

Session 3

FISCAL POLICY AND GROWTH

TAX REFORM IN THE CONTEXT OF BUDGETARY RESTRAINT: A NOTE ON THE PORTUGUESE CASE

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This note illustrates, in the framework of a dynamic general equilibrium analysis of tax reform in Portugal, the difficulties in the design of efficient tax reforms in a context of budgetary restraint.

1. Introduction

Tax reform is in the air in less developed EU countries, like Greece, Ireland, Portugal and Spain, and is on the horizon for the future Eastern European entrants. This is due mostly to a growing sense that there is a need not to fall behind in the process of real convergence to the EU standards of living. It is also due to the knowledge that, as the tax bases become increasingly mobile across EU countries, the ability of domestic authorities to use tax policy to give the country an edge in this process is quickly eroding.

In this setting, it is important to recognize that such reforms would have to occur in a context of significant budgetary restraint. The stringent public deficit targets of the Stability and Growth Programs place serious limitations on the use of either public deficits or reductions in public spending to finance tax reform in the less developed EU countries. In turn, the requirements of nominal convergence are expected to place equally stringent demands on the public finances of the new entrant economies.

Tax reform in such an environment of budgetary consolidation is, thus, inevitably reduced to an exercise in trading off distortionary tax margins. In this sense, a trade-off between GDP and welfare is a real possibility. When trading off distortionary tax margins one would expect the compensatory tax increases to either reduce labour demand, lower the net wage, or increase labour supply. Either way, after-tax labour income

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and disposable income will fall. Eventually, with the stimulus part of the package, capital income will increase and so will consumption. To the extent that investment is subject to adjustment costs, however, capital income adjusts only gradually. As a result, what happens to labour income and to the overall tax households pay will determine whether disposable income, and therefore private consumption, rises or falls in the short-run. Consumption levels will eventually be higher, but a long transition period can imply a welfare loss in a discounted sense. In such cases, finding a tax proposal that simultaneously enhances long-term GDP and private welfare may be a non-trivial task.

The objective of this note is to illustrate these points with a tax reform package currently under debate in Portugal. This tax shock was proposed initially in the spring of 1999 by Cavaco Silva, Portugal's Prime Minister from 1985 to 1995 and has served ever since as a central reference in the tax reform debate in Portugal. On the stimulus side, the corporate income tax rate would be reduced by 4pp, the employers' social security contribution rate by 4pp, and the personal income tax rate corresponding to the highest income bracket by 5pp. On the financing side, foregone revenues would be offset by additional revenues from a more effective combat to tax evasion as a result of prohibiting tax amnesties and abolishing banking secrecy for tax inspection purposes as well as a reduction of the wastefulness in public health care spending. If after these measures are implemented there is still a revenue shortfall then, to meet the budget deficit targets in the context of the Stability and Growth Pact, the general value-added tax rate would be increased, as needed, by up to 2pp.

To evaluate this tax reform package, we use a dynamic general-equilibrium model of the Portuguese economy. This model was originally developed by Pereira (1999) and has been used in the context of analysing the sustainability of the social security systems (see Pereira and Rodrigues 2002) as well as more general tax reform issues (see Pereira and Rodrigues 2001a, 2001b). This model shares with the computable general equilibrium literature the ability to consider the tax system in great detail and to analyse the effects of large and simultaneous changes in the tax parameters. Furthermore, it recognizes that a country's overall budgetary position depends on its macroeconomic performance. This is because, among other things, tax bases are endogenous and respond to changes in tax rates. On the other hand, it shares with the endogenous growth literature the fact that fiscal policy has the potential for affecting the fundamentals of long-term growth and not just for generating temporary

level effects. In this regard, two of the most relevant channels are public investment activities and changes in tax policy that motivate an increased demand for capital and labour. (See the above references for the fully-fledged pedigree of this model.)

2. The dynamic general equilibrium model

We consider a decentralized economy in a dynamic general equilibrium framework. With money absent, the model is framed in real terms. There are four sectors in the economy – the production sector, the household sector, the public sector and the foreign sector, which are interconnected through competitive market equilibrium conditions, the evolution of the stock variables and their relevant shadow prices. Economic agents are price-takers in all markets and are assumed to have perfect foresight. The intertemporal trajectory of the economy can be summarized by the optimal evolution of seven stock variables and three shadow price variables. These are private capital, public capital, and human capital and their respective shadow prices, as well as public debt, foreign debt, private financial wealth, and human wealth.

In the long-term, endogenous steady-state growth is possible because the production technology displays constant returns to scale in the factors that accumulate. Long-term endogenous growth is induced by the optimal accumulation of private capital as well as public capital and human capital. While the first is subject to private sector decisions, the last two are publicly provided. This implies that the command optimum for this economy cannot be replicated in a decentralized context in the absence of public intervention that is, itself, responsive to market incentives.

The model is presented in detail in Table 1. Here we present its basic outline. The reader is referred to Pereira and Rodrigues (2001b) for full details. Optimal production behaviour (see equations 1-7) consists in choosing the investment and labour demand levels that maximize the firms' market value, subject to the equation of motion for private capital accumulation, adjustment costs. Public capital and human capital are externalities in private sector production.

Table 1

The dynamic general equilibrium model

Equations of the Production Sector

$$Y_t = A(L_t^d H K_t)^{\theta_L} K_t^{\theta_K} K G_t^{1-\theta_L-\theta_K} \quad (1)$$

$$K_{t+1} = (1 - \delta_K)K_t + I_t - \mu_I \frac{I_t^2}{K_t} \quad (2)$$

$$NCF_t = Y_t - (1 + \tau_{FSSC})W_t L_t^d H K_t - I_t - (1 - \rho_I)\tau_{VATET,I} I_t - \tau_{CIT} \cdot [Y_t - (1 + \tau_{FSSC})W_t L_t^d H K_t - \alpha I_t] + \tau_{ITC} I_t \quad (3)$$

$$\alpha = [1 - (1 + g)^{-NDEP}] / NDEP [1 - (1 + g)^{-1}] \quad (4)$$

$$\theta_L Y_t = (1 + \tau_{FSSC})W_t L_t^d H K_t \quad (5)$$

$$\frac{q_{t+1}^K}{1+r_{t+1}} (1 - 2\mu_I \frac{I_t}{K_t}) = 1 + (1 - \rho_I)\tau_{VATET,I} - \alpha\tau_{CIT} - \tau_{ITC} \quad (6)$$

$$\frac{I_t}{K_t} = \frac{1}{2\mu_I} - [1 + (1 - \rho_I)\tau_{VATET,I} - \alpha\tau_{CIT} - \tau_{ITC}] (2\mu_I q_{t+1}^K)^{-1} (1 + r_{t+1}) \quad (6a)$$

$$q_t^K = (1 - \tau_{CIT})\theta_K \frac{Y_t}{K_t} + \frac{q_{t+1}^K}{1+r_{t+1}} \left[1 - \delta_K + \mu_I \left(\frac{I_t}{K_t} \right)^2 \right] \quad (7)$$

Equations of the Household Sector

$$U_{a,t} = \frac{\sigma-1}{\sigma} \sum_{v=0}^{\infty} \gamma^v \beta^v \left(c_{a+v,t+v}^{\frac{\sigma-1}{\sigma}} + B \ell_{a+v,t+v}^{\frac{\sigma-1}{\sigma}} \right)^{\frac{\sigma}{\sigma-1}} \quad (8)$$

$$\text{Consumption component of } U_t = \sum_{n=t_0}^{\infty} (\beta\gamma)^{n-t_0} C_n \quad (9)$$

$$\text{Leisure component of } U_t = \sum_{n=t_0}^{\infty} (\beta\gamma)^{n-t_0} \ell_n \quad (9a)$$

$$\sum_{v=0}^{\infty} \gamma^v [1 + (1 - \tau_r)r_{t+v}]^{-v} (1 + \tau_{VATET,C})c_{a+v,t+v} \leq TW_{a,t} \quad (10)$$

$$TW_{a,t} \equiv HW_{a,t} + FW_{a,t} + K_t \quad (11)$$

$$HW_{a,t} = \sum_{m=0}^{\infty} \left(\frac{\gamma}{1+(1-\tau_r)r_{t+m}} \right)^m \cdot \{ (1 - \tau_{WSSC})(1 - \tau_{PIT}) \cdot [W_{t+m} H K_{t+m} (\bar{L} - \ell_{a+m,t+m})] + (1 - \tau_{PIT}) \cdot \varphi TR1_{t+m} + (1 - \varphi)TR1_{t+m} + TR2_{t+m} + TR3_{t+m} + R_{t+m} - LST_{t+m} \} \quad (12)$$

$$FW_{a,t} = [1 + (1 - \tau_r)r_{t-1}^D]PD_{t-1} + (1 - \tau_{\pi})NCF_{t-1} - (1 + r_{t-1}^{FD})FD_{t-1} + (1 - \tau_{PIT})[(1 - \tau_{WSSC})W_{t-1}HK_{t-1} \cdot (\bar{L} - \ell_{a-1,t-1}) + \varphi TR1_{t-1}] + (1 - \varphi)TR1_{t-1} + TR2_{t-1} + TR3_{t-1} + R_{t-1} - (1 + \tau_{VATET,C})C_{a-1,t-1} - LST_{t-1} \quad (13)$$

$$(1 + \tau_{VATET,C})C_t = \{1 - [1 + (1 - \tau_r)r]^{\sigma-1} \gamma \beta^{\sigma}\} [HW_t + (PD_t - FD_t) + K_t] \quad (14)$$

$$\ell_t = \left(\frac{B(1 + \tau_{VATET,C})}{(1 - \tau_{WSSC})(1 - \tau_{PIT})W_t(1 - UR_t)HK_t} \right)^{\sigma} C_t \quad (15)$$

Table 1 (continued)

Equations of the Public Sector

$$PD_{t+1} = (1 + r_t^{PD})PD_t + (1 + \tau_{VATET,CG})CG_t + (1 + \tau_{VATET,IG})IG_t + (1 + \tau_{VATET,IH})IH_t + TR_t - T_t \quad (16)$$

$$\begin{aligned} T_t &= PIT_t + CIT_t + VATET_t + WSSC_t + FSSC_t + LST_t \\ &= \tau_{PIT}[(1 - \tau_{WSSC})W_tHK_t(\bar{L} - \ell_t) + \varphi TR1_t] + \tau_r r_t^{PD} PD_t + \\ &\quad \tau_\pi NCF_t + \tau_{CIT}[Y_t - (1 + \tau_{FSSC})W_tHK_t(\bar{L} - \ell_t) - \alpha I_t] - \\ &\quad \tau_{ITC}I_t + \tau_{VATET,C}C_t + (1 - \rho_I)\tau_{VATET,I}I_t + \tau_{VATET,IH}IH_t + \\ &\quad \tau_{VATET,IG}IG_t + \tau_{WSSC}W_tHK_t(\bar{L} - \ell_t) + \\ &\quad \tau_{FSSC}W_tHK_t(\bar{L} - \ell_t) + LST_t \end{aligned} \quad (17)$$

$$TR_t = TR1_t + TR2_t + TR3_t + TR4_t \quad (18)$$

$$KG_{t+1} = (1 - \delta_{KG})KG_t + IG_t - \mu_{IG} \frac{IG_t^2}{KG_t} \quad (19)$$

$$HK_{t+1} = (1 - \delta_{HK})HK_t + IH_t - \mu_{IH} \frac{IH_t^2}{HK_t} \quad (20)$$

$$\frac{q_{t+1}^{PD}}{1 + (1 - \tau_r)r_{t+1}^{PD}} = \frac{q_t^{PD}}{1 + (1 - \tau_r)r_t^{PD}} \quad (21)$$

$$-q_{t+1}^{PD} = q_{t+1}^{KG}(1 - 2\mu_{IG} \frac{IG_t}{KG_t}) \quad (22)$$

$$\begin{aligned} q_t^{KG} &= [-\frac{\partial T_t}{\partial KG_t} q_{t+1}^{PD} + q_{t+1}^{KG}(1 - \delta_{KG} + \mu_{IG} (\frac{IG_t}{KG_t})^2)] / [1 + (1 - \tau_r)r_{t+1}^{PD}] \\ &\quad + \frac{(1 - \theta_L - \theta_K)Y_t}{KG_t} \end{aligned} \quad (23)$$

$$\frac{\partial T_t}{\partial KG_t} = [\tau_\pi(1 - \tau_{CIT}) + \tau_{CIT}](1 - \theta_L - \theta_K)Y_t / KG_t \quad (24)$$

$$-q_{t+1}^{PD} = q_{t+1}^{HK}(1 - 2\mu_{IH} \frac{IH_t}{HK_t}) \quad (25)$$

$$\begin{aligned} q_t^{HK} &= [-\frac{\partial T_t}{\partial HK_t} q_{t+1}^{PD} + q_{t+1}^{HK}(1 - \delta_{HK} + \mu_{IH} (\frac{IH_t}{HK_t})^2)] / [1 + (1 - \tau_r)r_{t+1}^{PD}] \\ &\quad + \frac{\theta_L Y_t}{HK_t} \end{aligned} \quad (26)$$

$$\frac{\partial T_t}{\partial HK_t} = \frac{\theta_L Y_t}{HK_t} [\tau_{PIT}(1 - \tau_{FSSC}) - (1 - \tau_\pi)(1 + \tau_{CIT})\tau_{FSSC} + \tau_{WSSC}] \quad (27)$$

Conditions for Market Equilibrium

$$L_t^d = (1 - UR_t)(\bar{L} - \ell_t) \quad (28)$$

$$FW_t = PD_t - FD_t \quad (29)$$

$$Y_t = C_t + CG_t + I_t + IG_t + IH_t + NX_t \quad (30)$$

$$FD_{t+1} = (1 + r_t^{FD})FD_t + C_t + I_t + CG_t + IG_t + IH_t - Y_t - R_t \quad (31)$$

Table 2

Data set

Variable	Description	Value
	<i>Domestic spending data</i> (% of Y_0)	
Y_0	GDP at market prices in 1999 (10^{12} PTEs)	20.36300
g	GDP growth rate	2.65000
C_0	Private consumption	64.90000
I_0	Private investment	21.50000
CG_0	Public consumption	11.10000
IG_0	Public investment in infrastructure	3.80000
IH_0	Public investment in human capital	6.50000
	<i>Foreign Account data</i> (% of Y_0)	
TB_0	Trade deficit	7.80000
$r_0^f FD_0$	Interest payments	0.70875
R_0	Unilateral transfers	7.26420
CAD_0	Current account deficit (+) (CAL)	0.505119
FD_0	Foreign debt in 1999	13.50000
	<i>Population and employment data</i>	
POP_0	Population in 1999	9,979,450
$PARTRA_0$	Participation rate of those aged 15-64	72.47210
$PARTRE_0$	Participation rate of those aged 65+	11.23917
UR_0	Unemployment rate	5.70000
	<i>Capital stocks</i> (% of Y_0)	
K_0	Private capital stock (CAL)	204.21222
KG_0	Public capital stock (CAL)	53.70281
HK_0	Human capital stock (CAL)	341.10706
	<i>Public Account data</i> (% of Y_0)	
TR_0	Total public transfers	14.20069
T_0	Total tax revenues	36.33026
PIT_0	Personal income tax revenues	6.10000
CIT_0	Corp. income tax revenues (incl. <i>derramas</i>)	3.24781
$derramas_0$	Municipal corporate income tax revenues	0.24781
$VATET_0$	Value-added and excise tax revenues	14.20000
$VATET, C_0$	on private consumption expenditure	11.41600
$VATET, I_0$	on private investment expenditure	1.84100
$VATET, CG_0$	on public consumption expenditure	0.47100
$VATET, IG_0$	on public investment in infrastructure	0.38000
$VATET, IH_0$	on public investment in human capital	0.09200
$FSSC_0$	Firms' social security contribution revenues	4.46074
$TrCGA_0$	Transfers to the CGA included in CG_0	2.51000
$WSSC_0$	Workers' social security contribution revenues	3.99042
$WSSC1_0$	on private sector workers	2.97383
$WSSC2_0$	on public sector employees	1.05659
LST_0	Lump sum tax revenues (CAL)	4.33128
$r_0^{PD} PD_0$	Interest payments on public debt	2.96625
DEF_0	Public deficit (+) (CAL)	1.49725
PD_0	Public debt in 1999	56.50000

Note: All values are 1990-1998 averages unless otherwise stated.

Table 3

Structural parameters

Symbol	Description	Type	Value
<i>Household parameters</i>			
β	Discount factor	CAL	0.97705
	Discount rate	CAL	0.02349
γ	Probability of survival	DAT	0.97449
$gPOP$	Population growth rate	DAT	0.00000
σ	Elasticity of substitution	ARB	1.00000
σ^{social}	Social elasticity of substitution	ARB	1.00000
<i>Production parameters</i>			
θ_L	Labour share	DAT	0.47500
θ_K	Capital share	DAT	0.37500
$1 - \theta_L - \theta_K$	Public capital externality	CAL	0.15000
δ_K	Private capital's depreciation rate	CAL	0.05866
μ_I	Adjust. cost coefficient	CAL	2.20037
AC_I	Adjust. cost as a % of private investment	CAL	0.25000
\dot{A}/A	Exogenous rate of technological progress	ARB	0.00000
<i>Public sector - outlays parameters</i>			
δ_{KG}	Public infrastructure's depreciation rate	CAL	0.02997
μ_{KG}	Adjust. cost coefficient	CAL	3.32028
AC_{IG}	Adjust. cost as a % of public investment	CAL	0.25000
δ_{HK}	Human capital's depreciation rate	CAL	0.01000
μ_{HK}	Adjust. cost coefficient	CAL	11.36713
AC_{IH}	Adjust. cost as a % of hum. capital inv.	CAL	0.25000
<i>Real interest rates</i>			
r	Basic real interest rate	DAT	0.05250
r^{FD}	Real interest rate on foreign debt	DAT	0.05250
r^{PD}	Real interest rate on public debt	DAT	0.05250
<i>Public sector - tax parameters</i>			
τ_{PIT}	Effective personal income tax rate	DAT	0.09964
φ	Fraction of pensions taxed	DAT	0.07500
τ_π	Effective distributed profits tax rate	DAT	0.10000
τ_r	Eff. (and Stat.) interest income tax rate	DAT	0.20000
τ_{CITd}	Eff. corp. income tax and <i>derramas</i> rate	DAT	0.10449
$NDEP$	Time for fiscal deprec. of inv. (years)	DAT	16.0000
ρ_I	Frac. of priv. inv. that is VAT exempt	DAT	0.68000
τ_{ITC}	Effective investment tax credit rate	DAT	0.00446
τ_{VATET}	Eff. value-added and excise taxes rate	DAT	0.15171
$\tau_{VATET,C}$	VAT and excise taxes on priv. cons.	DAT	0.21344
$\tau_{VATET,I}$	<i>idem</i> on private investment	DAT	0.09365
$\tau_{VATET,CG}$	<i>idem</i> on public consumption	DAT	0.04431
$\tau_{VATET,IG}$	<i>idem</i> on public inv. in infrastructure	DAT	0.11111
$\tau_{VATET,IH}$	<i>idem</i> on public inv. in human capital	DAT	0.01438
τ_{FSSC}	Firms' effective SS contributions rate	DAT	0.13984
τ_{WSSC}	Workers' effective SS contributions rate	DAT	0.11467
$gLST$	Growth of lump sum taxes	CAL	0.02650

Key: ARB - arbitrary; CAL - calibrated; DAT - data.

On the household side (see equations 8-15), we follow a Blanchard-Yaari overlapping generations specification, in which households have finite but non-deterministic planning horizons. Under conventional simplifying assumptions the marginal propensity to consume out of total wealth is age-independent and aggregation over all age cohorts is a simple matter. Aggregate consumption is a function of the economy-wide stock of total wealth while the aggregate supply of labour is, itself, a function of aggregate consumption.

Public investment in human capital and infrastructure are determined in an optimal fashion by the fiscal authorities (see equations 16-27). The public investment decisions are determined by the maximization of the present value of the future stream of GDP subject to the respective equations of motion, including adjustment costs, as well as the equation of motion for public debt. The choice of GDP as the objective for the public sector was suggested by the terms of the policy debate in Portugal. In fact, since the late 1980s, the public investment decisions in coordination with the EU structural policy programs seem to be clearly dictated by the goal of real convergence to EU standards of living as measured by GDP per capita

Different agents contribute differently to the overall economy-wide equilibrium (see equation 29-31). Households demand consumption goods and financial securities, and supply labour. Firms supply output and securities and demand investment goods and labour. Finally, the public sector supplies public debt securities and demands goods for different consumption and investment purposes. Given the open nature of the economy, part of the demand is satisfied through the recourse to foreign production. Finally, the financial market equilibrium reflects the fact that, household savings and foreign financing finance private capital formation and public indebtedness.

The model is implemented numerically using detailed data and parameter sets. The data set is reported in Table 2 and reflects the GDP and stock variable values in 1999. In addition, the decomposition of the aggregate variables follows the average for the period 1990-98. This period was chosen to reflect the most recent available information and to cover a complete business cycle. The choice of averages for the decomposition of the aggregate variables reflects the nature of this model, which captures the behaviour of the economy around a smooth trend but does not capture the fluctuations of the business cycle.

Parameter values are reported in Table 3 and are specified in different ways. Whenever possible, parameter values are obtained from the available data sources or the literature or as implied by the conditions for the existence of a steady-state equilibrium. All of the other parameter values are obtained by calibration, i.e., in such a way that the data for 1999 was exactly replicated and the trajectory of the economy for the period 1990-98 was exactly extrapolated as the steady-state trajectory into the future. This trajectory is slightly modified in the baseline scenario to accommodate the public deficit targets of the Stability and Growth Program for Portugal.

3. On the implementation of the tax shock

The stimulus component of the tax package is amenable to direct quantification. Naturally, the tax changes are phrased in statutory terms. Pereira and Rodrigues (2001c, 2001d) present estimates for the Portuguese economy of the effective tax rates at the most important tax margins as well as estimates on how changes in the statutory tax rates translate into changes in the effective tax rates. Using this information, Table 4 reports on how the effective tax rates at the various tax margins would be affected by the tax shock.

Table 4

How the tax shock changes statutory and effective tax rates

Statutory change	Effective impact	From	To
$\Delta t_{CIT} = -4\text{pp}$	$\Delta \tau_{CITd} = -0.04 \cdot 0.30734$	0.10449	0.09219
$\Delta t_{FSSC} = -4\text{pp}$	$\Delta \tau_{FSSC} = -0.04 \cdot 0.54656$	0.13984	0.11797
$\Delta t_{PIT,4} = -5\text{pp}$	$\Delta \tau_{PIT} = -0.05 \cdot 0.07100$	0.09964	0.09609
$\Delta t_{VAT,5} = +2\text{pp}$	$\Delta \tau_{VATET,C} = +0.02 \cdot 0.67402$	0.21344	0.22692

Sources: Cavaco Silva (1999) and Pereira and Rodrigues (2001c, 2001d).

Key – CIT - corporate income tax; CITd - CIT including *derramas*; FSSC - Firms' social security contributions; PIT,4 - personal income tax corresponding to the highest income bracket; VAT,5 - general value-added tax; VAT-ET, C - value-added and excise taxes on private consumption.

The financing component of the tax reform package is more vague and there are some crucial uncertainties. Because of the current environment of budgetary restraint, a mere reduction in tax revenues, implicitly financed by public deficits, is not a realistic option. This means that the stimulus component of the tax shock has to be matched by offsetting increases in tax revenues at other margins or by a decrease in public spending. Indeed, the tax reform package considers increased tax revenue from more effective control of tax evasion and reductions in public spending as the offsetting mechanisms. They are not, however, explicitly quantified since it is exceedingly difficult to evaluate the revenue effects of fighting tax evasion or saving on wasteful public expenditures.

4. On the effects of the tax shock

In our simulations we consider different scenarios depending on the financing mechanisms used to offset the proposed tax reductions. We start by considering the case of lump-sum tax financing. Admittedly, this is an

Table 5

Effects of the tax shock – A summary table

Case	Y	TW	TW_C	TW_ℓ
<i>Effects of the stimulus component under lump sum tax financing</i>				
Effects of reducing the CIT rate	+0.94	-0.23	-0.14	-0.09
Effects of reducing the FSSC rate	+1.02	+0.49	+0.75	-0.25
Effects of reducing the PIT rate	+1.15	-0.55	-0.36	-0.17
<i>The full stimulus component financed by...</i>				
Lump sum tax	+2.91	-0.18	+0.33	-0.49
Corporate income tax	+0.95	-0.27	+0.12	-0.35
Personal income tax	+0.72	-0.99	-1.04	+0.07
Value-added and excise taxes	+2.77	-0.91	-0.55	-0.32
Public consumption	+2.56	+0.90	+1.24	-0.30

Key – Y GDP in 2050, TW Total welfare, TW_C Consumption component, and TW_ℓ Leisure component.

unrealistic scenario. It is, however, a clear benchmark case. It yields the best possible scenario in that it minimizes the distortion induced by offsetting tax increases. Simulation results suggest that under lump-sum financing the tax shock would increase GDP in the long-term by 2.91%.

The shock affects capital accumulation positively as well as employment and after-tax wages. Accordingly, the consumption component of private welfare is 0.33% higher. The leisure component, however, shows a long-term decline. The overall private welfare indicator reflects this decline and shows a long-term loss of 0.18%.

The next two scenarios consider the possibility of the stimulus component of the package being financed by increases in either corporate income or personal income tax revenues. These correspond to the idea of increased tax revenues due to a more effective combat against tax evasion. Ultimately, these scenarios require tax changes, which are in themselves distortionary.

Simulation results suggest that under corporate income tax financing of the tax shock the statutory tax rate would have to increase by between 6.64 and 8.63 pp. The effective tax rate would have to be 0.125 up from 0.105. Under this scenario, the gains in GDP performance are reduced by as much as 67.4% compared to the lump-sum financing scenario. Indeed, in the long-term GDP is only 0.95% higher than in the baseline scenario. Naturally, the private capital stock is lower as a result of tax policy change. Nevertheless, because employment and the after-tax wage still show some increase there is a long-term gain of 0.12% in the consumption component of the private welfare indicator. Overall, however, welfare declines by 0.27% reflecting a decline in the leisure component of welfare.

In turn, if the tax shock were to be financed by changes in personal income taxation, the effective personal income tax rate would have to rise by around 34% from 0.099 to 0.134. In this scenario, GDP in the long-term is only 0.72% higher than in the baseline, a 75.3% reduction compared to gains under lump-sum financing. In this scenario capital accumulation is lower than under lump-sum financing, employment rises only marginally and the after-tax wage declines as a result of higher personal income taxes. Naturally, despite the long-term gain in GDP, the consumption component of the private welfare indicator is 1.04% lower and the overall decline on 0.99% in public welfare reflects this fact.

The next scenario considers the case of value-added tax financing. Indeed, the tax proposal suggests that if there were a revenue shortfall as a result of the tax shock, the VAT tax rate would be temporarily increased by up to 2 pp. Simulation results suggest that, if no other means were available to finance the stimulus component then the general statutory VAT rate would have to increase by between 2.59 and 3.35 pp, a permanent increase that is somewhat higher than the maximum increase allowed in the tax proposal. Under this scenario, the current effective tax rate would have to be 0.236 up from 0.213. Under VAT financing, the tax shock would yield a long-term increase in GDP of 2.77%, which is comparable to the gains under lump-sum financing. Capital accumulation responds positively to the tax shock, as do employment and the after-tax wage. The consumption component of the private welfare indicator declines by 0.55%. This is because the increase in the VAT rate penalizes consumption. Furthermore, with leisure being a complement of consumption, households naturally increase their supply of labour and the leisure component of welfare declines as well. Under such a setting, in spite of higher corporate profits down the road, we should not be surprised that the GDP welfare trade-off makes its appearance once more. Indeed, in the long-term private welfare declines by 0.91%.

