative implications of the regression results. However, because of "out-of-sample" prediction, the accuracy of these estimates may differ substantially between the presented cases. Nevertheless, we think these values are illustrative. Table 5 shows some of these typical values, which are based on the base regression in Table 4. As a benchmark, we take the elasticity based on country statutory rates, ordinary FDI data and an average sample year of 1987. The benchmark makes no distinction between credit or exemption systems. We see from Table 5 that a study with these characteristics yields a typical semi-elasticity of –1.2.

For alternative tax rate measures, Table 5 shows typical values for the corresponding semi-elasticities. In particular, if a study has the same characteristics as the benchmark except that it adopts the micro average tax rate instead of the country statutory tax rate, the typical elasticity becomes –2.4. If a study uses a forward-looking concept for the tax rate, the typical elasticity increases significantly. Elasticities based on marginal effective tax rates are typically –4.2, whereas the average effective tax rate even yields a value of –9.3. These values may serve as benchmark values in future research on the relation between company taxes and FDI.

Table 5

Typical Elasticities According to Our Meta Regression

Elasticity benchmark based on country statutory rates[*]	–1.2
Elasticities based on alternative tax rates:	
• State statutory tax rate	–9.0
• Average tax rate based on firm-level data	–2.4
• Average tax rate based on aggregate data	–3.8
• Marginal effective tax rate	–4.2
• Average effective tax rate	–9.3

[*] Benchmark: Ordinary FDI data; average sample year 1987; no distinction with respect to credit/exemption system.

4. Conclusions

Applying meta-analysis to the tax rate elasticity of FDI has some pitfalls. First of all, the substantial heterogeneity among studies renders a direct comparison of elasticities problematic. This makes it difficult to specify the appropriate meta-regressions to identify study characteristics responsible for the variation in elasticities. Second, some observations in the meta sample are dependent because they originate from the same study. Indeed, a relatively small number of studies has a disproportional impact on the meta sample because some authors have (and others have not) decided to present a whole set of regression results. A third pitfall refers to publication bias. In particular, a number of elasticities might not have been reported by authors because they were either insignificant or of the unexpected sign.

These pitfalls qualify the results from our meta-analysis. However, the same limitations apply to ordinary literature surveys. Moreover, compared to ordinary surveys, meta-analysis contains an important value added in making the heterogeneity among studies more transparent, the selection process verifiable, and studies better comparable. Furthermore, the meta-regressions provide a rigorous analysis in the variation of elasticities and the structural impact of various study characteristics. Thus, meta-analysis teaches us more about the literature. In fact, whereas regression analysis in general can be seen as a method to better understand the underlying data, meta-regressions can be seen as a method to better understand the existing literature, which comprises the data of the meta sample.

The paper reveals a number of insights that are relevant for policy makers. On average, we find that the tax rate elasticity of foreign capital is around –3.3. There is, however, substantial variation among studies. This can be partly explained by the choice of the tax data. Most economists argue that country statutory tax rates are imperfect measures to determine the impact on investment behaviour by multinational firms. Indeed, when we control for other characteristics, we find that studies using country statutory tax rates yield substantially smaller elasticities than studies adopting effective tax rates or average tax rates. It is also often claimed that *ex ante* proxies of effective tax rates are superior to *ex post* measures. In our meta-analysis, this seems to be confirmed by the fact that effective tax rates based on tax codes (marginal and average) tend to yield higher elasticities. A typical elasticity based on marginal effective tax rates is –4.2, that is a one percentage point reduction in the host-country tax rate raises foreign direct investment in that country by 4.2 per cent. This value may serve as a benchmark for future research on the relation between company taxes and FDI.

APPENDIX

REGRESSION RESULTS
WITH ADDITIONAL STUDY CHARACTERISTICS

To analyze the robustness of our results, we have experimented with different combinations of study characteristics. Table 6 shows the regression results for five different specifications.

The first column repeats the results for our benchmark specification, that is the one discussed in the main text. In the second column of Table 6, we control for some additional study characteristics such as published/unpublished, log/linear

Table 6

Meta-Regressions for Different Combinations of Study Characteristics

	Base regression[a]	More characteristics[b]	Study effects[c]	Control variables[d]	Country effects[e]
State stat. rate (CSTR)	7.87 **	5.84 **	12.78 **	3.29	10.83 **
METR (CSTR)	3.08 **	4.95 **	4.02 **	3.92 **	3.64 **
AETR (CSTR)	8.09 **	2.02	5.81 **	8.15 **	5.25 **
Micro ATR (CSTR)	1.27 **	0.60	1.08	0.14	0.61
Macro ATR (CSTR)	2.64 **	4.31 **	3.19 **	3.40 **	2.61 *

[a] See Table 4 in the main text.
[b] As column 1 plus dummies for unpublished (published), log(linear), OLS(other), cross section/time series (panel), stock (flow) data, inward (outward) investment.
[c] As column 1 plus dummies for the studies of Swenson (2001), Slemrod, Hines, Altshuler *et al.*, Cassou, Gorter and Parikh, Grubert and Mutti, Boskin and Gale, and Young.
[d] As column 1 plus dummies if the following control variables were included: tax on domestic investors, GDP, population, openness, agglomeration effects, unemployment, exchange rate, wages.
[e] As column 1 plus dummies for US, UK, Japan, France, Germany, Canada, Netherlands, Australia, Sweden, Italy, Switzerland, Denmark, Portugal and Finland.
* Variable significant at 10 per cent confidence level.
** Variable significant at 5 per cent confidence level.

specification, OLS/other estimator, cross section/time series/panel data, stock/flow of FDI and inward/outward investment. The third column of Table 6 shows the regression results if we include country-effects,[12] that is a dummy variable for each investing country if it could be identified from the underlying study. This controls for unobserved heterogeneity of investing countries, such as special features of their tax systems.[13] The last two columns explore the effects of two methodological problems in meta-analysis on the main results. The fourth column show the effects of including a number of study-effects, that is a dummy variable for each study from which we obtained more than ten semi-elasticities. This may be seen as a modest attempt to deal with the dependency problem due to multiple measurement, as discussed above. The final column reruns the basic regression for the sample of published studies only. This eliminates 43 observations taken from six unpublished studies. The regression results from these analyses support our main results.

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[12]   The claim that intra-EU capital flows are more responsive than are continental flows cannot be investigated appropriately since Gorter and Parikh is the only study that includes only intra-EU flows.

[13]   We control for Belgium as an investing country in all regressions. The reason is that Belgium is only distinguished separately in the Swenson (2001) study in which it yields very high semi-elasticities.

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TAX COMPETITION vs. TAX HARMONISATION IN A DYNAMIC WORLD ECONOMY

Marco Catenaro[*] and Jean-Pierre Vidal[*]

Introduction

It is often argued that, in an environment in which capital is able to move freely, governments' ability to rely on capital taxation becomes increasingly constrained. Fiscal authorities would then be made better off by more actively coordinating their tax policies or, alternatively, by relinquishing their tax authority in favour of a supranational authority. While the common wisdom that capital mobility exerts a "race-to-the-bottom" on capital tax rates is widely spread in the theoretical literature on tax competition, the empirical literature so far has found little support for this outcome.
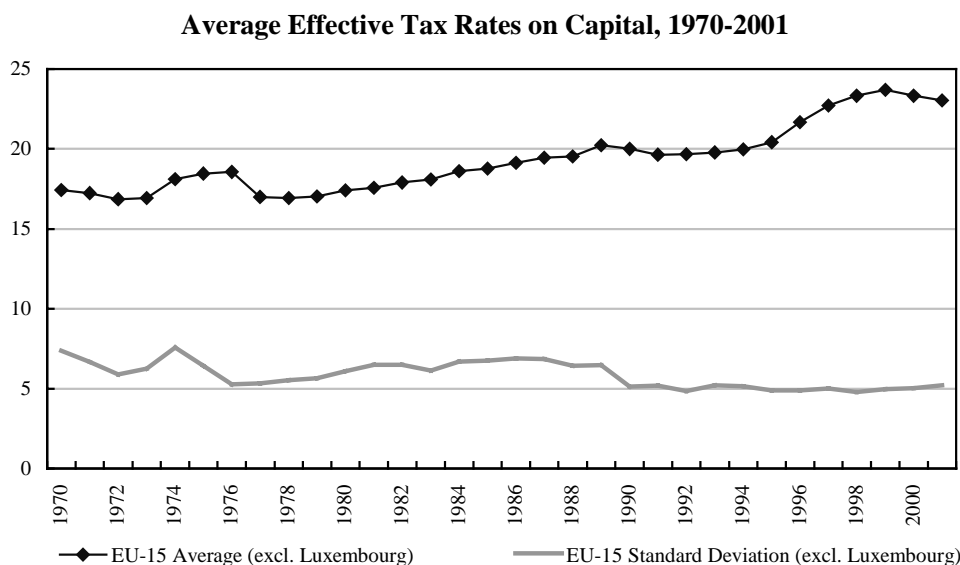
The theoretical literature on tax competition is largely based on conventional static frameworks,[1] in which the tax game lasts only one period, thereby disregarding the possibility of repeated interactions between policymakers. Concerning capital income taxation, in particular, it traditionally relies on the assumption that capital owners are sensitive to net returns to capital (*i.e.* to tax differentials) when making portfolio choices or investment decisions. Settings of these tax competition models are essentially twofold. On the one hand, small open economies compete for a fixed amount of internationally mobile capital (e.g. Zodrow and Mieszkowski, 1986), but fail to internalise the impact of their respective tax policies on the world after-tax return to capital. On the other hand, governments are assumed to engage in tax games *à la* Nash, in the context of which they are, however, aware that their tax policy affects the after-tax return to capital (see for instance Wildasin, 1988). Under both settings, capital mobility drives down capital tax rates, albeit to a lower extent in the latter class of models. When tax revenues finance public goods, this results in an under-provision of local public goods that negatively affects the citizens' welfare. Nevertheless, tax competition is welcome if governments are revenue-maximisers and subordinate their competitive behaviour to, for example, the aim of increasing their size. Clearly, a normative assessment of tax competition ultimately depends on the views one has on the preferences of governments (Edwards and Keen, 1996).

Chart 1

Average Effective Tax Rates on Capital, 1970-2001

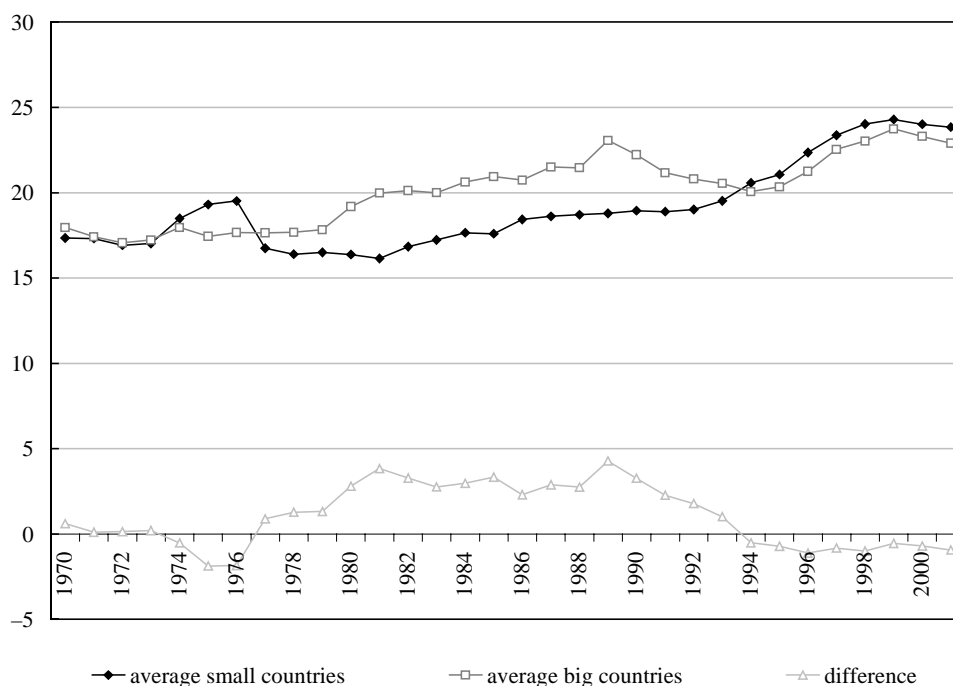Source: Martinez-Mongay (2000) and own calculations.

Despite the fact that the above static tax competition models generally conclude that tax competition leads to a "race-to-the-bottom", empirical research has so far found limited support for a significant downward effect of capital mobility on tax rates. In this regard, a recent review of empirical studies on the sensitivity of capital flows to tax rates by Krogstrup (2003) has also confirmed that there is no strong empirical evidence supporting the conclusions of tax competition models. Regarding the location choice of foreign direct investment, it is also stressed that empirical evidence supports the view that the tax policy of a country does not affect the choice of its resident investors between home and foreign investment. On the other hand, a country's tax policy affect the investment decisions of prospective foreign investors.

A simple inspection of the evolution of effective tax rates on capital in the European Union over the past three decades confirms the absence of a significant downward pressure on capital taxation (see Chart 1). The upward trend of capital tax rates, which stands at odds with the standard predictions of the tax competition literature, applies to both big and small countries,[2] suggesting that some form of tax coordination might be at work (see Chart 2).

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[2]   The tax development in "big" countries has been computed by averaging effective tax rates on capital in Germany, France, Italy, the United Kingdom and Spain.

Chart 2

**Average Effective Tax Rates on Capital, 1970-2001
Big vs. Small Countries**

→ average small countries   □ average big countries   △ difference

Source: Martinez-Mongay (2000) and own calculations.

This paper attempts to reconcile theory and evidence by extending the basic tax competition model to account for repeated policy interactions between governments. When the latter are associated to a systematic "punishment" of the deviating policymaker, the Nash equilibrium outcome of static tax competition models may not necessarily coincide with the outcome of the tax game in a repeated interaction framework. On the contrary, governments may secure a cooperative or coordinated outcome by threatening to retaliate if one of them deviates from the coordinated tax rates. In such a case, explicit policy coordination via a supranational tax authority – a federal government – would not be necessary. However, one could argue that some explicit tax coordination may continue to be desirable in order to avoid the pitfalls of competition from smaller economies. This policy asymmetry relates to the fact that large regions face a weaker response of the capital stock to tax rates, which means that they are less inclined to engage in tax competition. By contrast, as competition generally benefits smaller economies, the latter are more likely to be the source of negative externalities to large countries in the absence of supranational regulation.

To our best knowledge, there are only few papers in the literature addressing the topic of fiscal competition in a repeated interaction framework. In his model of property tax competition, Coates (1993) assumes that governments do not take into account the externalities associated to the use of their domestic tax rate, showing that there may be incentives to subsidise capital. Cardarelli, Taugourdeau and Vidal (2002) extend upon the framework developed by Coates, setting up a repeated interactions model of tax competition and establishing the conditions under which tax policy harmonisation can result from repeated interactions between the policymakers. They show that tax harmonisation will not prevail in the case of strong regional asymmetries,[3] in which case the establishment of a centralised fiscal authority is suggested as a solution to the tax competition problem. In a related game theoretical approach inspired by Barro and Gordon (1983), Fourcans and Warin (2002) also find that the lack of explicit tax harmonisation may not lead to a "race-to-the-bottom" of tax rates, as a cooperative outcome can result from repeated interactions between governments.

The goal of our paper is to build upon the paper by Cardarelli *et al.* by looking at capital tax competition in a repeated interaction framework characterised by the absence of capital mobility sunk costs. While such costs were postulated in their paper to avoid a zero tax rate on capital under the assumption of linear technologies, the underlying assumption in our paper is that production occurs according to Cobb-Douglas technologies. Furthermore, we analyse the role of cross-country asymmetries on the outcome of the tax competition repeated game. We adopt the view that governments compete for a fixed world supply of capital and abstract from welfare considerations, assuming that governments only aim to maximise tax revenues. Moreover, governments are either short-sighted, maximising only current revenue, or far-sighted, seeking to maximise a discounted sum of current and future tax revenues. Only under the second scenario is the coordinated tax outcome ultimately sustainable, provided cross-country asymmetries remain limited and governments are sufficiently patient.

The paper proceeds as follows. Section 1 develops a streamlined classical one-shot model of tax competition. Section 2 extends this model to account for repeated interactions, while section 3 presents a simple numerical exercise. Section 4 concludes.

1.   The 'one-shot' tax game

Let us consider a world economy consisting of two countries (indexed with subscripts i and j), whose governments compete to tax the income of a fixed and exogenously given world supply of capital. The allocation of capital between country i and j satisfies:

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[3]   Taugourdeau (2002) extends the analysis of Cardarelli *et al.* (2002) by considering a bargaining equilibrium between governments.

$$2k = k_i + k_j \tag{1}$$

where *2k* stands for the world total supply of capital. Labour is perfectly immobile and in fixed supply, whereas capital is perfectly mobile. The gross return to capital invested in country *i* is given by:

$$r_i = \alpha \, A_i \, k_i^{\alpha-1} \tag{2}$$

where A_i is a country specific scale factor, capturing cross-country differences in their endowments of immobile factors such as, for example, labour or land, or even differences in total factor productivity. The underlying production technologies are assumed to be of the Cobb-Douglas type. Governments levy taxes on capital according to the source principle of taxation.[4] The capital tax revenue in country *i* is:

$$T_i = t_i \, \alpha \, A_i \, k_i^{\alpha} \tag{3}$$

where t_i is country *i*'s capital income tax rate. Perfect capital mobility implies that net returns to capital are equal in all locations. The equilibrium capital allocation is therefore determined by the arbitrage condition:

$$(1 - t_i)\alpha \, A_i \, k_i^{\alpha-1} = (1 - t_j)\alpha \, A_j \, k_j^{\alpha-1} \tag{4}$$

Governments act strategically with a view to maximising capital income tax revenue. In order to address the question of whether tax coordination is feasible in the absence of any coordinating supranational authority, we assume that governments are intrinsically revenue-maximisers, hence departing from the view of governments as benevolent social planners. In this context, it should be noted that our model abstracts not only from labour income taxation but also from spending, so that we are focusing on a precise aspect of tax policy, namely the taxation of internationally mobile capital.