The final scenario considers the case of public consumption financing. Simulation results suggest to finance the tax shock an additional permanent decrease of 1.05 pp of GDP would be required. This is in addition to the 1.30 pp reduction required under the current Stability and Growth Programs. Under this financing scenario the tax shock would yield a long-term GDP increase of 2.56%. In this scenario the public sector is doing the required saving to finance the tax shock and private consumption needn't fall as much. With leisure being a normal good that is also a complement of consumption, households choose to supply less labour. For this reason, the after-tax wage rises the most of all scenarios. Naturally then, consumption is always higher and the respective component of private welfare increases 1.24%. Overall private welfare increases by 0.90%.

5. Concluding remarks

The critical aspect of our results is that the effects of the tax shock, both the magnitude of its positive effects on GDP and the sign of its *welfare effects depend critically on how the shock is financed*. Among the

scenarios based on tax financing, the cases of lump-sum and VAT financing yield the largest positive GDP effects while the case of lump-sum and corporate tax financing yield the lowest welfare losses. Interestingly, only in the case of public spending financing would the tax shock yield simultaneously positive GDP and welfare effects. This is not particularly good news in that this is not a very realistic scenario. This is because any reductions in public spending to finance the tax shock would have to be in addition to the already stringent reductions required under the Stability and Growth Program.

These considerations place at the centre of the tax reform debate the idea that all realistic changes have to be in the form of trading off distortionary tax margins. In this case, a *fundamental trade-off between the GDP and the welfare effects of tax reform seem to be difficult to avoid*. This trade-off can be traced to the effects of the tax changes on employment, after-tax wages, and disposable income, in particular, in the presence of adjustment costs.

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THE CONTRIBUTION OF PUBLIC FINANCES TO THE EUROPEAN GROWTH STRATEGY

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The objective of the paper is to point out the impact of public finances in the context of the Lisbon growth strategy. Official communications from the Commission and ECOFIN Council note that public finances can contribute to achieving the goal of higher growth and employment via three mechanisms: (a) supporting a stable macro-economic environment, (b) making tax and benefit systems more employment friendly, and (c) redirecting public expenditures towards productive areas. This paper surveys the literature to investigate these channels, to quantify their impact and to identify conditions for their effectiveness. Based on empirical results in the literature, we conclude that there is substantial evidence to suggest that public finances can be considered a source of endogenous growth, but there remains considerable uncertainty regarding the size of their impact. This uncertainty emerges, among other factors, because the effectiveness of fiscal policies hinges on external conditions, such as the state of development. In addition, the link between these policy mechanisms and economic growth seems to have a non-linear functional form in the short and in the long-run.

1. Introduction – The European Growth Strategy

The European Council, meeting in March 2000 in Lisbon, set the new strategic goal for the European Union "... to become the most competitive and dynamic knowledge-based economy in the world, capable of sustainable economic growth with more and better jobs and greater social cohesion".¹ It proclaims a comprehensive strategy preparing the

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¹ Conclusion of the Presidency, p. 2.

transition to a knowledge-based economy through better R&D, the spread of information technologies, stepping up of structural reforms for competitiveness and innovation, and by completing the internal market. Moreover, the appropriate macro-economic policy mix is considered an ingredient for a healthy economic outlook and favorable growth prospects. Many of the measures envisaged by the heads of states as part of a comprehensive strategy affect not only the regulatory setting but also public finances. If implemented, the Council considers "an average economic growth rate of around 3% [as] a realistic prospect for the coming years".²

In a follow up to the process initiated in Lisbon, the Commission and ECOFIN Council underscored that the "quality" of public finances plays a crucial role for growth and employment.³ In particular, public budgets can contribute to higher growth and employment via three mechanisms: (a) supporting a stable macro-economic environment through sustainable public finances, (b) making tax and benefit systems more employment friendly, and (c) redirecting public expenditures towards physical and human capital accumulation and encouraging technological progress.

The first mechanism builds upon and pushes further the consolidation process, which has been initiated since the start of the Maastricht process. In line with the principles set forth in the Stability and Growth Pact, fiscal policy can contribute to a stable macroeconomic environment through sustainable public finances avoiding disruptive fiscal adjustments. In addition, the cyclical fluctuation of the budget attenuates economic cycles, when governments do not replicate the errors of the past and engage in procyclical fiscal policies. In addition, it is argued that the challenges of aging populations need to be addressed to avoid excessive deficits in the future and preserve the sustainability of public finances.

The second mechanism, tax and expenditure reforms, aims at a sustainable reduction of the tax burden and more employment friendly tax and benefit systems. Any progress in reducing the tax burden however should not jeopardize the sustainability and appropriate cyclicity of public finances. In particular, the tax burden on labour as well as the marginal income tax rate should be lowered and benefit systems should be

² Conclusions of the Presidency, p. 2.

³ Report from the Commission and the (ECOFIN) Council to the European Council (Stockholm, 23/24 March 2001), The contribution of Public Finances to Growth and Employment: Improving Quality and Sustainability, (Press Release: Brussels, 12 March 2001 No. 6997/01).

reshuffled so as to make work pay and curb unemployment traps. According to the Commission and the ECOFIN Council report, reducing the tax wedge for low-paid workers and developing in-work benefits are instruments to bring labour back into work.

The third mechanism is the redirection of public spending to productive areas. Shifting public spending towards capital accumulation and technological innovation, as the Commission and the Council argue, needs to be compatible with the first and second mechanism. Therefore, it has to be based on the restructuring rather than the augmentation of public finances. In the official documents, particular emphasis is given to the areas of education and training as well as R&D. Increased investment in physical and human capital should complement and support private investment rather than substitute it. This requires the design of a comprehensive reform strategy setting incentives for private investment activities. Moreover, due consideration has to be given to the efficiency of investments, among others, by reaping the gains from public-private-partnerships for the development and implementation of projects.

The paper will discuss each of these three mechanisms in turn in the following sections. The main purpose of each section is, first, to briefly outline theoretical approaches provided in the literature, linking the respective mechanism to short-term and long-term growth. Then we survey the empirical literature in the field in order to find evidence of the quantitative impact of these mechanisms and the conditions for their effectiveness. Based on empirical results in the literature, we conclude that there is evidence indicating that public finances can be considered a source of endogenous growth, but considerable uncertainty remains regarding the size of their impact. This uncertainty emerges, among others factors, because the effectiveness of fiscal policies hinges on external conditions, such as the state of development. In addition, the link between policy mechanisms and economic growth often seems to have a non-linear functional form in the short- and in the long-run.

2. Supporting a stable macroeconomic framework via sound fiscal policies

This section focuses on the first channel. Its main purpose is to assess, by reviewing the empirical evidence and main theoretical arguments, under which conditions and to what extent sound fiscal

balances can enhance long-term growth and dampen short-term fluctuations, supporting a stable macroeconomic framework.

2.1 Public budgets and short-term macroeconomic stability

There are several demand and supply channels through which fiscal policies can affect economic activity in the short-run thus being able to contribute to a stable macroeconomic environment. Nevertheless, there is little consensus on the possibilities of fiscal policies affecting economic activity in a predictable way.

A good starting point to understand the macroeconomic implications of budget deterioration and consolidation is to contrast Keynesian and neo-classical theories about short-term macroeconomic impact. The impact on output is usually termed the fiscal multiplier. In a Keynesian framework, a tightening of fiscal policy can have temporary contractionary effects on output, and a fiscal expansion can temporarily raise output via the aggregate demand channel. The change in demand owing to a change in government expenditures or taxes affects output via private agents' reactions to the change in disposable income derived from the government's measures. The immediate fiscal multiplier of higher spending is bigger than the effect of a corresponding tax increase to finance these expenditures. Assuming no changes in investment, the multiplier would be exactly one if the rise in spending would leave the budget balance unaffected. However, if this assumption is changed the results may deviate considerably. Under these circumstances higher demand leads to an increase in interest rates, which in turn crowds out private investment. Therefore, the impact on aggregate output may be largely reduced or even reversed if supply side factors are fully taken into account.

The idea of a positive reaction of consumption to an increase in public spending strongly contrasts with the standard neo-classical view on how people react to fiscal expansions. In a neo-classical model an increase in public spending, would have a negative impact on private consumption due to the permanent income effect. In contrast to the Keynesian model, where consumption is oriented towards current income, the basic foundation of the neo-classical models is that people form forward-looking rational expectations. Individuals would anticipate that an increase in spending has to correspond to the net present value of the future tax

increases to finance it. They would therefore adjust their labour-leisure choice, reducing consumption, increasing labour supply and saving more.

In the neo-classical models of business cycles, the crucial condition is the elasticity of labour supply. If the elasticity of labour is high, labour supply increases, real wages fall and the marginal product of capital increases. If the response of labour and the positive effect on the marginal product is large enough, some households start to save more due to the high rate of return. Therefore, investment rises leading to an overall increase in output. If labour elasticity is low, the marginal product of capital, savings and investment do not change and overall output falls. On this score, as in the Keynesian theory a fiscal spending impulse may yield a positive output effect in the short-run, however, the composition of economic changes, that is the contribution of consumption or investment to the overall development, may be reversed.

The fact that neo-classical models are based on forward-looking agents implies that the multiplier depends on temporary and permanent characteristics of the fiscal expansion or consolidation balance. In general, a permanent increase in government spending should have a stronger impact on people's labour-leisure choice and therefore lead to a larger capital stock. As a consequence, output reduction as a reaction to a permanent fiscal expansion will be less than for a temporary expansion. A permanent expansion may even have a Keynesian-type multiplier larger than one (Aiyagari *et al.*, 1992). These effects are obviously very sensitive to the way spending increases are financed. They are essentially reversed if an expansion of public employment or distortionary taxation negatively affects labour supply and capital accumulation (Fatás and Mihov, 2000; Alesina and Perotti, 1997; Lane and Perotti, 1999).

However, it must be noted that the reaction of aggregate output in the Keynesian or neo-classical setting also depends on a number of other economic conditions.⁴ First, in an open economy the associated increase in the interest rate leads to capital inflow, the real exchange rate will appreciate and the external current account of the country and overall output deteriorate. This is the basis for the well-known finding that fiscal policy is unable to stimulate an open economy with a flexible exchange rate regime even in a purely Keynesian framework. Second, the crowding out of private activity would be larger if investment is rather sensitive to

⁴ On this issue see also IMF (2000) providing an excellent overview.

interest rates. Conversely, if investment is an increasing function of current income, an accelerator effect can generate sizeable fiscal multipliers, despite the crowding out effect. The same holds if excess capacity exists in the economy, which may be reduced through the fiscal expansion. Third, the impact depends on the reaction of monetary policy on the fiscal expansion. In general, the more sensitive the interest rate is to changes in income, the stronger the crowding out effect. Relaxing monetary policy could accommodate this. If this would happen as a surprise, one could indeed expect a positive output effect. If the accommodative monetary stance would be permanent, however, it would feed into inflationary expectations, and would not change output or even lead to the reversed effect in the longer run. Finally, the crowding out effect will also depend on the degree of price flexibility. If firms incur costs for changing prices, they are reluctant to do so and respond to a positive external demand shock, e.g. in the form of increased government spending, with an expansion of output. Thus, the output effect of a fiscal expansion increases in the degree of price stickiness, because it prevents an adjustment of prices from rising to an equilibrium level weakening aggregate demand. However, the same mechanism may also lead to a stronger crowding out of private investment. The increase of aggregate demand without a price adjustment implies a higher real interest rate, which in turn undermines investment activity.

Moreover, expectations about future government policies affect the risk premium on interest rates. When government debt is high and building up through an expansionary fiscal policy, interest rates will increase reflecting a higher default risk on debt and a larger inflation risk. Under these circumstances, a temporary easing should produce a larger positive multiplier than a permanent increase. The crucial aspect here is the credibility of the government to control public finances. If the government lacks this credibility, the risk premium may become sizeable and even lead to a negative multiplier. Depending on the conditions under which the fiscal expansion occurs, people's expectation about future policies can produce a non-linear reaction scheme, corresponding to Keynesian or non-Keynesian predictions. When debt is low and no quick reversal of a fiscal expansion is expected, the macro-economic reaction may be Keynesian. However, when the government eases fiscal policy, but it is widely perceived that the resulting development of the debt level is unsustainable, and that a large tax rise will be needed soon to correct this misalignment, the reaction of private demand could be non-Keynesian, because the fiscal expansion is associated with a loss of people's net wealth

(Sutherland, 1997). Alternatively, people may have the perception that government spending is continuously evolving into a direction requiring even higher levels of taxation. Under these circumstances, a fiscal contraction of cutting government spending could convince them that a certain critical state will not be achieved, and induce higher private consumption (Bertola and Drazen, 1993).

Although, explanations along these lines are often found in the literature, it should also be noted that non-linearities may also emerge from the financial market access of individuals. If the government consolidates, by lowering government spending expected future taxation decreases. The wealth and consumption of individuals not being credit constraint rise, while the disposable income of credit constraint individuals deteriorates. When the latter effect dominates, the overall effect on private consumption may be “Keynesian” and the government multiplier on private consumption is positive. Conversely, the aggregate reaction will be distinctively “non-Keynesian” when the former effect dominates. (Perotti, 1999).

Empirical evidence supports the Keynesian multipliers effects in normal circumstances. Studies on the short-term impact of fiscal policy have used a number of different approaches. Given the limitations of fiscal data below annual frequency, cross-sectional and panel data studies with annual data have been fairly widespread. Several studies on non-linear effects use extensively simple sample mean comparisons to distil the stylised facts on which the analysis is based (see Alesina and Perotti, 1995 and 1997) and a growing number of studies focusing on non-linear effects). Since this line of research often focuses on “strong fiscal consolidations”, cross sectional analyses are often supplemented by country case studies, with different degrees of detail. Model simulation is a well extended method of analysis. Traditionally international institutions use macro models e.g. the IMF’s Multimod model; but also neo-classical models have been used for simulation. More recent studies have introduced the use of time series techniques for the analysis of fiscal policy effects. In particular VAR models, which easily take account of the problem of endogeneity of fiscal policies, are present in most of the empirical analysis. (Some examples of studies using VAR are Ramey and Saphiro (1997), Edelberg *et al.* (1999) and Burnside *et al.* (1999) or Blanchard and Perotti (1999), Fatas and Mihov (2000) and Perotti (2002) for SVAR). Nevertheless, the usage of time series econometrics is relatively limited by the difficulty in finding

high frequency data, often focussing on individual countries for which fiscal data at a quarterly frequency is available.

Each of the specific methods has specific limitations. Yet, some of the problems should be enlisted: first, several authors try to overcome the problem of endogeneity with respect to the explanatory fiscal variable by using cyclically adjusted budget figures. But there is considerable controversy on how to appropriately correct fiscal variables for the impact of the cycle. Therefore empirical findings are probably subject to measurement errors and methodological qualifications. Second, the short-term perspective often does not allow us to fully capture the effect of fiscal policy measures, which may have long-run implications. This holds particularly for changes of social security payments, such as pensions. Thus it is notoriously difficult to assess the impact of fiscal policy reforms, which may have an expectational impact before they are actually implemented or may be particularly effective years after it has been approved due to (potentially unmeasured) exogenous changes. Third, the multiplier effect may be conditional on several state variables, such as the level of public debt etc, giving rise to non-linearities. Although some progress has been made in this direction a number of studies fail to account for this time-varying pattern of the multiplier to discriminate between different explanations for the effect. All this complicates the empirical analysis and certainly contributes to the fact that there is still considerable variation in empirical findings on fiscal multipliers.

In large scale macro-econometric models, a fiscal expansion is typically modelled as an increase of government purchases, without a corresponding increase in taxation. Simulations of fiscal multipliers for the G3 countries point to a positive short-term effect of fiscal expansions. The multiplier is above one in the short run and then slowly fades to ca. 0.5 or less in the medium-run. These findings are rather robust across different models. Country simulations for the G7 countries yield similar results, they point in a similar direction assuming a permanent increase of government non-wage expenditures of 1% of GDP. The sign of the multiplier is always positive. The size of short-term multipliers ranges from 0.6 to 1.1 if money supply is held constant and the exchange rate is allowed to float. When money supply is variable and the exchange rate fixed, it varies between 0.6 and 1.3 in the short run. The medium-run fiscal multiplier ranges from zero to 0.9 in the first setting and from 0.5 to 1.5 in the latter one. Moreover, there is little evidence that the monetary regime or inflation has an impact

on the size of the short-term fiscal multipliers (IMF, 2000, Koelln *et al.*, 1996).

Looking at components of domestic absorption, empirical results indicate a positive multiplier for private consumption.⁵ Simulations using the IMF multi-country model (MULTIMOD) indicate a multiplier of one in the short-run and minus one in the medium-run, potentially due to the stopping or tax rule imposed for the simulation exercise. For OECD countries, the estimated macroeconomic effect of a spending increase is 0.7 in “normal times”. However, the multiplier may become negative in difficult times of high debt levels, amounting to -0.4 . Overall, the results largely deviate from the predictions of neo-classical models (see also Fatas and Mihov, 2000, on this point). The picture is more ambiguous regarding the impact of public spending on private investment. The IMF multi-country model yields a multiplier of -0.6 in the short-run and essentially zero in the medium-run. Empirical estimates range from a sizeable positive multiplier of 0.7 to no impact in the short-run. For the medium-term horizon, they mostly indicate no impact, although one method yields a negative coefficient of -0.4 . For a sample of OECD countries, negative multipliers of -0.4 and -0.5 have been found for the short- and medium-term respectively.

Several empirical studies look at the non-linear effect of fiscal policy and its determinants. For European countries, evidence could be found that consumers behave in a non-Keynesian way when a country’s debt level is high and future taxation uncertain (Bhattacharya, 1999). Others look at the impact of the debt level on the reaction of private consumption to a fiscal expansion. Moreover the study finds some impact of credibility effects. When a fiscal consolidation seems particularly credible or persistent, it produces a larger negative multiplier (*ibidem*). For a sample of OECD countries, different constellations have been examined, producing the following results: first, fiscal contractions have a larger effect on the economy than fiscal expansions. Second, the effect of fiscal consolidations is non-linear. The otherwise Keynesian-type multiplier is strongly reduced for changes in taxes or spending, when it is associated with a large-scale contraction or expansion of the budget balance. Third, the non-linearity is not related to the debt level or growth of public debt (Giavazzi *et al.*, 2000).

⁵ This paragraph is based on Perotti (2000) if not indicated otherwise.

The implication of these findings for fiscal policy making is that fiscal policy can be conducive to smooth output and people's disposable income in normal circumstances.⁶ Therefore, the Council's recommendation to avoid pro-cyclical policies could have empirical support.

2.2 *The impact of public budgets on long-term growth*

Recent literature on endogenous growth theory predicts that policy changes can affect the long-term growth rate by influencing the determinants of growth (physical and human capital, technological change, employment and savings). Therefore, changes in public expenditure and taxes could boost employment, human capital accumulation or increase investment externalities that then would have effects on the growth rate of output. To enhance growth, fiscal policies should also be conducive to economic stability in the short run (see above).

The size and evolution of budget balances can have a direct effect on long-term growth via its impact on aggregate savings and investment and an indirect effect derived from the implications of deficits on inflation and economic stability. These effects are independent of the impact on growth derived from the size and composition of taxes and expenditures.

Aggregate Savings

The impact of public accounts on aggregate savings crucially depends on the prevailing relation of substitutability or complementary between public and private savings. If they are complements or imperfect substitutes a decrease in the structural deficit (increase in public savings) will lead to higher aggregate savings and therefore support long-run growth. This is in fact the finding of most of the literature.

The reaction of private saving to public dissaving is the underlying idea of the so-called Ricardian equivalence, which states that public deficits will leave aggregate savings unchanged since agents tend to see them as delayed taxes, and therefore will respond by increasing private savings to neutralise the public dissaving.

⁶ Nevertheless, the effectiveness of the positive fiscal multiplier through which fiscal policy can contribute to output stabilisation depends on a number of conditions, such as the exchange rate regime, the sensitivity of investment to interest rate changes etc.

There are some quite well known theoretical arguments both in favour and against the Ricardian equivalence (see, for example, Barro, 1974, Bailey, 1971 or Blanchard, 1985). The effects of public deficits depend on the time horizon, in infinite horizon models the Ricardian equivalence holds. The condition for it to hold when the planning horizons of agents are finite, is the existence of private transfers (bequests) between generations, so that the future burden for private agents of future generations is not ignored by the current generation. The existing empirical evidence is largely inconclusive, but tends to reject the hypothesis of a full offsetting of government deficits by private savings. Thus, fiscal policy affects the overall savings level and therefore the long-run growth prospects.

Most of the empirical work has focused on testing direct implications of the Ricardian equivalence, such as aggregate consumption or interest rates remaining unaffected by government deficits (see for example Feldstein, 1982, Kormendi, 1983, Hoelscher, 1986). Most of these studies relate to the USA, some exceptions are Bernheim (1987), and Giavazzi, Japelli and Pagano (2000). These type of studies suffer from methodological caveats that may invalidate the results, including measurement problems, simultaneity issues, treatment of non-stationarity, inappropriate treatment of expectations, etc. For a clear discussion on methodological aspects of the Ricardian equivalence tests see Seater (1993).

Some studies look directly at the correlation between private and public savings, for example Easterly and Rebelo (1993) find a negative and significant correlation, while Levine and Renelt (1992) only find a very fragile correlation. These studies also suffer from several limitations, namely, they lack statistical power due to small samples, they neglect the possibility that different shocks could offset the reaction of private saving to public dissaving and they, mainly, focus on contemporaneous behaviour to extract conclusions about the long run.

An alternative approach is to use time series techniques. Doménech, Taguas and Varela (1999) estimate the long-run response of national savings to public deficit using OECD data in the context of a structural VAR where they separate savings and deficit movements into two types of shocks associated with structural parameters of the economy. Their results indicate that private savings only offset a small fraction (less than 40%) of public dissaving.

Inputs accumulation

There are several channels through which fiscal deficit could affect inputs accumulation. High deficits could translate into *higher interest rates* therefore increasing the cost of investment in physical and also human capital with the consequent negative impact on long-term growth. This is the above-mentioned crowding out effect. If interest rates are sensitive to changes in demand expansionary fiscal policy could in a Keynesian framework of sticky prices lead to higher interest rates. Furthermore, if markets see the fiscal positions as unsustainable, the risk premium on interest rates will be high to the detriment of investment and long-term growth (See Bayoumi *et al.*, 1995, and Poterba and Reuben, 1999, 2001).⁷

Large deficits may also influence economic investment by contributing to *macro economic instability*. Most of the theoretical and empirical literature confirms the negative relationship between deficits and growth via inflation (typically seen as one of the most important indicators of macro instability). Large deficits may require monetization of the government debt and this will result in inflationary pressures undermining monetary stability. Sargent (1999) shows that under a persistent fiscal deficit, it is impossible to run a non inflationary monetary policy, while it is easy to do so if fiscal policy is tight. Similarly, the controversial fiscal theory of price determination argues that the price level is determined by the evolution of monetary aggregates only when fiscal policies are tight and solvent (see Sims, 1994, Woodford, 1994, 1995, Cochrane, 1998, and Canzoneri *et al.*, 1999).

High and volatile inflation can result in uncertainty in the markets, deteriorating the environment for private sector decisions and reducing the efficiency of the price mechanism, as absolute prices will fail to transmit the correct information on relative prices. This affects both the investment decisions and the efficiency of economic activity thus damaging long-term economic growth. Additionally, large deficits could lead economic agents to expect *a change of direction* in policies (i.e. a growing probability of higher inflation). This will also affect investment decisions.

Studies based on simple growth equations found a negative relation between *inflation* and economic *growth* (see Kormendi and Meguire, 1985, Grier and Tullock, 1989, Barro, 1996, etc.). Similar results emerge from panel data work (e.g. Andres and Hernando, 1999). Judson and Orphanides

⁷ These authors also find that strict legal restraints on deficits lowers the risk premium.

(1996) found that inflation volatility is negatively and robustly correlated with growth at all levels of inflation.

Regarding the relationship between growth and deficits, some empirical studies show that deficit is a robust variable in growth equations, although the interpretation is not clear since as Earstely and Rebelo (1993) point out, this may be simple correlation due to automatic stabilisers.

3. Making tax and benefits more employment friendly

The current situation of the labour market in Europe is characterised by a declining trend in the employment rates, combined with some unpleasant structural features, among them an uneven distribution of unemployment across different groups in the labour market (concentrated mainly in younger and unskilled people), long-term unemployment, and geographical and skill mismatches. Well-articulated public spending could deliver the right incentives to reduce these problems.

Public expenditure affects labour demand and supply and, consequently, the determination of equilibrium employment. There is therefore a direct impact on human capital stock and economic growth. The way in which public expenditure affects employment is a complex issue, and the incentive and disincentive effects of public intervention need to be weighed carefully. For example, well-designed unemployment benefits provide important safety nets for people and allow workers to search longer for the most productive employment. However, this might lengthen the period of unemployment, which would have second-round effects on the productive potential of the economy, because long-term unemployed workers experience a depreciation of their human capital. But the drawbacks of social benefits are illustrated most clearly by their effects on labour supply, the unconditional payment of unemployment benefit or other social security benefits for a large period has been cited as an important disincentive to work and as one of the main causes of unemployment in Europe (Layard *et al.*, 1991, Blanchard and Wolfers, 2000). These kinds of benefits (even if temporarily) are subject to moral hazard problems and should be linked to active manpower policies (training, placement services, etc.) to help workers find a productive job.

Moreover little penalisation or even active encouragement of early retirement have reduced labour supply. Early retirement policies may

reduce the incentive for older people to continue to work and (as well as work-sharing policies) are counter-productive in the sense that the employment equilibrium will remain most likely unaffected. The reduction of the labour supply will result in wage pressures causing employment to fall (see for example, Layard *et al.*, 1991). Early retirement prospects also constitute a disincentive for workers to maintain professional skills and engage in lifelong learning. Furthermore, early retirement incentives can facilitate labour shedding even when dismissal is very difficult. As a result, firms needing to reduce employment would cut their older workforce. This may be the more experienced rather than the least productive staff.

Labour market policies can, when properly designed and implemented, enhance labour supply and demand and consequently the rate of employment. Training programmes can facilitate skill maintenance and upgrading, thereby reducing skill-mismatch and human capital degradation among the long-term unemployed. Another challenge is the re-integration of groups, which are difficult to employ, such as low-skilled people, the long-term unemployed and older workers. Other incentives to participate could be wage subsidies (or negative income taxes) for low paid jobs in order to make these jobs more attractive to workers.

As regards labour demand, the effect of taxes, social security contributions and minimum wage regulations on wages may be a problem for workers with low productivity (typically young and low skilled workers). In this case, wage subsidies could help these workers to find a job and become more productive. Wage subsidies can also be directed to employed by new enterprises, to help cover the initial cost of starting a business. Other active labour market policies are job search assistance and direct job creation.

The empirical evidence on the effect of these public policies comes from two different kind of studies. The macroeconometric studies, pioneered by Layard, Nickell and Jackman (1991), consist of estimating reduced forms of unemployment equations across countries. Expenditure on active labour market policies (as one of the institutional factors entering these equations) is found to be significant, and it is associated to lower unemployment. Similar results are those in Nickell and Layard (1999). Blanchard and Wolfers (2000) find that the relationship becomes insignificant when allowing for economic shocks. A number of country specific studies following a similar approach have been conducted and some of them, particularly those for Scandinavian countries, do not support the finding of most of the cross-countries analysis that active labour market

policies could contribute to lower unemployment. Macroeconomic studies typically suffer from several shortcomings, such as misspecification and omitted variables, measurement errors and simultaneity biases. Studies using microdata on specific episodes or schemes, or evaluating effects on particular industries, sectors, etc. give quite an ambiguous message depending on the data and on the empirical approach. Furthermore, it is adventurous to extract general policy implications from micro studies as they are based on specific countries, events and reforms. Overall, it could be concluded that training and subsidies are the active labour market policies that could play a role in increasing employment.⁸

All the potentially beneficial effects of public policies cannot be assessed independently of the impact of the taxes required to finance them. Labour taxes, including social contributions, which are the main source of financing for these policies, raise labour costs and drive a wedge between gross wages (paid by the employer) and net wages (received by the employee). The extent to which labour taxes translate into higher gross compensation or lower net earnings also depends on institutional factors, such as the functioning of the labour market and the wage bargaining process. As such factors differ across countries, one would expect different wages response across countries.

Under competitive conditions in the labour market, labour taxes will be mostly borne by workers, resulting then in a lower net wage.⁹ In this case decisions on labour supply will be influenced by an income and a substitution effect. According to the income effect, lower wages will increase labour supply in order to keep constant the income level. However, the substitution effect will induce a lower labour supply, as lower wages make leisure relatively cheaper in terms of labour. The net effect depends on the elasticity of labour supply to wages. This is difficult to measure due to the fact that different labour market groups have different sensitivities to wage fluctuations. Labour supply elasticities appear to be generally low for men. By contrast they are higher for women. Main household earners and single workers have an inelastic supply while secondary earners have a much more elastic supply. The empirical evidence finds very diverse estimates of labour supply elasticity. The

⁸ For an assessment of the impact of recent active labour market measures in Europe J. Morgan and Mourage (2002).

⁹ Also, wages will adjust differently depending on the type of labour taxes, evidence is that there are different adjustment speeds but not intrinsic long-run differences.

Congressional Budget Office (1996) has calculated an overall measure for the US using different estimates of between 0 and -0.3 . In Europe labour supply elasticity is likely to be higher given the lower female labour force participation.

By contrast, in the presence of rigidities, such as regulation and labour protection, partly decentralised systems of wage bargaining workers will not be willing to accept lower wages and employers will be the ones bearing the taxes, and therefore, they tend to reduce labour-demand. The extent to which producers cut employment is measured by the elasticity of labour demand with respect to real labour cost. This elasticity does not seem to be very high on average, but it is estimated to be higher for low-skill workers, who are often more easily replaced for physical capital and rationalisation than high skill workers.

Empirical work shows that generally labour-demand elasticities are much higher than overall supply elasticities, so that labour taxes tend to be more distortionary in countries where there are inflexible labour markets. Hence, most of the tax effects fall on the demand rather than on the supply of labour. Empirical evidence also shows that in most EU countries taxes have played an important role in raising wages (Cotins *et al.*, 1996).

The empirical studies on the effect of labour taxes on equilibrium employment and growth has followed three different approaches. The macroeconometric approach is the most developed. It consists of estimating reduced forms of unemployment equations, which show that labour income taxes do not significantly affect employment/unemployment level in Europe (e.g. Layard, Nickell and Jackman, 1991 and 1996, Bean, 1994, Blanchard and Wolfers, 2000). However, a similar study which accounts for countries' heterogeneity, particularly with respect to institutional features, finds that labour taxes are a major cause of unemployment in Europe (Daveri and Tabellini, 2000). These macroeconomic studies typically suffer from a number of shortcomings, such as misspecification and omitted variables, measurement errors and simultaneity biases.

An alternative approach is based on micro econometric techniques, relating to countries' specific experience (or quasi-natural experiment), as it might be in the case of Chile's pension reform or the adoption of a special insurance scheme in the US. These studies find that labour taxes are neutral in the long run (Gruber, 1997). This approach has important advantages with respect to the macroeconomic approach, as it avoids

simultaneity problems and singles out clearly the policy to be assessed and the scope to be evaluated. However, the main problem with this approach is the lack of generality of the results, as they are based on specific countries, events and reforms.

A third approach to test the effects of labour taxes on employment looks at dynamic model simulations. Pissarides (1998) simulates the impact on equilibrium employment of a linear employment tax using four alternative models of the labour market. The main conclusion is that this impact crucially depends on the unemployment benefit system. If unemployment benefits are indexed to wages, real wages absorb tax changes and therefore tax cuts will not have much impact on employment. In contrast, if unemployment benefits are fixed in real terms the employment effect of a tax cut can be large, a 10% cut in taxes could reduce equilibrium unemployment by up to 1 percentage point. Altenburg and Staub (2002) using a different model find also that the tax cuts impact depends on whether unemployment benefits are indexed to wages or to prices. In the first case, tax cuts are found to have adverse effects on employment, while if unemployment benefits are constant in real terms the effect of a tax cut is ambiguous. Daveri and Maffezzoli (2000) calibrate an infinite-horizon model with endogenous growth and unemployment on data for the largest EU countries and find that a 1% labour tax cut increases growth by about 0.2% when fiscal constraints do not bind and undo the positive effect of tax cuts.

Macromodel simulations are quite popular among national and international institutions. Some simulations using the EU Commission's Quest model (see Leibfritz *et al.*, 1997) explore the impact of a 1% of GDP cut in taxes. When labour income tax is reduced GDP goes up by 2% in the EU (vs. 3.7% in USA and 0.7% in Japan). The reduction in transfers and unemployment benefits has significant effects, according to these simulations, on employment as it lowers the reservation rate.

From the available empirical evidence it can be safely concluded that, on balance, it is often the combination of high labour taxes and generous benefit systems that results in employment disincentives. The disincentives are typically strongest for low-skilled/low-income workers.

4. Redirecting public expenditures towards physical and human capital accumulation

Redirecting public expenditures towards productive areas is the third mechanism identified by the Council and Commission communication. In principle almost all expenditures could be justified by this definition, as long as they contribute to social cohesion and well-being, and thereby have a positive impact on people's capacity to work. Nonetheless, the following sub-sections will focus on the three areas more directly linked to the production process: public infrastructure investment, education and human capital formation, and R&D investment.

4.1 Public infrastructure investment

The accumulation of physical capital is a key factor in the growth process. Governments contribute to physical capital accumulation by directly providing physical capital (public infrastructure), but government expenditures could also improve private capital productivity either directly or via the positive impact of public infrastructure on private activity.

Public infrastructure mostly consists of large capital intensive "monopolies" such as highways, some transportation facilities, water and sewerage pipes and communication systems. The conventional view is that public provision of this kind of investment contributes to growth by overcoming the problems associated with market provision. Infrastructures cannot be considered pure public goods. Therefore, the rationale for the government to get involved in their provision is their feature as natural monopolies. If private monopolists are allowed to charge prices above marginal cost, and have supranormal profits, large inefficiencies may arise in the market. In most industrialised countries, governments have directly provided a large part of the infrastructure. In recent years this role of the government has been questioned due to inefficiencies in the production of infrastructure. This disenchantment may have also contributed to the current tendency to engage in public-private partnerships or out-source infrastructure investment to the private sector entity, which is regulated by public authorities.

A large number of studies have empirically investigated the effects of public infrastructure on private sector productivity and growth. The econometric techniques, samples and data sets vary considerably. The

widely cited study of Aschauer (1989a) estimates the impact of infrastructure on output in *an aggregate production function framework* and finds an elasticity of output with respect to public capital of 0.39 for the US. This finding would give public investment a prominent role as a “growth enhancing” mechanism and it fuelled the political debate on whether the low productivity growth in the 1970’s was due to a lack of public investment.

Aschauer himself, as well as others, extended the sample to a small number of industrialised countries. These studies generally find a positive effect of public infrastructure investment on productivity growth, although it is not always robust to the choice of the econometric specification. Aschauer (1989b) finds for the sample of G7 countries an output elasticity of even 0.41. Seitz (2001) reports for a sample of 13 OECD countries, including the G7, estimates of 0.12 to 0.17. This is relatively close to the coefficient of 0.18 found by Evans and Karras (1994) for seven developed economies.¹⁰ These small samples, on the one hand, have the advantage of including a fairly homogeneous set of countries, but on the other hand, results may largely depend on individual country performance. This problem has been overcome by a series of studies, started by Barro (1991), using a worldwide sample of countries. Among others, Barro and Lee (1994) find a positive relationship between total investment and per capita growth. In addition, they cannot find any significant impact of public investment measured as a share of total investment. This implies that the return on public capital is similar to private investment and the contribution of each component is therefore not relevant.

The previously quoted work was heavily criticised on different methodological and economic grounds. First, it has been argued that the finding may be driven by “reversed causation”. Governments would then tend to invest more in periods of high growth and public investment would be a superior good to them. This argument however, could be invalidated by empirical evidence in other studies suggesting that the direction of causation indeed goes from investment to growth.¹¹ Second, Aschauer’s

¹⁰ The latter authors cannot find an effect significantly different from zero for all specifications, but it is unclear how reliable these specifications are since they produce at the same time highly unlikely values for private production factors.

¹¹ Apart from using instrumental variables, the evidence against ‘reversed causation’ essentially builds upon the differentiated pattern between public investment and output. If public investment were a superior good for governments, one would expect a broad increase in overall investment during upswings. However, the expected positive correlation can only be found for specific areas of (continues)

finding could be the result of the “spurious regressions” problem and it has been argued that the coefficient is therefore too large. As a consequence, growth equations should be estimated in first differences. Estimating the impact of public investment on output in first differences, in fact, yields much weaker and sometimes inconclusive results. But this does not apply to all countries. De la Fuente (2000) shows that estimates for the US states become contradictory, while those for Spanish regions rather robustly indicate an elasticity of close to 0.1. Therefore, it may be rather the size of the coefficient than the effect per se which seems questionable. Finally, it has been argued that the study controlled insufficiently for other possible determinants of growth. The common pattern of decline in productivity and public investment could in fact emerge from a third factor, such as the increase in energy prices. However, the Barro-type growth equations include a large amount of control variables, so that a simple omitted variables bias is rather unlikely.

The last issue can also be understood differently. An important question is whether the impact of public investment is *conditional* on other factors. For example, Demetriades and Mamuneas (2000) use a panel for 12 OECD countries and estimate the impact on output growth per capita individually for each country. The output effect of infrastructure investment varies in the range of 0.36 to 2.0. Similarly Ford and Poret (1991), replicating Aschauer’s analysis for eleven OECD countries find a consistent positive correlation between investment and productivity growth in only five cases. The implied marginal product of infrastructure ranges from 0.45 in the United States to 1.7 in Germany. We are not aware of studies analysing the complementarity or substitution between public investment and “third factors”, such as political and regulatory institutions, but two explanations for this differential impact can be put forward.

First, as mentioned above, the relationship between public investment and output or productivity growth may be non-linear, since public investment eventually may crowd-out private capital formation and become increasingly inefficient. The impact should therefore vary across countries depending on their stock of capital or public investment rate. De la Fuente (1997) investigates that issue for a sample of OECD countries. Using the investment to GDP rate, as a proxy for the public capital stock, and an interaction term of the investment rate with its log, he finds a

investment, such as productive infrastructure, or with respect to specific sectors of the economy, which heavily use these types of infrastructure. (see de la Fuente 2000).

non-linear effect, although the second term is not always statistically significant. According to these estimates, the elasticity of aggregate output with respect to the stock of public capital is around 0.20 for very low levels of investment. Then returns diminish rapidly. The point estimates of this non-linear relationship indicate that investment expenditures could only be expected to yield higher growth rates in countries which devote less than 2% of their GDP to public investment. These estimates however do not take into account the “saturation” of investment, i.e. the size and quality of the existing infrastructure stock. Therefore it may underestimate the growth effect, if the existing capital stock is small.¹²

Second, the type and sector of public investment instruments may be important. The composition of public investment could explain cross-country differences in the impact since the above evidence is generally based on aggregate investment figures. In their large-scale cross-sectional analysis, Easterly and Rebelo (1993b) distinguish the following sectors of public investment: education, health, housing and urban infrastructure, transport and communication, and industry and mining. They only find a consistently positive correlation growth for transport and communication, but no correlation with private investment. The return on investment is rather high, indicated by a coefficient of 0.6. Education and urban infrastructure investments do not yield a positive and significant estimate for all specifications.

The importance of infrastructure investment is corroborated by several studies looking at regions. In a study on the US states, Munnell (1992) finds that roads and the water supply networks have the largest positive impact on productivity. This is confirmed by a study of García-Milà and McCuire (1992) regarding public roads. Using a panel of Spanish regions, Mas *et al.* (1994) assess the impact of the stock of productive infrastructure, including transport, water supply and urban structure, on output. They find a positive and statistically significant coefficient. Similar results on the importance of core infrastructure are found by González-Páramo and Argimón (1997), and Dabán and Lamo (1999).

Finally, another group of papers more specifically looks at the effect of public investment and its complementarity with private production

¹² Interestingly, Kelly (1997) does not find diminishing returns to public investment for a sample of 56 low and middle income countries. Thus the non-linearity seems to be particular relevant for highly industrialised countries.

factors by estimating *cost functions*. The cost function approach allows us to determine the impact of public infrastructure investment on the demand for different private input factors in the production process. Thus, it answers the question of whether public investment, private investment and labour are substitutes or complements. Seitz (2001) analyses 13 OECD countries using an ERC-model. He finds a substitutive relationship between public infrastructure investment and labour, and a complementary effect on private capital. In other words, higher infrastructure investment leads to lower demand for labour and a higher demand for private capital. For both private factors the elasticity is close to 0.2, with an opposite sign however. This finding corroborates other evidence in the literature, partly based on regional panels (see Seitz, 2001 and Sturm, 1998).

In short, although the original estimate by Aschauer apparently is too large, there is reasonable evidence supporting a positive effect of public investment on growth. Still the effect does not seem to be linear. The differences in the contribution of public capital to a country's growth performance can depend on saturation with public investment and its quality. The most robust evidence for a positive effect exists for road construction and basic infrastructure provision in transportation and communication.

4.2 *Education and Human Capital*

Spending in education can be growth enhancing since it contributes to human capital accumulation and human capital provides one growth enhancing mechanism in endogenous growth theory. This is basically due to its character of non-rival and non-excludable good, which decrease the chances of encountering the diminishing returns typical of exogenous growth models.

In most industrialised countries, spending in education is typically shared by the private sector and government. The idea is that the government does not substitute private spending, but complements it. The role of the government in financing education expenditure is justified by several markets failures that will otherwise result in sub-optimal provision of education. Individuals only take into account private returns to education, when they decide on how much to invest in their human capital. The social returns on schooling, arising because educated workers are more productive, able to adapt to technological change, able to take care of

themselves, etc. are not necessarily internalised by the individual. Therefore, the socially optimal level of investment in education may be higher than the private one and individuals may be inclined to invest less than is socially optimal in education. Even if the private incentives to invest in education exist, the lack of collateral in imperfect credit markets can make it impossible for many individuals to finance their education. Similarly, firms have no incentive to provide on-the-job training if trained workers can leave the company. Government subsidisation of education and training is therefore important for an optimal provision.¹³

Several authors propose growth models where endogenous growth is associated with public provision of education (see e.g. Saint-Paul and Verdier, 1993). In these models, generally, human capital is either understood as a direct production input or as a condition for technological innovation and productivity increases. Empirical studies addressing the link between human capital and growth have followed several approaches. A first one explores the relationship between education attainment and earnings using *micro data*, usually estimating wage equations.¹⁴ The focus here is necessarily on the private returns on education. Different data sets and samples find that an additional year of schooling adds from 5 to 15% on earnings (Ahn and Hemmings, 2000 and Temple, 2000). A major problem here is the interpretation of the results, i.e. whether education itself contributes to the rate of return or whether it actually measures the impact of other variables. If more gifted individuals have relatively high earnings and also chose to invest more in education, then the two phenomena are correlated and estimates may actually overstate the impact of schooling. A plausible approach to explaining a positive correlation between schooling and individual ability argues that individual's use longer schooling to "signal" their personal capacity, since individual ability is not observable by the employer. Therefore, the above estimate on the private return on education should be taken with caution, even though some variables, such as family background and native ability, can be evaluated fairly easily.

A second approach directly investigates the contribution of human capital accumulation to economic growth by estimating cross-country regressions *à la* Barro using *macro data*. Different proxies of human

¹³ On how the public sector could provide/finance education while minimising the market distortions see Tanzi and Schuknecht (2000).

¹⁴ See Card (1999) for an overview.

capital have been tried. Often researchers have used schooling at different levels to operationalise human capital formation. In several studies, schooling appears insignificant or has the wrong sign, particularly when the equations are estimated using panel specification (see in particular Pritchett, 1997 and Benhabib and Spiegel, 1994). However, more recent evidence casts doubts on the robustness of these results for various reasons: misspecification of the equation (Topel, 1999 and De la Fuente and Domenech, 2000), unrepresentative outliers in the sample (Temple 2000), measurement error (Krueger and Lindhal, 2001 and De la Fuente and Domenech, 2000).

Correcting for some of these problems, by cleaning and adjusting data, provides more encouraging evidence on the growth enhancing impact of human capital formation. De la Fuente and Domenech (2000) consistently find a positive impact of education, measured as the average number of years of schooling of the adult population, on total factor productivity in OECD countries. This finding holds for estimates based on five-year averages of educational levels as well as first differences. In addition, specification tests indicate that the assumption of constant coefficients across countries and a linear relationship between education and growth does not fit actual data very well. Correcting for the constant coefficient problem, Krueger and Lindhal (2001) then find for a worldwide sample of countries that changes in educational attainment have a sizable positive impact on growth, whereas the initial stock of human capital does not exert a systematic influence.

These results for overall human capital formation raise the question of the specific contribution of public provision of education and the impact of different levels of schooling. Empirical studies on the contribution of public education services on growth partly corroborate the results for human capital formation in general. Among others, Mankiw *et al.* (1992), Kneller *et al.* (1999) have included public spending in education as a variable in the growth equation specification finding a small, yet positive effect of education spending on growth. Recent papers use *time series techniques* (VAR) to model the joint dynamics of output growth and different kinds of public expenditure including education. Cullison (1993) finds that government spending in education and training has statistically and numerically significant effects on future economic growth. Unfortunately, we are not aware of any study explicitly analysing potential substitution effects between public and private investment.

Most studies on the return (private and social) of the different stages of education find diminishing returns of education, primary education being the one with highest returns (Wolff and Gittleman, 1993, and Judson, 1998) Results for secondary and tertiary education are contradictory (see Barro and Sala-i-Martin, 1995, and Psachorapoulos, 1994). However, these studies face difficulties in accounting for the exact impact and externalities of education. In particular, these results are usually found for a very heterogeneous set of countries, including low income as well as high-income industrialised countries. Thus, a more homogeneous set of industrialised countries could lead to different results. Second, these findings refer to average rates of return, while marginal rates may be more relevant for individual investment decisions and technological progress. Finally, they neglect the interaction between different levels of education. Therefore it remains rather unclear whether European countries could actually expect higher rates of return by funnelling more resources into primary, as compared to secondary and tertiary education.

4.3 *Technological Change – The Role of R&D*

Investment in research and development (R&D) is a key factor in determining technological change and innovation and therefore promoting growth. Examples of R&D-driven endogenous growth models are Romer (1990), Grossman and Helpman (1991), Aghion and Howitt (1992) and more recently Jones (1995), and Segerstrom (2000). Investment in R&D leads directly to the creation of innovation and new technologies of the investing firm. The central idea behind the endogenous growth literature, again, is that the non-rivality and less than full excludability of knowledge means that there are “technological spillovers” and the social returns of investing in R&D may diverge from private returns. As a consequence the private sector may not invest at the socially optimal level, and government involvement correcting the market failure in the production of scientific and technological knowledge may be warranted.

There are several types of spill-overs:¹⁵ a *rent spill-over* emerges if the innovation in an intermediate good cannot be fully captured by the monopoly supplier, but also goes to the user; a *knowledge spill-over* emerges when the technological know-how can be freely borrowed or

¹⁵ The following classification is based on Jones and Williams (2000) and also used in Ahn and Hemmings (2000:22).

adopted from others. Moreover, there is *creative destruction* if the invention of a new product or technology makes the old one less attractive or even obsolete. Finally, there may be congestion externalities, for example, if several firms run the same research with the hope to patent first, and they thus multiply research efforts. While the social returns tend to be higher for the first two spillovers, the reverse may hold for the latter two cases, and the overall effect of these externalities on the social rate of return of R&D activity is unclear.

What then is the empirical effect of R&D on output? There are two main measures for the contribution of R&D investment, public and private, on output growth. Using a Cobb-Douglas *production function approach*, often the effect of the stock of R&D capital and other inputs on total factor productivity has been estimated. Alternatively, the rate of return on R&D, measured as a share of sales or output, with respect to the total factor productivity has been assessed. The estimated magnitude of the elasticity of output with respect to the total stock of R&D and the rate of return vary substantially, depending on the type of data, the method of estimation, and the unit of analysis (firm, industry or country). Nonetheless, according to Nadiri (1993) the overwhelming evidence from the 1970s onward indicates a positive effect of R&D on output and productivity. The estimates of the elasticities of total factor productivity with respect to R&D, mostly gained from studies on the US, range from 8% and 30% and the estimates of the rate of return between 20% and 40%. Firm or industry studies on individual countries are less numerous for other countries and therefore provide less basis for comparison.

However, cross-sectional studies indicate that there are differences in the impact of R&D. Griffith *et al.* (2000) also provide a rationale for these differences by distinguishing the effect of R&D investment on innovation and technology transfer. They find that investment has a positive statistically significant relation with both the rate of innovation and technology transfer. Therefore they argue that R&D investment not only furthers total factor productivity through innovations, but also the *absorptive capacity* to adopt and imitate new technologies from other industries or from abroad. Adoption of technologies is an important factor, which raises the rate of return on R&D investment in catching-up countries. For example, for the United States, which maintained the frontier of total factor productivity in manufacturing throughout most of the sample period, the effect of R&D on total factor productivity consists almost entirely of its effect on the rate of innovation. By comparison, in an

economy such as Finland, where the average level of relative total factor productivity was roughly 50%, the total effect of R&D is more than twice as large as its effect on the rate of innovation. Moreover, the authors find that increases in educational attainment support innovation and technological transfers.¹⁶

The overall positive impact of R&D however does not identify the role of public finances in contributing to technological progress. Policy-makers have different instruments at their disposal to support private research activities. First, the public sector itself engages directly in research activities through public laboratories etc. The purpose here is usually to satisfy public needs and to provide the basic knowledge that can be used in the applied work of firms. Second, the public sector contracts out research activity and provides research grants or subsidies. R&D contracts are particularly important in the area of defense. Public grants and subsidies similarly allow the targetting of specific firms or projects that are either directly useful to the governments objectives or carry a high social return. Finally, the government can provide tax breaks or credits for R&D activities, which for the purpose of this survey we consider “tax expenditures”. This instrument is usually less discriminatory and does not directly intervene in the firms’ own research strategies.

The effects of these instruments on private R&D investment are not uniform and unambiguous, since they can be complements or substitutes of private R&D activities. (see David *et al.* 2000). For example, tax credits generally allow the private agent to choose the investment project and directly lower the marginal costs of that project. Therefore, one would not expect a “crowding out” effect as long as the input costs of the agent are not adversely affected. Input costs could rise if, for example, qualified labour supply is inelastic and demand increases due to tax measures. Public grants or contracts, in principle, should focus on those areas where there is a strong divergence of individual and social rates of returns, and therefore no displacement of investment should occur. However, this is not guaranteed since government projects could directly replace activities which the private sector would have undertaken anyway. Moreover, the fact that some firms receive government contracts or subsidies may lower the expected rate of return of those who did not and therefore lead to less

¹⁶ These findings on a countries absorptive capacity go in line with the result of Gittleman and Wolff (1995) who find that R&D activity contributes to the explanation of differences in per-capita output in developed economies, but not in less developed ones.

private R&D activities. The displacement effect through higher input prices may also similarly emerge using this policy instrument. Of course this would also hold for direct public R&D activities through universities etc. Summarizing these different forces, David and Hall (1999) argue it is more likely to see a complementary net effect of public involvement where the relative size of the public sector in total R&D input is small, where the elasticity of labour supply is high, and where the rate at which the private marginal yield of R&D decreases more gradually with increased public R&D expenditures.

The empirical research on R&D, according to Nadiri (1993), suggests that the rates of return on privately financed R&D are much higher than those on publicly financed R&D. This finding may be due to the fact that public research is more oriented towards basic knowledge and has no direct impact on total factor productivity. It could also emerge from a substitution effect between public and private investment, lowering the combined effect on output. However, in a review of a large number of studies on the impact of public subsidies, David *et al.* (2000) find that a minority reports a net substitution effect when they are based on an industry or higher level of aggregation. Although the authors do refrain from drawing any definite conclusions, but rather point out the methodological and theoretical problems associated with these studies, it is unlikely that the lower rate of return could be unambiguously related to the substitution effect. By comparison, "tax expenditures" seem to be more efficient in fuelling R&D. As a conclusion of a broad literature review, Hall and Van Reenen (2000:449) conclude, based on the "the current (imperfect) knowledge [...] a dollar in tax credit for R&D stimulates a dollar of additional R&D". More specifically, Bloom *et al.* (2000) find for a sample of OECD countries that the impact elasticity of tax incentives on private R&D is small in the short run, about 0.1, but close to unity in the long-run.

An OECD (1999) study empirically investigates the impact of the different policy instruments, based on a sample of 17 OECD countries from 1983 to 1996, and draws several interesting policy conclusions: first, well designed government programmes have a leverage effect on private R&D investment; second, frequently redesigning policy instruments reduces their effectiveness; third, a piecemeal approach to technology policy is detrimental to its effectiveness since different policy measures may have complementary but also substitutive effects; fourth, providing

too low but also too high levels of support is similarly inefficient;¹⁷ fifth, defence related research seems to crowd out private business activity while civilian public research is neutral for business R&D; finally, the usefulness of university research can be improved through targeted government funding enhancing the transfer of technology.

Summarising the evidence, empirical studies indicate that R&D investment in the public and the private sector can make a contribution to enhanced growth. The rate of return seems to be particularly large in countries with an intermediate level of technological advancement, which are able to absorb outside innovations and technological advancements. The evidence on the complementary or substitutive effect of different policy instruments with respect to private R&D investment is not unambiguous. However, tax breaks or deductions seem to promote rather than displace private activity.

5. Conclusion

The conclusions of the European Council Meeting in Lisbon (March 2000) on the future growth prospects leave open which growth model actually reflects best its intentions.. Exogenous and endogenous growth models have substantially different implications for the impact of a policy variable on economic growth. Exogenous neoclassical growth models confine the impact of fiscal policy and other policy instruments to permanently changing the level of per capita output, but alter growth rates only temporarily during the transition path to this new steady state. By contrast, endogenous growth models predict that policy variables cannot only permanently change the output level, but also the growth rates. If an exogenous growth pattern were the prevailing in Europe, all we could expect from the European growth strategy proclaimed in the Lisbon Meeting is output speeding up in the short and medium run, but then levelling off again. Conversely, under an endogenous growth pattern the structural changes which the European Council envisages to make Europe a more integrated, competitive and productive economy would imply that trend growth rises permanently. In reviewing the literature we found some evidence supporting the role of public finances in providing

¹⁷ According to their estimates, the threshold is about 14% of business R&D (OECD 1999:4).

growth-enhancing mechanisms, not only in the short-run but also along the lines predicted by endogenous growth theory.

In a follow up of the process initiated in Lisbon, the Commission and the ECOFIN council pointed out three mechanisms through which public finances can contribute to achieve higher growth and employment. (i) Supporting a stable macro-economic environment, (ii) making tax and benefit systems more employment friendly, and (iii) redirecting public expenditures towards productive areas. This paper has reviewed the empirical and theoretical literature to assess the impact and effectiveness of these mechanisms.