Governments choose their capital income tax rate under the constraint that capital is perfectly mobile, taking other governments' tax policies as given. This is a Nash tax game, where government *i* maximises its capital income tax revenue (3) from an internationally mobile tax base under the arbitrage condition for capital (4), taking government *j*'s capital tax rate as given. Government *i*'s reaction function is the solution to the following maximisation programme:

$$\max_{\{t_i, k_i\}} t_i \, \alpha \, A_i \, k_i^{\alpha}$$

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[4]   There are two polar principles of international taxation: the residence (of the taxpayer) principle and the source (of income) principle. Under the residence principle, residents are taxed on their whole income regardless of its origin. Under the source principle, all incomes originating in a country are taxed in this country regardless of the country of residence of the taxpayer. The source principle is usually assumed in models of tax competition; see Razin and Sadka (1994) for a survey on tax competition.

subject to:

$$\left(1-t_i\right)\alpha\,A_i\,k_i^{\,\alpha-1}=\left(1-t_j\right)\alpha\,A_j\,k_j^{\,\alpha-1}$$

The reaction function of government i, $t_i = R_i\left(t_j\right)$, is characterised by the system of two equations:

$$\frac{t_i-(1-\alpha)}{1-t_j}=(1-\alpha)\frac{A_j}{A_i}\left(\frac{2k-k_i}{k_i}\right)^{\alpha-2} \tag{5}$$

$$\left(\frac{k_i}{2k-k_i}\right)^{\alpha-1}=\frac{A_j\left(1-t_j\right)}{A_i\left(1-t_i\right)} \tag{6}$$

The relationship between t_i and t_j is obtained by plugging (6) into (5):

$$1-t_j=\frac{A_i}{A_j}\left(1-t_i\right)^{2-\alpha}\left[\frac{1-\alpha}{\alpha-\left(1-t_i\right)}\right]^{1-\alpha} \tag{7}$$

Although one does not obtain an analytical solution for government i's reaction function R_i, the above expression implicitly defines this function, the property of which can be easily analysed. Equation (7) is of the form:

$$y=f\left(x\right)=\Gamma x^{2-\alpha}\left(\frac{1-\alpha}{\alpha-x}\right)^{1-\alpha}$$

where x, y and Γ denote $1-t_i$, $1-t_j$ and $\dfrac{A_i}{A_j}$ respectively. The domain of f is $[0,\alpha[$ and its range $[0,+\infty[$. One can easily check that f is strictly increasing on $]0,\alpha[$ and that $f(0)=0$, $\lim\limits_{x\to\alpha}f(x)=+\infty$ and $f'(0)=0$.

Concerning the reaction function of government j, it is implicitly defined by:

$$1-t_i=\Gamma^{-1}\left(1-t_j\right)^{2-\alpha}\left[\frac{1-\alpha}{\alpha-\left(1-t_j\right)}\right]^{1-\alpha} \tag{8}$$

This expression, which can be easily obtained from (7) by substituting i with j, is of the form:

$$x=h\left(y\right)=\Gamma^{-1}y^{2-\alpha}\left(\frac{1-\alpha}{\alpha-y}\right)^{1-\alpha}$$

   The qualitative properties of this function are the same as those of the function f we studied above. In particular, we can define the inverse function $g = h^{-1} : [0,+\infty[\to [0,\alpha[$, which is also strictly increasing on $]0,+\infty[$. One can easily check that $\lim\limits_{x \to 0} g'(x) = +\infty$. The intersection of the curves representing the functions f and g characterises the Nash tax rates. The qualitative properties of these functions ensure the existence and uniqueness of the Nash equilibrium of this tax game, as illustrated by Figure 1. The Nash tax rates belong to the interval $]1-\alpha,1[$.

   From (7) and (8) one obtains a simple relation between $x^N = 1 - t_i^N$ and $y^N = 1 - t_j^N$:

$$(\alpha - x^N)(\alpha - y^N) = (1-\alpha)^2 x^N y^N \tag{9}$$

Plugging this equation into the expression (7) yields a new equation, the solution of which characterises the Nash tax rate of government i, $t_i^N = 1 - x^N$:

$$\Gamma^{\frac{1}{1-\alpha}} (1-\alpha) \left(\frac{x}{\alpha - x} \right)^{\frac{2-\alpha}{1-\alpha}} [1 - (2-\alpha)x]^{\frac{1}{1-\alpha}} = 1 \tag{10}$$

Figure 1

Nash Reaction Functions
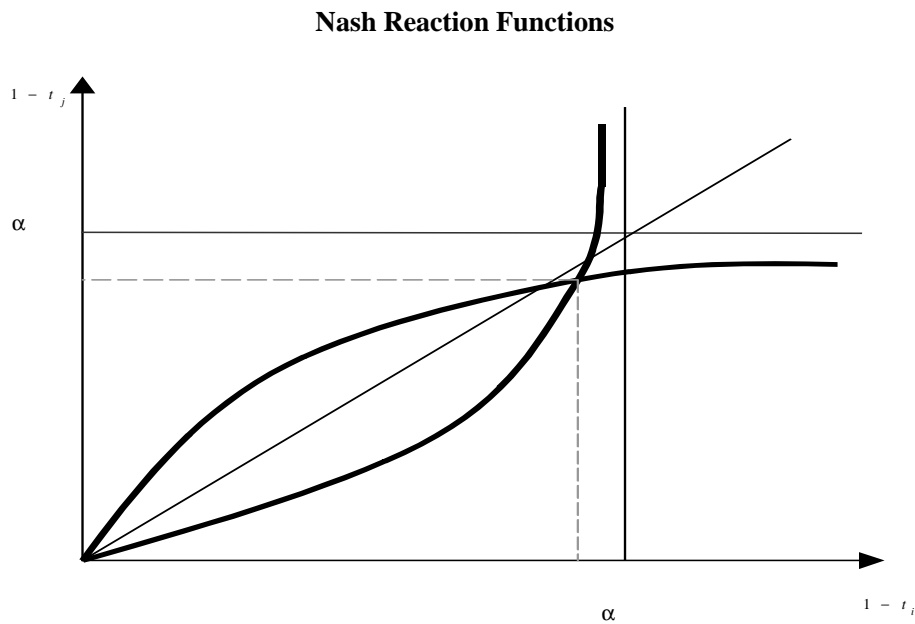
When countries are symmetric ($A_i = A_j$ or $\Gamma = 1$), the Nash tax rate is easily calculated from the equation (10):

$$t^N = \frac{2(1-\alpha)}{2-\alpha} \tag{11}$$

The equilibrium allocation of capital is given by plugging the Nash tax rates into the equation (6):

$$k_i^N = \frac{2k\,\Gamma^{\frac{1}{1-\alpha}}\left(\dfrac{x^N}{y^N}\right)^{\frac{1}{1-\alpha}}}{1 + \Gamma^{\frac{1}{1-\alpha}}\left(\dfrac{x^N}{y^N}\right)^{\frac{1}{1-\alpha}}} \tag{12}$$

$$k_j^N = 2k - k_i^N \tag{13}$$

Finally, the Nash tax revenues are defined as:

$$T_i^N = \alpha\, t_i^N A_i \left(k_i^N\right)^{\alpha} \tag{14}$$

$$T_j^N = \alpha\, t_j^N A_j \left(2k - k_i^N\right)^{\alpha} \tag{15}$$

Proposition 1

   An increase in the relative size of country i implies an increase in the Nash tax rate of government i and a decrease in the Nash tax rate of government j.

   Proof. We take the logarithmic derivative of the equation (10):

$$\frac{1}{1-\alpha}\frac{d\Gamma}{\Gamma} + \frac{2-\alpha}{1-\alpha}\frac{dx^N}{x^N} + \frac{2-\alpha}{1-\alpha}\frac{dx^N}{\alpha-x^N} - \frac{2-\alpha}{1-\alpha}\frac{dx^N}{1-(2-\alpha)x^N} = 0$$

$\dfrac{dx}{d\Gamma}$ is of the same sign as:

$$-\frac{1}{x^N} - \frac{1}{\alpha-x^N} + \frac{1}{1-(2-\alpha)x^N} = -\frac{\left(x^N\right)^2 - \alpha(3-\alpha)\,x^N + \alpha}{x^N\left(\alpha-x^N\right)\left[1-(2-\alpha)x^N\right]}$$

Let us study the sign of the polynomial:

$$P(x) = x^2 - \alpha(3 - \alpha)x + \alpha$$

Since we have $P'(0) = -\alpha(3 - \alpha) < 0$, $P'(\alpha) = \alpha(\alpha - 1) < 0$ and $P(\alpha) = \alpha(\alpha - 1)^2 > 0$, we conclude that $P(x) > 0$ for all $x \in [0, \alpha]$.

Hence: $\dfrac{dx}{d\Gamma} < 0$.

From equation (9) it also follows that $\dfrac{dy^N}{dx^N} > 0$.

This proposition shows that, in a two-country model, the tax rate differential is exacerbated by asymmetries in country sizes. The large country attracts more international capital than the small country.

2. Game under repeated interactions

In this section we examine how repeated interactions between governments affect their behaviour regarding taxation of internationally mobile capital. To extend this simple tax competition model to a dynamic environment, we assume that governments maximise the discounted sum of their tax revenues. The objective of government *i* can therefore be written as:

$$V_i = \sum_{t=0}^{+\infty} \delta_i^t T_{i,t} \tag{16}$$

where $T_{i,t}$ stands for government *i*'s capital income tax revenue in period *t* and δ_i is government *i*'s discount factor. In each period *t* governments play a stage game similar to the one-shot tax game described in the previous section. Clearly, an infinite repetition of the Nash strategies is a solution to the repeated tax game, which gives governments the following payoffs:

$$V_i = \sum_{t=0}^{+\infty} \delta_i^t T_i^N \tag{17}$$

$$V_j = \sum_{t=0}^{+\infty} \delta_i^t T_j^N \tag{18}$$

However, governments can achieve higher levels of capital income tax revenues by setting capital income tax rates in a cooperative manner. For instance,

they could meet and decide on coordinated tax rates, not necessarily equal across countries but still higher than the Nash tax rates. Let us denote with $t_i^c \, (> t_i^N)$ and $t_j^c \, (> t_j^N)$ the pair of coordinated tax rates. More specifically, we shall here consider the possibility for governments to coordinate on a common capital income tax rate ($t_i^c = t_j^c = t^c < 1$).

In a framework of repeated interactions between governments, tax coordination can be underpinned by trigger-type strategies. Each government cooperates and levies the coordinated tax rate as long as the other government cooperates and reverts to the Nash tax rates otherwise. In the repeated tax game, the tax strategy of government j can be expressed as follows:

$$t_{j,t+1} = \begin{cases} t^c \; if \; t_{i,t} = t^c \\ t_j^N \; otherwise \end{cases}$$

If governments implement their tax policies in a coordinated manner, the government $s \, (=i,j)$ can achieve the following payoffs:

$$V_s^C = \sum_{t=0}^{+\infty} \delta_s^t T_s^C = \sum_{t=0}^{+\infty} \delta_s^t T_s^C \alpha t_s^c A_s \left(k_s^C \right)^\alpha \tag{19}$$

where the international allocation of capital is:

$$k_i^C = \frac{2k\Gamma^{\frac{1}{1-\alpha}}}{1 + \Gamma^{\frac{1}{1-\alpha}}} \tag{20}$$

$$k_j^C = \frac{2k}{1 + \Gamma^{\frac{1}{1-\alpha}}} \tag{21}$$

Tax coordination prevails if governments have no incentive to deviate from the coordinated tax rate. The deviating government reaps short-run benefits but incurs long-run losses compared to tax coordination.

Without loss of generality, we shall consider the incentives to deviate of government j in the remainder of this paper. If it chooses to deviate, government j sets its tax rate according to its reaction function. This government's tax rate is its best reply against government i playing t^c. Hence, t_j^D is the solution to the following system of equations:

$$\frac{t_j^D - (1-\alpha)}{1 - t^c} = (1-\alpha)\Gamma \left(\frac{k_i^D}{2k - k_i^D} \right)^{\alpha-2} \tag{22}$$

$$\frac{k_i^D}{2k - k_i^D} = \left[\frac{\left(1 - t_j^D\right)}{\Gamma\left(1 - t^C\right)}\right]^{\frac{1}{\alpha - 1}} \tag{23}$$

where k_i^D is the equilibrium level of capital in country i under these strategies. Combining (22) and (23) gives the following expression, which implicitly defines t_j^D as a function of t^c:

$$\frac{\left(1 - t_j^D\right)^{2-\alpha}}{\left[t_j^D - (1-\alpha)\right]^{1-\alpha}} = \frac{\Gamma\left(1 - t^c\right)}{(1-\alpha)^{1-\alpha}} \tag{24}$$

By definition of the reaction function, note that $t_j^D = t_j^N$ if $t^c = t_i^N$. One can easily check from (24) that there exists a unique $t_j^D \in \left]1 - \alpha, t^c\right[$ for all $t^c \in \left]t_i^N, 1\right[$ and that the deviating tax rate varies positively with the coordinated tax rate ($\dfrac{dt_j^D}{dt^C} > 0$). It should also be noted that, not surprisingly, international capital flies from the country that implements the coordinated strategy to the deviating country, increasing its short-run tax revenue ($k_j^D > k_j^C$). Government j can enjoy only once the benefits of its treachery, as government i will thereafter revert to the Nash tax strategy. However, government j's value of the continuation game is the Nash payoff, V_j^N. The payoff the deviating government can achieve is given by:

$$V_j^D = T_j^D + \delta_j V_j^N = \alpha t_j^D A_j \left(2k - k_i^D\right)^\alpha + \delta_j V_j^N \tag{25}$$

Our next proposition stresses that tax coordination can emerge endogenously from repeated interactions.

Proposition 2

When there are no cross-countries differences, coordination on a common capital income tax rate is sustainable if governments are sufficiently patient.

The proof is simple and intuitive, as the result is quite similar to the folk theorem in game theory. Tax coordination is sustainable if the loss incurred by the deviating country in terms of future losses stemming from the setback from the coordinated to the Nash tax strategies exceeds the short-run gain generated by undercutting the coordinated tax rate. Hence, coordination of tax policies is sustainable if:

$$V_j^D = T_j^D + \delta_j V_j^N < V_j^C \tag{26}$$

where we check that deviation does not benefit government j. Multiplying (26) by $(1 - \delta_j)$ we obtain:

$$\left(1 - \delta_j\right) T_j^D + \delta_j T_j^N < T_j^C \tag{27}$$

When δ_j tends to 1, this expression becomes:

$$t_j^N < t^C \tag{28}$$

since in the symmetric case, we have $k_i^N = k$ and $k_i^C = k$.

Condition (28) holds owing to the definition of the coordinated tax rates. Hence, if governments' discount factors are sufficiently close to 1, tax coordination can be an outcome of the tax game with repeated interactions. It follows that in the case of symmetric countries, the endogenous outcome of the repeated tax game suggests that there is no intrinsic need for greater centralisation. Nevertheless, it should be emphasised that centralised tax coordination or harmonisation may still be needed in the presence of strong regional asymmetries.

The next proposition deals with the sustainability of decentralised or endogenous tax coordination in the presence of strong regional asymmetries.

Proposition 3

If cross-countries differences in size are sufficiently large, decentralised coordination on a common capital income tax rate is not sustainable.

In order to show that decentralised tax coordination cannot be the outcome of the repeated tax game, we shall proceed as follows. First, we consider the feasibility condition in the limit case where governments' discount factors tend to 1. Second, we prove that this condition cannot hold whenever asymmetries are sufficiently large. Condition (27) can be written as follows:

$$\left(\frac{t_j^N}{t^C}\right)^{\frac{1}{\alpha}} < \frac{1}{1 + \Gamma^{\frac{1}{1-\alpha}}} \frac{1}{1 - \dfrac{k_i^N}{2k}} \tag{29}$$

Using the expression (12) we obtain:

$$\left(\frac{t_j^N}{t^C}\right)^{\frac{1}{\alpha}} < \frac{1 + \Gamma^{\frac{1}{1-\alpha}} \left(\dfrac{1 - t_i^N}{1 - t_j^N}\right)^{\frac{1}{1-\alpha}}}{1 + \Gamma^{\frac{1}{1-\alpha}}} \tag{30}$$

When the indicator for regional asymmetries, Γ, tends to infinity, one can easily check from the equations (9) and (10) that t_i^N and t_j^N tends to 1 and $1-\alpha$ respectively. When Γ tends to infinity, the condition (30) becomes: $\left(\dfrac{1-\alpha}{t^C}\right)^{\frac{1}{\alpha}} < 0$. Since the LHS of this expression is strictly positive, we have shown by contradiction that decentralised tax coordination is not sustainable if regional asymmetries are sufficiently large.

3.   Numerical exercise

This section briefly exposes the key results of a series of numerical exercises carried out on the basis of the models developed in sections 1 and 2. Far from constituting a realistic calibration of the real economy, these exercises simply aim to illustrate the role of cross-country asymmetries and the discount factor on the sustainability of tax coordination under repeated interactions.

An initial step in the analysis consists in assessing the impact of the coordinated tax rate t^c on the sustainability of tax coordination, as captured by the sign of the difference $V^D - V^C$, in the case of asymmetric countries. For the purposes of this exercise, the size of the small country is normalised to unity without loss of generality, since only the relative size of countries is relevant in this model. The governments' discount factors and the capital share are set equal to 0.8 and 0.3 respectively. The world supply of capital is equal to 2.

Chart 3 illustrates the incentives to deviate in three different scenarios for the coordinated tax rate. When the coordinated tax rate on internationally mobile capital is 1 per cent higher than the Nash rate of the deviating government, tax coordination is no longer sustainable once cross-country asymmetries exceed 40 per cent, corresponding to a value of 1.4 for the asymmetry indicator. When raising the coordinated tax rate to 5 and 10 per cent above the Nash tax rate, the sustainability threshold on the asymmetry indicator increases to 2 and about 2.7 respectively.

A next step in the analysis consists in the assessment of the impact of the discount factor on the sustainability of tax policy coordination. The result here is that a higher discount factor is associated to higher sustainability of coordination. Hence, a country with a higher discount factor will deviate from the coordinated tax rate only for a significantly higher degree of asymmetry (see Chart 4).

Finally, the impact of governments' discount factors on the sustainability of tax coordination is assessed from the perspective of a small country. The deviation incentive and the discount factor are plotted against different degrees of asymmetry. Chart 5 clearly shows that a higher government discount factor is necessary to sustain tax coordination when countries become more asymmetric. This is explained

Chart 3

Impact of the Coordinated Tax Rate on Coordination Sustainability
(α=0.3; delta=0.8, Aj=1)
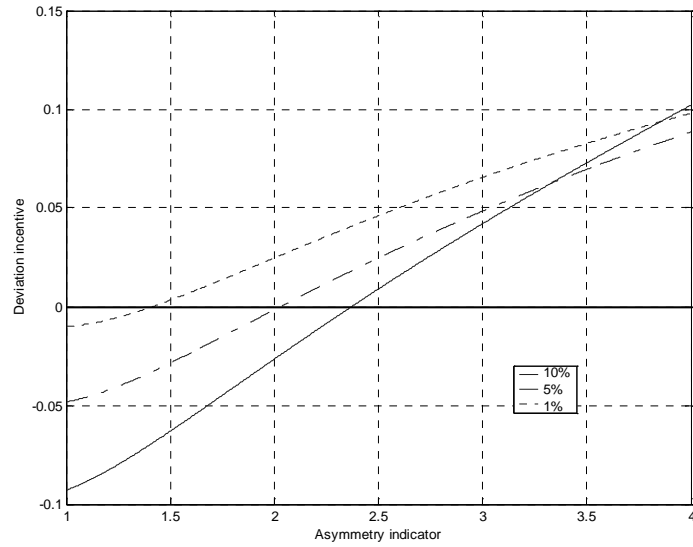
Chart 4

Impact of the Discount Factor on Coordination Sustainability
(α=0.3; t^c=0.9; Aj=1)
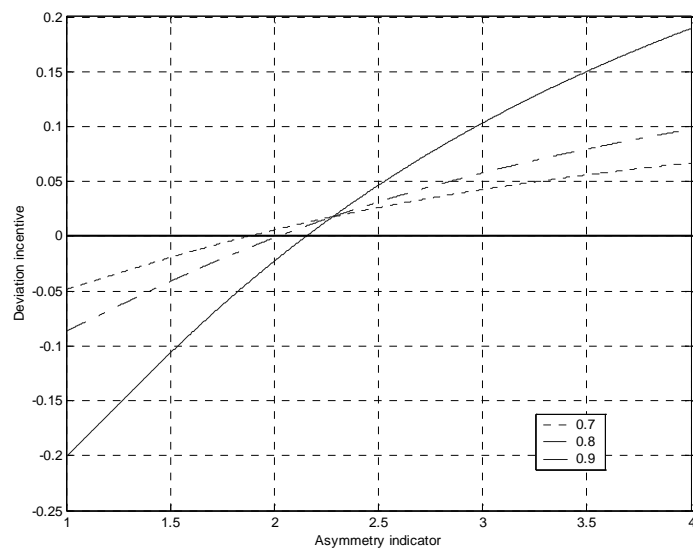
Chart 5

Impact of Asymmetry on Coordination Sustainability
(α=0.3; Aj=1; t^c=0.9)
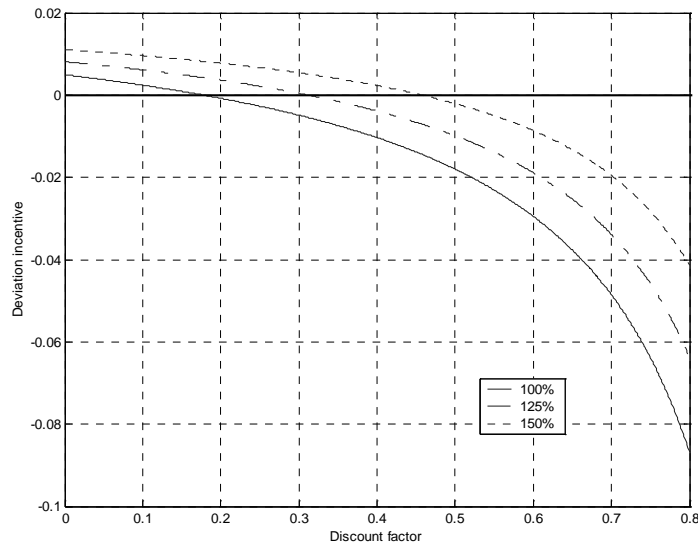
by the fact that more patient governments put a lower weight on the short-run gains stemming from deviation.

4.   Conclusion

Tax harmonisation in Europe is a recurrent debate. While static theoretical models of tax competition traditionally point to the dangers of harmful tax competition, empirical evidence supporting the extreme view of a "race-to-the-bottom" of tax rates remains weak. This suggests that implicit coordination mechanisms may in fact be at work. In this paper, we argued that repeated interactions between policy-makers may be key to reconciling theory with evidence. Repeated interactions and the threat to revert to the unpleasant Nash equilibrium forever may lead to coordination of tax strategies in the absence of a supra-national tax authority such as a federal government.

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TRADE AND TAX POLICY IN THE PRESENCE OF MARKET FAILURES: LESSONS FROM AMERICAN REGIONS

Andrew F. Haughwout[*]

Under what conditions does atomistic behavior between competitive governments lead to efficient industrial location patterns? Is there a call for cross-subsidies between countries which impose different tax rates? In this paper, we address these questions, drawing on the large literature on American metropolitan areas. There is compelling evidence that American regions are linked by a substantial degree of intraregional trade. There have been many papers that propose fiscal equalization and/or tax harmonization policies designed to internalize the fiscal externalities that intraregional trade may create. We study an equilibrium model of a single region, whose separate political jurisdictions are linked by trade in intermediate goods. When the trade linkage is strong in the sense that a downstream economy depends heavily on an upstream good, market failures in the upstream economy lead to the possibility of Pareto-improving fiscal redistributions. But not all such plans yield equal benefits, and we conclude by offering a discussion of the economic features that support fiscal redistributions and the coordination of tax policies.

Introduction

The role of tax harmonization and fiscal competition across countries in a monetary and trade union is receiving much recent attention Europe (Lambertini and Peri, 2001; Baldwin and Krugman, 1998). Yet these issues have a long history in the US, where independent fiscal authorities within regions have long competed for a highly mobile tax base. Recently, research has begun to indicate that in this setting, some forms of cooperation might yield benefits to both (all) jurisdictions.

In the US, it is by now widely accepted that city and suburban economies move together over time, and that the connection is not simply the result of positive correlations between exogenous shocks to the two parts of metropolitan area economies. Instead, it appears that negative shocks that are specific to the city also result in reduced well-being in the suburbs (Haughwout and Inman, 2002a). This form of intraregional interdependency in US metro areas has more general implications for fiscal policy-making in economically integrated areas, and these implications are the subject of the present paper.

It turns out to be difficult to write down a model of regions that is consistent with the observed intraregional competition for economic activity but that also generates the sort of interdependency that has been observed in the data for American regions. Two important features of the model studied here generate intraregional interdependence: non-reproducible production non-convexities in the "core region", and "secondary region" production that relies in a fundamental way on the productivity of the core region's firms. The question we address here is how, and to what extent, these features support fiscal interdependency and fiscal coordination.

The paper is organized as follows: Section I reviews some empirical evidence supportive of the contention that American city and suburban economies tend to move together and briefly discusses some potential structures that could generate these correlations. Taking what we believe to be the essential messages of these studies, and focusing on the one that is most relevant in the regional case, we describe a model of trade-linked regional economies in Section II. Section III discusses the results of a series of fiscal transfer simulations, and Section IV explores the key structural features that generate the benefits we observe. Section V concludes the paper.

Section I
City-Suburban interdependence

We begin by discussing the evidence in favor of fiscal interdependency within American metropolitan regions, and then draw lessons from this experience for the more general problem of fiscal interactions in a world with trade. The notion that American central cities offer something valuable to suburbanites is hardly new; see, for example, Jackson's (1985, chapter 8) review of the arguments in favor of municipal consolidation in the 19th century. The case weakened over time, however, as secondary regions began to develop apparently independent economic bases. By the time that Tiebout's (1956) seminal paper extolling the benefits of fiscal competition was published, the idea that small political jurisdictions' economies were independent of each other was well established. Yet by the Seventies, scholars began to argue that the Tiebout approach obscured some important arguments in favor of metropolitan governance or other forms of financial assistance from suburbs to cities. Among these arguments were three that became particularly relevant.

First, some authors argued that suburbanites "exploited" the city by benefiting from city-produced public goods without contributing to their construction and operation (Neenan, 1970). Theoretically, this kind of direct public good benefit spillover could lead to underprovision of congestible public goods in the city, as city residents equate their own marginal benefit with marginal cost, ignoring the positive externality. Regionalizing public finance could generate contributions for city public goods valued by residents of the suburbs. Yet the solution to this problem is not, in general, intergovernmental transfers: where feasible, user fees and average cost

pricing, charged without regard to residential location, is the most efficient means of allocating congestible public goods.

A second argument sometimes put forward in favor of fiscal transfers in metropolitan areas is based on suburban altruism. If suburbanites value the welfare of the geographically proximate poor, then they might wish higher subsidies to these families than the city chooses to provide (Pauly, 1973). Yet in the US, the primary responsibility for determining the level of transfers to the poor generally resides at the state level and in many states the median voter is a suburbanite. It is not clear that allowing suburbanites directly to choose (and help finance) the level of transfer income received by city poverty households would substantially change the outcomes we currently observe.
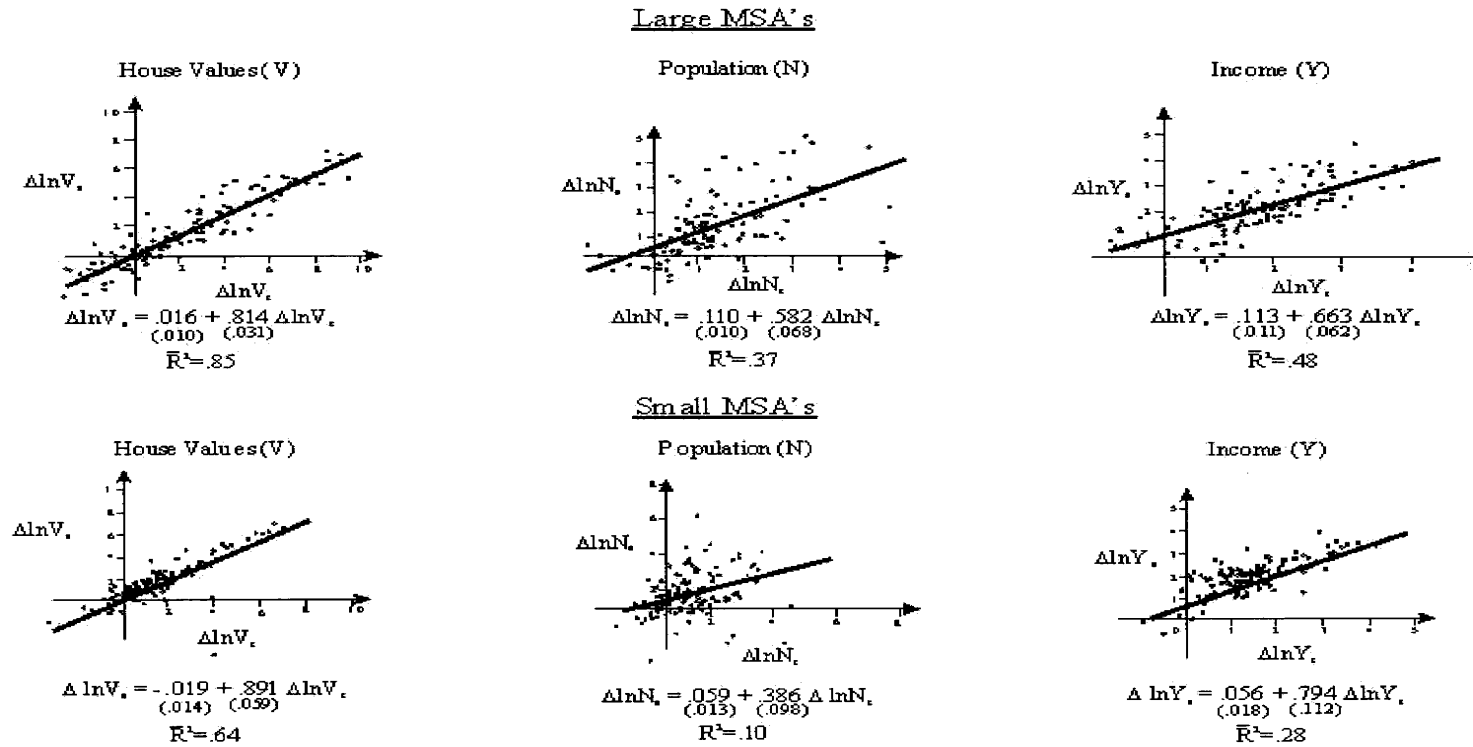
Recent research has returned to the theme, albeit from a perspective quite different from those which dominated the academic literature in the Seventies. Whereas the previous literature had emphasized the competition among jurisdictions, leaving equity and altruism as the primary motivations for suburbanites to make financial contributions to their central cities, the recent literature has explored whether doing so may is in suburbanites' own economic self-interest. The foundation of this argument is a series of recent papers documenting positive correlations between city and suburban economic outcomes.[1] Figure 1 and Table 1 provide some evidence of this relationship which, on its face, suggests that suburbanites may care about what happens in their central city because it has important implications for what happens to them.

While it difficult to uncover a structural relationship by examining simple correlations among outcome variables, the patterns in the table and figure provide some insight into the structure of the relationship between cities and their surrounding suburbs. In particular some features of the data rule out, or at least severely undermine, certain structural explanations. First, growth in both incomes and housing values are positively correlated for city-suburb pairs. Were the appeal of strongly growing central cities based on consumption opportunities or aid packages to the poor valued by suburban households, standard compensating variations logic (Rosen 1979) would imply that suburban incomes would fall in response to improving central city economic health. This is because households will demand higher wages to reside in unattractive locations. If a city offered many attractive consumption opportunities, workers would be willing to accept lower wages if they were to locate in its suburbs. Instead, the raw data suggest that firm productivity is playing an important role in connecting cities and their suburbs (Haughwout, 2002a). If the connection between city and suburb were on the production side, then we would anticipate that positive productivity shocks to the city would raise incomes in both city and suburbs, which is what we observe.

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[1]   See especially Voith (1993, 1998) and Brooks and Summers (no date). A more complete survey is available in Haughwout and Inman (2002).

Figure 1

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City-Suburban Growth Correlations

Large MSA's

House Values(V)

$$\Delta \ln V_s = .016 + .814 \Delta \ln V_c$$
$$(.010) \quad (.031)$$
$$\bar{R}^2 = .85$$

Population (N)

$$\Delta \ln N_s = .110 + .582 \Delta \ln N_c$$
$$(.010) \quad (.068)$$
$$\bar{R}^2 = .37$$

Income (Y)

$$\Delta \ln Y_s = .113 + .663 \Delta \ln Y_c$$
$$(.011) \quad (.062)$$
$$\bar{R}^2 = .48$$

Small MSA's

House Values(V)

$$\Delta \ln V_s = -.019 + .891 \Delta \ln V_c$$
$$(.014) \quad (.059)$$
$$\bar{R}^2 = .64$$

Population (N)

$$\Delta \ln N_s = .059 + .386 \Delta \ln N_c$$
$$(.013) \quad (.098)$$
$$\bar{R}^2 = .10$$

Income (Y)

$$\Delta \ln Y_s = .056 + .794 \Delta \ln Y_c$$
$$(.018) \quad (.112)$$
$$\bar{R}^2 = .28$$

The panels illustrate the relationship between suburban and city home value appreciation, suburban and city population growth, and suburban and city income growth over the decade from 1980 to 1990, both for large and small MSA's. Large MSA's are defined as MSA's whose 1970 population was greater than or equal to 250,000; our sample includes 116 large MSA's. Small MSA's are defined as MSA's whose 1970 population was less than 250,000; our sample includes 128 small MSA's. Also reported are the OLS linear regressions relating city and suburban rates of population and income growth and city and suburban rates of home value appreciation.

Table 1

City and Suburban Correlations

Correlations Between Levels of City and Suburban:			
	Home Values	Populations	Incomes
1970	.311**	.547**	.559**
1980	.554**	.544**	.345**
1990	.696**	.526**	.353**

Correlations Between Growth Rates of City and Suburban:			
	Home Values	Populations	Incomes
1970 to 1980	.712**	.493**	.678**
1980 to 1990	.849**	.420**	.600**

"City" corresponds to the largest central city in each MSA, while "Suburban" corresponds to the balance of the MSA not in the central city. There are 252 MSA's in the full sample. Correlations denoted with an ** are significantly different from zero at the .99 level of confidence.

Source: Haughwout and Inman (2002).

Second, size matters: the income and house value correlations are strongest in large MSAs, which tend to be those with larger central cities.[2] This indicates that the scale at which city production takes place is important in determining how "connected" the city and its suburbs turn out to be. Urban economists have long studied productive agglomeration economies arising from city size or density. Recent work (Rosenthal and Strange, 2001) indicates that the benefits of agglomeration decay rapidly over distance, implying that large, concentrated central business districts of the sort typically found in American central cities may offer distinct productivity advantages over more dispersed geographic patterns of employment.

There are several channels by which stronger growth in a central city could lead to these growth patterns in its suburbs. One is commuting: higher firm productivity in the core of the metropolitan area could raise welfare throughout the area if some workers live outside the center. Voith (1993) shows that this linkage is a significant determinant of suburban housing prices. But we argue that there must

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[2]   The role of city size increases when we examine structural or reduced form models. See Voith (1998) and Haughwout and Inman (2002) for more detail.

be more to the story. The importance of suburb-to-city commuting has clearly diminished significantly over time, while the linkages between city and suburb appears to have remained strong, or possibly even strengthened. This is particularly true in house values, which we have argued elsewhere is the best indicator of fiscally induced changes in local welfare in small open economies (Haughwout and Inman, 2002a; Haughwout, 2002b).

A second possible source of the positive correlations, and the one on which we will focus in the balance of this paper, arises from vertical production linkages. Of the potential structures described here, trade is clearly a primary source of interdependency among larger regions and countries. We specify a model in which the central city offers production advantages that are not readily reproducible in the suburbs. Suburban firms buy inputs from city firms and convert them to finished goods that they sell to suburban consumers. This structure generates interdependence that is consistent with the American data.

While intra-regional trade in the US, particularly in services, is poorly measured, there exists modest empirical evidence in support of this structure. Schwartz (1992), analyzing a survey of suburban employers, finds them to rely quite heavily on producer service providers in their own central city. Haughwout and Inman's (2002a) reduced form analysis of the data for MSA growth between 1980 and 1990 find that indicators of the strength of agglomeration benefits in the core of metropolitan areas are statistically and economically significant determinants of growth in suburban incomes and house values.

We thus propose a structural model of regional economies that incorporates two critical features: a core economy externality that gives it an advantage in production of basic goods and services, and a core-secondary linkage through trade. This structure is, of course, applicable to more general settings than the US metropolitan context. Around the world, many regions and countries are increasingly linked by trade relationships, at least some of which spring from comparative advantage. While in our model the size of the city's advantage is endogenous, it is also inherent in the nature of the city economy. A similar phenomenon might arise from industry-specific skills among a country's labor force, or another form of "built" comparative advantage. The next section provides an overview of the model.