The second section discussed the role of public finances in stabilising the economy and the importance of fiscal sustainability. The stabilising impact of fiscal policies and its short-run growth effect crucially hinges upon the sign and size of the fiscal multiplier. Evidence gained through empirical studies and simulations indicates that there is a relatively wide range of estimates of the size of fiscal multipliers. Generally, in those studies fiscal multipliers operate in line with Keynesian predictions in the short-run. The sign and size of multipliers however depends on the structure of the economy, such as its openness, interest rate elasticity etc., as well as the state of public finances. Non-Keynesian effects may prevail under exceptional circumstances, when credibility effects play a strong role and misalignments of public finances are severe. Then the budgetary reaction to economic fluctuations through automatic stabilisers, for example, could be ineffective or destabilising. Sustainable budgetary positions are also important for long-run growth. When high deficits contribute to inflation dynamics and higher interest rates, they affect capital accumulation. Although not entirely conclusive, the empirical literature indicates that “Ricardian equivalence” does not hold empirically and public balances can affect aggregate savings and capital accumulation.

As discussed in the third section, tax and benefit systems affect the human capital stock available in the economy and therefore economic growth. The empirical literature in the field provides some evidence that the social security system affects unemployment rates and wages; excessively generous benefit systems can undermine labour supply. At the same time, wages and the level of unemployment are empirically positively related to the level of taxation. As a consequence, labour taxes can have a negative impact on growth. Simulation studies also indicate an inverse relationship between labour taxation and growth. The magnitude of the

growth elasticity however differs substantially, ranging from 0.2% to 2% as a reaction of a 1% cut on labour income taxation.

Finally, productive public expenditures can provide a source of endogenous growth. But the impact of these spending flows on economic growth is not linear. Empirical studies on public infrastructure investment indicate decreasing returns depending on the available stock of capital. Evidence on decreasing returns is less conclusive for education expenditures and it is non-existent for R&D. Research on R&D rather indicates that the rate of return depends on the technological state of the economy. A minimum level of human capital and technological knowledge seems to be necessary to generate innovation and growth and to imitate new technologies. Countries at the technological frontier have a lower rate of return on technological investments than others. While they benefit from their innovation, others are in addition able to absorb and imitate their technological advancement. Regarding the substitutability or complementarity of public and private investment, little is known on the public and private provision of education services. For public infrastructure investment, empirical evidence points to a complementary relationship with private capital investment, but a substitutive effect on labour input. For public R&D the impact varies somewhat with the policy instrument. However, there is less conclusive evidence on a complementary relationship for public subsidies, which is more compelling for tax incentives for private R&D investment.

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TAX DESIGN, ECONOMIC EFFICIENCY AND GROWTH

Paul van den Noord and Christopher Heady***

1. Introduction

Since the role of the public sector as a purchaser or provider of *e.g.* infrastructure, education and research is crucial for the economic potential, the net growth contribution of taxation through these government activities is undoubtedly positive. However, because taxation by itself inevitably impinges on most aspects of economic activity, careful consideration must be given to its design – in addition to its level and hence the level of related expenditure. So long as taxation affects incentives it may alter economic behaviour of consumers, producers or workers in ways that reduce the amount or utilisation of physical, human and knowledge capital, and thus growth. Therefore, to the extent the tax system matters for economic efficiency, its costs are likely to rise with the level of taxation. Empirical research suggests that an increase in the tax share in GDP by 1 percentage point reduces output per working-age person in the long run by 0.6 to 0.7 percent.¹

Meanwhile, it would be inappropriate to design tax systems with only revenue-raising and growth objectives in mind. An equally important consideration is taxation's impact on the distribution of income and wealth across the population, which raises issues of equity, or fairness, which must be given substantial weight even if it entails costs in terms of economic growth. Moreover, the practical enforceability of tax rules and the costs arising from compliance are important considerations, the more so since these are both affected by, and have implications for, the efficiency and public perceptions of the fairness of tax systems. Indeed, the key challenge for tax policy is to strike the best possible balance among these issues.

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The authors are writing this paper in a personal capacity and it does not necessarily reflect the view of the Organisation or its Member countries.

¹ See OECD (2000d).

In a recent OECD study² we have pulled together the findings for a selection of OECD countries whose tax systems have been reviewed in the past few years in the periodical *Economic Surveys*.³ The study benchmarked these tax systems against a set of best-practice principles and put forward a large number of policy recommendations. Behind these recommendations stand empirical analyses of how tax systems distort saving, investment, labour markets and product markets, on which the present paper heavily draws. The following sections discuss the impact of taxation on, respectively, saving (Section 2), capital formation and business organisation (Section 3), the labour market (Section 4) and product markets (Section 5). Section 6 concludes.

2. The impact of taxation on saving

2.1 *The impact on aggregate saving*

Saving is essential for raising economic performance in the medium and long run, as it is the final constraint on investment which, in turn, is key to raising productivity and economic growth. Some strands of the economics literature suggest that increased taxation and public spending may have been important contributing factors to the OECD area-wide trend decline in private savings.⁴ Reasons why this may have occurred are that higher taxation reduced the incentives to save (by reducing the rate of return on saving or providing public insurance against loss of income) and the income stream from which savings are generated (because it increased the tax wedge on wages and salaries).⁵

² See OECD (2001d).

³ The countries reviewed are (in chronological order): Mexico, Switzerland, Japan, Poland, Spain, the Czech Republic, Norway, Korea, Greece, New Zealand, Iceland and Portugal (see the respective *Economic Surveys*; tax reviews in this series are forthcoming for the United States and Finland). In addition, prior to this series ad hoc tax reviews in the *Economic Surveys* of Canada (1997), Austria (1998), Sweden (1999), have been carried out.

⁴ Tanzi and Zee (2000) have recently derived some empirical evidence from a panel set covering 19 OECD countries over the period 1971-95. They estimated negative coefficients of the tax/GDP ratio to be particularly high for income taxes but much lower for consumption taxes, as is predicted by economic theory. It is also found that, when controlling for the impact of the overall tax revenue/GDP ratio on the household saving rate, the household saving rate remains negatively correlated with the income tax revenue/GDP ratio in a statistically significant way, but its correlation with the consumption tax revenue/GDP ratio becomes statistically insignificant.

⁵ Moreover, income derived from savings is usually taxed in nominal rather than real terms, which can lead to very high effective tax rates on the real return.

However, the OECD country reviews do not convey a strong impression that the effect of taxes on aggregate savings is quantitatively important. New Zealand is the only reviewed country that appears to have shaped its tax policy with a view to stimulating national saving considering its large and persistent current account deficit. In particular it has provided a rationale for the introduction (in 1986) of VAT and maintaining a large share of VAT in the total tax mix. Such a shift in the tax mix towards consumption taxation has been advocated in the academic literature as a way to reduce the double taxation of savings.⁶ It might be argued that for an open economy with access to world capital markets, like New Zealand, there is no particular reason for economic policy to be concerned with domestic saving levels since any lack of domestic savings can be covered by inflows of foreign savings. However, to the extent that foreign debt places a risk premium on such foreign savings inflows, a call for higher domestic savings may be justified. A shift towards consumption taxes has occurred in Japan as well to stimulate national savings to prepare for population ageing, but the overall approach remains eclectic, combining elements of consumption and income taxation into the tax system. This seems to be wise, particularly in view of the perceived income distribution effects stemming from a shift towards consumption taxation.⁷

⁶ Proponents of consumption taxation – particularly in the United States – have suggested abandoning the entire income tax system and replacing it by some form of “pure” consumption taxation, see *e.g.* Boskin (1996) and CBO (1997a). This could be an income tax with net savings allowances or an expenditure-based tax such as VAT. Although no OECD country has opted for a radical switch towards “pure” consumption taxation, it has emerged in the academic literature as a benchmark for assessing the merits of consumption *vis-à-vis* income taxes. It has been advocated as a particularly promising route for countries that face strong growth in revenue needs in the future (Auerbach, 1997). The overall impression is, however, that a move towards “pure” consumption taxation risks having disruptive transition effects while the effects on savings are expected to be relatively small and uncertain (Bradford, 1995). One reason often quoted is that income effects might outweigh the substitution effects stemming from a shift towards consumption taxation, and hence savings may actually decline (Engen/Gale, 1996 and Feldstein, 1995). Even though that outcome would reduce the excess burden of the tax system and thus generate welfare gains, it conflicts with the objective of raising national savings to cope better with macroeconomic constraints.

⁷ It is often argued that consumption taxation is not progressive, particularly with reference to indirect taxes, as these are flat rate. However, much of the discussion of the “fairness” or progressiveness of consumption taxes hinges on the time frame of analysis. In a lifetime perspective, consumption tax is broadly proportional to life-time income. Moreover, as Gentry and Hubbard (1997) have argued, a consumption tax exempts only the pure interest component of capital income (*i.e.* the opportunity cost of capital investment), but eventually does tax rents and the risk premium. As the latter tend to be skewed towards the top end of the income distribution, consumption taxation could be more progressive than generally assumed.

2.2 *The impact on the composition of saving*

While the empirical evidence for a significant impact of taxation on aggregate savings is weak, tax systems are clearly non-neutral with respect to specific forms of savings, and thus affect the composition of saving.⁸ These therefore distort market signals with respect to the true comparative rates of return on each of these savings vehicles, and thus generate efficiency losses. Among the countries that went furthest in eliminating non-neutralities of income taxation across savings instruments are New Zealand and the Scandinavian countries that have been reviewed, Norway and Sweden. Norway and Sweden have moved in the early 1990s to a system that taxes all sources of capital income (including *e.g.* imputed rental income of owner-occupied housing) at a similar rate irrespective of the source of income or the income or other characteristics of the final investor. By contrast, loopholes have remained in New Zealand due to the absence of a broad-based capital gains tax and non-taxation of imputed rents of owner-occupiers.⁹

It has remained common in most OECD countries to use tax facilities to subsidise private pension plans (including life insurance), which regularly exceed a full percentage point of GDP (Adema, 1999). This has taken a variety of forms, most prominently the granting of tax allowances for private pension contributions and exempting returns on fund assets, while benefits are taxed (so-called EET tax treatment, with the initial saving Exempt, the return on assets Exempt and benefits Taxed; see Table 1).¹⁰ This approach represents a more favourable treatment of pensions than of other kinds of saving, which are normally taxed when the saving is made (*i.e.* there is no deduction from personal income tax) and when a return is earned, whereas the liquidation of the investment remains untaxed (TTE tax treatment, or savings Taxed, the return Taxed and benefits Exempt).¹¹ Moreover, among the countries that apply EET, taxation at retirement is often relatively light. Only a minority of countries (Australia, the Czech Republic, Luxembourg, New Zealand and Sweden)

⁸ OECD (1994), Bernheim (1999) and Arthur Anderson (1999).

⁹ However, it should be noted that the application of taxes on capital gains of equities that are attributable to retained profits distorts corporate funding decisions (see below).

¹⁰ In some countries a range of schemes applies, *e.g.* in the United States, where there are three main forms with preferential tax treatment, and in the United Kingdom, where nine different tax-favoured retirement savings vehicles exist (Banks and Emmerson, 2000).

¹¹ See Dilnot (1992), Arthur Andersen (1999) and Dalsgaard and Kawagoe (2000).

Table 1

Tax treatment of private pensions in OECD countries

	Contributions out of taxed income or exempt	Fund income tax or exempt	Pension benefits taxed or exempt	
			Annuities	Lump sum
Australia	T	T	T	T/E
Austria	P/C	E	P/T	..
Belgium	C	E	T	T
Canada	E	E	T	T
Czech Republic	T	E	T	T
Denmark	E	T	T	T
Finland	E	E	T	T
France	E	E	T	E
Germany	T/E	E	T	T/E
Hungary	E	E	E	E
Iceland	E	E	T	T
Ireland	E	E	T	T/E
Italy	E	E	T	T
Japan	E	E	T	T
Korea	T/E	T/E	E	E
Luxembourg	T/D	T	T	T/E
Mexico	E	E	T/E	T/E
Netherlands	E	E	T	T
New Zealand	T	T	E	E
Norway	E	E	T	T
Poland	E	E	T	..
Portugal	E/C	E	T	T
Spain	E	E	T	T
Sweden	E	T	T	..
Switzerland	E	E	T	T
Turkey	E	E	E	E
United Kingdom	T/E	E	T	E
United States	E	E	T	T

Source: OECD Tax Database.

Note: Key to abbreviations

G = credit; E = exempt; T = taxed; P = partial.

apply some variant of TTE treatment of pension saving akin to the treatment of savings deposits, although even some of these countries still subsidise private pension saving to some extent.¹² Denmark is the only country to apply ETT (saving Exempt, the return Taxed and benefits Taxed), which is broadly equivalent to TTE treatment.

While in most countries both mandatory (including public) and voluntary retirement contributions are tax privileged, tax incentives are instrumental only with respect to voluntary provision. Nonetheless, governments justify tax privileges even for forced pension savings in several ways. Pension savings to be paid out as annuities after retirement are illiquid and the return may be eroded by inflation. Therefore, higher after-tax rates of return may be required to compensate for these drawbacks. Furthermore, forcing people to participate in a private retirement savings program beyond the public system of social security contributions might be difficult to defend, unless this is tax-favoured or otherwise supported. Countries with an ageing problem who are moving away from a PAYG-system to pre-funding may find tax privileges an adequate compensation for the “double burden” hitting present workers, since they are required to finance both current and future pension payments.¹³ However, the double burden of present generations could be justified as these generations have saved on raising children – *i.e.* they preferred and benefited from lower fertility than previous generations (Sinn, 1999).¹⁴

The favourable treatment of long-term savings through private pension plans raises several issues of economic efficiency. By granting tax favours for private pension plans, governments pursue several social and

¹² For instance, the pension tax regime in Australia imposes tax at all three stages (contributions; earnings; and benefits), but at relatively low effective rates. It hence offers some subsidisation of pension saving, but there is a significant reduction in the net value of benefits received compared with an EET treatment (Atkinson *et al.*, 1999).

¹³ In the United States and some other non-European OECD member countries, tax incentives for retirement savings are seen as a way to overcome a lack of national savings. However, empirical estimates on this are not conclusive. Some have found these tax-preferred vehicles to encourage aggregate savings, and others concluded that they induce merely a reallocation of existing savings across savings vehicles or a joint rise in saving and borrowing (see *e.g.* Bernheim, 1999).

¹⁴ However, there might still be a case for tax privileges on inter-generational equity grounds: higher current PAYG contributions are a transfer from the current working population to the old, who also did not raise sufficient children, but did not have to save for their retirement. Therefore, it could be argued that the tax privileges compensate for the higher *current* PAYG contributions, for which the present working population is not responsible. Nevertheless, the line of arguing could be different once bequests are taken into account (see *e.g.* Miles and Eben, 2000).

economic objectives, but their effectiveness in this regard may be questioned. Most prominently, these favours aim to encourage long-term saving by households to ensure that households are less prone to moral hazard – *i.e.* rely excessively on social assistance at old age. However, while the proneness to moral hazard may be reduced, tax favours for pensions are susceptible to substantial dead-weight losses since the group that will be affected is much larger than the target group.¹⁵ There is also an undesirable effect on the income distribution since in most tax systems the “tax value” of the deductions or exemptions is largest for higher income groups.¹⁶ In addition, tax incentives for pension saving tend to favour a particular set of financial intermediaries (pension insurance providers) relative to other providers, thus distorting competition and encouraging rent seeking. It also favours investment in low-risk assets (government bonds) which have a relatively large weight in the portfolio of such intermediaries (OECD, 1998c), to the detriment of small (start-up) companies that depend on high-risk capital, including venture capital.

Households in all examined countries are encouraged by the tax system to use their home as vehicles for long-term private wealth formation. House-ownership produces notional rent income and may give rise to capital gains. Hence tax issues arise at three levels: the acquisition of the house (which is equivalent to a financial investment), the imputed rent and capital gains (equivalent to a return on investment) and the liquidation of the invested capital when the house is sold. The tax-neutrality criterion suggests that these components should be taxed in the same way as alternative investments, according to a TTE or ETT schedule. However, most countries apply a TEE tax schedule (acquisition cost is not deductible against the personal income tax and hence taxed, both imputed rental income (after deduction of mortgage interest payments) and capital gains are exempt and the liquidation of the house does not lead to taxation, see Table 2). Indeed, by exempting the imputed rent and/or capital gains from taxation, a tax preference is allowed to such investment compared with financial investments (although transaction

¹⁵ Moral hazard may not be an issue at all to the extent that investment in private pension schemes is mandatory. However, compulsory savings might be considered as if they were payroll taxes and could therefore lead to labour market distortions. If the resulting labour market distortions are substantial, some have argued it might even be optimal to remove mandatory pension savings and accept moral hazard (Homburg, 2000).

¹⁶ Except for dual income tax systems where deductions are against the flat rate for capital income which corresponds to the lowest tax bracket for personal income.

Table 2

Tax treatment of owner-occupied housing in OECD countries

	Acquisitions cost payable out of taxed income or deductible	Interest on loan for acquisition payable out of taxed income or deductible	Capital gain taxable or exempt	Imputed rental income taxable or exempt
Australia	T	T	E	E
Austria	PD	PD	E (if owner occupied for at least 2 years)	E
Belgium	D	D	E	T
Canada	T	T	E	E
Czech Republic	T	D	E (if owner occupied for at least 2 years)	E
Denmark	T	D	E (if owner occupied for at least 2 years)	T
Finland	T	D	E (if owner occupied for at least 2 years)	E
France	T	T	E	E
Germany	T	T	E (if owner occupied for at least 2 years)	E
Hungary	T	PD	T	E
Iceland	T	T	E (if owner occupied for at least 2 years)	E
Ireland	T	T	T	E
Italy	T	D	E	E
Japan	T	T	T	E
Korea	T	T	T/E	E
Luxembourg	T	D	T/E	T
Mexico	D	T	E	E
Netherlands	T	D	E	T
New Zealand	T	T	E	E
Norway	T	D	E	T
Poland	D	T	T/E	T
Portugal	PC	PC/C	E	E
Spain	PC	PC/C	E	E
Sweden	T	D	T	T
Switzerland	T	D	T/E	T
Turkey	T	T	E	T
United Kingdom	T	PD	E	E
United States	T	D	E (if owner occupied for at least 2 years; subject to a ceiling)	E

Source: OECD Tax Database.

Note: Key to abbreviations:

D = deductible; PC = partial credit; PD = partially deductible; E = exempt; T = taxed; C = credit.

taxes and property taxes may provide a partial offset).¹⁷ In fact, some countries even allow a tax deduction or credit for the acquisition of the house (*e.g.* Mexico, Poland and Spain). Meanwhile, countries that do tax imputed rental income (after deduction of mortgage interest payments) apply very favourable effective tax rates as rental values are generally under-assessed.

Tax favours for housing distort the allocation of resources towards owner-occupied housing at the expense of possibly more productive uses, and also have questionable distributional consequences. Comparing historical returns it is clear that pre-tax returns to housing investment are significantly lower than that on *e.g.* equity. However, when taking into account the tax advantages allowed to housing, the relative after-tax performance of housing against other saving instruments is more favourable. There are strong indications that such tax subsidies for housing are reflected in a higher level of house prices. Given that transaction costs (stamp duties, fees for real estate agents) are usually proportional to house prices, this tends to lock in large amounts of capital and reduce the geographical mobility of production factors (labour in particular). This is a pertinent finding for Spain, while lock-in effects are also prevalent in Japan. From an income-distribution perspective, the main drawback of such tax-driven lock-in effects is that it hits future generations twice: via higher house prices and via heavier taxation or lower public expenditure to fund the tax subsidy.

Aside from income taxation, the taxation of real and financial wealth is at the root of serious distortions of savings in several countries. In Austria, the widespread use of anonymous savings accounts has been instrumental in keeping savings deposits outside the tax net and therefore rendered the enforcement of inheritance tax difficult. The envisaged phasing-out of the anonymous savings accounts should improve the situation in this regard. By contrast, the taxation of savings deposits under the wealth tax in Switzerland, Norway and Sweden is heavy compared with alternative savings vehicles such as real estate and shares. Indeed, in the Scandinavian countries the wealth tax works strongly against the neutrality gains achieved by the system of uniform capital-income taxation. An abolition of the wealth tax could be instrumental in removing this

¹⁷ Exemption of capital gains on housing could be justified by horizontal equity and efficiency moves: it avoids an unfavourable tax treatment of geographically mobile taxpayers who are more often involved in housing transactions and as a result may realise these capital gains more frequently.

distortion. In Japan and Korea, the taxation of land (*e.g.* inheritance, property and transaction tax) favours farmland over land used for urban development which, given the specific geographical conditions of these countries, leads to inefficient land use. With land ownership concentrated in the hands of a few very wealthy landowners, property taxation in Korea has been a longstanding controversial issue. Prices have been pushed up by low controlled interest rates in the past and excessive regulations that limited the supply of land for development. While there are anti-speculation taxes in place – transaction tax on real estate and a capital gains tax of 40 percent if the real estate is held less than two years – it is questionable whether this has curbed speculation and it may have further contributed to higher prices through lock-in effects.

2.3 *The impact on international saving flows*

Globalisation and the associated growth in international financial transactions, while creating new tax bases, pose a growing tax policy challenge as new possibilities for evasion and avoidance emerge. An important set of issues arises from taxation of income from savings invested in portfolio instruments abroad and cross-border flows of interest and dividend income.¹⁸ The existing international tax system, developed through an expanding network of bilateral tax treaties, accords both source countries (where income is generated) and residence countries (where income is received) the right to tax investment income, with various mechanisms used to avoid double taxation.¹⁹ Taxing rights for portfolio investment income, however, are largely balanced towards residence countries. For example, source country withholding tax on portfolio interest is capped at 10 percent under the OECD model tax convention. This is intended to give countries the ability to collect tax on interest earned on foreign assets of resident investors at corporate and personal income tax rates, generally set in excess of source country withholding tax rates.

A divergence in source country (withholding) and residence country (income) tax rates creates tax evasion incentives to shelter income from home country tax by having that income accrue to intermediaries subject to

¹⁸ OECD (1999d).

¹⁹ However, in the case of dividends, bilateral treaties in most cases do not eliminate economic double taxation – see section 2 below.

no or low taxation, or simply to not report the income to tax authorities. At the same time, investors may seek debt securities subject to no or low withholding tax at source to minimise the overall tax bill. Faced with these difficulties, governments have responded in a number of ways. One response, observed in a number of Nordic countries is to adopt a dual income approach.²⁰ The essential feature of a pure dual income tax system is to tax capital income at a relatively low flat rate, while taxing earned income (mainly, wages, salaries, transfers) under a progressive tax rate schedule. Several other countries have adopted separate capital income tax systems to move in this direction as well (*e.g.* France, Spain and Italy). Scheduling taxation of income from capital at a low flat rate recognises the incentive, and expanding scope, for tax evasion where such income is subject to tax at a relatively high rate, and the fact that taxpayer compliance may be enhanced and administrative costs reduced through adoption of a dual income tax system, rather than a system based on a comprehensive income tax concept.²¹

Growing concerns over international tax evasion have also motivated efforts for a co-ordinated response. In particular, the Council of the European Union (EU), in December 1997, adopted a tax package that included, among other components, a resolution on taxation of savings. The draft directive was originally based on the so-called “coexistence” model, which envisaged a 20 percent withholding tax on cross-border interest payments to individual residents of another member state or, alternatively, the provision of information about such payments to the authorities of the member state in which the investor is resident. The withholding tax option, which waives tax where a beneficial owner can provide evidence that the income will be subject to tax in his/her home country, was favoured by many EU countries. Others, concerned with capital flight to non-EU financial centres and recognising potential efficiency benefits under a residence-based approach, preferred exchange of information as the mechanism to address the growing problem of taxing savings.

At the ECOFIN Council on 26-27 November 2000 agreement was

²⁰ Denmark introduced a dual income tax system in 1987, followed by Sweden (1991), Norway (1992) and Finland (1993).

²¹ However, this has generally not been the main motivation for moves from comprehensive to dual income taxation: the objective has mostly been to make investments in the home country more attractive to resident investors, and to reduce the practice of transforming dividends into interest payments that were traditionally taxed at lower rates in most OECD countries.

reached on the substantial content of the directive. The principal feature of the directive is that all member states will be required to exchange information with each other, on interest payments to individuals, seven years after the directive enters into force. Until then (during the so-called “transition period”) member states other than Austria, Belgium and Luxembourg will exchange information automatically on interest payments, without reciprocity reservations. During the transition period Austria, Belgium and Luxembourg will apply a non-final withholding tax at a 15 percent rate for the first three years and 20 percent for the remaining four years. However, member states operating a withholding tax are required to transfer 75 percent of the revenue earned to the state in which the investor is resident. The Council will decide no later than 31 December 2002 on the adoption and implementation of the directive on the basis of assurances which are to be sought from key third countries (the United States, Switzerland, *etc.*) and dependent or associated territories of member states regarding the application of equivalent measures in those countries.

Although conditional on assurances from non-EU financial centres and on progress in implementing the *Code of Conduct* (see Joumard, 2001) element of the tax package, this is a major step forward. It is noteworthy, in this respect, that in January 2001 the United States published draft regulations extending the information reporting requirements for bank deposit interest paid to non-resident individual resident in other treaty countries.

3. The impact of taxation on business funding, organisation and location

Corporate tax reform measures in OECD countries throughout the mid- to late-1980s were geared largely towards broadening corporate tax bases and lowering statutory corporate income tax rates. The move away from special tax incentives for business investment, including accelerated or enhanced depreciation of capital costs, flat or incremental investment tax credits, and an array of special financing incentives, was often based on findings that the revenue and dead-weight costs linked to these incentives outweighed possible benefits from incremental investment encouraged by the tax relief. In a number of countries, broadening of the corporate tax base continues to shape current reform efforts. In Germany, for example, new rules to tighten depreciation allowances have been introduced, in part

to raise revenues to finance significant tax rate cuts. A review of tax changes introduced during the 1990s shows ongoing interest in a number of countries in lowering statutory tax rates as a means of lowering marginal and average corporate tax burdens. However, progress remains uneven across OECD countries, which is reflected *inter alia* in the development of an extensive international industry that uses aggressive tax planning to serve both final investors and companies minimising their tax bill.

3.1 *The impact on corporate funding decisions*

The tax system may be said to be neutral towards corporate financing and investment decisions if a given pre-tax flow of corporate profits at the margin produces the same after-tax income for final investors, whether the return takes the form of interest payments, dividends, or capital gains. Moreover, this condition should hold also across capital assets such as commercial real estate, equipment, inventories or intangible capital. In practice no tax system in OECD member countries fully satisfies this neutrality criterion, but some countries are closer to meeting it than other countries. In most OECD countries the marginal effective tax rates vary substantially across financing vehicles, with a bias mostly in favour of debt financing (Table 3; see Box 1 for some methodological issues regarding the measurement of the marginal effective tax rates reported in this table), thus making companies more prone to insolvency. Retained earnings also are treated more favourably than new equity financing in some countries due to lower rates of capital gains tax at the individual level, including in some countries a zero rate if shares are held for more than a certain period (Austria, Belgium, Czech Republic, Germany, Greece, Mexico, Netherlands, New Zealand, Spain and Switzerland). The favourable treatment of retained earnings may lock in profits in the corporation, which may have undesirable effects on the liquidity of capital markets and corporate governance.