Section II
Model

Our model treats the region as a small, open economy occupying a fixed land area, and facing perfectly elastic supplies of private capital and workers. The land area is broken into two parts with exogenously given boundaries: city (core) and suburban (secondary) areas. We treat each as an independent political jurisdiction housing producers, workers and dependent households. Both jurisdictions provide local public goods, and the core offers an agglomeration externality to producers

located there; there is no agglomeration available in the secondary region. Details of the model are described in Haughwout and Inman (2002a, 2002b).

Private economy

A.   City

City firms buy capital, land, and labor from resident workers and non-resident commuter managers to produce a common consumption good to be sold at constant world price. The composite good may be consumed within the city, by its residents, or exported to the secondary or the wider world market. These firms also benefit from a locally provided all-purpose public good and a positive externality from city employment density. Both are assumed to influence firm production as beneficial Hicks-neutral shifters of the marginal productivities of private inputs. Long run equilibrium requires that firms locating inside the city earn the same profit as those locating elsewhere. Firms pay taxes on the value of their land and capital stocks, on the wages of their managers (see below) and on their revenues.

Working residents living in the city consume three private goods – an all-purpose consumption good, housing structures, and residential land – and the all-purpose pure public good. Work effort by working residents is exogenous; there is no labor-leisure choice in our model. Working residents pay a sales tax on their purchases of the composite consumption good, property taxes on the value of housing capital and land, and a wage tax on their earnings. The long-run equilibrium requires that residents or households living within the city achieve the same level of utility as available to them outside the city.

Commuting managers consume private goods, housing, and land at suburban residential locations. We assume that commuters are able to buy private goods and housing at suburban prices. As noted, to attract these workers into city jobs requires city firms to pay a wage equal to the commuters' suburban wage inclusive of compensation for all (assumed exogenous) disamenities of working within the city – e.g., the city's taxation of commuters' labor income.

The city is assumed to contain a fixed, immobile population of poor and elderly *dependent households* who each receive an exogenous income transfer paid for by the central government and perhaps in part, through local taxation, by the city government as well. Dependent households consume the composite private good, housing, and land and pay taxes on their consumption. They do not pay taxes on their exogenous income transfer. Dependent households also consume the pure public good provided by the city government. We assume dependent households do not move from the city.[3] Since dependent households cannot escape the city, their equilibrium level of utility is endogenous.

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[3]   For evidence that the average welfare household is not very sensitive to fiscal incentives in its location decisions, see Meyer (1999). Epple and Romer (1991) allow for mobile rich and poor households in their model of an open city in a metropolitan economy, but in their model all household incomes are exogenous.

B.   Suburbs

Like the city, the suburbs host a single type of firm, and several different kinds of residents. *Suburban firms* provide retailing services to suburban residents using "unfinished" output purchased from either the central city or from producers outside the metropolitan area. Purchased inputs are combined with resident suburban labor, capital, and land using a nested Cobb Douglas-CES specification. Suburban retailing also benefits from suburban produced public infrastructure.

All suburban residents (including commuters to the city) buy all their private good consumption from suburban "retailers" even though they might actually consume the good within the central city (entertainment; hospital services; legal services).[4] City firms have a transportation cost advantage over non-MSA firms in meeting suburban residents' demand for the common consumption good. In our model, it is this proximity to low cost central city production that makes suburban locations attractive. It is possible that in equilibrium city firms may not be able to supply all suburban demand. In this case the unfinished consumption good is imported by suburban retailers from outside the MSA; transportation costs are necessarily higher for these marginal units. Figure 3 displays the suburban product market under (a) low city exports and (b) high city exports.

All suburban households share city residents' common utility function defined over this single consumption good, housing structures, land, and the locally-produced public good. There are three types of households resident in the suburbs: mobile resident-worker households, who reside in the suburbs and work at suburban retailers at the endogenously determined suburban wage, immobile dependent households, who receive the same exogenous transfer income as city dependent households, and city managers, who work in the city (see above), but consume in the suburbs.

Equilibrium of the private economy

An equilibrium for the private sector of the urban economy requires that several conditions be met:

- Utility of city and suburban mobile resident-workers is the equilibrium level V_0,

- City and suburban firms earn zero economic profits,

- Both the city and suburban land markets clear,

- Both city and suburban labor markets clear.

Our equilibrium concept envisions mobile firms and households submitting "bids" – local land and labor price combinations that would make them willing to locate in the city or suburbs – based on the net fiscal and agglomerative benefits

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4   City residents receive their retailing services directly from city firms as a by-product of city firm production.

available to them in each location. In this, we follow the literature on urban quality of life, pioneered by Rosen (1979) and Roback (1982) and summarized in Gyourko, Tracy and Kahn (1999).

For firms, the zero profit condition yields a downward-sloping iso-profit curve in the local price space, depicted as $\Pi(\cdot) = \Pi_0$ in Figure 2. Household bids, conditional on the relevant local fiscal characteristics are represented by the upward sloping function $V(\cdot) = V_0$ in Figure 2.

The equilibrium local price vector is given by the intersection of the two curves – the land price/wage combination for which both firm and household equilibrium conditions are met. Individual firms and households then take these equilibrium prices, local fiscal policies and employment densities as given. Solutions of firms' problems yield per-unit-output demands for resident labor, managers, land and private capital. City households choose consumption of the composite good, housing capital and land.

Public sector

City and suburban governments produce the pure public good from preexisting public infrastructure stocks net of the costs of remaining principal and
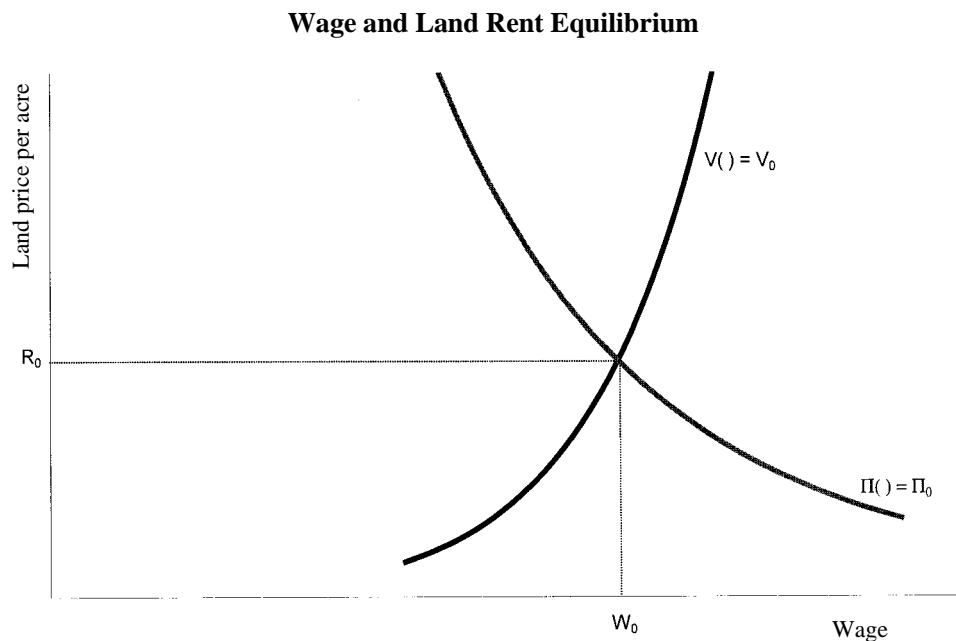
Figure 2

Wage and Land Rent Equilibrium

Figure 3(a)

The Suburban Product Market

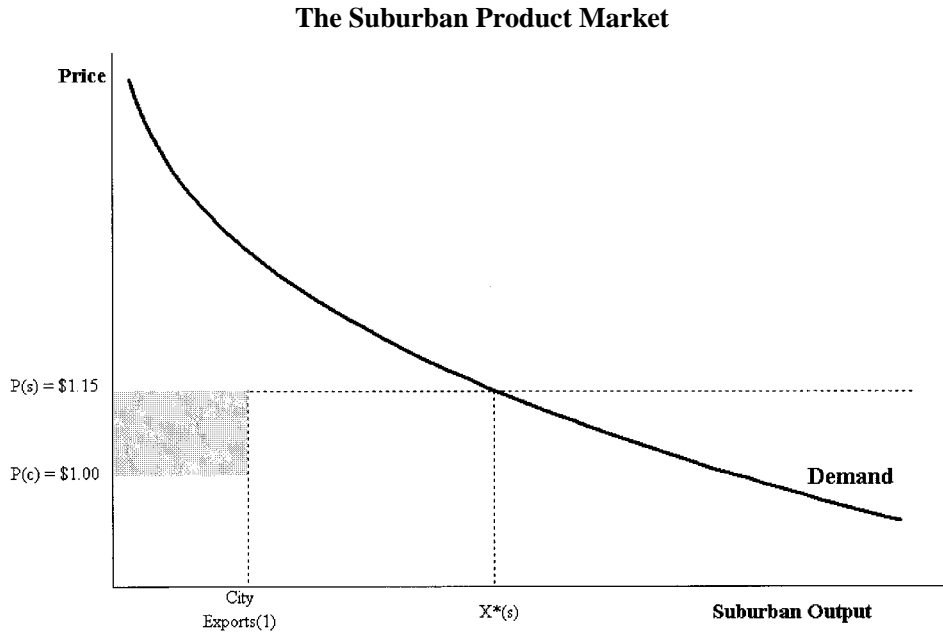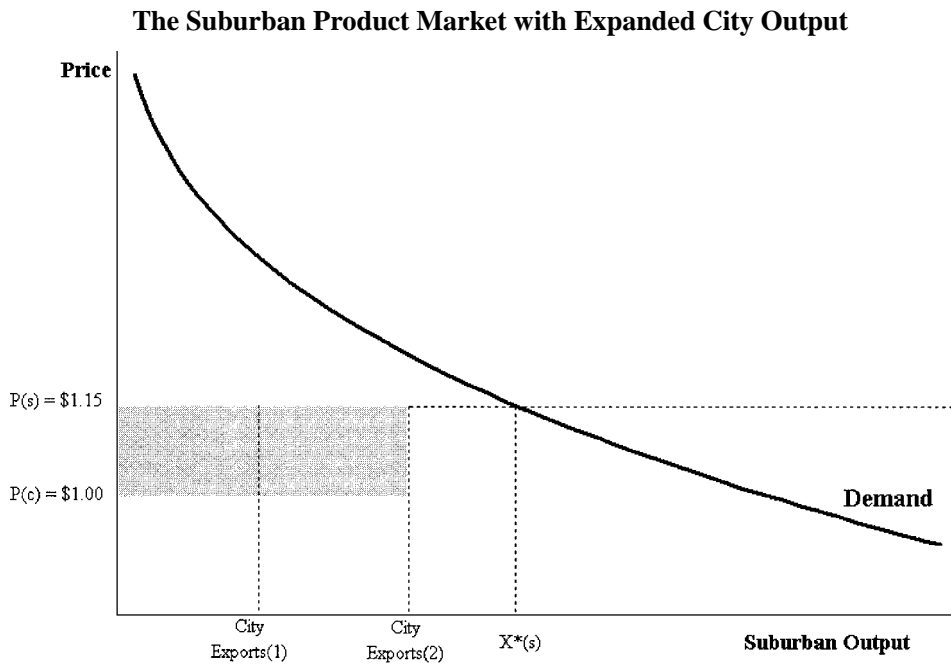**Figure 3(b)**

The Suburban Product Market with Expanded City Output

interest plus additional infrastructure stock that can be purchased from the aggregate revenues made available from locally-generated tax revenues, aid from higher levels of government, revenues earned from existing local public financial assets less payments to city and suburban dependent populations.

In both the city and suburbs the only locally chosen tax rate is the local property tax. City property tax rates are chosen so as to maximize aggregate revenues, while the suburban median voter chooses the utility-maximizing level of and then sets property tax rates so as to produce that level of public spending. If the city also uses a wage, sales, or commuter tax then aggregate city revenues includes revenues from those taxes as well at pre-determined rates.[5]

Section III
Simulating fiscal distributions in a metropolitan area

The model is calibrated to Philadelphia metropolitan area in 1990. Philadelphia City uses a tax on city land and capital, wage tax, a tax on commuters, a sales tax and a tax on firm gross receipts. Suburban governments tax only suburban land and capital.

The solution to the model under the baseline parameters is shown in Table 2.

Note that the starting point for our analysis is the equilibrium defined by the property tax rate that maximize city revenues, and that which maximizes the median (resident-worker) household's welfare. Since Philadelphia's actual 1990 property tax rate was somewhat below the revenue-maximizing rate (2.9 per cent), the city and suburban equilibrium values reported in Table 2 are smaller than the actual data for that year. Haughwout and Inman (2001) report detailed comparisons of the model's results with actual city outcomes.

The model is relatively successful at replicating results from Haughwout and Inman's (2002a) empirical work, as reported in Haughwout and Inman (2002b). In the latter paper, the authors report the results of tests in which the model was used to simulate the effects of changes in city fiscal institutions on the city and suburban economies. These simulations, and their implication that suburban residents have a strong interest in the state of the business climate in the central city, serve as the basis for the analysis that follows.

Here, we offer simulations of a variety of potential suburban aid packages to the City of Philadelphia. These simulations allow us to address two relevant questions. How big is the welfare loss from decentralization when regions are linked by trade? How can it be recovered?

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[5]   In most US cities, the property tax is the primary tax under local control. Other tax rates are often strictly controlled by the state government.

Table 2

Baseline Simulation – Top of Philadelphia's Revenue Hill

	City	*Suburbs*
Output (Billion)	$ 15.8	$ 28.3
Consumption (Billion)	$ 6.7	$ 28.3
Land value ($ per acre)	$ 423,317	$ 19,752
Wages	$ 33,120	$ 27,090
Commuter/Manager wage	$ 140,081	-
Population	946,913	1,652,498
Jobs	339,091	406,036
Resident	222,357	406,036
Commuter	116,734	-
Property tax rate	2.90%	1.55%

Since the model is calibrated to a particular set of values, we confine the analysis to modest changes around the baseline described in Table 2. We describe four sets of simulations involving suburban subsidies designed to:

- Relieve the fiscal burden of city poverty,
- Provide general purpose aid to the city government,
- Reduce the burden of capital taxes on city firms,
- Reduce the burden of capital taxes on city households.

In the baseline, Philadelphia pays 9.5 per cent of the annual cost of transfers to city dependent households. This cost raises city tax prices of both firms and households, reducing the equilibrium size of the city (Haughwout and Inman, 2001). In 1990, this mandate cost the city $182 million per year. We simulate the effect of three levels of suburban subsidy for this burden, with the suburbs funding 50, 75 and 100 per cent of its cost. Provision of this subsidy to the city reduces public good availability in the suburbs, taxes constant, by between $1.8 (=$91M/0.05) and $3.6 billion (=$182M/0.05). This reduction in suburban public goods induces an initial decline in suburban land values of about $900 per acre for the case in which suburbanites shoulder 100 per cent of the city's share of the transfer payment. But provision of the subsidy allows the city to provide additional public infrastructure, increasing its steady state employment, output and population. This increase in city size provides benefits to suburbanites by increasing the availability of the

Table 3

Simulating Suburban Aid to the Central City
(Philadelphia, 1990)

	Aggregate annual cost ($ million)	Annual cost per household ($)	Δ Suburban Land value ($ per acre)	Δ Suburban House price ($)	Aggregate suburban benefit (net) ($ million)
1. Reducing city Ψ (Baseline value: 9.5%)					
to 4.75%	91.0	142.5	155.4	365.9	156.7
to 2.38%	136.4	213.1	290.2	664.1	292.5
to 0.0%	181.9	292.4	900.7	1,120.0	908.1
2. Increasing city Z (Baseline value: $2.1 billion per year)					
to $2.205 billion (5% addition)	103.6	161.3	448.3	539.4	452.0
to $2.31 billion (10% addition)	207.2	320.0	778.3	1,218.1	784.7
to $2.62 billion (20% addition)	414.4	628.9	448.3	2,581.7	1,556.1
3. Reducing business capital subject to city p-tax (Baseline value: 75%)					
to 50%	250.7	282.9	22,731.7	13,846.2	22,918.8
to 25%	501.5	351.2	167,781.2	33,915.4	169,161.9
4. Reducing residential capital subject to city p-tax (Baseline value: 100%)					
to 75%	187.3	297.0	−353.3	122.0	−356.2
to 50%	374.6	599.6	−748.1	252.7	−754.3

city-produced export good. These benefits, like the cost of reduced suburban public good availability, are capitalized into suburban land values. The final results, displayed in the first panel of Table 3, indicate that this policy change would result in *net* benefits for suburban residents (measured as changes in the aggregate value of suburban land) ranging from $156 to $908 million, or between $150 and $900 per acre.[6] These land value changes represent about 1 to 5 per cent increases over the baseline value of suburban land.

In our model, aid from other governments is an important source of funding for city and suburban public good provision. Another policy option for suburban residents would thus be to offer general purpose aid to their central city. Essentially, this entails diverting aid from the suburban to the city's treasury. We simulate three sets of general suburb-city aid packages representing 5, 10 and 20 per cent increases over the 1990 level of aid received by the city. The cost of these transfers and their net effect on suburban land values are reported in the second panel of Table 3. The results are strikingly similar to those in the first panel. Both policies allow city government substantial autonomy in how it spends the proceeds of the subsidy provided by suburban residents. Our assumptions about city political economy, that the city always moves to the top of its revenue hill, yield this effect. This means that general or specific suburban subsidies to the city will result in increased spending (public good provision) by city government.

An alternative policy design would be for suburbanites to provide more precisely targeted subsidies to the city. The primary concern of suburban landowners in our model is the city's productive capacity, which affects suburban well-being through trade linkages. Suburban residents might thus choose a policy that directly targets city firms, rather than both households and firms, when designing a subsidy program.

In our baseline simulation, Philadelphia is assumed to tax 75 per cent of the productive capital located in the city. This assumption reflects the fact that machinery and other mobile capital are not taxed under the Philadelphia system, but firm land and structures are. The third panel of Table 3 shows the suburban effects of extending this business property tax abatement to a larger share of the city's productive capital stock. Targeting aid to city firms produces benefits that are far more substantial than those yielded by more general forms of assistance. For similar costs, subsidies to city firms offer benefits that are orders of magnitude larger than those provided by general aid packages. Even a relatively modest aid package of $251 million per year ($283 per family in equilibrium) is simulated to double suburban land values. The source of these increases is, of course, enormous gains in the productive environment of the central city. The initial gains are reinforced by

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[6] Matters are less promising when the suburbs directly subsidize dependent residents' incomes. In this case, city dependent households consume more land, reducing the space available for production and diminishing the size of the suburban "proximity dividend". Such transfers *reduce* equilibrium suburban land values, offering negative returns.

increases in public good availability and agglomeration economies. In equilibrium, city output doubles when suburbanites subsidize city capital formation in this way.

For purposes of comparison, we return the taxation of productive capital to its baseline value, and simulate the effect of a similar subsidy to housing capital. In the baseline, housing capital is fully taxable. The final panel of Table 3 shows the results of allowing households to exempt 25 and 50 per cent from the property tax. The example is instructive, if only about the model we have built. In these simulations, the city is better off: city land values rise 4 per cent when households can exclude 50 per cent of their housing capital from the city property tax. City population and employment rise by similar amounts. Yet suburban residents are made moderately *worse* off. The cost of the program to suburban residents is relatively high ($600 per family per year in the new equilibrium) but its structure does not promote those elements of the city economy that provide benefits to suburbanites. While reducing to 50 per cent the share of *productive* capital subject to the city property tax results in a doubling of city output, doing the same for *residential* capital results in just a 3 per cent increase to the same measure. This is simply not enough of a benefit to compensate potential residents for the lost suburban public services, and bids for suburban land decline.

Section IV
Fiscal allocations in trade-linked regions

Typically, arguments in favor of fiscal and tax harmonization are made on the basis of macroeconomic policy making. Here we have derived a set of microeconomic circumstances in which small open economies, linked by trade, may find it in their interest to engage in some forms of fiscal cooperation.

The results reported above are from a model designed to replicate empirical results from US metropolitan areas. Are they instructive for other kinds of regions? We believe that they are. There are several key features of the above model that generate the possibility of Pareto-improving fiscal redistributions in metropolitan areas. These features include:

- A high degree of production-side interdependence between the core (city) and secondary (suburban) areas.

- A productive externality within the core economy that yields increasing returns to scale at the regional level. In the present model, the two sources of such non-convexities are an agglomeration externality and a fixed preexisting public infrastructure stock.

- Distortionary taxation and redistributive fiscal policy in both areas. These features are particularly costly in the core economy and their costs are transmitted to the secondary economy through the trade linkage.

These features, particularly the fiscal aspects, characterize many kinds of regions other than US metropolitan areas. Durable local public goods and

distortionary taxation, for example, are prevalent features of virtually all economies. The externality described here as an urban agglomeration economy is a form of spatially constrained knowledge and information dissemination (see Glaeser *et al.,* 1992, Rosenthal and Strange, 2001), a general market imperfection described in many contexts (see, for example, Comin and Hobijn, forthcoming).

The trade linkage in the model deserves more attention than is possible in the current paper, but may be important to the results here. As structured, secondary economy firms are completely dependent on trade; without the unfinished good produced in the core region they cannot produce. This feature is formalized by a very low elasticity of substitution ($\varepsilon=.001$) between unfinished output and the labor-capital-land composite input in the secondary region. In addition, we provide the core economy of our region with a significant cost advantage over other producing regions. In the model, this trait is represented by the additional 15 per cent cost of unfinished output imported from other regions. While these assumptions are appropriate in the context of the US, as is evidenced by the ability of the model to replicate empirical results from American metropolitan areas, it is likely that alternative specifications are appropriate for other kinds of regions.

Preliminary experimentation with the substitution elasticity indicates that while the interdependence of the core and secondary economy is *qualitatively* robust to significant increases in the ability of secondary economy firms to produce in its absence, the scope for Pareto-improving fiscal redistributions is somewhat reduced. Further study of this issue, as well as analysis of the sensitivity of the results to the unfinished output cost differential discussed above, are required before more definitive statements about the microfoundations of fiscal policy in the presence of trade linkages can be made.

Section V
Conclusion

The results in Table 3 indicate that a plausible structural model can generate the kinds of city-suburban outcome correlations that have been observed in the Census data for metropolitan areas. They also lend credence to the view that some kinds of modest suburb-city fiscal redistributions could raise welfare in all parts of the metropolitan areas. Three of the four sets of simulations reported in Table 3, for example, result in net land value increases in the suburbs.

In addition, we find that suburban transfers that directly subsidize city productive capital accumulation (or, more precisely, reduce the distortion introduced by city capital taxation) are considerably more effective at raising suburban land values than policies that ultimately result in more city spending or attract more residential capital. Indeed, reducing the effective tax rate by on city productive capital is simulated to double suburban land values, with similar increases for suburban house values. These are large benefits indeed, and contrast sharply with the negative returns produced by reducing residential capital taxation.

These results are, of course, produced by a single model with a very specific structure. While most of the model's features are fairly general, the dependence of the suburban economy on its local central city is perhaps peculiar to American metropolitan areas. Future research might pursue the importance of these assumptions, and study whether alternative structures that are able to replicate empirical correlations across other types of regions will also generate similar policy implications.

Nonetheless, some conclusions are supported by the results reported here. In particular, the presence of trade linkages between regions complicates the case for the decentralization of fiscal responsibilities. The dependence of producers in one region on the productivity of those in another creates a fiscal externality that limits the ability of the Tiebout mechanism to generate socially efficient outcomes. This situation need not require intervention by higher levels of government. Instead, Coasean bargaining among the affected regions, with suitable attention to institutional design so as to eliminate free riding, can achieve significant welfare gains. Such arrangements, as they benefit all parties involved, will likely be more durable than those based on altruism alone.

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WELFARE EFFECTS OF TAXATION OF INCOME FROM CAPITAL

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Introduction

Is taxation of capital income inefficient? And if so, why do democratic governments persist with such taxation? In this paper, we evaluate the likely impact of capital taxation in the United Kingdom. The theoretical argument displaying the overall inefficiency of capital taxation is made by Chamley (1986). If individuals have infinite planning horizons, and face complete, competitive markets, government expenditures should not be financed by the taxation of capital income. These taxes discourage capital accumulation, and lower aggregate income and wages. The same level of expenditure is better financed by taxing wages directly. Lucas (1990) made a forceful case by demonstrating the quantitative impact of actual capital taxation in the US. More recently, Cooley & Ohanian (1997) evaluate the impact of substantial taxation of capital in the UK during and after the Second World War. They find that, compared with a tax-smoothing policy, the actual pattern of tax rates reduced welfare by about 2 per cent although this rises to 3 per cent if it is assumed that the growth rate is completely endogenous. They do not look at the welfare cost of the actual policy compared to the alternative of no tax on income from capital.

The theoretical argument that income from capital should not be taxed needs many assumptions: that households have infinite, or at least very long planning horizons, and that markets are complete, allowing them to borrow and lend any amount, and insure against every contingency in the indefinite future. The argument delivers, in turn, a very strong conclusion indeed, that capital taxes make everyone worse off, *i.e.* that they are Pareto-inefficient. Actual economies – including that of the UK – are unlikely to satisfy all these assumptions, or allow such an unequivocal comparison. Imperfections in capital markets can overturn the theoretical result. Individuals who are unable to borrow may save too much; Aiyagari (1995) shows that capital taxation may correct the resulting dynamic inefficiency. This suggests that capital taxation may not be inefficient, after all, but does not justify the levels of taxation that we observe. Imrohoroglu (1998) conducts a quantitative analysis, in an economy where individuals cannot fully insure against the risk of unemployment. In a model calibrated to mimic the US economy, he shows that a 10 per cent tax on capital income maximizes average welfare, and that this is unrelated to dynamic

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inefficiency. By implication, questions of Pareto-efficiency are immaterial in empirically relevant worlds. Taxing capital, rather than labour income, redistributes wealth, consumption, and welfare. Societies have to judge the extent to which these redistributions are desirable.

In this paper, we ask what are the likely effects of capital taxation in an economy calibrated to mimic the UK? We evaluate aggregate effects – on output, and capital accumulation, as well as the distributional effects.

1.   The effects of taxing capital income

The economic argument against capital taxation is simple, and intuitive. Imagine that individuals are infinitely lived, and can save or borrow to smooth their consumption. At the steady state of the neo-classical growth model, the rate of return on capital must equal the rate at which individuals discount the future. A tax on capital income is distortionary because it drives a wedge between the two. In response, the level of capital stock must fall. This decline in capital stock lowers aggregate output, wages, and consumption levels permanently, and this is the source of its inefficiency.

The argument may fail in the presence of one, or another departure from the assumptions. We feel that two institutional features are important in this situation: the welfare state, and borrowing constraints on individuals. The provision of social benefits associated with a welfare state can change the incentive to save and thus affect the distributional effects of taxation of capital income: for example, Feldstein (1978) points to the effect of state pensions, and Zeldes (1989) to the effect of free medical care for the elderly. If such benefits are available at flat rates, they affect the saving of poor people more than rich people. A tax on income from capital is redistributive and favoured by those for whom social benefits are particularly important.

If households are unable to borrow against future earnings to finance current consumption levels or tax payments, the taxation of capital rather than labour income redistributes from the young to the old: in effect, it allows individuals the opportunity to postpone their tax payments. This is beneficial if borrowing constraints bind. They are likely to do so if the age-earnings profile is steep, in the manner described by Mincer (1974). The argument is much the same as that made by Aiyagari (1995) in the context of infinitely lived consumers. It has yet more force if individuals have finite lives. In an overlapping generations economy, as we consider, a realistic age-earnings profile for individuals is consistent with stationary production possibilities in the aggregate economy.

So, in the presence of state benefits, the poor are likely to want capital taxes; and in the presence of borrowing constraints, the young would agree. At this point, it is tempting to quote Lucas (1990), who displays one, or perhaps both features, in saying: "When I left graduate school in 1963, I believed that the single most desirable change in the US tax structure would be the taxation of capital gains as

ordinary income. I now believe that neither capital gains nor any of the income from capital should be taxed at all."

In the Ramsey model studied by Chamley, the representative individual does not change his mind. In the environment we analyze, individuals prefer capital taxes when they are young, and change their view with age, particularly so if they have a large positive shock to their earning power. The model allows us to assess these issues affecting the taxation of income from capital in terms of its effect on the welfare of the population currently alive and the lifetime welfare of the young. We begin with an account of the taxation of income from capital in the United Kingdom and then proceed to set out our model and to investigate the effects of capital income taxation.

2.   Taxation of income from capital in the United Kingdom

In the mid-Thirties profits, dividends and interest were taxed on the grounds that they were income. A tax on excess profits had been imposed during the First World War but it was abolished in 1928. Two taxes were levied on high incomes, Income Tax and Surtax. The maximum rate of the two together was 50-55 per cent, levied on incomes above £50,000 p.a. (£1.65m in today's spending power). While high tax rates were criticized for their disincentive effects, we have not been able to find any early indication of the modern criticism of taxes on income from capital – that they are regressed onto labour and drive a wedge between the rate of return and the rate of time preference.

In 1937 Mr Chamberlain, then Chancellor of the Exchequer, announced a National Defence Contribution intended to raise £20-25m towards the cost of the government's rearmament programme. The initial proposal was extremely complicated, but intended to be levied on profits arising from the armament programme itself. The tax was welcomed from unexpected quarters. Sir Stafford Cripps, an austere Socialist who was Britain's wartime ambassador in Moscow and Chancellor of the Exchequer from 1947-50 commented (Cripps 1937): "This little start that he has made here can be the beginning of a form of taxation which will enable us to terminate the capitalist system much earlier than we should otherwise be able to do."

But the proposed tax led to substantial criticism from many Members, most notably from Mr. Churchill (Churchill, 1937) who argued that it was reasonable for Parliament to tax income but wrong for it to tax different types of income differently. Mr Chamberlain became Prime Minister while the budget was passing through Parliament. His successor, Sir John Simon, replaced Chamberlain's proposal with a tax of 5 per cent on all profits above £12,000 with lower rates on smaller amounts of profit. This was levied on profits net of interest payments but gross of dividends. Thus, until 1937, high taxes on profits arose only to the extent that those profits accrued to individuals facing high rates of surtax. The 1937 tax was the first step towards very high general taxation of income from profit from

1939 onwards. The last budget before the Second World War (27 April 1939) saw the introduction of an Armaments Profit Duty as a second attempt to recoup excess profits resulting from arms spending. An Excess Profits Tax was also introduced to put the government in a position to recoup any abnormal profits, assumed to arise from war. 60 per cent of profits above those earned in 1937, and reported in 1938 were to be paid in tax. The first wartime budget, on 27th September 1939 saw the rate of income tax raised to 37.5 per cent and the top rate of tax, taking income tax and surtax together, set at 85 per cent. Far from this being a Keynesian policy as suggested by Cooley and Ohanian, Sabine (1970) records: "The Chancellor could have turned to Keynes but it was quite clear the country was not receptive enough to his proposals".

Sabine was referring to the post-war credits, introduced later, but his comment supports the notion that there was nothing particularly Keynesian about trying to finance the war from taxation as far as was possible. The first Keynesian Budget came in 1941. The Chancellor, Sir Kingsley Wood, spoke not just about the need to pay for government spending but about the overall state of demand relative to supply in the economy as a whole. The budget saw the income tax rate raised to 50 per cent with a maximum overall rate, including surtax, of 97.5 per cent.

Looking at the debate about the taxation of profits and taxation in general in this period, it is plain that the notion of levying taxation, rather than relying on inflationary finance, in order to pay for government spending was widely supported throughout the House. There was some concern that the Excess Profits Tax whose rate was raised to 100 per cent on 22nd May 1940 would lead to inefficiency. Firms had no incentive to control their costs if the whole of any saving accrued to the Government. But it is easy to understand why there was little debate when it was imposed. It came in as part of an Act which passed hurriedly through Parliament on the day that German troops reached Boulogne and as the full scale of the catastrophe in France became apparent. The Act included the power to require "persons to place themselves, their services and their property at the disposal of His Majesty. for securing the defence of the Realm. or the efficient prosecution of any war in which His Majesty may be engaged".

The war situation handicapped discussion of economic issues. In the brief debate on the Excess Profits Tax it was suggested moral suasion would be enough to prevent waste.

A contemporary view of taxation of profit is offered by Hicks, Hicks and Rostas (1941)[p. 43]. They argue: "All taxes on profits have some adverse effect on the efficiency of production... But since taxes have to be raised… this general restrictive effect of taxation is usually (and properly) regarded as a minor consideration. The restrictive effect of excess profits tax is, however more considerable. Excess profits taxes, where the rate of tax is from 20 to 50 per cent are innocuous as compared with taxes where the rate is 60 to 80 per cent. A 100 per cent tax is... beyond all question, very dangerous indeed".

They also noted, that, as compared with the First World War "Industry has learned to bear more and Labour to ask it".

Later on in the text their view on distortionary taxation seemed to have changed somewhat. We read: "The effect of high income taxation of the willingness of the businessman to bear additional risks... is a much more serious matter than its effect upon the supply of labour" (p. 192).

But the authors were concerned about the effect of taxation on the "equity premium" that may be required over and above the interest costs of financing marginal capital and not about the effects of any wedge between the rate of interest and the rate of time preference. It is plain that, from 1941 onwards profits were taxed very heavily. This was, in the main, a consequence of the very high level of general taxation which was regarded as a better means of paying for the war either than inflationary finance or a greater reliance on borrowing. Such a view was the conventional fiscal orthodoxy rather than, as Cooley & Ohanian (1997) suggest, a Keynesian innovation. Nevertheless an element of fiscal drag operated which much increased the average tax burden on profits.

Normal profits, and therefore excess profits were defined in nominal terms. Prices rose by 56 per cent between 1939 and 1945, while the various tax bands were not adjusted and the Excess Profits Tax continued to be calculated with reference to nominal pre-war profits. Thus a powerful fiscal drag raised the rate of widening the scope of the Excess Profits Tax and, at the same time brought more people into the various tax nets. This raised both the average and the marginal rates of tax on all types of income.

Taxes paid by companies had risen from £88mn in 1938, and £325mn in 1941 to £634mn in 1946 while gross trading profits rose from £673mn in 1938 to £1,202mn in 1941 and £1,484mn in 1946. Taxes paid by the personal sector rose from £295mn in 1938 to £1,053mn in 1946, while personal sector income rose from £4,601mn to £7,443mn. Thus the effect of the fiscal drag was to increase the tax burden on the corporate sector disproportionately, particularly after 1941. There is no reason to believe that the Conservative inventor of the Excess Profits Tax realized what effect it would have. During the period before the Second World War prices had fallen from 1922 to 1933 and people did not think in terms of inflation. Thus nowhere in the debate on the Excess Profit Tax is it suggested that the base for the tax should be calculated after adjusting peacetime profit levels for changes to the value of money. There is a very marked contrast with 1977 when an amendment to the Finance Bill required the Government to index tax allowances to the Retail Price Index.

The first proposals for the shape of the post-war environment, due to Beveridge (1942), formed the core of both parties' proposals in the 1945 General Election, suggesting that, whatever the outcome of the Election, public spending would have been much higher after the War than it had been in the Thirties. A separate, and less foreseen factor behind public spending was the need to maintain a high level of peacetime defence spending; this reached 9 per cent of GDP during the

Korean War. That the root of continued high taxation lay in the new spending programme rather than the consequences of war finance may be seen from the fact that between 1936 and 1948 debt interest slightly more than doubled (from £223m to £507m) while consumption of goods and services rose from £252m to £1,265m with a smaller increase in transfers to persons. With a higher level of spending it was natural to develop a tax structure which took as its starting point the framework left over from the war. The problems of the Excess Profits Tax were, however addressed at an early stage. In September 1945 Dr Dalton, the Chancellor of the Exchequer in the Labour government, reduced the rate to 60 per cent. At the end of 1946 the Excess Profits Tax was abolished, and the National Defence Contribution was renamed the profits tax. In this regime, which lasted until 1952, companies paid tax on their profits at a rate which was fixed initially at 25 per cent on distributed profits and 10 per cent on undistributed profits. Income tax was payable at the standard rate (45 per cent rising to 47.5 per cent in 1951) on the residue after the profits tax had been paid. Recipients of distributed profits were allowed to offset the income tax, but not the profits tax against their own tax liability. The maximum rate tax rate on individual incomes remained at 97.5 per cent until 1952. In 1949 the rate of profit tax on undistributed profits was raised to 30 per cent with a further increase to 50 per cent in 1951. The rate on undistributed profits remained at 10 per cent throughout this period. True to form, the Conservative government, which came to power in 1951, imposed a new Excess Profits Levy in 1952. This amounted to a levy of 30 per cent on an average of profits calculated for 1947-49, but limited to a total of 15 per cent of taxable profits. It was not allowed as an expense when assessing either income tax or the standard profits tax. However, the tax was abolished at the end of 1953. In 1952 the tax structure was reformed. The tax rate was reduced to 22.5 per cent on undistributed profits and 2.5 per cent on distributed profits, but income tax was calculated on the amount gross rather than net of profit tax. Thus the total corporate tax bill on £1 of distributed profits fell from 72.5p to 67.5p, but the income tax component, which could be offset against personal tax, rose from 22.5p to 45p. The tax rate on undistributed profits fell from 50.5 per cent to 47.5 per cent.