The wide variation in marginal effective tax rates reported in Table 3 mirrors the different approaches that co-exist in the OECD area concerning the taxation of distributed profits. A minority of OECD countries applies a pure “classical” system (Luxembourg, the Netherlands, Switzerland and the United States). According to this approach distributed profits are taxed twice, first at the level of the corporation, and subsequently when after-corporate-tax profits are paid as a dividend to the shareholders, at whatever (marginal) rate applies under the progressive personal income

tax. By contrast, interest payments, while taxed as personal income at the level of the final investor, are deductible from the corporate income tax base. Other countries (Austria, Belgium, Hungary, Italy,²² Japan, Poland and Sweden) also use a classical system but apply a lower flat tax rate on dividends – which replaces the personal income tax – to reduce the all-in tax burden on distributed corporate income. The remaining countries have introduced relief for double taxation by granting a tax credit against the liability for dividend tax, corresponding to a legally fixed share of the corporate tax paid by the companies that pay out the dividend (the so-called partial imputation system, applied in Canada, Denmark, Ireland, Italy, Korea, Portugal, Spain, Turkey and the United Kingdom). A number of countries have opted for full rather than partial imputation (Finland, France, Mexico, New Zealand and Norway), while some of these countries have recently moved away from this approach (see below). Greece, finally, has removed double taxation by simply exempting dividends for the personal income tax.²³

It is important to highlight that imputation relief is normally confined to residents investing in domestic corporations, unless there are special provisions included in bilateral tax treaties.²⁴ This may be seen as a source of non-neutrality, as it results in a different treatment of foreign investors investing in domestic corporations and domestic investors investing in foreign corporations. Aside from the international distortions of foreign direct investment, which will be discussed in some more detail below, this feature has encouraged tax-planning activities, such as dividend stripping.²⁵ A number of European countries, including Germany, France

²² Italy allows investors to choose between final withholding or partial imputation. It also grants a corporate tax rebate for investment financed through new equity or retained earnings to balance the relative cost of debt and own-capital funding of new investment.

²³ Alternatively, (full or partial) relief from double taxation can also be granted through the corporate tax system, by applying a lower rate on distributed profits (so-called “split-rate” system, such as in Germany (until 2001) and Mexico). For a discussion see OECD (1991). The Czech Republic, Iceland and Spain apply a partial deduction system, instead, by which the distributing company may deduct from its corporate tax liability a fixed share of the withholding tax relating to the dividend.

²⁴ For example, prior to 1999 the United Kingdom granted imputation tax credits in respect of corporate income tax to foreign portfolio and direct shareholders resident in countries with which it had signed a tax treaty providing for such treatment. In 1999, however, the government introduced rules reducing the imputation tax credit rate from 20 to 10 percent. The reduction ensured that under the standard United Kingdom treaty article, foreign portfolio shareholders would no longer receive a tax credit repayment. Foreign direct investors entitled to half tax credit would receive a relatively small repayment, equivalent to less than 0.3 percent of a dividend.

²⁵ Dividend stripping relies upon two transactions between residents and non-residents. A (continues)

(draft legislation) and Sweden, have now abandoned imputation relief.²⁶ In part, these changes may be viewed as addressing the non-neutrality and tax-planning concerns expressed above. They may also be judged as preferable to extending imputation relief to non-resident shareholders that could entail too high a revenue loss, relative to general investment incentive benefits operating through a reduction in the cost of capital. At the same time, parallel restrictions on imputation relief provided to domestic shareholders serve to not discourage foreign investor participation, insofar as domestic double taxation relief has the effect of lowering after-corporate (but pre-personal) tax rates of return.

Even if several countries have (partially) removed double taxation of dividends, there remains double taxation of retained profits. This form of double taxation occurs to the extent retained profits are reflected in capital gains and hence taxed again at the level of the final investor to the extent that capital gains taxes are a feature of the tax system. Only one country, Norway, has introduced relief for this form of double taxation by way of the so-called “opening value adjustment” method. According to this method, capital gains are taxed only to the extent the increase in market value of the company exceeds the increase in the stock of retained earnings. As an alternative, New Zealand has abolished the taxation of capital gains on shares altogether.²⁷ Both countries also maintain a full imputation system and moreover apply (practically) the same tax rate across all forms of capital income. Hence their respective tax systems are the most neutral ones from the point of view of corporate funding – although Australia, Mexico, Denmark, Italy and Korea also have relatively neutral systems in this regard (but, as noted, at the risk of introducing non-neutralities *vis-à-vis* foreign direct and portfolio investment).

non-resident who owns a participation in a domestic company sells it temporarily to a resident (before dividend distribution), who will profit from the imputation tax credit. After the distribution, the sale is reversed.

²⁶ Germany has enacted legislation to take effect in 2001, replacing its split-rate imputation system with a partial (50 percent) dividend inclusion system. The split-rate imputation system taxes retained earnings at 40 percent and distributions at 30 percent, with full imputation for the 30 percent tax corporate-level tax provided to domestic shareholders. The new system introduces a single uniform corporate tax rate of 25 percent and denies imputation credits, but under partial inclusion, taxes only half of distributed income. The partial inclusion applies to both domestic and foreign shareholders, with the statutory withholding tax rate falling from 25 to 20 percent, with a possible further reduction under treaty arrangements. France is considering similar changes to its current imputation system.

²⁷ While this eliminates the problem of double taxation, the broader scope of the New Zealand exemption distorts the choice of investments to areas where other types of capital gains are likely to arise.

The challenge to protect their neutral taxation of capital income from distortions stemming from progressive income taxation was an additional motive for the Nordic countries to implement a dual income tax system in the early 1990s. As noted above, under a dual income tax system, all capital income is taxed at a separate proportional rate, while labour income remains subject to the progressive personal income tax rates. In order to minimise tax arbitrage, the capital income tax rate is (ideally) aligned with the corporate income tax rate.²⁸ By doing so, the system departs from the conventional global income tax, under which a common progressive schedule is applied to the sum of income from all sources. There are certain advantages to dual income tax systems. Lower and proportional rates for capital income could be defended on horizontal equity grounds, as part of the capital income may in fact serve to offset real capital losses due to inflation. Furthermore, labour taxation leaves (idle) human capital always untaxed, whereas financial capital and real estate are often subject to, respectively, wealth or property taxation (Nichen and Sørensen, 1997). Moreover, optimal tax theory suggests the application of lower rates on capital as opposed to labour, as it is more mobile and its supply more elastic. The uniform rate also mitigates the tax avoidance possibilities of progressive taxation and reduces incentives for tax planning (Cnossen, 1995). Finally, from a tax administration and compliance point of view, it is important to note, that the separate taxation of capital and labour income makes the tax system more easily adjustable to international developments in the taxation of capital income. However, the experience in the Nordic countries has shown that maintaining a dual income tax with a large public sector is challenging. If the statutory progressiveness of labour income tax is too steep, incentives for tax shifting threaten to undermine the system. In particular, the introduction of dual income taxation requires a careful trade-off between the efficiency gains stemming from neutral and low taxation of capital income and the efficiency losses associated with the opening-up of opportunities for arbitraging between labour and capital income by small entrepreneurs. Moreover, the political consensus underlying a dual income tax may be fragile due to equity concerns.²⁹

²⁸ The Norwegian system is closest to the dual income tax ideal, followed by Finland. Sweden and Denmark only exhibit some of the features of a “pure” dual income tax. For an overview of this approach as well as for a comparison of the four systems, see Cnossen (1999).

²⁹ Equity concerns seem to have been one of the reasons behind Denmark’s decision to move away from the dual income tax in 1994 (see Sørensen, 1998) and Norway’s recent decision to introduce a dividend tax, which clearly goes against the principles of the dual income tax and tax neutrality (see the 2001 *OECD Economic Survey* of Norway).

Box 1. Measuring marginal effective tax rates on corporate investment

The marginal effective tax rates (METRs) on returns to investment, under alternative financing methods, reported in Table A.4 make use of a method developed by King and Fullerton (1984) and extended by the OECD (1991). The methodology assumes that final investors (shareholders and bond owners) are remunerated at a particular real after-tax rate of return. In order to ensure that this is achieved for each type of physical investment (machinery, buildings and inventories) and funding method (bonds, new equity and retained profits), a specific real pre-tax rate of return (or cost of capital) is required at the company level for each of these items. This cost of capital depends *inter alia* upon the tax treatment of various forms of capital income, the statutory depreciation schemes for the three different kinds of physical assets considered, and the economic depreciation rates. Subtracting the after-tax rate of return from the cost of capital results in the effective marginal tax wedges, which can be converted into METRs by expressing the wedges as a percentage of the cost of capital.

This method, while attractive for its simplicity, makes several rather bold assumptions, calling for vigilance when interpreting METRs. In particular:

- The pre- and after-tax rates of return are valid only for a marginal investor since infra-marginal returns or “economic rents” are ignored. This allows many of the complexities of the tax system that do not affect the marginal investor (*e.g.* regarding reserves and tax allowances) to be left aside.
- In any particular application, such as the calculations reported in Table 3, a set of specific assumptions has to be made. In this case, the representative investor is assumed to be a resident person, taxed at the highest possible marginal income tax rate. In some countries, however, the typical investor may in fact be, for example, a tax-exempt institution, which would significantly alter the picture. These METRs also ignore the taxation of non-residents and resident investing in foreign assets. These calculations also take no account of special depreciation schemes or rules for carrying forward losses.
- In order to facilitate cross-country comparisons, several additional assumptions have been introduced in the METR calculations. Perhaps the most crucial and controversial ones are those of uniform inflation and real rate of return before personal tax across countries. Care is therefore needed in interpreting the results to compare METRs across countries in which these factors differ substantially.
- Finally, constant weights are used to combine the METRs for machinery, buildings and inventories into an average value for each source of finance. The METR for any particular investment project will differ from the values reported in Table 3 to the extent that the importance of these various components of capital differ from these weights.

Table 3

Marginal effective tax wedges in manufacturing¹
(percent, 1999)

	Sources of financing ²			Standard deviation
	Retained earnings	New equity	Debt	
Australia	2.02	0.81	2.11	0.59
Austria	0.74	2.65	0.06	1.10
Belgium	1.36	2.54	-0.60	1.29
Canada	4.48	5.63	1.98	1.52
Denmark	1.89	2.43	2.49	0.27
Finland	2.20	0.85	0.85	0.64
France	3.58	7.72	0.67	2.89
Germany	0.89	2.53	1.28	0.70
Greece	0.92	0.92	-0.58	0.71
Iceland	1.82	2.28	-0.08	1.02
Ireland	1.52	4.12	0.69	1.46
Italy	1.27	1.27	0.39	0.41
Japan	3.30	5.50	-0.09	2.30
Korea	0.61	1.59	1.59	0.46
Luxembourg	3.57	2.37	1.62	0.80
Mexico	0.77	1.04	1.04	0.13
Netherlands	0.46	5.33	2.46	2.00
New Zealand	1.48	1.48	1.48	0.00
Norway	1.06	1.06	1.06	0.00
Portugal	1.13	2.50	-0.25	1.12
Spain	3.20	2.23	1.65	0.64
Sweden	2.07	2.83	0.77	0.85
Switzerland	0.38	3.49	1.81	1.27
United Kingdom	2.88	2.40	1.55	0.55
United States	1.66	4.79	1.42	1.54
OECD ³	2.02	4.03	1.09	1.23
EU ³	1.95	3.24	1.01	0.91

Source: OECD Secretariat.

1. These indicators show the degree to which the personal and corporate tax systems scale up (or down) the real pre-tax rate of return that must be earned on an investment, given that the household can earn a 4 per cent real rate of return on a demand deposit. Wealth taxes are excluded. See OECD (1991), *Taxing Profits in a Global Economy: Domestic and International Issues*, for discussion of this methodology. Calculations are based on top marginal tax rates for the personal income tax and a 2 per cent inflation rate.
2. The weighted average uses the following weights: machinery 50%, buildings 28%, inventories 22%.
3. Weighted average across available countries (weights based on 1995 GDP and PPPs).

3.2 *The impact on organising business*

One important set of tax issues relates to the choice of the way of organising business. As noted, most tax systems in the OECD favour debt financing over alternative funding modes such as new equity and retained earnings at the company level. As a result, they favour large established companies over small companies and start-ups, which are susceptible to less favourable terms on debt financing and therefore have to rely on equity capital to a greater extent. Moreover, to the extent that tax rates applied to capital gains decline with the holding period of stock, it also penalises start-ups due to a reduced liquidity of stock markets. A number of striking country-specific features also stand out. For example in the Czech Republic and Korea the tax code fails to recognise holding companies (which are normally granted double taxation relief for vertical dividend transfers), thus promoting large horizontal corporate structures which are difficult to manage.

Some countries have attempted to gear the corporate tax system to support smaller businesses, notably through a progressive corporate tax rate structure or “simplified” tax regimes. There may be a case for favouring small corporate business to the extent it is prone to market failure, for example due to imperfections in patent systems penalising start-ups, high cost of compliance with regulations due to diseconomies of scale and reduced access of smaller firms to venture capital. Unfortunately, however, there is a risk that progressive corporate taxation gives rise to abuse, with large companies splitting their activities up in order to qualify for favourable treatment (Mexico). Moreover, simplified regimes that aim to facilitate tax compliance of small businesses also produce incentives for larger companies to abuse this facility through under-invoicing and under-reporting (Mexico and Korea). Hence while tax preferences for small firms may be motivated by a need to correct market failures they can introduce other distortions.

The reviews suggest that the tax treatment of the self-employed is often the Achilles heel of the system of income taxation. In tax systems where the self-employed face low effective tax rates as compared to dependent employees, incentives to be self-employed may be strong also in activity areas where this is not necessarily optimal. There may be various reasons for low effective tax rates for self employed. It may be that they have more scope for deductions and credits regarding expenses that qualify as necessary for carrying out their business than dependent employees, as is reported for Austria. Another reason may be that the self-employed pay

less social security contributions in proportion to their labour income, as is the case in the Czech Republic and Portugal. Underreporting of income of the self-employed is also widespread due to self-assessment of taxable income and weak auditing by the authorities, notably in Korea, Portugal and Greece, or lump-sum settlements of income tax or social security contributions which are applied in, respectively, Spain and Greece. In Mexico, the self-employed escape taxation almost entirely, hence the tax incentives to operate as a private micro-business as opposed to dependent employment are extremely powerful.

Conversely, if taxation of self-employed income is more severe than taxation of corporate business income, incentives to incorporate may be strong. A specific problem associated with the dual income tax systems operated in Sweden and Norway is that the self-employed and small business owners have strong incentives to incorporate and qualify as “passive” shareholders to avoid high taxation of labour income. The dual income tax requires self-employment income to be split into labour and capital components each taxed at a specific level. Since the statutory tax rate on labour income is high, incentives to incorporate and to convert labour income into capital income (dividends) are powerful, especially in Norway where there is full imputation relief for dividends. The tax authorities in these countries have attempted to counteract these incentives by establishing a special regime of “closely-held corporate business”, with total business income split into labour and capital components according to a complex set of rules in order capture labour income. However, loopholes prove difficult to close, the more so since pressure groups have successfully lobbied for exemptions. The efficiency of dual income tax systems would benefit from limiting the incentives to incorporate by diminishing the difference in statutory and effective tax rates on capital and labour income, especially at the upper end of the pay schedule.

Corporate tax codes in many OECD countries contain a plethora of special allowances, exemptions and credits to favour certain geographic locations, which are also not captured by the marginal effective tax rates reported in Table 3.³⁰ For example, in Poland the corporate tax regime offers exemptions in Special Economic Zones and the Czech Republic also offers a wide range of special arrangements, while in Spain tax-induced

³⁰ Although there is evidence that OECD Members countries are moving away from such tax incentives to regional grants, they remain sizeable. Meanwhile, the remaining tax incentives become increasingly tailor-made as investors bargain with national or regional investment promotion agencies (UNCTAD, 1998).

location shifts of companies to benefit from the favourable Basque special regime are reported. Japan and Korea maintain special depreciation allowances for investment in developing areas. In some countries of the European Union several of such special regimes exist as well.³¹ Some countries provide time-constrained exemptions from corporate tax, or so-called “tax holidays” (France, Poland). Such arrangements may be defended in some cases as a way to correct market failure.³² However, they often act to create arbitrage opportunities, eroding the tax base and distorting the allocation of resources. Support for investment in depressed areas could be justified on equity grounds, but tax incentives are generally not the most effective way of doing so, as they do not overcome initial location shortcomings.³³ Measures that lower the overall cost of doing business in a certain region, such as infrastructure development or the provision of training facilities, while comparable both in terms of net budget cost and in value for the individual firm, are more transparent and likely to create stronger positive externalities.

There are also special arrangements favouring specific industries still being operated in several countries. The corporate tax code favours capital intensive heavy industries in Korea and mining in Canada. In Greece and Norway the special, more generous, tax schemes for shipping companies generate incentives for tax shifting. In Norway the high marginal tax rate in the special regime for the offshore oil and gas sector (to capture natural resource rents) provides an incentive for companies to shift deductible interest expenditure into that regime. Special corporate tax regimes may be unavoidable in countries where the government is committed to capturing natural resource rents. However, tax authorities should guard against incentives for tax shifting, for example by adopting or enforcing “thin capitalisation” rules. In contrast, OECD countries are taking concerted steps to eliminate preferential tax regimes for certain

³¹ For example, concerning the *Mezzogiorno* (Italy), Northern Ireland (United Kingdom), designated enterprise zones (Denmark, until 1999), polar region (Finland, Norway), Shannon Airport Zone and Dublin Custom House Docks (Ireland), Basque Country, *Navarra*, *Ceuta* and *Melilla* (Spain), *Azores* and *Madeira* (Portugal).

³² Regional investment support may be warranted if information asymmetries lead to a higher perceived risk and, thereby, to higher required rates of return. Furthermore, proponents argue that by compensating for, e.g. higher transport costs, investment inducements might contribute to achieving the socio-political objective of fostering “competitive neutrality” among regions. They might therefore be considered as an appropriate supply-side measure for regional development, especially if the establishment of one industry is followed by others.

³³ Most empirical studies available conclude that tax incentives have only a small, albeit statistically significant, impact upon location behaviour (Papke, 1993 and Wasylenko, 1997).

mobile business activities (*e.g.* shipping) to reduce the opportunities for aggressive tax planning that they represent.

3.3 *The impact on international investment flows and the financial structure of multinationals*

Notwithstanding the general trend towards lower corporate tax rates and broader bases, some narrowing can be observed over the past decade in a number of countries, including tax allowances granted in several EU countries for start-ups, SMEs, IC technology and R&D. The proliferation of ‘beggar thy neighbour’ policies in the area of business tax incentives led the Council of the European Union to implement a “Code of Conduct” to address this issue (see Joumard, 2001).

Of course, the code of conduct only applies to EU countries, and the country chapters reveal that several non-EU countries have policies to attract foreign direct investment. These are Korea, Poland and the Czech Republic. The example of the Czech Republic is of particular interest because the 1993 tax reform abolished tax holidays for foreign investors and only allowed limited activity-specific allowances and credits. However, this policy of reducing incentives was reversed in 1998 with the introduction of a new set of incentives. This suggests that the Czech government felt that it was losing foreign investment as a result of its earlier cutback in incentives. This contrasts with the widespread view among international tax specialists that tax incentives have very little effect on FDI, partly because tax is only one of a large number of considerations that influence business location decisions and partly because such tax incentives are often offset by increased taxation by the country of residence. However, the Czech experience is consistent with an emerging new view, that incentives will not motivate large changes in location but could influence the choice between countries that are close together and similar in many respects. Thus, the Czech Republic could be seen as participating in a very competitive market to attract FDI, consisting of the transitional economies of central and Eastern Europe.³⁴

Moreover, recent empirical work indicates that the financial structure of multinational firms is influenced by the tax regime of the host country alongside that of the residence country, and confirms the central

³⁴ The likely impacts of alternative incentives are explored in OECD (2001a).

role played by the host country statutory corporate income tax rate in influencing chosen debt/equity ratios.³⁵ In particular, a high statutory corporate tax rate in the host country encourages borrowing in that country, tending to erode the corporate tax base. Similarly, empirical work examining transfer-pricing behaviour shows the incentive to use non-arm's length prices to artificially shift profits to relatively low-tax countries.³⁶ These issues can also arise to some extent within countries, especially federal ones or ones that have granted tax autonomy to certain regions.

4. The impact of taxation on the labour market

For several decades labour markets' performance has been unsatisfactory in many countries in the OECD area, especially in countries of the European Union where the average structural unemployment rate rose from around 4 percent in the 1970s to 7 to 8 percent in the 1990s. Other salient features of labour market outcomes in past decades have been the lengthening average duration of joblessness, the concentration of unemployment among the young and the falling employment rate of older and low-skill workers. The factors explaining these trends have been extensively analysed in the framework of the OECD *Jobs Study*, which highlighted a number of features of taxation that impinge on labour market outcomes:

- By boosting labour cost, heavier taxes on labour have adverse effects on structural unemployment, especially if labour cost increases persist for longer periods due to wages not responding promptly to lower labour demand.³⁷ Specifically for low-income earners offsetting reductions in their wages may not be feasible at all due to minimum wage rules. For them, higher labour taxes almost unavoidably translate into lasting higher wage cost and reduced employment.
- The interaction between labour taxes and social benefits distorts work-leisure trade-offs, resulting in reduced labour supply. In particular it produces weak work incentives among older workers, but also among secondary workers and lone parents. Concerns over the efficacy of social expenditure have prompted many countries to target social safety

³⁵ See for example, Hines and Hubbard (1990) and Grubert (1998).

³⁶ See for example, Grubert and Mutti (1991) and Hines and Rice (1994).

³⁷ See for some recent evidence also Daveri and Tabellini (2000).

nets on the truly needy and withdraw benefits as income increases. Such means testing, in combination with the tax system, weakens the incentives for job search and enhanced work effort further.

The *Jobs Study* therefore recommended that governments should “reform unemployment and related benefit systems – and their interaction with taxation – such that societies’ fundamental equity goals are achieved in ways that impinge far less on the efficient functioning of the labour markets”.³⁸

The analysis in the country reviews has focused on the tax-related incentive structures that discourage employment through the above channels in the countries concerned. For this purpose the surveys have relied on the statutory labour tax wedges, *i.e.* the gap between labour compensation and take-home pay generated by the tax system, for earnings levels at specific points or intervals of the income distribution.³⁹ Statutory average tax wedges, together with information on the incidence of taxes on the worker’s take home pay, gauge the impact of taxation on the labour cost for the employer, and thus provide an indication of adverse labour demand impulses stemming from taxation. The analysis of average and marginal statutory tax wedges in combination with information on the interaction between tax and benefit systems, can be used to gauge the work incentives associated with work-leisure tradeoffs.

4.1 *The impact on labour demand*

Raising public expenditure amid pressure to keep taxation of “mobile” tax bases low has resulted in a secular increase in the effective tax rates on labour income in many countries. This reflects a widening of the statutory labour tax wedges over a wide range of earnings levels, which may explain the decline in employment rates and rising structural unemployment rates in some countries. An international comparison of the most recent available statutory average tax wedges on labour in OECD countries is shown in Figure 1, with a breakdown into personal income tax, employers’ and employees’ social security contributions. As may be

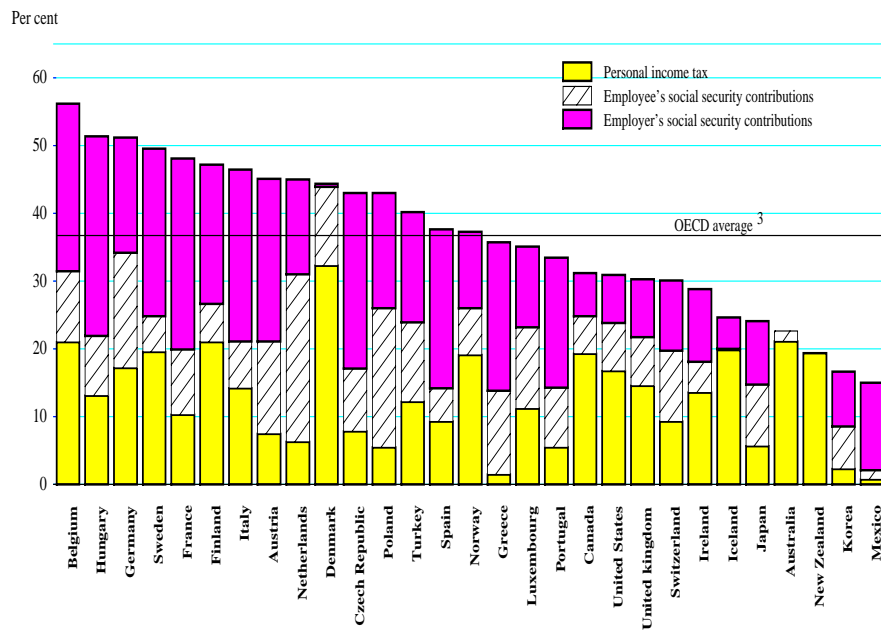
³⁸ OECD (1997a).

³⁹ OECD (1999a) and OECD (1999b). Statutory wedges do not necessarily coincide with the actual tax wedges that can be calculated from the Revenue Statistic or National Accounts which reflect also the impact of tax avoidance and evasion on the relevant tax base.

expected, the wedges are generally the highest in countries of the European Union (EU), where they average 43 percent of the total labour compensation. However, the variation within the EU is wide, ranging from almost 60 percent in Belgium and around 50 percent in Germany and Sweden to well below 40 percent in the examined countries Spain, Greece and Portugal and around 30 percent in Ireland and the United Kingdom. As may be expected, the examined transition economies Czech Republic and Poland portray tax wedges akin to the EU countries that are at the upper end of the range, and so does Hungary. The other examined countries all have comparatively small labour tax wedges (in ascending order Mexico, Korea, New Zealand, Japan, Iceland, Switzerland, the United States and Canada).

Fig. 1

Tax wedges on labour, 2000¹
(percentage of gross labour costs²)



Source: OECD, *Taxing wages*, 1999-2000.

1. For a single individual at the income level of the average production worker. Data for 2000 are based on estimated wage levels of the average production worker.
2. Gross wage plus employers' contributions.
3. Unweighted average.

Importantly, the cross-country variation in labour tax wedges is largely explained by the variation in social security contributions, most prominently employers' contributions. This is a concern to the extent employers tend to bear most of the incidence of their contributions. The reason is that higher employee taxes initially reduce the after-tax wage, as gross wages may be slow to respond, while, in contrast, employer payroll taxes will raise the labour costs of firms immediately. Therefore employers' contributions are expected to have stronger adverse employment effects than other forms of labour taxation. Countries that rely mostly on employers' social security contributions – including the countries reviewed Czech Republic, Spain, Greece, Portugal and Mexico – seem to have little scope for exploiting this tax base to a larger extent, and a shift in the tax mix towards consumption taxes may prove beneficial. On the other hand, some labour taxes, including employers' contributions, are less tax-like than others to the extent their payment gives rise to benefit entitlements and therefore meet different degrees of workers resistance to cuts in take-home pay. In this regard it is interesting to note that the Poland review reports the credibility of future public pension entitlements to be key to the impact of taxation on labour market performance in the years ahead.

Rigidities in wage formation are instrumental in shifting the incidence of labour taxation onto employers, and hence increasing unemployment. The countries in the European Union are particular prone to such effects, including the examined countries Austria, Sweden and Spain, while there are indications that the transition countries Czech Republic and Poland are increasingly confronted with this “tax penalty on employment” as well. For example in Spain, workers' resistance to accept cuts in their take-home pay due to labour taxation is particularly strong, even though the Spanish average tax wedge is low by EU standards (but exceeding the OECD average). An explanation put forward in the review is that high severance payments give workers a strong bargaining power. In addition, wage bargaining rarely takes place at the company or local level and thus fails to internalise the impact of wage demands on individual firms and local jobs prospects.⁴⁰ The Spanish review mentions a low level of competition in sheltered sectors and a malfunctioning housing market as additional factors hampering labour mobility and wage adjustment. There is evidence that such labour and product market rigidities, combined with

⁴⁰ See Scarpetta (1996) and Elmeskov *et al.* (1998).

sectoral wage bargaining, contribute to high structural unemployment in several other EU countries as well (Joumard, 2001). On the other hand, it is striking that Norway is reported to achieve a low level of structural unemployment despite the average labour tax wedge being similar to that of *e.g.* Spain, which may be attributable to the prevailing centralised wage bargaining structure.