The rate of profit tax levied on distributed profits was raised to 27.5 per cent in 1955 and 30 per cent in 1956, with the rate on undistributed profits rising from 2.5 per cent to 3 per cent in 1956. From 1958 a uniform rate of profits tax of 10 per cent was imposed. This was raised to 12.5 per cent in 1960 and 15 per cent in 1961. However, during this period, the standard rate of income tax was gradually reduced to 38.75 per cent, so that in 1961 the total tax charge on corporate profits, whether distributed or not, was 53.75 per cent; the income tax component could be set off against personal taxation. The maximum rate of surtax remained at 50 per cent on incomes above £15,000, so that a top rate tax payer who received a dividend would pay a total tax of just over 90 per cent on it (15 per cent profits tax and then 88.75 per cent income and surtax on the residue).

In 1965 the combined profits and income tax regime was replaced by one of corporation tax, levied on profits at 40 per cent (rising to 42.5 per cent in 1957 and 45 per cent in 1968) whether they were distributed or not. Dividends were treated as paid net of income tax but, until 1973, there was no tax credit, so that recipients of

dividends who did not pay income tax (most notably pension funds) were unable to recoup any of the corporation tax paid on their behalf. In 1973 a tax credit, equivalent to income tax at the standard rate was imputed. The high rates of tax on personal incomes remained in force until 1979 although the tax structure changed considerably. In 1967 a one-off "special charge" was imposed on investment incomes. The charge was 45 per cent on incomes of £8,000 or more, paid in addition to the income tax of 41.25 per cent and surtax of 50 per cent. It was, in effect, a tax on wealth. The Conservative government, which came to power in 1970, consolidated income tax and surtax, with a maximum combined rate of 75 per cent. Labour, returning in 1974, raised this to 83 per cent with an investment income surcharge of 15 per cent. But when the Conservatives regained office, in 1979, they set a maximum tax rate to 60 per cent which was reduced to 40 per cent in 1989. The view that high tax rates were a damaging way of raising revenue became a cross-party consensus. The Labour Government of 1997 did not revive of high tax rates. The Corporation Tax structure was, however, changed once again, with a lower tax rate (of 30 per cent). At the same time imputed tax credits were reduced to 10 per cent on payments to individuals and abolished on payments to pension funds, although dividends paid out of post-tax corporate income were again regarded as having had tax paid on them at the standard rate. This change did not affect most individual tax payers, but it did mean that pension funds and others which were exempt from income tax were unable to reclaim any tax credits.

Table 1

Tax Rates on Income from Labour and Capital in the United Kingdom, 1946

	Tax Rate on Labour Income	Tax Rate on Income from Capital
1946	11.7%	45.2%
1950	12.2%	37.3%
1960	13.9%	23.2%
1970	22.7%	29.3%
1980	25.6%	17.3%
1990	29.6%	18.8%
1995	28%	15.2%

The figures are calculated from data in successive editions of National Income and Expenditure. They are approximate only because a number of assumptions had to be made in their calculation. All trading incomes are treated as income from capital as is the tax levied on them although national insurance contributions paid by the self-employed are treated as a tax paid by labour. The Council Tax and its predecessor, the Community Charge (the Poll Tax), which are regarded as direct taxes, replaced domestic rates, which were an indirect tax in the Eighties. These taxes have been excluded from the total revenue of direct taxes when calculating the figures for 1990 and 1995. Taxes on expenditure are excluded completely from the calculations.

Thus the overall picture is one in which very high rates of tax on income from capital, both on average and at the margin, were established in the Second World War, but building on a framework in which there were already high marginal tax rates levied on individuals with high incomes. Table 1 provides a guide as to how rates of tax on income from labour and capital have changed since the Second World War. We now describe the model we need to look at the factors which might influence people's choices between labour income and capital income taxation in a situation where a given amount of revenue needs to be raised.

3.   The General Equilibrium Model

The model used to understand the factors influencing the setting of tax rates on income from capital is a generalization of the overlapping generations economy described by Diamond (1965). Its structure is similar to the model that Huggett (1996) used to show that a lifecycle economy can replicate most of the salient features of the US economy and in particular its wealth distribution. Our model is described in detail in Sefton, Dutta & Weale (1998) and the numerical solution algorithm in Sefton (2000). It incorporates all the principal factors that can affect individuals' saving behaviour; uninsurable income risk, wealth constraints, retirement, state pensions, bequest motives and an annuity market.

3.1   The population

The economy consists of 5000 households. We treat the household as the basic economic unit, and describe its life span and composition. Each household begins life at $\tau=0$ and consists of a man and a woman who are both 20 years old. The household dies when the second of the spouses dies and it is immediately succeeded by a successor household consisting of two twenty-year olds.[1] The life of each adult is uncertain, but we assume that the maximum age of each spouse is 90 ($\tau=70$). We denote the conditional probability of the household dying at the end of period τ given that it has survived to the beginning of that period as ψ_τ implying of course that $\psi_{70}=1$.[2] It follows that the probability that a household will survive another i years from period τ, $\varphi_{\tau,i}$, is simply the cumulative product of the conditional probabilities $\varphi_{\tau,i} = \prod^{\tau+i-1}_{j=\tau} (1 - \psi_j)$.

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[1]   This convenient mechanism thus assumes that the successor household is comprised from two children who are both twenty at the time of the household's death, whether this be when the second spouse is 25 or 90.

[2]   These probabilities were estimated from the UK life tables; we consider both the mortality rates found in the life tables from 1952-54 and for 1991-93. As both the male and female adults are aged 20 when the household starts, we estimated the conditional probability ψ_r as the probability that both adults had died after τ years, but at least one of them has been living at $\tau - 1$ years.

Table 2

The Values of the Demographic Constants Used in the Model

Household age at end of period	Year	5	10	15	20	25	30	35
Age of Adults		25	30	35	40	45	50	55
P(dying) at period end	1991	0	0	0	0	0	0.001	0.002
Average Age of Adults	1991	2	1.994	1.988	1.98	1.963	1.953	1.927
Average Number of Children	1991	0.137	0.579	1.161	1.589	1.471	0.977	0.429
McClements Family Size	1991	1.003	1.051	1.155	1.284	1.359	1.3	1.152
Household age at end of period		40	45	50	55	60	65	70
Age of Adults		60	65	70	75	80	85	90
P(dying) at period end	1991	0.006	0.016	0.04	0.087	0.173	0.313	1
Average Age of Adults	1991	1.884	1.817	1.715	1.581	1.427	1.273	1.142
Average Number of Children	1991	0.107	0.011	0	0	0	0	0
McClements Family Size	1991	1.017	0.939	0.89	0.837	0.777	0.716	0.665

The Before Housing Costs McClements equivalent scale is used by the UK Department of Social Security in all their Household income statistics. The scale is normalised so that a two adult household has a value of one. To calculate the score add the following scores: 0.61 for the first adult, 0.39 for the second, and for each dependent aged 0-1 add 0.09, aged 2-4 add 0.18, aged 5-7 add 0.21, aged 8-10 add 0.23, aged 11-12 add 0.25, aged 13-15 add 0.27 and for each dependent over 16 add 0.36.

During its existence the size of the household varies for two reasons. First because children are born and secondly because one of the spouses may die. We use figures for the number of children belonging to mothers of different ages to calculate the number of children in each household as a function of the age of the latter. In order to do this, we assumed that no child ever dies and every child leaves home at 19. Secondly, from the life tables we can calculate the average number of adults as a property of the age of each household. We then convert the number of adults and children in each household to an adult equivalent using the standard McClements scale to take account of economies of scale in household management; this scale is summarised in Table 2. We denote the McClements equivalent size of the household at age τ as m_τ. This effective household size influences the utility that the household derives from any particular level of consumption. But we also need to keep track of

the number of adults in each household in order to assess voters' preferences. This depends on the mortality rates of the men and women who can make up the adult component of the household. But in the cases we examine there are just under 9000 adults in the population.

To ensure that the population of households stays constant, we assume that on a death of a household a descendent household is born immediately. This descendent household inherits not only the remaining physical assets of its parent household but also a proportion of its human capital characteristics.

3.2   *The income process*

Households earn until age 65 ($\tau=45$) and then retire. During their working lives, their labour endowment, or earning power, $h_{i\tau}$ varies randomly. To maintain the distinction between calendral time, t and the age of a typical household, τ, we write τ *(i, t)* to represent the age of household *i* at time t. Earnings are $y_{it}=s_t h_{i\tau}$, where s_t is the market wage rate. Earnings are taxed at a rate t_{lt}. In addition households save and earn interest on their savings. This interest income is taxed as well, at rate t_{kt} so that the rate of interest net of tax is $r_t(1 - t_{kt})$. At retirement households may annuitize an amount z_i. Annuity income or private pensions are taxed in the same way as interest; tax is levied on the interest component of the annuity but not on the repayment of principal. Retired households also receive uniform state pensions free of taxes.

3.2.1   *Persistence across generations*

The initial level of earning power of the descendent household, *j*, h_{j0} is related to the earning power of its parent household, i, when it started work, h_{i0}. We use the simple mean reversion model:

$$log\ h_{j0} = \lambda\ log\ h_{i0} + (1 - \lambda^2)\varepsilon^* - (1 - \lambda)\ \sigma^{*2}\ /2 \tag{1}$$

where ε^* is independently distributed as $\varepsilon^*_\tau \sim N(0,\ \sigma^*\ )$ and the parameter λ represents the degree of persistence across generations. The process has been normalised so the steady-state of the distribution of log of earning power is $N(-\sigma^{*2}\ /2,\ \sigma^*\ )$, which also implies the distribution of earning power has a mean of 1. These parameters are detailed in the Table 3.

3.2.2   *Labour income during working life*

The evolution of earning power of a household working life is the first order autoregressive process studied in Atkinson, Bourguignon & Morrisson (1992):

$$log\ h_{\tau+1} - log\ h^*_{\tau+1} = \rho(log\ h_\tau - log\ h^*_\tau)+ \varepsilon_{i\tau}$$

where $\varepsilon_{i\tau}$ is an uncorrelated innovation processes drawn from the distribution $\varepsilon_{i\tau} \sim N(\mu_\tau, \sigma)$ and $h^*\tau$ is the mean level of earning power for a household of age τ. The mean μ_τ is calculated so that the distribution of earning power has mean $\exp(h^*\tau)$, hence given $\mu_{-1} = -\sigma^{*2}/2$, then:

$$\mu\tau = \rho^2\mu\tau{-1} - \sigma^2/2$$

This is the model of income dynamics studied in detail in Atkinson *et al.* (1992) and used by Huggett (1996) in his equilibrium model of the US economy but differs from that adopted by Imrohoroglu (1998) who assumes that people are either employed or unemployed, and when employed they earn the mean wage for their age. As Atkinson *et al.* state, our autoregressive process has a number of desirable properties. First, if earning power is lognormally distributed for the youngest cohort, it remains so for every cohort thereafter. This is useful the log normal distribution has for a long time be used as a reasonable fit of the earnings distribution. Secondly it can be easily calibrated to fit the observed earnings distribution.

3.2.3 Pensions and retirement

Households cease to work at $\tau=45$. At retirement they can choose to annuitize all or part of their wealth, z_i at actuarially fair rates; the annuity income represents their private pension. The state pays a fixed and tax-exempt pensions p_{st} to each retired household. In retirement a household's income consists of private and public pensions and the return on the remainder of their wealth.

At the beginning of its retirement each household annuitises all its wealth, w_{i45}, at the actuarially efficient rate, χ, giving a private pension p_{pi}, where:

$$\text{ppi} = w_{i45}/\chi i(t_k) \tag{2}$$

and

$$\chi i(tk) = \sum_{n=45}^{70} \frac{\phi_{45,n-45}}{\prod_{j=45}^{n}\left(1+\left(1-t_k\right)r_{tBirth,i+j}\right)} \tag{3}$$

with *tBirth,i* being the year in which household i is born. We have defined the annuity rate as a function of the capital tax rate so as to succinctly express the tax take from annuity payments later. Thereafter its income consists of this annuity or private pension, p_{pi}, the state pension, p_{st}, as well as the post-tax return to its remaining wealth.

3.2.4 Calibration

We used data from the British Household Panel Survey data on household gross labour income to calibrate the coefficients of our income process. These

Table 3

Parameter Values for the Income Process
(all at annual rates)

Parameter	ρ	σ^2	λ	σ^{*2}				
Value	0.993	0.013	0.6	0.203				
Household age at end of period	5	10	15	20	25	30	35	40
Age of Adults	25	30	35	40	45	50	55	60
Mean earning power	1	1.225	1.386	1.482	1.515	1.486	1.394	1.241
Var(h_τ)	0.203	0.251	0.296	0.338	0.378	0.414	0.448	0.48
Gini ($\exp(h_\tau)$)	0.25	0.277	0.299	0.319	0.335	0.349	0.361	0.371

coefficients are detailed in Table 3. The mean estimates of earning power are also given in Table 3, where they have been normalised so that the mean household's earning power in the first period of working life is 1. In the table we have also included the variance of the distribution of each cohort's log of earning power and the Gini of the distribution of earning power.

3.3   *Preferences and consumption*

Households derive utility from current consumption. Wealth which has not been consumed is left as a legacy to the next generation, but legacies are accidental, arising from premature death rather than any bequest motive. This assumption is in keeping with recent empirical work (Altoniji, Hayashi and Kotlikoff, 1992, Laitner and Juster, 1996, and Wilhelm, 1997) which finds little evidence for any altruism in the bequest behaviour.

Let c_τ and m_τ be consumption and household size at age τ and U_τ (c_τ/m_τ) be the current utility derived from instantaneous consumption. The utility of a household is then derived recursively as:

$$V\tau = (1 - \beta)U\tau (c\tau/m\tau) + \beta\psi\tau E t\{V\tau+1\}$$

As before $\psi\tau$ is the probability of surviving to the next period and E_t denotes the expectations operator conditional on survival. We assume that instantaneous utilities are of the constant elasticity of substitution form:

$$U(x) = x^{1-\gamma}/(1-\gamma); \gamma > 0$$

We note that the recursive utility function implies "double discounting". First of all, household's discount by a factor β because future consumption is valued less highly than current consumption. Secondly the fact that $\psi\tau$, the survival probability is less than one, means that households adjust the benefits of future consumption for the fact that they may not live to enjoy it.

A household's consumption is limited by the constraint that on its death it must not be in debt. As there is a finite probability of dying in any period, this constraint actually implies that at all times a household's wealth must always be positive or zero. Before retirement in year τRet=45 (when the adults are aged 65) a household can either consume or save its post tax income,

$$wi\tau >=0 \tag{4}$$

and

$$wi\tau+1 = (1+(1-t_k)rt)wi\tau + yi\tau - ci\tau \text{ for all } \tau + 1 < 45 = \tau\,Ret. \tag{5}$$

where t_k is the constant capital income tax rate and tlt is the varying labour income tax rate. $yi\tau$ is, of course, defined post-tax and $wi\tau$ is the wealth holdings at the beginning of the period.

At retirement, the household annuitize all its wealth so that the budget constraint can be expressed as:

$$wi\tau >=0 \tag{6}$$

and

$$wi\tau = 0 \text{ for } \tau = \tau\,Ret \tag{7}$$

and

$$wi\tau+1 = (1+(1-t_k)rt)wi\tau + ppi + pst - ci\tau \text{ for all } \tau >= \tau\,Ret \tag{8}$$

Borrowing constraints imply $wit >=0$ at each t.

Households foresee wages, interest rates and tax rates and they understand the uncertainty they face about their earnings. They maximise expected utility subject to budget and borrowing constraints, choosing consumption levels $ci\tau$. The parameter values for the demand side are summarised in Table 4.

Table 4

Parameter Values for Preferences
(annual rates for γ and β)

Parameter	β	γ
Value	0.95	2

3.4   The government

The government must fund a fixed exogenous level of public consumption, C_P, the state pensions and the cost of any minimum income guarantee from its tax revenues. The level of the state pension is fixed to be constant proportion, P, of the mean income level, $p_{st}=P s_t h^*_t$. where h^*_t is the average of earning power over the whole population. The level of capital income taxation is held constant at its pre-determined level but the level of wage income taxation is varied to ensure that budget is balanced. To express this constraint formally we shall index the households born in the same year by i and the cohorts by k, thus for example $c_{i,k,\tau}$ represents the consumption of the i_{th} household of the cohort born in year k, τ years later. Thus the government constraint in year t is:

$$\sum_{i\in X(t)} t_{lt} s_t h_i \tau + \sum_{i\in X(t)} t_k r t w_i \tau + \sum_{i\in X(t)} p p_i \; (\chi_i(0) - \chi_i(t_k)/)\chi_i(t_k) = \sum_{i\in X(t)} p_{st} + CP$$

where $X(t)$ is the set of households alive at time t. The age of each household, τ *(i, t)* is a function of its index number and also of the time period in question.

3.5   Production technology

The supply side of the economy is represented by a Cobb Douglas production function. Let gross output be denoted Y_t, the total physical capital be denoted K_t, and total earning power be denoted , $h^*_t L_t$, where h^*_t is, as before, the mean level of earning power of the total working population and L_t is the working population, then:

$$Y_t = A K_t^{\alpha} (h^*_t L_t)^{1-\alpha}$$

Capital depreciates at an annual rate δ. The capital stock follows the following equation:

$$K_{t+1} = (1 - \delta)K_t + I_t$$

where I_t is aggregate investment. Firms maximise profits. As a consequence wages, s_t and interest rates, r_t satisfy:

$$r_t = \alpha Y_t/K_t - \delta$$

$$s_t = (1 - \alpha)Y_t/h^*_t L_t$$

Goods markets clear in every period so that:

$$Y_t = I_t + \sum_{i\in X(t)} c_{i,\tau} + CP$$

The labour endowment and population size are exogenous. Given a sequence of taxes, state pensions and government purchases, $\{(t_{kt} , t_{lt}), p_{st}, CP \}$, goods market

clearing determines output, the capital stock, wages and interest rates and the distribution of consumption at each t:

$$\{Yt, Kt, st, rt, (cit)\, i \in X(t)\}$$

The production function is calibrated from the UK national accounts so that the share of output allocated to capital, α, is 36 per cent. The depreciation rate of capital, δ, is set at 6 per cent, which is about average for the complete economy. The technology level A is normalized so that with a mean level of human capital in the economy of 1.0 and a capital/output ratio of 3.0 the aggregate wage is 10.0. These values are summarised in Table 5.

Table 5

Parameter Values for Technology

Parameter	A	δ	α
Value	1.01	0.06	0.36

The model is solved by finding the prices, the interest rate, r_t and the wage rate, s_t, where:

$$rt = \alpha Yt/Kt - \delta$$

$$st = (1 - \alpha)Yth^*tLt$$

such that the demand and supply sides are in equilibrium.

4. The effects of capital taxation on the economy

Having set out our model we use it to assess the effects of the taxation of income from capital. Representation of heterogeneous households allows us to establish who is helped by particular tax structures and thus to explore whether the taxation of income from capital is likely to command majority support. The first assessment we do is comparative static. We choose values of the state pension, p_s and the rate of tax on income from capital t_k. These affect the aggregate variables, *Y, K, w, r* and *tt* and also the distributions of consumption, c_i and expected utility, $E(Vi\tau)$. The model has no aggregate uncertainty; individual incomes are uncertain but the large number of consumers means that mean household income is certain. This in turn implies that, for each value of our policy and behavioural parameters there is a deterministic aggregate steady state which can be found by simulating the model from an initial position.

In Table 6 we present the equilibrium results from our model. Since the model represents overlapping generations rather than infinitely-lived consumers and the economy is stationary, dynamic efficiency requires simply that the interest rate should be positive (Diamond, 1965). This is met without any difficulty. Indeed the tighter condition that the interest rate applicable to a situation with infinitely-lived households, that the interest rate should exceed the discount rate of 5 per cent p.a. is also met. The introduction of a tax on income from capital has the effect of depressing the post-tax rate of return and raising the pre-tax return. However, it can be observed that, in contrast to the situation generated by infinitely-lived consumers, more than half of the tax on income from capital falls on the income from capital, and the reduction in the rate of tax on income from labour allows post-tax earnings to rise even though NDP has fallen. The reason for this may be conjectured as follows. People save up for their retirement. The intertemporal elasticity of substitution, at 1/3, is plausible but low. An increase in the cost of retirement consumption has relatively little impact on savings and the total wealth/income ratio falls only slightly in response to the tax, leading to a relatively modest rise in the pre-tax interest rate.

These results are similar to those presented by Imrohoroglu (1998) who uses a model of similar structure to address some issues associated with taxation of income from capital, but does not address the question of voters' preferences which is central to our study. He finds that an increase in the tax on income from capital from 0 per cent to 40 per cent of income leads to the pre-tax return to capital rising from 5.2 per cent to 6.6 per cent p.a.; our figures show a rise from 7.6 per cent to 8.9 per cent p.a. We show total consumption (taking public and private consumption together, falling by 8.5 per cent while her results show a fall of 5.2 per cent). Our results are not intended to replicate his and the stronger effects may be in part due to the higher base-line interest rate. But the similarities are strong enough to give confidence in both sets of results.

We now look at the distributional changes that result from a change in capital taxation. In Table 7 we show the effect on the level of consumption at different age groups. A tax on income from capital raises the consumption levels and incomes of the young and reduces those of the elderly.

Table 8 looks at the overall effect on welfare in the steady state. We can see that old people gain when taxes on income from capital are reduced, while young people lose out. This is despite the fact that the young people are eventually going to become old people who benefit from low or no taxes on income from capital. Amongst the elderly, it is not surprising that the benefit is higher for people in higher utility quintiles.

5.   Conclusions

A simulation model of a panel of households with finite lives suggests that, in such circumstances, it is not true that taxes on income from capital are fully

Table 6

The Aggregate Effects of Taxation of Income from Capital

t_k	tl	r	$r(1-t_k)$	s	$S(1-tl)$	$(W+Z)/Y$	W/Y	Z/Y
0%	45.00%	7.557	7.557	1.084	0.596	2.555	1.51	1.046
5%	43.40%	7.622	7.29	1.08	0.612	2.533	1.497	1.036
10%	41.80%	7.72	7.043	1.075	0.626	2.51	1.482	1.028
15%	40.20%	7.845	6.807	1.068	0.639	2.482	1.466	1.017
20%	38.50%	7.977	6.564	1.06	0.651	2.452	1.447	1.006
25%	36.90%	8.126	6.319	1.052	0.663	2.421	1.424	0.996
30%	35.30%	8.292	6.068	1.043	0.675	2.383	1.399	0.984
35%	33.70%	8.485	5.817	1.033	0.685	2.341	1.37	0.971
40%	32.10%	8.701	5.558	1.022	0.694	2.293	1.337	0.957
45%	30.50%	8.943	5.291	1.009	0.702	2.243	1.302	0.941
50%	28.80%	9.231	5.02	0.995	0.708	2.192	1.266	0.926
55%	27.20%	9.556	4.734	0.98	0.713	2.13	1.223	0.907
60%	25.60%	9.94	4.437	0.962	0.716	2.062	1.175	0.887

t_k	G.D.P.	N.D.P.	$(1-tl)sL$	$(1-r)(W+Z)$	Ps	CP	C
0%	76.729	66.295	26.988	17.222	6.479	15.6	50.675
5%	76.395	66.096	27.705	16.321	6.457	15.6	50.456
10%	76.001	65.849	28.345	15.467	6.424	15.6	50.209
15%	75.52	65.544	28.934	14.621	6.382	15.6	49.92
20%	74.998	65.211	29.504	13.763	6.338	15.6	49.574
25%	74.446	64.856	30.046	12.914	6.289	15.6	49.232
30%	73.813	64.454	30.563	12.046	6.235	15.6	48.816
35%	73.106	63.998	31.031	11.18	6.175	15.6	48.357
40%	72.282	63.46	31.438	10.299	6.108	15.6	47.806
45%	71.374	62.856	31.789	9.418	6.034	15.6	47.198
50%	70.362	62.155	32.051	8.56	5.95	15.6	46.532
55%	69.333	61.474	32.32	7.685	5.857	15.6	45.821
60%	68.082	60.612	32.443	6.806	5.751	15.6	44.958

Key:

t_k tax rate on income from capital   *tl* tax rate on labour income

r rate of return on capital (per cent p.a.)   *s* wage rate

W aggregate wealth   *Z* aggregate annuitized wealth
   not annuitized   *L* labour force

C household consumption   *p*s state pension

CP public consumption

Table 7

Mean Consumption Levels

Age t_k	20	30	40	50	60	70	Total
0%	0.5498	0.7216	1.0888	1.0807	1.147	1.1711	1.0082
5%	0.5671	0.7366	1.1019	1.0829	1.1322	1.1443	1.0038
10%	0.5834	0.7504	1.1123	1.0822	1.119	1.1184	0.9985
15%	0.5991	0.7633	1.1217	1.0803	1.1053	1.0923	0.9924
20%	0.6145	0.7754	1.1294	1.0764	1.0854	1.0649	0.9859
25%	0.6298	0.7875	1.136	1.0722	1.0652	1.0387	0.9776
30%	0.6466	0.799	1.1415	1.0664	1.0505	1.0067	0.9694
35%	0.6615	0.8109	1.1451	1.0598	1.0278	0.9768	0.9594
40%	0.675	0.8196	1.1453	1.0491	1.006	0.9458	0.9477
45%	0.6874	0.8281	1.1446	1.0375	0.983	0.914	0.9352
50%	0.6987	0.8367	1.1444	1.0269	0.961	0.8828	0.9232
55%	0.7087	0.8437	1.1394	1.0113	0.9338	0.847	0.9074
60%	0.7174	0.8488	1.1324	0.9936	0.9048	0.8106	0.8901

displaced to labour. We find that the post-tax rate of return falls by 80-90 per cent of the effect of the tax when a tax on income from capital is imposed. Pre-tax returns are nevertheless increased and the tax has the expected effect of reducing aggregate wealth and thus the capital stock, with a consequent reduction in gross and net domestic product.

A high tax on income from capital, and therefore low tax on income from labour has the effect of raising the consumption of the young at the expense of the consumption of the old. There are two reasons for this. First of all, because young people are mostly wealth-constrained, there is an income effect. The young are able to spend more because their taxes are reduced. There is less incentive to plan for consumption to rise over the lifetime because the post-tax interest rate is depressed.

If we look at the welfare effects of tax on income from capital relative to a situation where it is not taxed, we observe a surprising result. Young people are

Table 8

**The Percentage Change in Steady-State Lifetime Utility for Each Utility
Quintile in Each Age Group on a Move from 20% to 0% Capital Tax Regime**

Quintile	1	2	3	4	5
85-89	7.37	5.75	10.22	9.43	14.98
80-84	5.07	6.7	9.37	10.8	18.07
75-79	4.36	7.69	9.33	11.54	17.22
70-74	3.56	6.84	8.31	11.76	16.82
65-69	2.91	8.62	6.96	11.73	17.24
60-64	5.94	5.82	6.99	8.76	13.36
55-59	2.88	3.58	4.72	7.5	9.71
50-54	2.1	3.24	4.08	5.31	7.33
45-49	1.66	1.62	2.68	2.81	5.47
40-44	0.92	1.04	1.01	1.16	1.77
35-39	–0.02	–0.56	–0.29	–0.54	–0.19
30-34	–0.84	–1.78	–2.24	–2.78	–2.76
25-29	–2.11	–3.31	–4.05	–4.96	–6.91
20-24	–3.47	–4.49	–5.58	–7.06	–8.64

For each age group we grouped the households into quintiles in accordance with the ranking of their utility in a 0% capital income tax regime. For each age group and quintile we then calculated the mean percentage change in their utility between this 0% capital regime and a 20% capital tax regime, the calculations being done after the former had reached a steady state.

better off in a situation in which income from capital is taxed than where such a tax is absent despite the distortionary properties of such a tax. This comparison is based on the present discounted value of lifetime utility and therefore takes account of the fact that savings decisions are distorted by the tax. It arises, however, because young people are wealth constrained. They would like to be in debt but they cannot borrow.

A tax on income from capital allows them to put off part of their tax bills until they can afford to pay and thus eases the constraint they face on their consumption when they are young.

The tax system is, in effect, going some way to replacing a missing credit market; it reduces the difference between the amount of credit actually available to the young and the amount that they would like to borrow. In that sense the argument set out for tax on income from capital is plainly a second-best argument: the tax is mitigating a distortion arising from elsewhere. Nevertheless, the absence of good credit markets in which young people can easily borrow against future earnings is easily understood in terms of adverse selection and moral hazard. Thus there seems little point in arguing, as do Atkeson, Chari and Kehoe that the appropriate solution is to deal with the market failure. In reality, it may not be possible to deal with such market failures; second-best solutions to dealing with their consequences should not be despised.

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COMMENTS ON SESSION III:
TAX COMPETITION AND TAX HARMONISATION

Vieri Ceriani[*]

Let me start by commenting on the paper by Kastrop. It is an interesting and stimulating paper because it underlines the importance of considering the institutional framework, which we often disregard in our economic analyses. Constitutional arrangements are very important in shaping the behaviour of governments. I do not want to address the German case, with which I am not sufficiently familiar, but Kastrop's conclusions and suggestions seem to me appropriate in terms of general policy indications. Kastrop has the merit of reminding us of the importance of some basic results that stem from public choice literature. Namely, the coherence principle and the financial autonomy of governments, as well as the importance of accountability and transparency in tax collection and decision making in general. He also has the merit of stressing the role of equalisation when jurisdictions differ in the level of economic development and natural endowments. Equalisation, *i.e.* inter-jurisdictional redistribution, is a necessary feature of inter-governmental financial relations. Particularly so when constitutions grant their citizens specific rights, as in the case of health, education, social assistance and the like. Constitutional "imbalances" can arise when constitutions grant citizens social rights, but do not make explicit provision for equalisation and inter-jurisdictional redistribution. Where this is the case, jurisdictions may end up with very different levels of satisfaction of citizens rights, so different that the principles of equality among citizens may be violated.

Kastrop has also made some very telling remarks on the EU budget. The European budget is very peculiar from the constitutional point of view because the European Parliament votes the expenditures, but not the revenues. European citizens pay for the European budget, but they contribute in an opaque fashion. They pay taxes to their home-states and then each member state transfers resources to Brussels from the expenditure side of its budget. The financing of the EU budget is agreed and decided on the basis of a purely inter-governmental procedure: it is the result of decisions taken by governments. It is true that in voting their national budgets the member states' parliaments also vote EU financing, which is one of the expenditure items. But national parliaments merely ratify decisions taken by governments. One of the merits of Kastrop's paper, in my opinion, is that it highlights these shortcomings, draws attention to this important transparency and accountability failure in the current institutional and constitutional setting of Europe. There are different possible ways to address this issue: one would be quite straightforward, although it is unlikely: the European Convention, which is currently preparing the draft Constitution of Europe, could consider the desirability of giving the Union powers to tax European citizens. As I just said, this is a rather unlikely outcome:

[*]   Banca d'Italia.

very few of the participants in the Convention would dare to give the Union the right to tax its citizens. Yet, this would be a straightforward solution in terms of accountability, transparency, coherence and financial autonomy.

Let me now turn to the second paper. Professor Boothe reminds us of a very important point. A properly designed federal system may increase efficiency, with respect to a centralised government, in part because it may be able to reflect local preferences more accurately. Boothe describes an interesting case study and draws his conclusions from it. It is worth noting, in his paper, the stress on administrative and compliance costs. In policy making, we have to keep in mind that taxpayers have the right to be taxed in a fair, but also in a simple and clear way. In addition, the reduction of administrative costs linked to taxation may improve overall economic efficiency. This is also an important starting point for the recent proposals to modify corporate and business taxation in Europe. In November 2001 the Commission put forward proposals aimed at moving towards an internal market without tax obstacles. The Commission also underline the need to reduce administrative and compliance costs, which stem from the very existence of fifteen different tax systems.

Boothe's analysis shows that, besides reflecting local preferences more accurately, the greater autonomy Canadian provinces have enjoyed since the end of the Nineties has resulted in a decrease of tax rates, both average and marginal. I have some questions for Professor Boothe on this issue. I am curious to know whether tax allowances and tax credits at provincial level have been modified and, if this is the case, whether they have been reduced or increased, in order to compensate (at least partially) for the fall in tax rates. Or do Professor Boothe's estimates of tax rates already take into consideration tax credits and allowances?

Boothe told us that in 1997 the federal government wanted to introduce tax cuts. The fact that the federal government and the provinces reached an agreement to change the institutional arrangements can perhaps be interpreted as a "deal" in which the provinces allowed the federal government to carry out the proposed tax cuts, in exchange for more tax autonomy. But it might also be that the provinces simply wanted to share the political benefits of tax cuts with the federal government. I would be interested in Professor Boothe's views on this issue.

Boothe has told us that all the provinces reduced their tax rates, as the federal government had proposed. Was there a "necessity" to reduce taxes? And if so, what was it? Was there an issue of tax competition, not so much among the provinces themselves, but with respect to other countries? Obviously, the reference is to the neighbouring United States. But I also raise the question of whether NAFTA played a role. I mention NAFTA because my impression is that when we talk about tax competition and mobility we should qualify mobility. Mobility is not simply a global phenomenon. Mobility – intended in a broad sense, not just as mobility of capital, but also as mobility of labour and of goods and services – is likely to increase more in regional areas. It has probably increased more within NAFTA and the European internal market than elsewhere and worldwide. The decision by firms

to locate in a specific area is strategically driven by the fact that that location is within a market, an integrated market.

Let me now turn to the paper by Ederveen and de Mooij. This is also a very interesting paper, a good and accurate review of different measures and definitions of tax rates. In my opinion, it also provides a good and accurate review of the literature on the relationship between tax rates and foreign direct investment (FDI), which, in the end, is the main issue for this section of our conference. In short, do taxes really matter for investment decisions? Or, in other word, is there an economic reason for states to engage in tax competition? Using the meta-analysis, the authors conclude that the answer is positive, that there is evidence of a significantly negative relationship between tax rates and FDI. So, we feel reassured, as economists, that our conventional wisdom seems to be confirmed.

But this result leads to a second question. Did governments effectively use tax rate reductions to attract foreign investment? Is there any evidence of tax competition having occurred in the last few years? The issue is dealt with by the paper by Briotti, which is included in Session 4. She reviews some interesting literature on this issue, showing that there is evidence that in the last two decades tax rates, using different definitions (statutory, marginal, backward and forward looking), have effectively decreased. But there is no evidence of a "race to the bottom". This is an important result, and leads us to the following question: why did a race to the bottom not happen?

There are some possible tentative answers to this question.

One is provided by Vidal and Catenaro, who presented a very elegant paper. They introduce some simple and clear assumptions in a standard game theory model and reach the conclusion that there may be a cooperative solution, with positive taxation and no race to the bottom, simply introducing repeated strategies in the model, conditional on the fact that countries are symmetric (*i.e.*, neither too large nor too small). This interesting paper shows that, by introducing some change in the model and bringing in new simple assumptions, it is possible to reach results that are significantly different from the standard results we are used to reading in the literature.

Catenaro and Vidal also have the merit, in my opinion, of underlining and questioning, from the point of view of realism, the conventional assumption of selfish governments, that are commonly assumed to be solely revenue maximisers. This assumption is really at odds with the facts. If we look at the experiences of the Nineties (for instance, at the G7 initiatives against harmful tax competition, the OECD project in the same area, the EU Code of Conduct on business taxation), there is evidence that governments are interested in taking action against "abuse". If we look at these initiatives in conjunction with similar initiatives in the fields of money laundering and financial stability, we can easily see that governments are concerned with and interested in preserving the social public good of globalisation. Governments are interested in creating a level playing field; they pursue efficiency and growth; they want to guarantee financial stability; they want to repress

economic criminality; and they want to avoid "harmful", or "unfair", tax competition.

There are also other reasons to explain why a race to the bottom in taxation did not occur. Governments may have taken some national countermeasures against aggressively competitive jurisdictions. In this area, it seems appropriate to make reference to CFC (controlled foreign company) legislation, thin capitalisation legislation and similar provisions.

There are also economic reasons which may explain why the race to the bottom did not occur. The mobility of factors, in reality, may be far from the perfection that is usually assumed in the economic literature. Even capital markets, where the highest mobility is usually assumed, are far from perfect. Even after liberalisation and globalisation, many segmentations and imperfections still exist, which leave governments room for manoeuvre in taxation.