Although the reviews do not provide numerical evidence on the impact of labour taxation on structural unemployment, it is possible to make a rough estimate based on available regression analysis (see Elmeskov *et al.*, 1998). Table 4 shows the change in the labour tax wedge during the 1990s for countries that are characterised by, respectively, low, intermediate and high centralisation and co-ordination of wage bargaining. Intermediate-level wage co-ordination and bargaining is an exclusive feature of EU countries, notably Belgium, Finland, France, Portugal, Spain and Sweden. Several of these countries portray, moreover, very large labour tax wedges. Centralised wage bargaining occurs in other EU countries, where tax wedges are wide as well, and Norway. Other OECD countries typically combine low tax wedges with decentralised wage bargaining structures, which is least detrimental to labour demand. For each country the contribution of the change in the tax wedge to the change in structural unemployment has been calculated, taking into consideration the prevailing wage bargaining structure, which is also shown in the table. From the estimates can be inferred that:

- In several EU countries with intermediate-level wage bargaining, notably Belgium, Finland, Spain and Sweden, the labour tax wedge widened in the first half of the 1990s with the increases in social security taxes associated with the recession at the beginning of the decade. The estimated effect on structural unemployment stemming from the wider tax wedge in these countries is of the order of $\frac{1}{2}$ to 1 percentage-points. On the other hand, Japan, Denmark, Ireland, the Netherlands and Norway achieved a narrowing of the tax labour tax wedge in this period, which is estimated to have contributed to a reduction in the structural unemployment rate.
- Labour tax wedges have mostly stabilised or declined in the second half of the 1990s, with the exception of several EU countries, notably Belgium, Sweden, Austria and Germany. As a result Austria and Sweden are estimated to have seen their structural unemployment rate somewhat increase in the second half of the decade as a result of a wider tax wedge. By contrast, New Zealand and Finland have in this

Table 4

**Estimated change in structural unemployment due to changes in the
labour tax wedge¹**
(percent)

	Change in tax wedge on labour income ²		Contribution from the change in the labour tax wedge to change in structural unemployment rate	
	1991-95	1995-99	1991-95	1995-99
Low centralisation/co-ordination of wage formation				
Australia	1.2	1.4 ³	0.1	0.2
Canada	2.5	0.3	0.3	0.0
Japan	-2.0	-0.2	-0.2	0.0
New Zealand	0.7	-5.1	0.1	-0.6
United Kingdom	0.2	-2.4	0.0	-0.3
United States	0.3	0.1	0.0	0.0
Intermediate centralisation/co- ordination of wage formation				
Belgium	2.6	0.7	0.4	0.1
Finland	6.7	-3.1	1.0	-0.5
France	-2.5	-1.2	-0.4	-0.2
Portugal	-0.2	-0.3	0.0	0.0
Spain	2.0	-1.1	0.3	-0.2
Sweden	3.3	1.2	0.5	0.2
High centralisation/co-ordination of wage formation				
Austria	2.1	4.8 ⁴	0.1	0.3
Denmark	-1.5	-0.9	-0.1	-0.1
Germany	3.8	1.7	0.2	0.1
Ireland	-2.9	-4.3	-0.2	-0.3
Italy	1.5	-3.0	0.1	-0.2
Netherlands	-1.7	-0.4	-0.1	0.0
Norway	-3.7	-0.2	-0.2	0.0
OECD	0.6	-0.6	0.1	-0.1
European Union	1.0	-0.6	0.1	-0.1

Source: OECD.

1. Based on Elmeskov *et al.* (1998).

2. For a single average production worker.

3. The number for the period 1995-2000 would be considerably lower due to a tax reform in 2000.

period made comparatively large inroads into their labour tax wedges, which is estimated to have had significant favourable effects on structural unemployment of the order of ½ percentage-point or more.

In most countries the statutory progressiveness of combined income and social security taxation is moderate or virtually absent for top earners in the majority of the examined countries. This is due, in most cases, to ceilings on social security contributions or tax-deductibility of social security contributions offsetting part of the statutory progressiveness of income taxation. The progressiveness of taxation across income levels matters for labour demand as well. Progressiveness may be detrimental for labour demand to the extent that earnings growth over time pushes more workers into higher income-tax brackets (bracket creep), which could in turn be shifted into higher wage claims. Some authors have suggested that union wage demands may in fact become more moderate, and hence more favourable towards unemployment, with greater income tax progressiveness, as it diminishes the take-home value of pay rises.⁴¹ However, the empirical support for this view is weak. A concern – underscored in the reviews of Austria, Sweden and Spain – is that greater reliance on social security contributions, which are usually flat-rated without a tax-free threshold, can make it particularly unprofitable for employers to hire workers on a part-time or temporary basis. In some countries (Austria, Spain) this problem is heightened by nominal floors in the social security system, with a fixed minimum amount of contributions levied irrespective of the number of hours worked or income earned (see Box 2). Importantly, as there has been increased reliance on social security contributions to finance the expanding social transfer systems, these mechanisms have become more rather than less pervasive. While this problem has prompted several countries – notably Austria, Belgium, France, Greece, the Netherlands, Spain and the United Kingdom – to implement cuts in social security contributions on low-paid or low-qualified workers in recent years, they may add to the complexity of the tax system and may entail dead-weight costs.

⁴¹ Tyrväinen (1995).

Box 2. Social security contribution ceilings and floors

In many OECD countries, social security contributions are often levied only up to a certain maximum level of wages, earnings above this ceiling being exempt. Earnings below a particular threshold are often exempt as well, which is referred to as a floor (type A). Alternatively, floors can take the form of a “lump sum” minimum contribution (type B). The rationale behind ceilings and type B floors is the linkage of benefits and contributions since benefits are usually also subject to floors and ceilings. Type A floors are in fact tax allowances, and serve vertical equity.

There are several problems associated with floors and ceilings:

- Contributions with ceilings introduce a regressive element into the tax schedule and produce higher marginal tax rates below the ceiling (see *e.g.* Coronado *et al.*, 2000). In addition, ceilings and floors lead to kink points in the tax schedule, which might result in “bunching”, although empirical evidence suggests this phenomenon is rather weak (for the United States, see *e.g.* Saez, 1999).
- Moreover, contributions subject to ceilings or type B floors are non-neutral regarding part-time, seasonal employment, job sharing or shorter working hours. In the presence of ceilings and type B floors, the wage cost for a given amount of labour will increase with the number of employees but not with the number of hours worked per person. Type A floors have the opposite effect of encouraging the atypical forms of employment. If ceilings and floors are imposed relative to the hourly wage and not to total wages, they would be neutral regarding “atypical” labour (Euzéby, 1988).
- Finally, floors and ceilings increase the complexity of the tax system, particularly for those having multiple jobs or those that are changing their employment (see Hotz/Scholz, 2000).

4.2 *The impact on labour supply*

The decision of an individual of working age to participate in the labour market occurs in two forms: whether to participate in the labour market at all and how many hours to work once working. Taxes may have important effects on both these decisions, and the effects may differ

markedly for main or single earners in a family, secondary earners or lone parents. Moreover, the direction of these tax impacts is a priori ambiguous: the decline in after tax wage income associated with a widening in the tax wedge has an income effect, which raises labour supply, and a substitution effect which lowers labour supply. The labour supply response to taxation therefore hinges on the elasticity of labour supply with respect to real after tax wage. In a nutshell, the following basic profiles of workers' responses to income taxation emerge:

- *Single or primary earners* often have little choice about labour participation, hence normally work fulltime so that tax considerations should have little effect on their labour supply (though not so in quality since this depends on the return on human capital invested). In other words, while there may be an incentive for substitution between leisure and work it is typically offset by the income effect (except at high income levels where the substitution effect may outweigh the income effect). However, this would still imply a distortion to the extent the total utility derived from consumption and leisure declines.⁴² Moreover, this situation may change considerably as workers approach the age of retirement as there may be tax incentives to retire early.
- *Secondary earners* are likely to be particularly sensitive to the relative price between work and leisure, hence to taxation, both in their decision to work and in the number of hours worked, as they normally face a wider set of options. Importantly, in countries where the basis of taxation is the household unit, the marginal tax rate applying to the first unit earned by a secondary worker is equal to that of the last unit earned by the primary worker. In those countries, secondary earners' labour supply response to taxation crucially depends on their partner's earnings.⁴³ The response of secondary earners also depends on where they are on the labour supply curve. For those working few hours the substitution effect most probably outweighs the income effect whereas for (almost) full-time working secondary earners the reverse is more likely.

The distortions stemming from tax incentives on the number of hours of work supplied may be gauged by the marginal tax wedge, *i.e.* the

⁴² It can be shown that the "excess burden" of taxation is independent of the income effect and just depends on the substitution or "compensated supply" effect.

⁴³ Mothers, moreover, face high fixed costs connected with childcare upon entering the job market, which acts like an extra tax.

gap between labour compensation and take home pay as a percentage of labour compensation for an additional hour of work. A key finding is that workers across a wide range of earnings levels face significantly higher marginal wedges in the EU and the transition economies than in other OECD countries, although the United Kingdom, Portugal and Greece are at the lower end of the range (Figure 2). Particularly high marginal wedges are found in Belgium, Germany, Hungary, Finland, Ireland, Austria, Italy and France. By contrast, comparatively low marginal tax wedges are found in Mexico, Japan, New Zealand and Korea – although the top marginal wedge in Japan is relatively high it kicks in only at extremely high earning levels (Table 5). These cross-country differences would be even more pronounced if the marginal tax wedge included the taxation of (additional) consumption, given that consumption tax is also lower in the latter group of countries.

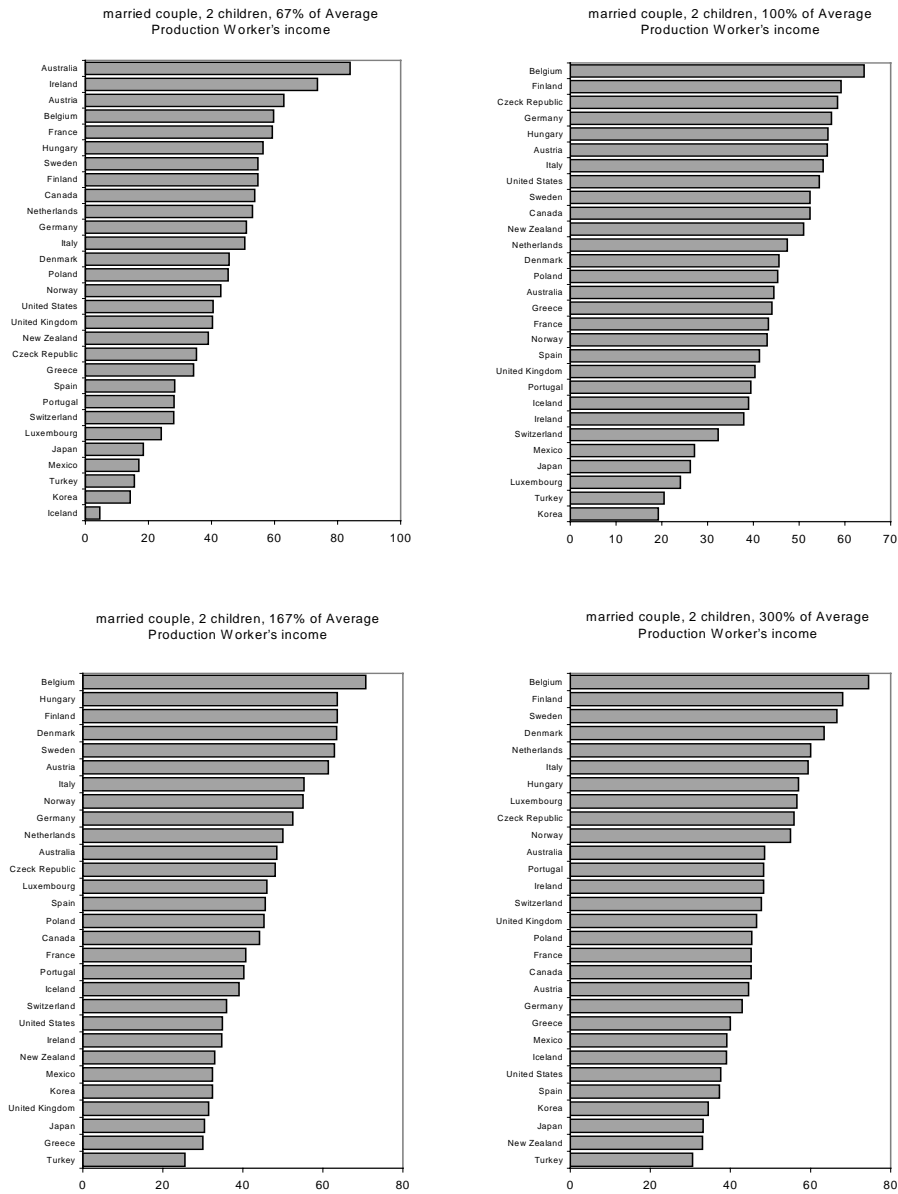
A measure of tax incentives with regard to the decision to participate in the labour market at all looks at the tax wedges including the impact of benefit withdrawals on after-tax earnings as persons accept a job (Figure 3). This measure provides evidence that adverse work incentives stemming from taxation and benefit withdrawals, while dependent on the specific family situation, are again generally strongest in EU countries. In particular, Figure 3, which assumes full-time earnings to correspond to the “average production worker wage” level, indicates that:

- In families where the principal earner is full-time employed, secondary earners moving from non-employment to part-time or full-time employment face wedges below 30 percent in the United States, Japan, Korea, Spain, Portugal, Greece, Switzerland, Ireland, the United Kingdom and the transition economies.⁴⁴ However, in the other countries, most of which are in the EU, wedges are found for the most part to be in the range of 40 to 60 percent, with Germany and Belgium being at the upper end of the range.
- If the principal earner is unemployed, the effective wedges for a secondary earner entering the labour market varies widely across OECD countries, but are again generally the highest in the EU. In cases where a secondary earner accepts a part-time job (40 percent of normal working time), the spread is particularly large. It ranges from nil or almost nil in the United States, Japan and Korea to 118 percent in

⁴⁴ In France this METR is below 30 percent only if the secondary earner accepts to work full-time but rises to 40 percent when accepting a part-time job.

Fig. 2

Marginal statutory all-in tax rates on labour
1999



Source : OECD Tax Equations, 1999.

Table 5

Rate schedules of central government personal income tax
(single person, no dependants, January 1998¹)

	Lowest standard rate	Number of tax brackets	Highest standard rate	Starting point (times APWwages) ²
Australia	20	4	47	1.4
Austria	10	5	50	2.3
Belgium	25.75	7	56.65	2.2
Canada	17.51	4 ³	31.3	1.8
Czech Republic	15	5	40	5.9
Denmark	8	3	29	1.1
Finland	6	6	38	2.2
France	10.5	6	54	2.2
Germany	formula	4	53	2.1
Greece	5	4	40	2.5
Hungary	20	6	42	1.7
Iceland	29.31	2	34.31	1.8
Ireland	26	2	48	0.7
Italy	19	5	46	3.5
Japan	10	5	50	7
Korea	10	4	30	5.5
Luxembourg	6	17	46	2.4
Mexico	3	8	35	7.5
Netherlands	8.85	3	60	1.9
New Zealand	15	3	33	1
Norway	18.8	3	32.5	1.1
Poland	19	3	40	4.7
Portugal	15	4	40	4.5
Spain	17	8	47.6	4.6
Sweden	25	1	25	1.1
Switzerland	0.77	10	11.5	10.4
Turkey	25	7	55	28.5
United Kingdom	20	3	40	1.8
United States	15	5	39.6	9.7

Source: OECD.

APW = average production worker.

1. Deductions or allowances related to specific income sources are not included.
2. Indicates salary level at which the highest income tax rate begins to apply; for example, in Australia, the highest starts at 1.4 times the APW wage.
3. Formally, the Canadian system has only three brackets, but beyond a certain threshold (which lies part way through the second bracket) a surtax is imposed.

Greece, with most observations for EU countries in the 30 to 70 percent range.⁴⁵ The zero rate in the United States is explained by employment-conditional tax credits offsetting the loss of other means-tested allowances and benefits at the average earnings level, but the rate is generally positive for higher earnings levels. The other extreme observation for Greece reflects *inter alia* that unemployed principal earners lose part of their (tax-free) unemployment benefit once their partner accepts a job.

- A striking common feature of all the surveyed countries is the very high wedge facing unemployed workers with a non-employed spouse, although differences among countries are also very large. Assuming the unemployed principal earner accepts a full-time job, wedges are nowhere below 50 percent, except in Poland and Mexico where most workers escape the income tax net, and between 70 to 90 percent in most EU and the other transition countries. However, accepting a part-time (rather than full-time) job is a very costly decision, with wedges exceeding 100 percent due to the loss of tax credits or benefits reserved for poor families, even in countries that otherwise display small distortions, such as the United States, Japan and Korea.

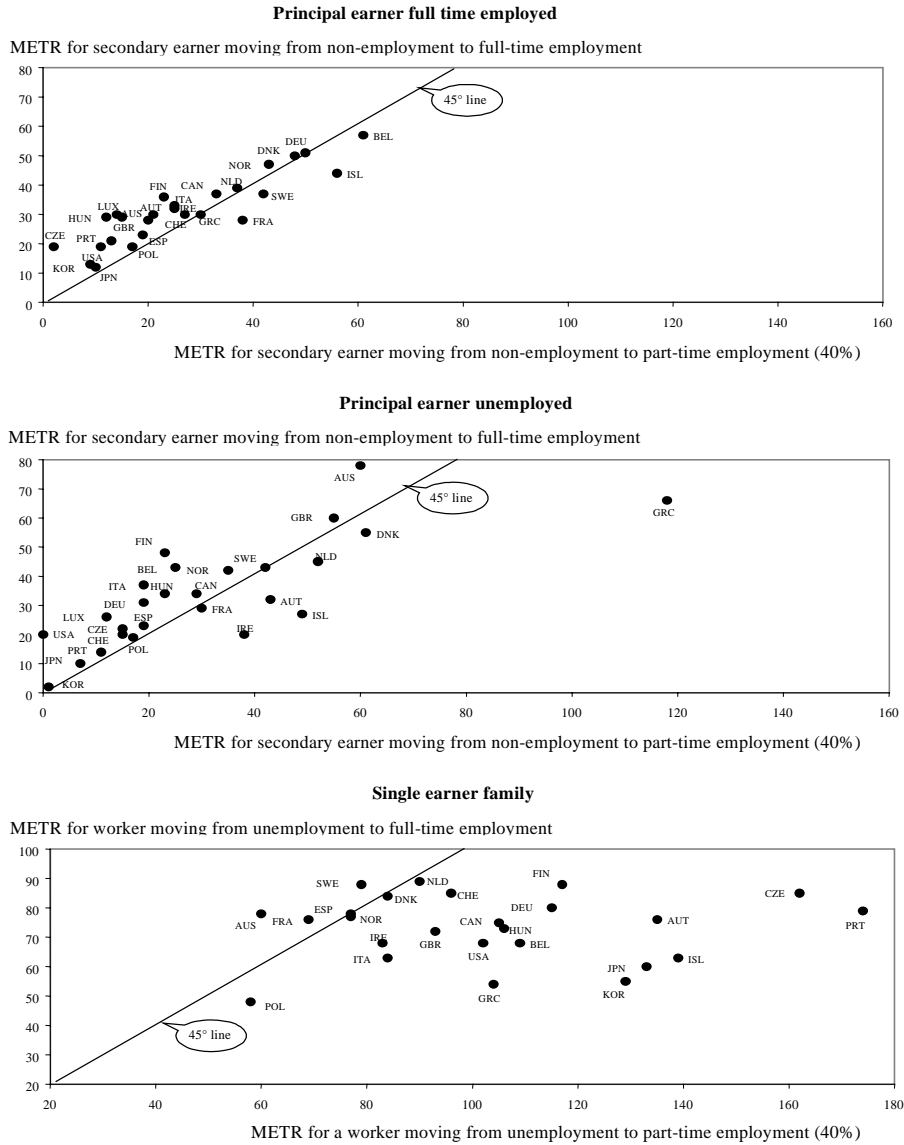
In recent years several countries have attempted to reduce the effective tax wedges for people entering the labour market by granting employment-conditional tax credits, akin to the Earned-Income Tax Credit (EITC) that has been operated for several decades in the United States.⁴⁶ An example is the Working Families Tax Credit in the United Kingdom. France, Finland, Greece, Ireland and New Zealand have similar programmes. Employment-conditional tax credits, unlike targeted cuts in social security contributions, impinge on labour supply rather than on labour demand, although both types of measures aim to favour labour market participation of lower qualified workers. While employment-conditional tax credits have the advantage of distributing income to the most needy and strengthen the incentives for jobless people to take a job, even if low-paid, they may also induce those already in low-paid work to reduce their work effort. For example, the review for New Zealand reports that the abatement of credits and welfare benefits as

⁴⁵ See OECD (1999b) for a fuller explanation of these results.

⁴⁶ The earned income tax credit (EITC) in the United States is an in-work benefit scheme, which uses the tax system as a means of transferring income. It is designed as a non-wastable tax credit supplement to earnings, which increases along with earned income up to a maximum limit, depending on the number of children, and is subsequently phased out.

Fig. 3

Marginal effective tax rates on household labour income



Source: OECD, Benefits and Work incentives Database.

Note: The 45° line corresponds to a situation where there is neutrality between a person moving to part-time or full-time unemployment from a tax-benefit perspective. Observations below the 45° line point to an unfavorable treatment of part-time as compared to full-time work.

earnings grow implies very high marginal wedges for lone parents in the abatement range (roughly between one-third and two-thirds of the average production worker's wage), up to around 100 percent.⁴⁷ Nevertheless, employment-conditional tax credits are valued for their contribution towards encouraging workers who are active in the grey economy to surface in the official economy. Employment-conditional tax breaks are particularly powerful if the pre-tax income distribution is wide (*i.e.* sufficient low-paid jobs are available) and in combination with a binding minimum wage to ensure that take-home pay increases.⁴⁸ Under such conditions, moreover, employment-conditional tax breaks may be revenue-neutral (Audric *et al.* 2000).

It is clear that tax distortions at the lower end of the income distribution are not confined to labour/leisure substitution effects, but also involve substitution between the formal and informal sectors of the economy. Informal economies are reported to be large in Mexico, Greece, Spain, Portugal and Poland. In the former two countries this mainly reflects poor tax enforcement, but in the latter two countries incentives stemming from the tax code itself also play a significant role. In Spain, social security contribution floors in combination with labour market rigidities (notably high levels of protection and severance payments) underpin the extensive informal labour market for lower qualified work. While this phenomenon is particularly widespread in Spain it may to some extent be representative for other EU countries with relatively rigid labour markets. The obvious policy response is to reduce wedges on labour income at the lower end (*e.g.* by removing social security floors type B; see Box 2) and to enhance tax enforcement. In Poland, in contrast, informal labour is concentrated in sectors where economic activity for statutory reasons largely remains outside the tax net (notably agriculture). Bringing such activity into the tax net and enforcing the tax law should be instrumental in closing this loophole.

As noted, contribution ceilings and tax deductibility of contributions in the social security system act to reduce progressiveness at the upper end

⁴⁷ This is confirmed by empirical studies suggesting that, as a result of the EITC, labour supply increases only in terms of the number of people working, with overall hours worked remaining broadly unchanged; see Ochel (2000), Liebman (1998), OECD (1997), L'Horty (2000), Kramarz and Philippon (1999), Blundell (2000) and Bertola (2000). But, even if the number of hours worked does increase only slightly due to offsetting effects, there may still be positive externalities associated with raising the number of people working (Phelps, 2000).

⁴⁸ Low qualified labour supply tends to be relatively wage-elastic, see for example Koskela and Schöb (2000), Assouline *et al.* (1997) and Pearson and Scarpetta (2000).

of the earnings distribution, thus generating a further taxation bias in favour of highly qualified and at the detriment of low skill labour. It is indeed striking how little effective progression labour tax systems in OECD countries produce as a result. Tax privileges for in-kind compensation and other non-wage components of executives' earnings which are not included in the statutory tax wedges presented here, further accentuate this bias.⁴⁹ Stock options usually receive a favourable tax treatment relative to the alternative of investing traditional labour compensation in stock to the extent that no capital gains tax is levied on the spread between the market value and the acquisition price of the stock. Moreover, several countries apply favourable tax rates if the options are held for a specified number of years (Belgium, France, Germany, Netherlands, United Kingdom and United States) or for start-up companies (France). While these tax privileges may offset some of the efficiency drawbacks of highly progressive the tax systems, the minimum holding-period requirements tend to reduce the labour market mobility of workers receiving remuneration in the form of stock options.

While these features may give rise to concerns over the limited income redistribution achieved through the tax system, it has the advantage of mitigating the incentives for tax avoidance and evasion of higher-income groups. Nevertheless, in a number of reviewed countries, notably Canada, Sweden and Norway, high progressivity at the upper end of the income distribution is reported to be a problem. In particular:

- In Canada, top income earners are prone to labour mobility *vis-à-vis* the United States, where income taxation is considerably lower at the top end of the income distribution. While cross-border labour mobility is a general feature of higher-qualified workers in most OECD countries, Canada is particularly sensitive in this respect given its geographical location and the limited linguistic or cultural barriers separating its labour market from that of the United States. Maintaining high tax progressiveness under such conditions frustrates the efficiency tax system without gaining much in terms of equity.
- Although most OECD countries tax labour and capital income at different final rates, the dual income tax systems adopted in Sweden and Norway go furthest in combining a relatively low taxation of capital

⁴⁹ Stock options have become the single largest component of executive pay in the United States to a point where they may have measurable effects on increased volatility in tax revenues (Goolsbee, 1997 and 2000).

income with high and strongly progressive taxation of labour income.⁵⁰ As a result, the incentives for human capital formation are weakened and top earners face strong incentives to move towards self-employment and eventually incorporate in order to be able to report a significant part of their earnings as lower-taxed capital income. It is therefore advisable for countries that maintain a dual income tax system to avoid excessive progressiveness of labour income tax and keep the gap between labour and capital taxation as small as possible.

In fact, high marginal tax wedges affecting the upper end of the earnings spectrum (of 50 percent or higher) are found in several other EU countries as well, notably Italy, France, Germany, Belgium, Denmark and the Netherlands (Figure 2). This points to incentives for tax planning and avoidance activities, with top earners attempting to reduce their tax bill by maximising tax deductions or by attempting to shift income into low-taxed jurisdictions or tax bases (dividend, capital gains, *etc.*). These disadvantages of high marginal tax rates explain why many OECD have substantially reduced their top rates of income tax in recent years.

Most countries, notably in the European Union, have implemented tax incentives for early retirement as a way to ease excess supply conditions on the labour market. There are large differences in these rates between countries, but some general patterns emerge.⁵¹ Tax rates on continued work are generally highest in continental European countries (Denmark, Portugal and Switzerland are notable exceptions) and lowest in the Anglo-Saxon countries (Australia, Canada, Ireland, New Zealand, United Kingdom and the United States) and Korea. Japan occupies an “intermediate” position. These differences generally tend to be even more pronounced when account is taken of the possibility that workers retire early through unlimited unemployment benefits, disability or special early retirement programmes: in some continental European countries implicit tax rates on continued work quickly rise to well above 50 percent.

The experience in some examined countries (Sweden, Norway) suggests that it is important to match the build-up of benefit entitlements, notably (credible) pension rights, with the payment of contributions into the social security system, according to the insurance principle. To the extent workers perceive social security contributions as an investment in

⁵⁰ Finland also applies a strict dual income tax system.