Economic reasons may also explain the indesirability of racing to the bottom. The existence of location specific "rents" (extra-profits) may be a valid reason for taxing profits, at least those stemming from foreign investment. This assertion is to be seen in connection with my previous considerations on the European internal market and NAFTA. Wherever governments create areas of enhanced mobility, they create a public good which offers the opportunity to extract "rents" to those who invest within those areas. Hence, it is appropriate to tax these "rents".

My final remark is that Vidal and Catenaro's conclusions are dependent upon the symmetry hypothesis between large and small countries. This argument gives me the opportunity to make a digression into the future, namely into the prospects of EU enlargement. Some small countries are entering the EU. Estonia is entering without a proper corporation tax. The Channel Islands may soon eliminate their existing corporation taxes. It cannot be ruled out that the EU will enter a new phase of tax competition, of enhanced tax competition, with specific regional characteristics. In fact, the absence of corporation taxes cannot be dealt with by other member states with traditional anti-abuse measures, such as CFC legislation. CFC legislation, like other national anti-abuse provisions, may conflict with the principles of the internal market and, hence, not pass the scrutiny of the European Court of Justice.

COMMENTS ON SESSION III:
TAX COMPETITION AND TAX HARMONISATION

David Heald[*]

Thank you very much for the invitation to come to this conference and be a discussant. I start by apologising for what will be a rather uneven treatment of papers. Five of the papers are about fiscal federalism and/or about tax competition; the Weale paper is – as was explained earlier – rather different.

The first thing I want to do is to describe my personal interest in this topic. The United Kingdom has traditionally been a very centralised state with a very dependent system of local government, central government being extremely dominant. But in the peripheral parts of the United Kingdom – Scotland, Wales and Northern Ireland – there are now devolved administrations with many of the characteristics (in terms of their expenditure responsibilities) of Australian states and Canadian provinces. These, however, are funded by a block grant system. It doesn't really look as though there are going to be substantial changes to that kind of funding system, though in the Scottish elections due on 1 May 2003 there is likely to be very substantial discussion around a rather loosely described "greater fiscal autonomy". So these topics, quite apart from the question of European enlargement and integration, have great salience in terms of the contemporary United Kingdom.

We need to pay some attention to what kind of criteria we want to address these questions with, and I think that becomes much more important when we start talking comparatively among different countries. One very quickly starts acquiring a substantial list of criteria that are relevant. If you look at the traditional public finance literature, this strongly emphasises issues about efficiency – I'm not going to say much about this now but I will come back to it. Equity is a much more complex topic than people usually recognise. One of the points that was made almost in passing at a previous session is the important distinction between horizontal equity and vertical equity. As soon as you get into a fiscal federalism situation, with different levels of government having expenditure and tax responsibilities, horizontal equity issues become very complicated. There are distributional issues about equalisation, where you have to be careful about whether you are talking about equalisation among individuals or equalisation among sub-national governments (*i.e.*, among geographical areas). Interpersonal equalisation and geographical equalisation aren't the same. One of the ways in which the Weale paper does link in is that it emphasises that there are intergenerational equity issues as well. I don't have time in 15 minutes to spend much time on that, but I just want to emphasise quite how complex the equity issues are.

There are also other issues that are attracting attention. "Accountability" is a term that people keep using in this kind of discussion. It is often linked to the

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concept of autonomy but we need to be very careful about terms. I want to make two quick points. The first point is that there is a prior tax assignment issue – the question of which level of government actually gets particular taxes. There may well be a mismatch between expenditure responsibilities and tax revenue raising at the sub-national level, but it is not necessarily obvious that it's the fault of the sub-national level; there has to be a willingness of the national level to let go of important taxes. And the second point I want to make is that you have to very careful that you don't set up twin requirements which cannot both be met. The United Kingdom's previous experience with devolution was in Northern Ireland between 1921 and 1972; the political violence connected with Northern Ireland has rather drawn attention away from the important fiscal federal implications of that failed experiment. But one thing that happened is that Northern Ireland was told to finance its own expenditure, and make what was then called an "Imperial contribution" towards United Kingdom responsibilities. At the same time, it was told that it had to provide the public services associated with the British welfare state.

There are important issues, which emerge very clearly from the German paper by Christian Kastrop, concerning the transparency of the fiscal equalisation system. Systems that people don't understand and can't explain cannot be transparent. The comprehensibility of fiscal systems in the context of decentralised governments is a very important issue to be addressed. One of the interesting points which Paul Boothe's paper made very clearly is the importance of transaction costs, which include taxpayer compliance costs. In a system with three levels – central government, sub-national government and local government – the question of transaction costs becomes important.

Before I go on to talk more about individual papers, I just want to emphasise that I think that institutions matter, I think culture matters, I think path dependence matters. Policy reformers don't start with a clean slate – one has an inherited historical position. And I think there are also important issues that come up about whether constitutions are there to be kept or constitutions are there to be changed. One of the arguments for having formal constitutions is that they create a degree of predictability and stability, and if constitutions are always going to change that loses one of the purposes they are supposed to fulfil. The final general point I would like to make is that I have been coming to international conferences long enough to notice a cycle of national moods. Twenty years ago, one saw a very confident mood from Japanese speakers and from German speakers, and a much less confident mood from Australian speakers and from British speakers, but one sees something of a cycle. Different countries have, at different points in history, a sense of whether their institutions are working well or working badly.

That takes me to Christian Kastrop. I never thought I would live long enough to hear a German speaker talk about the German model in terms of the German disease. My knowledge of the German fiscal equalisation system is rather superficial, but I think there is a tendency to exaggerate both the scale of problems and the extent of reforms that have recently been taking place. Essentially what the

German fiscal equalisation scheme is concerned about is how to distribute assigned revenues; there is a great deal of debate and a great deal of complexity in terms of how the revenue-sharing system should operate. The German federal system is dramatically different from the Canadian system. Where there is genuinely tax discretion at the provincial level in Canada, the German system is a revenue-sharing system of taxes essentially governed at the central level. What strikes me, as an outsider, is that the German Länder would be in a very weak position if it weren't for the strength derived from their representation in the Bundesrat. I also think there is a danger of underestimating the benefits of the expenditure-side autonomy of the German Länder and of the devolved administrations in the United Kingdom.

Turning specifically to Paul Boothe's paper, I think one of the really intriguing points, counterpointed by the conference, is why Australia and Canada are so different. Greg Smith's interesting paper on Australian tax policy yesterday said almost nothing about the relationship between the Commonwealth and the states. You have two countries which will both tell you very quickly that they are federal, but federalism in Canada and federalism in Australia mean very different things. They are both very big countries geographically, so it's not just size which makes them different from European Union countries. Canada, which has the very fragmented system of government, has the high public expenditure/GDP ratio, whereas you might have expected the opposite relationship, and in Canada you get very big variations between tax and expenditure levels among provinces. I think that the Boothe paper really brings out very clearly the tax assignment issues about who actually has which taxes. Alberta has control over oil revenues, but Scotland does not. Who has access to particular tax bases is obviously a fundamental question. My own instinct is that the Canadian example is much more relevant to Europe than is the German experience. An enlarged Europe, even the present European Union, does not have the degree of cohesion that Germany has.

Turning very briefly to the other papers, I found the Ederveen and de Mooij survey of the effect of taxes on foreign direct investment to be very interesting, because an important question has been the role that foreign direct investment has played in the Republic of Ireland. Rightly or wrongly, the Irish economic miracle after 1988 is perceived to have been partly to do with the way in which it played a small-country game with corporation tax, relative to the United Kingdom. And certainly in Scotland and Northern Ireland this issue of the level of Irish corporation tax relative to the United Kingdom corporation tax is perceived to be very important. The Ederveen and de Mooij paper is a very careful review of the literature, trying to standardise the results on a topic which, from my United Kingdom policy perspective, is really very important. That leads me to the Catenaro and Vidal paper: one of the things that I focused on was their emphasis on asymmetry in country sizes, and the issue of positioning. If Scotland became independent, one of the first things it would do is harmonise its corporation tax system with the Republic of Ireland and try to gain a competitive tax advantage over the United Kingdom.

Turning to the Haughwout paper, one of the things that this reminds us of is that there is a long tradition in the public finance literature of stressing an efficiency

basis for intergovernmental transfers. There is currently a tendency to think that equalisation transfers are essentially for equity reasons. What comes out very clearly from the Haughwout paper is that one solution to the problem in the Philadelphia metropolitan area is consolidation, merging all the authorities into a metropolitan area government; the other possibility is to deal with the spillover effects through an intergovernmental transfer system. There's a very interesting footnote in the paper on page 384, which emphasises that you don't get the same effects in the model if you increase the incomes of the residents of the central city. The form of the externality means that the policy response must take a specific form to generate the benefits to the suburban economy. So it's very important that one doesn't think that equalisation systems are just about equity – there are also very important efficiency issues.

Martin Weale's paper is well outside my field of competence. I would just like to highlight that we are coming back to my earlier point that there are different dimensions to be considered: the interpersonal; the territorial and the intergenerational.

COMMENTS ON SESSION III:
TAX COMPETITION AND TAX HARMONISATION

Ranjana Madhusudhan[*]

The six papers included in this session span over a wide array of interesting topics and I found them very stimulating. I will focus on issues relating to tax competition and tax harmonization using the New Jersey example.

In 1997, the Federal Reserve Bank of Boston had organized a Symposium to examine the impact of inter jurisdictional competition and tax harmonization on economic development. The first question addressed dealt with the definition of inter jurisdictional competition (IJC). One of the definitions provided by the U.S. Advisory Commission on Intergovernmental Relations (ACIR) was that "IJC is the manner in which the free movement of goods, services, people and capital constraints the actions of independent governments in a federal system" (ACIR 1991). The consensus was that regardless of whether IJC was good or bad, there should be no attempt to constrain it (in US by the Congress or the Supreme Court).

Kastrop's paper presents a good outline of the German federal evolution and highlights unique features in the German federal system such as the clause "for all time", which is unique among modern democratic constitutions. An interesting feature is that even though there are three levels of government, including the communes, the Federal Republic of Germany is a two-tier federal state comprising the Federation and the Lander. The big taxes are federal while state and local governments have a limited but exclusive revenue base.

In the United States the degree of fiscal decentralization is quite apparent. States can levy personal income and corporation business taxes that are levied by the federal government. They also have state level taxes such as sales and use taxes. Although, the property tax constitutes the primary local revenue source, local governments have the power to utilize income taxation. New York City is a case in point.

New Jersey is very decentralized with a strong tradition of home rule. There are close to 1,600 units of local government, including 21 counties, 566 municipalities, 611 school districts, 400+ local authorities, fire districts and special purpose districts.[1] In 2000, local governments raised $14.2 billion through property taxes, which was greater than the sum of revenues from the Big three state taxes: personal income tax ($6.5B), sales tax ($5.3B) and corporation business tax

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The views expressed are those of the author and do not represent the views of the New Jersey Department of Treasury.
[1]   See Coleman *et al.* (2001), pp. 18-9.

($1.6B).[2] In contrast to Germany where local taxes are shared with the federal and Lander governments, New Jersey does not get directly involved with the local government budgeting process and revenues from property tax is not shared with the State.

Kastrop points to the serious efficiency issues that arise with the relatively high degree of expenditure side autonomy on the one hand and the diminished revenue side autonomy on the other hand. The current system is also suffering from other problems accentuated by stagnating economic conditions, coined the "German disease". The paper lays out and evaluates major reform proposals to promote efficient and effective economic and fiscal policies.

State Tax Study Commissions have made similar recommendations to improve the fiscal imbalance situation facing local governments in New Jersey, including measures to improve local government structure through greater cooperation among jurisdictions and employing diverse funding sources, particularly non property tax sources to increase revenue independence for local governments. The Regional Efficiency Aid Program and Regional Efficiency Development Incentive are two measures that illustrate the promotion of inter jurisdictional cooperation and efficiency in New Jersey.

Kastrop recommends the promotion of healthy inter jurisdictional competition, which is good when regional preferences are satisfied in line with the Tiebout model. A good competition has the potential to generate creative legislations, which in turn lead to inter jurisdictional cooperation. This is illustrated by the development of interstate banking legislations in the U.S.

There are some ambiguities in the paper on financial equalization measures and in the distribution of tax revenue by source and level of government. In particular, the percent distribution is unclear. It would be useful, for instance, to clarify the >100 per cent rule and explain the 72.5 per cent cap in greater detail. The paper reflects that constitutional changes would be needed to legislate serious reforms in Germany. The policy implications that are expected when the German federal system is fully modernized are somewhat speculative (see p. 304). The paper concludes by extending the analysis in the EU context. It would be helpful to have more specific recommendations and details on what type of tax is being considered for the EU and indicate if is it going to be a revenue neutral tax change?

The paper by Boothe focuses on a recent natural experiment to examine the issue of tax competition in the Canadian context. It attempts to measure and assess the impact of change from the TOFT to TONI on the degree and nature of inter provincial tax competition. Economic efficiency in the Tiebout context is discussed and it is suggested that political efficiency may be gained by pooling tax collection systems when regions use similar tax systems. This is supported by U.S. experience with interstate cooperative compacts. The present "CITE" (cooperative interstate tax enforcement) program between two neighboring states, New Jersey and New York,

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2   New Jersey State budgets.

which was signed into law in 1986 is a good example. Under this agreement, businesses located in bordering jurisdictions agree to collect/remit sales tax from non-residents. As of early March 2003, there were 7,689 active vendors under CITE, including 3,521 vendors from New Jersey and the remaining 4,168 from New York. During fiscal year 2002, New Jersey collected close to $52 million for New York while New York collected over $22 million for New Jersey.[3] Boothe notes that tax structures got simplified with no increases in compliance/administration costs since provinces adopted federal definitions. Again this is similar to the experience in the United States where states have adopted uniform definitions under the Uniform Definition for Income Tax Purposes Act (UDITPA) to improve administrative efficiency. Currently, states are working on a 'Streamline' project, developing uniform definitions of tax base and situs rules to deal with the challenges posed by electronic commerce, particularly to state sales tax systems.

It may be too early to generalize and draw policy conclusions from the new Canadian experiment. The policy implications may be tentative and the results may be different if provinces move away from the federal definition, which may be limiting the degree of regional diversity. It would be helpful to explain in detail why over the period under consideration, taxes over $10,000 to $100,000 range became more progressive in the maritime provinces (Nova Scotia, New Brunswick and Prince Edward Island) and somewhat less progressive in other provinces? It would also be useful to know what happened in Quebec during all these changes that took place in the rest of Canada?

The third paper by Ederveen and Mooij is an interesting application of Meta analysis to empirical literature examining the impact of company taxes on the allocation of FDI. The analysis embodied in this paper is very detailed and includes 25 empirical studies; the primary finding is that the elasticities derived from studies using forward-looking concepts are significantly higher as compared to backward looking approaches. A typical elasticity based on marginal effective tax rate is shown to be –4.2 per cent. The paper then reports that on average the tax rate elasticity of foreign capital is around –3.3 per cent. This opens up the question as to which value should be used for benchmarking? The paper is insightful but suffers from certain limitations as some observations in the Meta sample are dependent and there are other problems noted by the authors. As such some of the methodological issues remain unresolved under Meta analysis.

An extension of the analysis to track countries that have experienced an increase in FDI after changing tax rate on their company taxes would be helpful to policy makers. The U.S. has been experiencing different trends in the level of FDI, particularly, a slowdown in recent years, independent of changes in company tax rates. Other factors that have affected the level of FDI include the general health of the economy (U.S. and global), the relative strength of the dollar, regional distribution of corporate profit margins, and the level of productivity. The application of Meta analysis should be extended to understand the role of other

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[3]   Information obtained from the New Jersey Division of Taxation.

significant factors such as the interest rate environment, which has a bearing on the flow of FDI via the rate of return on investment.

The paper by Catenaro and Vidal demonstrates in the context of a stylized game theoretic framework of capital tax competition that when repeated policy interactions are associated to a systematic punishment of the deviating policymaker, a coordinated outcome can be the solution to the non cooperative tax game. The methodology moves beyond the static tax competition model to examine the issue of tax competition/ harmonization in a dynamic world setting with a repeated interaction framework. An interesting reflection in the paper is that the Nash equilibrium outcome of the static tax competition models may not necessarily coincide with the outcome of the tax game in a repeated interaction framework. The paper indicates that governments may secure a cooperative or coordinated outcome by threatening to retaliate if one of them deviates from the coordinated tax rates. In the U.S. we can find examples – the use of retaliatory taxes to discourage negative tax competition (insurance industry taxation) on the one hand and the use of inter-state tax compacts (such as inter state fuel tax agreement or IFTA) to encourage tax harmonization.

The methodology employed in the paper uses a two-country model. An extension to a multi-country structure would be more useful in understanding policy issues relating to tax competition/harmonization in the EU. Other useful extensions would include examining implications when the assumptions regarding factor mobility change? What happens when labor is also mobile, as may be possible within the EU region? Other questions worth examining include: What happens when countries under consideration are more symmetric in size and what are the effects specific to bordering regions?

The paper by Haughwout is an insightful application of intra regional trade model to examine fiscal policy issues. The paper examines an equilibrium model of a single region, whose separate political jurisdictions are linked by trade in intermediate goods. I found the paper very thought provoking and stimulating. From a practitioner's perspective I am interested in understanding the implications of relaxing certain assumptions made in the model. What happens, for instance, when the elasticity assumptions are changed or when non intermediate goods/final goods are introduced in the model? That is, exploring the linkages via final goods? What are the implications of assuming agglomeration externality in the secondary region as well? The production function is assumed to be linear and homogenous but in the complex real world context it may be useful to look at a non-linear function since inter regional variations are expected to be significant in some parts of the EU.

It would be useful to extend the analysis to explore multi-dimensional linkages and to more than one jurisdiction to examine issues with the open EU economies and inter-regional dependence. For the policy maker it would be useful to know the implications when several countries are involved, particularly, in the EU context? Consider the case when Country A takes advantage of production in Country B but exports to Country C due to other trade advantages? In Jersey City, New Jersey, lot of relocation is taking place of major businesses from New York

City but the underlying dynamics may be different from those being examined in this paper.

Finally, Weale's paper examines the nature of capital income taxation in the UK and raises the issue of short term vs. long term dynamic inconsistencies. The paper indicates that even when distributional effects are taken into account there would be a majority among rational electorate for setting the tax rate on income from capital at zero because of the change in demographic dynamics. In the Weale's model, younger population favor taxation of income from capital while older people do not due to the wealth constraint facing the former group.

The question that remains open is what is an optimal tax rate that would satisfy both the young and the old? Another question of interest relates to the IT age which made lot of the young people rich (before the financial bubble) and this could change the inter temporal dynamics. For instance, it would be useful to know if the results change when rich young folks from the era of new technology are introduced in Weale's analysis?

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