⁵¹ See Blondal and Scarpetta (1997).

pension annuities, the adverse impact of marginal wedges on labour market behaviour may be reduced. Indeed, as seems to be suggested by the Swedish and Norwegian experiences, making the “right” to benefit from the social transfer system (aside from minimum income support and in-kind transfers which are universally available) conditional on work history encourages labour market participation, including of secondary earners. This experience underpins the recommendation to governments of transition economies (in particular Poland) to ensure that public pension entitlements remain credible; otherwise the adverse impact of wide tax wedges for labour participation risks becoming stronger.

5. The impact of taxation on product markets

Indirect taxes have several favourable features, most prominently their relative neutrality from the point of view of savings and investment decisions and that they are comparatively easy to administer. Moreover, value-added tax (VAT), by far the most important indirect tax in most countries (constituting over half the indirect tax take), has “self-policing” properties since many payers of the tax have an interest to register in order to be reimbursed for their own VAT payments. Nevertheless, indirect taxation may also produce non-neutralities in product markets. For example, turnover taxes, which have been abolished in Europe several decades ago, were faulted for applying discriminatory rates to goods and services that depend on various productive stages, due to so-called “cascading” of taxation. This led to very inefficient organisation of work by discouraging outsourcing. The VAT served to eliminate cascading by exempting the purchase of intermediate goods and services from the tax base. Moreover, by introducing the destination principle (by taxing imports but exempting exports) VAT and sales taxes avoid distortions in consumer choice between imported and home-produced goods and services that would otherwise stem from international differences in tax rates. On the other hand, indirect tax systems that mostly rely on sales taxes – which are generally levied only on final consumption of tangible goods – insert a wedge between the relative prices of goods and services in favour of the latter. The indirect tax system of the United States continues to rely on sales taxes that are levied at the state and local level, while the federal

government collects excises and tariffs.⁵² Meanwhile in Canada, additional efficiency in tax collection and lower compliance costs have been achieved by harmonising the retail sales taxes in some provinces with the federal VAT (*i.e.* a single VAT is collected with revenue distributed to both the provincial and federal governments).

The country reviews highlight two other possible mechanisms through which indirect taxes produce distortions:

- Exemptions or taxation at lower or zero rates of certain goods and services, which are a widespread feature of indirect taxation systems, may distort choices among various consumption or production alternatives. However, it may be successful in relieving regressive effects of indirect taxation on the income distribution.
- Product-specific sales taxes, or excise taxes, may aim to enhance economic efficiency by internalising harmful external (*e.g.* environmental) or hazardous health effects and discouraging economic activities and consumption that carry such external effects. Others raise revenues by taxing goods that carry a low price elasticity heavily, in accordance with Ramsey's rule.⁵³ However, in many instances the tax structure is modified to protect certain industries so that neither of these objectives is achieved.

5.1 *The impact on consumption and production patterns*

While the majority of OECD countries have achieved efficiency gains by introducing VAT, rate differentiation and exemptions produce non-neutralities. Low indirect tax rates and exemptions are often motivated by concerns over indirect taxation hitting disadvantaged groups heavily or, in the case of exemptions from registration of small companies, to facilitate compliance. However, rate differentiation may also be motivated by industrial policy objectives, although this is not very effective as VAT is neutral between imports and domestic production (except in, for example, the international tourism industry), or may have simply emerged from ad hoc revenue-raising measures. While most countries have these features in

⁵² With the introduction of a General Sales Tax as of July 2000 in Australia, the United States is the only remaining OECD country not to apply a VAT.

⁵³ Ramsey's rule states that the excess burden is minimised if the product of tax rates and price elasticities is equalised across all goods.

common to some extent, several of the reviewed countries stand out. Notably in Korea many fees, charges and contributions are levied in a discretionary and non-transparent manner and excise taxes are complex. Moreover, major loopholes erode the VAT base and undermine neutrality, including the special regime for small businesses, the zero VAT for “indirect exporters” and for inputs into agriculture/fisheries as well as the exemption of agricultural products. A streamlining of the indirect tax structure in Korea should clearly receive priority.

A synthetic indicator of the neutrality of VAT rate structures across goods and services is the ratio between the average effective and the statutory standard rate of VAT (Figure 4). If this ratio is close to one, it points to a relatively neutral and efficient VAT system in the sense that rate differentiation and exemptions are not very pervasive and that base erosion is moderate. Conversely, if the ratio is closer to zero, the VAT system may be poorly performing in either or both ways. While this indicator should be interpreted with caution, it broadly confirms the above findings drawn from the country surveys.

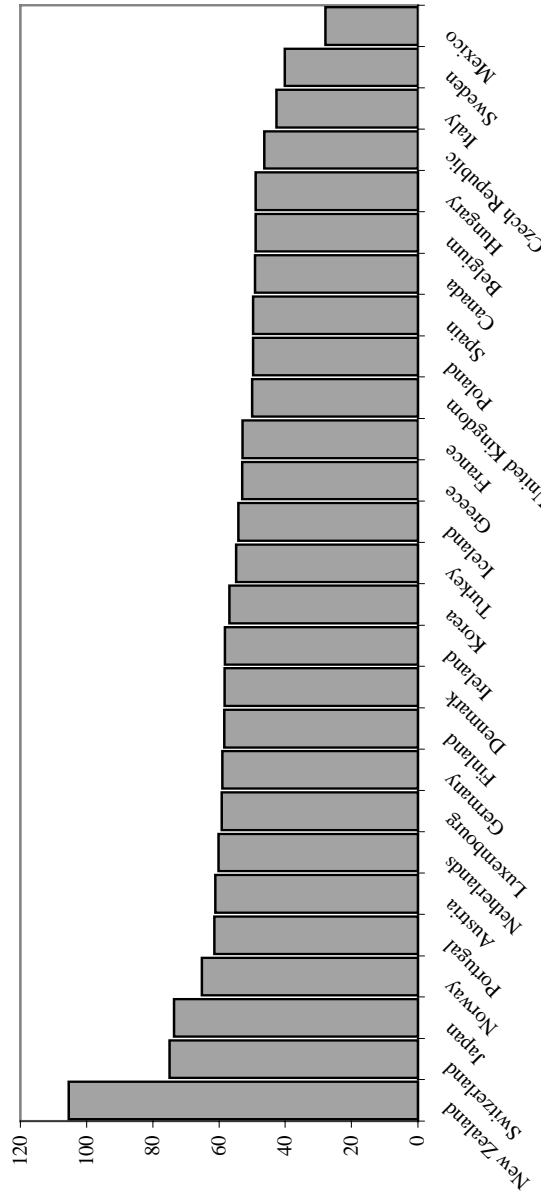
- New Zealand has an almost perfectly neutral VAT system, owing to the single uniform tax rate of 12.5 percent and the virtual absence of exemptions.⁵⁴ This has resulted in the highest effective tax rate relative to the standard statutory rate in the OECD area.
- At the other extreme, Mexico stands out by a very low ratio of effective over statutory standard VAT rates. This reflects the many loopholes and incentives for evasion associated with widespread exemptions and zero-rating of certain goods and services, while there is evidence of transactions being falsely attributed to zero rated tax bases. A serious non-neutrality stems from a high threshold below which sales are tax exempt – the VAT-exempt threshold in Mexico is very high by OECD standards, broadly matched only by Japan (Table 6) – which favours the set-up of micro-businesses that are particularly difficult to monitor.
- Most other countries have ratios of effective over statutory standard rates that are within some reasonable margin around the OECD average, but clearly below 100 percent. With compliance being mostly satisfactory, this suggests that VAT systems are non-neutral, for a

⁵⁴ The uniform 10 percent rate of the new General Sales Tax (GST) that has been implemented in Australia represents a move in the same direction, although the exemption of basic food diminishes the simplification gains and leaves scope for tax avoidance schemes.

Fig. 4

Effectiveness of value added taxes (1998)

(percent)



Source: OECD, *Revenue Statistics, 1965-1999*, OECD, *Consumption Tax Trends, 1999* and OECD calculations. See also Carey (2000).

Note: Effectiveness of VAT is measured as the effective VAT rate as a per cent of the standard statutory rate, where the effective rate is VAT revenues divided by the potential VAT base (*i.e.* consumption minus VAT). The effectiveness of the VAT reflects the broadness of the VAT base and the level of compliance. The VAT effectiveness for New Zealand exceeds 100 per cent due to differences between the actual VAT base and consumption as measured in the national accounts.

variety of reasons. As noted, in Japan the VAT (registration) threshold well exceeds those of other OECD countries, hence small business units (including farms) pay less VAT (since their intermediate consumption and investment are not exempted). Korea maintains a “special regime” for small businesses largely to the same effect and, as indicated, extends zero-rating of exports to “indirect exporters” (industries that provide inputs into exporting industries). In the European Union and Norway, where standard VAT rates are around four times higher than in Japan (which has a standard rate of only 5 percent), the proliferation of reduced rates and exemptions also acts to lower VAT neutrality.

Several countries extensively use the VAT system as a vehicle for income redistribution, most prominently Mexico (see above) and the transition economies, Poland and the Czech Republic, at the expense of serious distortions in the resource allocation and dead-weight losses. In Poland, a harmonisation of the VAT with EU rules to prepare for accession started to come into effect in 2000. However, bringing the agricultural sector – which accounts for 27 percent of employment but only 4 percent of GDP – into the VAT net to comply with EU accession requirements, remains on the agenda. In the Czech Republic a reduced VAT rate is applied to an exceptionally wide range of “socially sensitive” items, including heating and telecommunications, which is also in violation of EU regulations.⁵⁵ In addition Korea exempts both inputs and sales of agriculture and fisheries while Norway exempts long-distance public transportation to favour remote (mostly rural) areas.⁵⁶ There is evidence to suggest that countries that extensively use VAT rate differentiation for income redistribution purposes are prone to large dead-weight losses, as consumption patterns are similar across a wide range of income levels. Under such circumstances efficiency gains could be reaped by cutting down zero or low rating to a few basic staples, while moving towards targeted aid through direct cash payments, in-kind benefits and vouchers.

⁵⁵ Just adjusting the VAT rate on heating would generate enough extra revenue to allow the standard rate to be reduced for 22 to 19 percent. The situation in Hungary is largely similar in this respect.

⁵⁶ The airline industry has moreover the possibility to avoid (non-reimbursable) VAT on fuels by combining domestic with international flights.

Table 6**Turnover thresholds for VAT exemption***(1998)*

	Domestic currency	1998 US PPP
Austria	AUD 300 000	22 023
Belgium	BF 225 000 excluding VAT	5 954
Canada	CAD 3 000	25 659
Denmark	DKK 20 000	2 332
Finland	FIM 50 000	8 161
France	FRF 100 000 excluding VAT	14 917
Germany	DEM 32 500	16 202
Greece	GRD 1 800 000	7 451
Iceland	ISK 200 600	2 404
Ireland	IEP 40 000	57 552
Italy	ITL 5 000 000	2 987
Japan	JPY 30 000 000	182 935
Korea	KRW 24 000 000	35 886
Luxembourg	LUF 400 000	9 633
Mexico	MXP 1 000 000	198 037
Netherlands	Nex tax payable up to NLG 4 150	2 026
New Zealand	NZD 30 000	20 250
Norway	NOK 30 000	3 265
Portugal	PTE 3 000 000	15 986
Spain	Individual retailers	..
Sweden
Switzerland	CHF 75 000	37 707
Turkey	Varies with activity	..
United Kingdom	GBP 50 000	75 757

Source: OECD.

Note: These thresholds are for "common cases". Various deviations and special cases exist in several countries, cf. OECD, Consumption Tax Trends, 1999.

5.2 *The impact on cross-border and digital consumption flows*

VAT and sales taxes give rise to distortions where tax rates are not uniform across a country. Sales taxes in the United States are levied by individual states and are usually collected by requiring retailers in the state to collect the sales tax from their customers at the time of purchase. However, if a mail-order company does not have a business presence in the same state as the consumer, this approach does not work. Theoretically, in some states, the consumer is liable to pay the sales tax but this is virtually impossible to enforce and mail-order sales in the United States are seen as effectively free of sales tax, and hence the tax system favours this mode of retail trade over other modes.

This problem does not normally arise in sales between countries because of the basic principle that exported goods, having been relieved of VAT on dispatch, are then subject to VAT when they are imported into the country of receipt. This function is often, though by no means exclusively, frontier-based. Indeed, in 1993, the EU, having abolished internal border controls for fiscal purposes, had to develop a system whereby this principle could continue to apply but without frontier-based formalities. It has done so through the adoption of a system whereby intra-EU sales between businesses registered for VAT continue to be zero-rated on 'dispatch' with the receipt business accounting for VAT on 'acquisition' (under the rules applicable in the recipient Member state). This system is corroborated through an EU-wide VAT registration numbers verification system, and enhanced co-operation between the tax administrations. The EU system also has some special regimes which apply to certain intra-EU transactions (for example, to "distance selling", *i.e.* mail order sales to private consumers). Such special regimes introduce a degree of additional complexity, and can create additional compliance burdens for the businesses concerned. In some instances, therefore, the three-part regime in the EU is complex and generates additional compliance costs for business. In addition, there are concerns about the possibilities for fraud because sales to foreign businesses are crossing frontiers without having tax paid. This undermines the self-enforcing mechanism of VAT. However, closer examination of this point shows that this risk is not as great as might be thought. Businesses that are registered for VAT have no incentive to avoid declaration of their 'imports', because any VAT that they pay will be refunded. Indeed, they have an incentive to declare, because they need to put the cost of the inputs into their accounts so that their profits (and hence their corporation tax liability) are not overstated. This means that the

possibility of fraud only arises from the diversion of goods intended for VAT-registered businesses to private consumers or businesses that are not registered for VAT. This could happen either as a result of fraud on the part of the exporter or on the part of the purchaser (who could pretend to be VAT registered). Clearly, the possibilities of such fraud depend very much on the nature of the product being traded. It is more likely to fall into the hands of consumers the nearer it is to being a final product.

Overall, while the current EU system has appreciable drawbacks, so do the possible alternatives and this explains the lack of progress in moving towards a final system. The drawbacks of alternative systems would be reduced if VAT rates were harmonised between countries, but there are considerable political objections to this approach. With progress towards harmonisation of VAT rates being slow, distortions arising from “cross-border shopping” will thus also be a growing issue. Interestingly, countries that participate in the single market via the European Economic Area agreement seem to be already affected. For example, Norway is reported in the review to be prone to significant cross border shopping for food in neighbouring Sweden, which, like other EU member countries, applies reduced VAT rates for food products.

Meanwhile electronic commerce is growing rapidly and increasing the opportunities for, and the volume of, international trade. This different way of doing business poses challenges to traditional methods of tax collection both in terms of ensuring fair competition between electronic traders and more traditional businesses, and in terms of effective tax administration.⁵⁷ In considering commodity taxation, it is important to distinguish between commodities that are ordered electronically but delivered in a traditional way (whether to business or private consumers) and commodities that are delivered electronically (particularly to private consumers). The first category poses no substantive additional commodity tax issues (save for those posed by mail order sales to private consumers), even though there will be an increase in the quantity of goods crossing frontiers, and traditional customs based procedures for tax collection will need to be further streamlined to ensure that they can cope with this

⁵⁷ OECD countries are working, in partnership with the international business community and with non-member economies, to implement the core principles set out in the Taxation Framework Conditions (OECD, 2001b). These point, in short, to the application of existing taxation principles and norms to e-commerce, albeit with some clarification and development of those norms in selected areas. For consumption taxes, they point towards the goal of applying the principle of taxation in the place of consumption.

increased volume. It is the second category, products that are delivered electronically, that poses a real challenge. How can the delivery of such products be detected, and so be taxed?

Given the broad consensus internationally that such electronic deliveries should not be regarded as a supply of goods, they do not fall liable to customs duties and the only tax issue is the collection of VAT (or its equivalent) in the country of consumption. In a VAT system, the electronic delivery of commodities to VAT-registered businesses does not cause a problem. As with the current intra-EU system of transactions between VAT-registered businesses, the purchasing firm has no incentive not to declare the purchase.⁵⁸ Thus, the problems arise in connection with supplies to consumers and businesses that are not registered for VAT, a comparatively small part of the market. Under a traditional VAT model, the supplier should fulfil the VAT obligations in relation to such sales (*i.e.* to register with the tax authority, and to remit the VAT charged to customers). Such an approach becomes less tenable in the electronic environment when, for example, suppliers are non-resident (*i.e.* outside the jurisdiction of the consumer) and there is little or no incentive for those suppliers to undertake the VAT-related functions. Effective tax collection on these transactions (to ensure neutrality of treatment with domestic suppliers, and to safeguard the revenue at stake) begs some difficult questions, for example, about identification of suppliers, about the obligations that might bear upon them, and about the verification of the jurisdiction of consumers (since this is crucial to their being charged the correct tax rate).⁵⁹

⁵⁸ The emerging conclusion from the OECD's current work on this issue is that a self-assessment (or so-called 'reverse charge') mechanism can be applied to the cross-border consumption of such services.

⁵⁹ In the medium term, technology-facilitated systems offer the potential to support the tax calculation and remittal functions. In the interim, where countries consider the distortion of competition or revenue loss sufficient to merit action, a registration-based approach to collection is probably the only practical alternative. A highly simplified registration system would go some way to minimising related compliance burdens, and securing voluntary compliance on the part of non-resident suppliers.

5.3 *The impact on economic behaviour in the pursuit of environmental policy goals*

All OECD member countries levy excise taxes or user charges on specific products and public services, raising revenues in the range of 30 to 70 percent of the total indirect tax take. Excises and charges were originally mostly designed to raise revenues, which in many cases were either formally or informally earmarked for purposes such as maintenance of public infrastructure or subsidising welfare services. However, since a substantial share of the excises and charges is de facto levied on energy consumption, they have come to be seen as a means of internalising harmful external effects on the environment and to discourage economic activities that are at the root of these harmful effects. Since the early 1990s, several countries have introduced so-called green tax reforms, which have led to a restructuring of existing taxes and the introduction of new environmental taxes.

The GDP share of environmentally related taxes, nevertheless, still represent a rather small share of total tax revenues –7 percent on average in the OECD in 1997 (see Table 7). Motor fuel and motor vehicle taxes, which, as noted, pre-date the wave of green tax reform and have been introduced for fiscal rather than environmental reasons, made for the bulk of these revenues. Other taxes on energy represented about 7 percent of total environmentally related taxes on average in the OECD, while more directly environmentally based taxes represented only about 1 percent of the total.⁶⁰ These averages obviously conceal differences across countries, with some countries already making a rather large use of environmental taxes. Mineral oil in particular is heavily taxed in the EU although some countries have cut fuel taxes recently in view of inflation and competitiveness risks and in response to the oil price hike. Within the European Union, Austria, Belgium and Spain are lagging the EU average. Among the transition economies, Poland and the Czech Republic portray low environmental taxes even if environmental pressures are strong. This is also true of Japan and Mexico.

There are several reasons why environmental taxes and other economic instruments such as trading systems may be preferred over

⁶⁰ However, these numbers may understate the actual importance of environmental taxes to the extent these have been instrumental in removing their own base (e.g. taxes on nickel-cadmium batteries in Denmark).

“command and control” types of regulation.⁶¹ First, by letting individual market agents decide upon how much and in which way to reduce pollution, they allow the agents with the lowest abatement costs to contribute the most to the total reduction in pollution, thereby minimising the overall cost of the policy (*i.e.* securing cost-effectiveness). This property is usually referred to as “static efficiency”. Second, in contrast with “command and control” regulation, which cannot be continuously adapted, economic instruments promote “dynamic efficiency” by providing permanent incentives for reducing emissions through technological improvement. Third, taxes and tradable permits (when sold or auctioned) provide revenues, which can be used to increase the overall efficiency, for example by reducing other taxes. Finally, as economic instruments work through the price system, they allow an effective integration between economic and environmental policies, (and avoid environmental policies simply curing the ills generated by sectoral policies).

Unfortunately, a key finding in the country surveys is that, overall, environmental tax rate structures are not only sub-optimal from a point of view of inducing cost-effectiveness but in some cases even perverse. In particular:

- Industrial use of energy is typically taxed at much lower rates than households’ energy consumption, even if the potential for pollution abatement in industry may be substantial. For example, in most countries unleaded premium petrol is taxed at higher rates than diesel fuel, notably in a host of EU countries, Japan, Korea, New Zealand and the transition economies, despite the heavy environmental burden associated with diesel combustion. Poland, moreover, has so far not implemented significant differentiation of excise taxes on unleaded and leaded petrol. Similarly, industrial use of electricity and gas is usually taxed at much lower rates than household use.⁶²
- Within industry, in most countries a preferential tax treatment is granted to heavy polluters (agriculture, energy-intensive manufacturing), while rate structures poorly reflect the pollution content of energy use or conversion. This is often done to protect the international competitiveness of the industries concerned, which is especially costly in the case of local pollution problems where shifting the most polluting

⁶¹ OECD (1999e).

⁶² See O’Brien and Vourc’h (2001).

Table 7

Revenues from environmental taxes

	Share of environmentally related tax revenue in total tax revenue, per cent		Share of environmentally related tax revenue in GDP, per cent	
	1994	1998	1994	1998
Austria	4.5	5.1	1.9	2.3
Belgium	4.3	5.0	2.2	2.3
Canada	4.9	5.5	1.8	2.0
Czech republic	7.4	7.4	3.2	2.8
Denmark	8.0	10.1	4.1	5.0
Finland	5.8	7.3	2.7	3.4
France	5.5	4.7	2.3	2.1
Germany	6.4	5.9	2.5	2.2
Greece ¹	12.7	11.7	4.0	4.0
Hungary	6.6	8.2	2.3	3.2
Iceland ²	9.0	9.5	2.8	2.9
Ireland	9.1	9.4	3.3	3.0
Italy ¹	8.0	7.3	3.3	3.3
Japan	6.1	6.1	1.6	1.7
Korea	10.2	13.5	2.1	2.9
Luxembourg	8.0	6.9	3.6	2.8
Mexico ²	10.8	7.2	1.8	1.2
Netherlands	7.7	8.7	3.5	3.6
New Zealand	4.5	5.1	1.7	1.8
Norway	8.8	8.2	3.6	3.6
Poland	4.1	4.4	1.8	1.7
Portugal	11.6	10.9	3.8	3.7
Spain	6.6	6.5	2.3	2.2
Sweden	6.0	5.9	2.9	3.1
Switzerland	6.1	5.9	2.0	2.1
Turkey	6.8	10.6	1.5	3.0
United Kingdom	8.4	8.3	2.9	3.1
United States	3.8	3.2	1.1	0.9
Average ³	7.0	7.4	2.6	2.8
Standard deviation	2.2	2.5	0.8	0.9
Coefficient of variation	0.3	0.3	0.3	0.3

Source: OECD Database on environmentally related taxes; OECD Revenue Statistics.

(1) 1997 instead of 1998.

(2) 1995 instead of 1998.

(3) Simple average excluding Iceland and Mexico.

activities abroad may in fact be part of a cost-efficient solution.⁶³ At the same time, while cross-border pollution calls for international co-ordination of environment related taxes, this has largely failed to date, with most green taxes being implemented unilaterally. A particular problem is associated with the coal sector in transition countries, where fees have been increased dramatically compared to the pre-transition regimes, but are still insufficient to induce investment in pollution abatement or alternative energy sources on a large scale.

One consideration when assessing the usefulness of environmental taxes is that these may be used to cut distorting taxes in other areas. However, such opportunities may be smaller than hoped for. Indeed, a shift in the tax mix towards environmental taxes away from labour taxation is not a sufficient condition for removing the “tax penalty” on employment. An additional important determinant is the tax incidence: if the burden of environmental taxes finally falls upon households through higher prices of consumer goods and services, the reduction in the labour tax wedge will be less effective and the employment effect reduced. Since labour is a relatively immobile factor of production, and capital relatively mobile, especially in open economies, this ultimate tax incidence on labour is likely to occur.⁶⁴

6. Conclusions

The above exposition aims to demonstrate that the distortions in economic behaviour stemming from taxation are substantial, and that the growth dividend arising from easing these distortions may be considerable.

Policies in this regard would need to involve the reduction of tax disadvantages to employment, especially in several European countries. Although recent reforms have been going in this direction, further efforts are needed to reduce the high tax wedges affecting low-income earners as well as those workers that are at the upper end of the income distribution – preferably combined with further broadening of tax bases to avoid an

⁶³ There are alternative methods of protecting industrial competitiveness, while providing some incentive to reduce pollution. It would be possible to apply the tax to imports of polluting products. It would also be possible to levy the tax in proportion to the consumption or emissions that are to be discouraged and to refund the revenues in proportion to sales or production.

⁶⁴ See OCDE (2001c).

increase in marginal tax rates of middle income earners. Such changes would be instrumental in raising the chances of lower-skill workers finding gainful employment while reducing tax planning and avoidance activities of the higher skilled that go against objectives of both economic efficiency and equity.

The neutrality of tax systems with regard to the choice of investment funding, business organisation and location are other priorities for reform, with a view to reducing the, potentially costly, distortions in these areas. Strengthening the neutrality of taxation across savings vehicles would be complementary to this approach. The tax regimes facing the self-employed are in need of streamlining to remove incentives for the shifting of smaller business activities either into the unofficial economy or into the corporate sector in areas where this is not necessarily the optimal organisation form of business. Meanwhile, taxes that have been designed to correct market failures could be made more efficient. For example, improvement in the effectiveness of environment taxation should definitely be on the policy agenda.

Admittedly, governments are often faced with trade-offs between equity and efficiency goals of tax policy. There is an abundance of examples of conflicts between equity and efficiency inherent in the taxation of income-generating activity. Specifically, the choice of progressive tax rate structures enhances so-called vertical equality – *i.e.* people on higher incomes pay a higher proportion of their income in tax, at least in statutory terms – but increases inefficiency by reducing incentives to utilise labour and capital resources and may prompt avoidance and evasion. Indeed, this conflict between equity and efficiency lies at the heart of many differences between OECD countries in their choices of tax rate. Evidently, this does not mean that there is no scope to improve both the equity and efficiency of existing income tax systems. Poorly-designed income taxes can distort economic behaviour without doing much to redistribute income, no matter what the level of taxation is. In such cases reform may not involve any trade-off between equity and efficiency at all.

Greater neutrality in tax systems is usually consistent with better horizontal equity, *i.e.* the requirement that people in a similar economic position should pay the same amount of tax. Hence in most cases it should not imply any conflict between efficiency and fairness either. For example, taxing all forms of saving at the same rate both limits economic distortions and is consistent with horizontal equity. Similarly, moves towards

uniformity in the tax treatment of different forms of corporate finance and different types of investment projects, and to the sales taxes applied to different consumption goods, would appear to be horizontally equitable. On the other hand, ambiguities remain. For example, the large number of income tax allowances available in most countries, while clearly non-neutral, can be seen by some as promoting horizontal equity by taking account of the detailed financial circumstances of households. But others may perceive them as a source of horizontal inequity because they produce differences in taxes paid between households on the basis of differences that reflect deliberate choices, as regards family circumstances for example, and are therefore irrelevant.⁶⁵ Similarly, taxing income from saving at low flat rates, as has become common in many OECD countries, may be considered as lacking horizontal equity. While this may be true in a “static” sense, it may also be seen as promoting horizontal equity in a “dynamic sense”, *i.e.* reducing discrimination between different lifetime profiles of saving and consumption.

A tax that is generally seen as unfair or arbitrary in its incidence can generate reluctance among taxpayers to comply. Neutrality is important not only for its favourable efficiency and horizontal equity effects, but also because it usually helps tax rules to be clear and simple to understand,⁶⁶ reducing both the administrative and compliance costs of taxation. Neutrality also reduces the incentives and possibilities for taxpayers to rearrange their financial affairs to minimise tax payments, and limits the lobbying and litigation that surrounds borderline decisions on how to classify particular types of income or goods for tax purposes.

But achieving greater neutrality of national tax systems is not a sufficient condition for better compliance and less distortions. The effectiveness and efficiency of tax collection, enforcement and administration needs to be improved. A key feature of these efforts must be improved co-operation between tax authorities in different countries, including effective exchange of information, as tax systems need to cope

⁶⁵ Aside from the choice of rate structures, horizontal equity considerations may affect the choice of tax bases, although there is some ambivalence in this regard as well. For example, countries which attempt to use comprehensive income (including, for example, fringe benefits or capital gains) as the predominant tax base are satisfying those who regard comprehensive income as the relevant income concept for judging the horizontal equity of tax systems. However, they are not satisfying those who regard consumption as a better indicator of lifetime welfare than current income, and so regard taxing consumption as more horizontally equitable.

⁶⁶ In some cases, such as the taxation of comprehensive income, including *inter alia* imputed incomes and fringe benefits, horizontal equity may require complex laws.

with increasingly mobile tax bases internationally. Recent advances in communication technologies, ongoing developments in complex, innovative financial instruments, and the expansion of tax havens and preferential “niche” regimes designed to attract mobile capital, particularly financial capital, are creating horizontal inequities between taxpayers and producing a misallocation of capital. Governments may find themselves competing for these mobile activities, but this is different from the sort of tax competition over generally applied tax rates that has been the subject of the economics literature. This literature shows that tax competition can be beneficial for economic performance, both by restricting tendencies towards excessive government spending and by providing individuals with a choice between locations according to their desired level of public provision. However, this reasoning does not hold for tax competition that is non-transparent or discriminatory, or where it facilitates illegal tax abuses that enable companies or individuals to reduce their tax liability without actually moving their residence away from a jurisdiction with high public provision. In many cases, tax havens do not attract much real activity; they simply provide a place to shelter the proceeds of real activity that takes place elsewhere.

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HUMAN CAPITAL AND GROWTH IN OECD COUNTRIES: THE ROLE OF PUBLIC EXPENDITURE ON EDUCATION

*Kristel Buysse**

1. Introduction

The argument that a knowledge-based economy with a high capacity to innovate necessitates a highly skilled labour force is very appealing and often brought up today, as is the recommendation to some governments that they should increase spending on education. Indeed, most governments have traditionally been heavily involved in the formation of human capital. Total expenditure on educational institutions expressed as a percentage of the collective GDP of the 29 OECD countries amounts to almost 6% each year. On average, public funding accounts for 90% of these educational expenditure.

Recent empirical estimations of growth equations have all included a variable measuring the accumulated stock of human capital. The underlying idea is that the stock of human capital affects subsequent growth by influencing a country's ability to adopt new technologies. Most empirical research of this kind has confirmed the existence of a positive relationship between the initial stock of human capital and subsequent growth. However, the results are often derived from samples that are dominated by developing countries. The same conclusions do not necessarily hold for the sub-sample of OECD countries, see for example Englander and Gurney (1994).

A shortcoming common to most empirical work on human capital and growth is that the quality of human capital is insufficiently accounted for. Resources devoted to education and the organisation of educational systems both differ across countries and these differences have an impact on the quality of human capital (Hanushek and Kim, 1995; Lee and Barro, 2001). Several variables have been suggested to measure various qualitative aspects of educational systems, such as public expenditure on education, pupil-teacher ratios or the distribution of educational attainment

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The views expressed in this paper are those of the author and do not reflect those of the National Bank of Belgium.

(Dessus, 2000). Such variables should be included in cross-country growth regressions to control for differences in the quality of human capital.

The purpose of this paper is twofold. On the one hand, it aims to reassess the relationship between the stock of human capital and economic growth in the long run. On the other hand, it aims to find out whether differences resources allocated to education contribute to cross-country differences in economic growth. Panel data regressions will be applied to a sample consisting of 20 OECD countries, covering the period from 1970 to 2000. Concentrating on OECD countries only offers the advantage that policy conclusions with direct relevance to the OECD can be drawn. In addition, improved data for OECD countries on the educational attainment of the adult population have been constructed by de la Fuente and Domenech (2000) and by Bassanini and Scarpetta (2001), whereas data on the physical capital stock can be found in the OECD economic outlook database.

2. The role of human capital in growth models

2.1 Review of the literature

How does human capital or the educational attainment of the labour force affect the growth of an economy? One approach is to treat human capital as an ordinary input in the production function. The seminal work of Mankiw, Romer and Weil (1992) is in this tradition. They augmented the neo-classical Solow model by adding human capital as a production factor and showed that the model could be made more consistent with cross country data this way. The augmented Solow model succeeded in explaining 80% of the cross-country variability in per capita income. However, it was not able to account for much of the observed cross-country variation in income per capita when restricting the sample to OECD countries.

Recent empirical research which continues to build on the Mankiw-Romer-Weil model has used panel data approaches instead of cross-country regressions and improved measures of the educational attainment of the adult population. Panel data approaches allow for the inclusion of country-specific effects that reflect technological and institutional differences between countries (Islam, 1995; Hill and Jones, 1997). Recent papers following this approach tend to point to a positive

relationship between human capital and per capita GDP growth (Dessus, 2000; Bassanini and Scarpetta, 2001; Andrés, Doménech and Molinas, 1996), although the coefficient may not be very stable (Andrés, Doménech and Molinas, 1996). In contrast, the coefficient turned out to be negative in Islam (1996). The only paper of the four mentioned above with an application to OECD countries was Bassanini and Scarpetta (2001).

An alternative approach associated with endogenous growth theory, is to model technological progress or the growth of total factor productivity as a function of the stock of human capital. According to this approach, the level of human capital directly affects total factor productivity through two channels. Romer (1990) postulated that human capital may directly influence total factor productivity by enhancing the capacity of nations to innovate with respect to new technologies and products. In addition, Nelson and Phelps (1966) developed a model in which human capital affected the speed of technological catch-up and diffusion. In other words, the ability to adopt and implement new technology from abroad is a function of the stock of human capital. Combining the insights provided by these models implies that growth rates may differ across countries for a long time due to differences in levels of human capital stocks (Benhabib and Spiegel, 1994). Moreover, it predicts that the country with the highest stock of human capital will always eventually emerge as the technological leader nation and maintain its leadership as long as its human capital advantage is maintained.

There may also be positive externalities from human capital. Where the average level of human capital is high, the incidence of learning from others will be higher, and it is likely that there are greater productivity gains to be derived from exchanging ideas (Lucas, 1988). Human capital also tends to flow to countries that already have large amounts of such capital (the 'brain drain'), raising the level of human capital and hence the level of output.

Several empirical studies have found that the educational attainment of the adult population or labour force contributes positively and significantly to subsequent economic growth (Barro, 1991; Easterly and Rebelo, 1993; Levine and Renelt, 1992; Benhabib and Spiegel, 1994). However, these results are based on samples dominated by developing countries and it is not clear that these results are applicable to OECD countries. In an interesting exercise, Englander and Gurney (1994) re-estimated growth equations based on four influential papers including Barro (1991), but restricting the sample to the OECD. Three of the four

equations included variables for human capital, typically primary and secondary school enrolment rates. These variables turned out to have some explanatory power, but their estimates were not robust.

2.2 *The measurement of human capital*

Earlier studies by Mankiw, Romer and Weil (1992) and Barro (1991) used a proxy for human capital defined as the secondary school enrolment rate multiplied by the fraction of the working age population that is of school age (they used the age group 15-19). This variable alone is likely to underestimate the true variation across OECD countries in the educational achievements of the working age population as it ignores primary and most importantly tertiary education. Moreover, changes in enrolment rates are likely to have an impact on GDP per capita and labour productivity growth only with a long time lag. Due to relatively short time series, there are limits to the number of lags that can be included in any regression model. Finally, measures of educational achievements based on enrolment rates are sensitive to the problem of reverse causality. The causality may indeed run from GDP per capita to enrolment, with an increase in per capita GDP prompting an increase in school enrolment in response to the higher returns on schooling produced by economic growth.

Barro and Lee (1993, 1996) have constructed an alternative set of estimates of the educational attainment of the adult population for 129 countries, covering the period 1960-85 at five-year intervals. They estimated the average years of schooling of the population of working age (25-64) using census data on school attainment from individual governments, as compiled by UNESCO and other sources. Adults can be classified into seven different groups according to their highest level of attainment:

- (1) no formal education,
- (2) incomplete primary education,
- (3) complete primary education,
- (4) first cycle of secondary education,
- (5) second cycle of secondary education,
- (6) incomplete higher education, and
- (7) complete higher education. Information by country about the typical duration of each level of schooling then allowed them to compute the

number of years of attainment achieved by the average person in each country. To estimate attainment levels for years in which census data are not available, they applied a perpetual inventory method which makes use of gross enrolment ratios at various levels of schooling and the age composition the population. The basic idea is that the enrolled population is the flow that adds over time to the prior human capital stock to determine the subsequent stock.

This dataset has subsequently been revised and updated by De la Fuente and Domenech (2000) and Basemen and Scarpetta (2001) for OECD countries only. The contributions of the former paper consisted in using previously unexploited resources to estimate net enrolment rates and in removing sharp breaks in the data series that seem to reflect changes in classification criteria. The authors thus significantly improved the quality of the data contained in Barro and Lee for the OECD countries. The latter paper constructed a series of annual data on the average years of schooling of the adult population of age 15 to 64 for 21 OECD countries covering the period 1971-1998, which will be used in this paper.

Data on the average years of schooling of the adult population are better suited to investigate the effects of schooling, and have been widely used in empirical work since the mid 1990s. In addition, as pointed out by Temple (2000), the problem of reverse causality is less severe when using the average years of schooling of the working age population instead of enrolments rates as a measure of the human capital stock.

However, the measure also has its shortcomings. First of all, institutional aspects such as the hours spent in school each day, the length of educational cycles or the mandatory age until which young people have to attend school differ between countries and are likely to affect the average number of years that an adult has spent in school with no significant impact on the skills of a worker. Secondly, not all fields of education / specialisation contribute equally to the skill formation needed to facilitate the adoption or innovation of new technologies, yet they receive the same weight in the computation. Finally, the measure does not account for adult training and lifelong learning, although it is widely recognised that these types of learning are increasingly important in an environment of rapid technological progress.

More innovative research has attempted to measure the quality of the adult population more directly by using a country's average score on international mathematics and science tests taken at the 4th and 8th grade

(Hanushek and Kim, 1995). Their results support the idea that education has an important effect on growth. This approach will not be followed in this paper, but it would be worthwhile to examine the robustness of their results in a sample restricted to OECD members in future research.

2.3 Methodology

This paper uses a standard growth accounting framework with a constant returns production function which does not include human capital as a separate input. The production function is written in intensive form and in first differences:

$$\Delta(q_{it}) = \Gamma_0 + (1-\alpha)\Delta(a_{it}) + \alpha\Delta(k_{it}) + \eta_t + \mu_i + \epsilon_{it} \quad (1)$$

where q_{it} is output per worker in country i at time t , k the stock of physical capital employed by the business sector per worker, and a the Solow residual per worker. Note that the measure of the physical capital stock does not include the public capital stock (infrastructure, public buildings...) or the residential capital stock. Data on the business capital stock, total employment and gross domestic product are all taken from the OECD Economic Outlook database. All monetary variables are expressed at constant prices of 1995 using the appropriate deflator, and converted into dollars using 1995 purchasing power parities. Dummy variables are added to capture fixed time (η_t) and country (μ_i) effects. Time dummies are included to control for temporal shocks that may be responsible for productivity slowdowns or accelerations and that are common to most OECD countries. Country dummies pick up permanent cross-country differences in productivity levels that presumably reflect differences in R&D investment and other omitted variables.

In the simplest possible specification as suggested by the endogenous growth theory, the change in the Solow residual depends on the stock of human capital per worker, h_{it} :

$$\Delta(a_{it}) = g(h_{it})$$

More in particular, countries with higher levels of human capital per worker will experience faster technological progress. This is so because human capital enhances the ability to innovate. The average level of human capital per worker is proxied in this paper by the average years of schooling of the adult population aged 15 and over at the beginning of each

period. Assuming that technological progress is a logarithmic function of human capital, equation (1) can be written as:

$$\Delta(q_{it}) = \Gamma_0 + \beta \log(h_{i,t-1}) + \alpha \Delta(k_{it}) + \eta_t + \mu_i + \epsilon_{it} \quad (2)$$

However, as can be seen from Table 1, countries with a highly educated adult population need not always be the high growth countries. In fact, countries where the average years of schooling of the adult population was already high in 1971 (USA, Canada, Australia, Switzerland and New Zealand) grow on average considerably slower during the period 1971-2000 than countries with a lower initial average educational attainment of the adult population (Ireland Finland, Spain and Japan). This can be explained by the catch-up factor which causes laggards to grow faster than leaders during a transitional period of time. This effect has been strengthened by the process of EU enlargement, the creation of the single European market, and closer integration of OECD economies. Based on the work of Nelson and Phelps (1966), Bils and Klenow suggest that the growth rate of technology for a country i may be written as:

$$\Delta(a_{it}) = \beta \log(h_{it}) - \gamma \log(q_{i,t-1}/q_{US,t-1})$$

and interpreted as follows: the growth rate of technological progress will be higher the larger the productivity gap with the highest productivity country (the US in this sample). In addition, countries will bridge the productivity gap more rapidly when they are rich in human capital. This results in an alternative specification of the growth regression (2):

$$\Delta(q_{it}) = \Gamma_0 + \beta \log(h_{i,t-1}) + \alpha \Delta(k_{it}) + \gamma \log(q_{i,t-1}/q_{US,t-1}) + \eta_t + \mu_i + \epsilon_{it} \quad (3)$$

The paper uses pooled data at 5 year intervals starting in 1971 and ending in 2000. The appropriate length of the time span is of course subject to some debate. Time spans of just one year are technically feasible, but often deemed too short for studying growth behaviour as short term disturbances may loom too large (a possible alternative may be to use annual data based on trend measures). Time spans longer than 5 years may be superior though not feasible given the lack of long time series. As a result, most studies have opted for 5 year intervals.

2.4 Results

Panel estimates (pooled OLS with time-specific effects and country specific effects) are provided in Table 2 for the two specifications of the

model. In a first specification, the catch-up effect is solely determined by the initial level of human capital at the beginning of each 5 years period. In a second specification, relative productivity levels (GDP per worker) relative to those in the US at the beginning of each period are added to better capture the catch-up effect. Earlier empirical research (Barro, 1991; Benhabib and Spiegel, 1994) had found a positive effect for human capital, at least when initial productivity levels were also controlled for.

The coefficient on the initial level of human capital per adult worker comes out to be negative and significant in both specifications, and more strongly when initial relative productivity levels are not controlled for. This result is not very surprising. Given that the initial level of human capital is correlated with the initial productivity level, the former picks up the catch-up effect with its predicted negative sign when the latter is not included in the growth regression. Adding initial productivity levels to the model attenuates the negative effect somewhat, but does not lead to a sign reversal.

It needs to be pointed out that previous studies were based on cross-section regressions – that is one observation per country for the entire period – and samples that included developing countries. When the regressions were re-estimated for the smaller sample of OECD countries only, the coefficient on human capital became insignificant (Englander and Gurney, 1994; Benhabib and Spiegel, 1994). However, a recent study by Domenech and De La Fuente pointed to a positive role for human capital in growth regressions after the existing data had been meticulously revised; in particular the growth in the average years of schooling per adult contributed positively to GDP per worker growth.

It is also a common finding that, when researchers attempt to incorporate the temporal dimension of human capital variables into growth regressions, the coefficient on human capital becomes either insignificant or strongly negative (Islam, 1996). In our sample of OECD countries, some countries experienced rapid growth in their transition to EU membership (Ireland, Spain, Finland, and to a lesser extent Sweden) or during their earlier stages of industrialisation (Japan, most European countries during the 70s). These growth rates gradually fell back to a lower level until a turning point was reached in the early or mid 90s. At the same time, the educational attainment of the adult population continued to rise as young people invested more in education (possibly in anticipation of higher returns). Since panel data methods rely more on within country variation, this negative temporal relationship surfaces more forcefully in panel

Table 1
Average growth of GDP per worker, years of schooling and resources devoted to education

	1971-2000 Average growth of GDP per worker (percentage)	1971 Average years of schooling	1970-1995 Average public education expenditure (percentage of GDP)	1970-1995 Average public education expenditure corrected for demographic patterns (percentage of GDP)	1970-1995 Average expenditure per student for all levels of education (percentage of GDP per capita)	1970-1995 Average ratio of students to primary teachers for education
Australia	1.6	11.1	5.4	4.9	24.2	20.3
Austria	2.4	9.8	6.2	6.7	29.7	15.0
Belgium	2.3	8.3	6.0	6.6	25.4	16.3
Canada	1.1	11.4	7.7	7.0	28.3	17.3
Denmark	1.6	9.9	7.4	8.1	36.1	12.2
Finland	2.6	8.7	6.6	6.9	30.8	17.4
France	2.0	9.0	5.5	5.6	22.3	20.0
Greece	2.0	7.5	2.5	2.6	13.2	n.a.
Ireland	3.6	8.0	6.5	5.3	24.0	28.5
Italy	2.2	6.8	5.0	5.3	26.2	15.7
Japan	2.5	9.6	5.3	5.5	24.9	23.5
Netherlands	1.6	9.1	6.4	6.4	26.5	22.2
New Zealand	1.0	10.3	5.9	5.1	21.4	20.3
Norway	2.4	9.9	7.1	7.4	32.8	15.5
Spain	2.5	5.8	2.9	2.9	11.9	28.3
Sweden	1.7	9.2	7.6	8.7	38.6	14.3
Switzerland	0.7	10.6	4.8	5.5	25.8	n.a.
United Kingdom	1.9	9.2	6.1	6.4	29.8	21.0
United States	1.4	11.6	6.7	6.2	25.9	15.0

Sources: UNESCO, OECD.

Table 2**The impact of human capital on growth**

Dependent variable: Growth of real GDP per worker		
	(a)	(b)
Growth rate of business sector capital stock	0.288*** (5.86)	0.248*** (4.89)
Log of initial human capital stock	-0.44*** (3.28)	-0.302** (2.12)
Initial GDP per worker relative to US		-0.207** (2.45)
Time fixed effects	Yes	Yes
Country fixed effects	Yes	Yes
R ²	0.625	0.646

Note: t-values in parentheses.

* significant at 10%, ** significant at 5%, *** significant at 1%.

estimates. Moreover, in this case, the negative temporal relationship is strong enough to outweigh the positive cross-sectional relationships found in earlier studies. Some recent studies (Dessus, 2000) have used a varying parameter method instead, with better results.

There are probably some other factors biasing the temporal relationship between human capital and economic growth. For example, the average educational attainment of the adult population (aged 15-64) is likely to understate the average educational attainment of the workforce because low educated workers are less likely to participate in the labour market. In some OECD countries; skill-based employment growth has been

particularly strong, causing older and generally less educated workers to be pushed out before the age of 64 by younger and better educated ones.

More importantly, the measure used does not account for the quality of education. Quality differences are likely to be important though, because school systems are known to vary widely across countries in terms of management, organisation, resources provided and the preparation of students coming to school. It often happens that fast growing countries witness rapid increases in the educational attainment of the workforce, but that increased enrolment rates are not matched by an equally large expansion of school resources. In this case, quantitative improvements are achieved at the expense of quality, and the growth of the human capital stock is overstated when looking exclusively at the average years of schooling. In contrast, some mature economies where the educational attainment of the adult population is already high may further expand their human capital stock mainly by upgrading the quality of education. It may therefore be useful to employ a richer specifications of the growth regression with respect to human capital, including quantitative as well as qualitative measures. This will be discussed in a next point.

3. The role of public expenditure on education

3.1 The quality of human capital: the role of public expenditure on education

In the richest possible specification, the stock of human capital would be modelled as a function of the quantity of schooling, the school resources, family background and other socio-economic factors, and ability. This paper is less ambitious and will focus on a subset of variables contributing to the performance of school systems. These include the resources invested in education, the organisational structure of the education system (such as the length of the school year, the use of computers in school, opportunities to combine with apprenticeships) and the regulation of education. Financial resources are mainly provided by the public sector, although private funding plays an increasing role in a number of countries (US, Japan, Australia) at the tertiary level. Given the lack of internationally comparable quantitative indicators of several aspects of education quality (such as the organisation and regulation of an education system), indicators on public funding allocated to education will be used as a proxy for education quality in this paper.

Expenditure on education consists of capital expenditure (less than 10% on average in OECD countries) and current expenditure (more than 90% on average in OECD countries). Current expenditure are dominated by teachers' salaries. The higher a teacher's salary is relative to average earnings, the easier it becomes to attract better qualified and more productive teachers. The relationship between expenditure on education and the quality of the future labour force is therefore expected to be positive.

Public expenditure on education expressed as a fraction of GDP is commonly used as an indicator to compare how much of their wealth different countries invest in education. However, this indicator needs to be interpreted in the light of a number of inter-related supply and demand factors, including

- (1) the demographic structure of the population,
- (2) the enrolment rates at different levels of education,
- (3) per capita income,
- (4) the length of educational programs,
- (5) the national price level for educational resources.

Moreover, the indicator may obscure decisions about the allocation of funds which influence the quality of instruction such as relative expenditure on teachers' salaries which depends on the generosity of compensation and pupil-teacher ratios, or the conditions of educational facilities. Another allocative decision is related to the division of resources between pre-primary, primary, secondary and tertiary education.

This paper attempted to correct the above indicator for demographic differences between countries. First, the fraction of young persons of school age (age groups 0 to 25) in the total population is computed for each country and period, and then the average is taken for all countries and time periods pooled together. Next, the share of GDP devoted to education for each country and time period is multiplied by the average fraction of people of school age in the total population and divided by the corresponding fraction for the country and time period. This results in an indicator that measures how much of its wealth each country would devote to education if the relative size of the population of school age did not vary with time and/or between countries. Whereas public spending on education, expressed as a fraction of GDP, tends to decrease over time, this

declining trend is weakened or over reversed after demographic structures have been accounted for.

Expenditure per student at 1995 constant prices and expressed in equivalent US dollars is an indicator which is corrected for both differences in the relative size of the population of school age and enrolment rates. This amount can be thought of as the weighted average of the amounts spent per student at the different levels of education, with the weights given by the corresponding fraction of students enrolled at that level. This implies that the measure is pushed upwards in countries where a large fraction of students participates in tertiary education (due to broad accessibility to and a high demand for tertiary education) because the cost per student increases with the level of education (see OECD Education at a Glance, various issues). Given that teachers' salaries tend to increase with per capita income, a better indicator of the importance attached to a young person's education can be obtained by dividing the average amount spent per student by per capita income.

It would be misleading to equate lower expenditure per student in general with lower quality of education because the efficiency with which education is provided also needs to be accounted for. In fact, average spending per student can be further decomposed into the average amount spent per teacher (= teachers' salaries) and the number of teachers relative to the number of students. The reverse of the latter, that is the ratio of students to teachers at a specific level of education has also been used as an indicator of quality. It needs to be pointed out that student-teacher ratios do not translate directly into class size because the relationship is complicated by many factors that vary between countries: the length of a school year, the number of hours for which a student attends class each day, the length of a teacher's working day, and many more. Still, student-teacher ratios are a good approximation of class size, especially at the primary level. The student-teacher ratio is expected to be negatively correlated with schooling quality because students can learn more rapidly by having more frequent interactions with teachers in smaller classes.

There has been a tendency in most OECD countries for the student-teacher ratio in primary education (no data available on secondary education) to drop over time until the beginning of the 90s. However, this decline may merely reflect a lag in the response of educational systems to demographic changes, adding little to the quality of education.

3.2 *Alternative specifications of the model corrected for the quality of human capital*

A first specification consists of correcting human capital measured by the quantity of schooling by an index of quality. For Islam (1995), the negative correlation between human capital and growth could be the consequence of a measurement error, caused by excluding the quality of education from the measure for human capital. One solution may be to multiply the average years of schooling (h) by an indicator of quality:

$$H_{it} = h_{it}^{\omega} I_{it}^{\nu}$$

which results in the following specification of the growth equation:

$$\Delta(q_{it}) = \Gamma_0 + \beta\omega \log(h_{i,t-1}) + \beta\nu \log(I_{i,t-1}) + \alpha\Delta(k_{it}) + \gamma \log(q_{i,t-1}/q_{US,t-1}) + \eta_t + \mu_i + \epsilon_{it} \quad (4)$$

The quality index must contain temporal information, otherwise it cannot be distinguished from other country specific effects. This condition seriously limits the available number of variables able to capture international differences in the quality of schooling. Four indicators were retained for this purpose:

- (1) the share of public education expenditure in GDP,
- (2) the share of public education expenditure in GDP corrected for variations in the relative size of the population of school age over time and between countries,
- (3) average public expenditure per student relative to per capita income,
- (4) pupil-teacher ratio in primary education.

Data on public expenditure on education, number of students and number of teachers were taken from the UNESCO database which goes back to 1970. Where possible, these indicators were measured as the average of the 5 years preceding the beginning of each period. For each country, spending on education was converted in constant prices of 1995 using the deflator of government consumption and subsequently converted into \$ using purchasing power parities. Due to the German reunification in 1991, no long series were available for Germany so this country had to be omitted. Data on the deflator of government consumption, purchasing power parities, and GDP are obtained from the OECD economic outlook database, whereas information on the size of the population and the composition thereof were taken from the UN demographic database.

One weakness of the quality indicators is that they are related to persons in school, which will be added to the future human capital stock. They are therefore at best a proxy of the quality of the current human capital stock. A larger lag for the quality indicators may seem advisable, but needs to be balanced against the resulting loss of observations. Given the current paucity of data, no additional lags were introduced.

An alternative is to argue that the contribution of educational systems lies in their capacity to produce one marginal unit of productive human capital. A country's ability to produce one marginal unit of human capital depends on the quantity of schooling at the beginning of each period as well as on the resources of a country invested in education. In other words, the contribution of a given educational attainment of the adult population towards growth will be larger the more a country invests in education. One way to test this hypothesis is to estimate a model in which the coefficient expressing the contribution of human capital to growth could be assumed to be increasing in the quality of education, as expressed by the various indicators mentioned above. This amounts to transforming the growth equation (3) as follows:

$$\Delta(q_{it}) = \Gamma_0 + \beta \log(h_{i,t-1}) + \alpha \Delta(k_{it}) + \gamma \log(q_{i,t-1}/q_{US,t-1}) + \eta_t + \mu_i + \epsilon_{it} \quad (5)$$

where:

$$\beta = \psi + \Phi Z_i + u_i$$

The variable Z is invariant in time, otherwise no degrees of freedom would be available (Dessus, 2000). The same indicators are used, but the difference with the previous specification is that the average measure of the indicator over the entire period for each country is used. It is true that the indicators of education quality vary with time in each country, fluctuating counter-cyclically in the short run and reflecting changes in educational policies, demographic structure and enrolment patterns among others. However, there also appears to be a country-specific element here: some countries exhibit a stronger preference for education than others. The averages of each indicator over the entire period for each country are shown in Table 1. The countries with the lowest GDP per capita (Spain and Greece) allocate a significant lower fraction of their GDP or GDP per capita to education. In contrast, the Scandinavian countries have a strong preference for public spending on education.

Equation (5) can be measured by replacing β with the expression $\psi + \Phi Z$. Other empirical research has indicated that heteroscedasticity may

arise in such specifications, therefore the White heteroscedasticity-consistent estimator will be used in this case.

3.3 Results

When the various indicators of investment in education are added in multiplicative form (Table 3), the estimations yield no significant results for three of the four indicators. Note that the coefficient of human capital has become insignificant as well in each of the specifications. These findings are consistent with those of Dessus (2000), who also found that the multiplicative specification didn't perform well. However, when public expenditure on education per student as a fraction of GDP per capita is used as an indicator of the quality of education, does a negative and significant coefficient appear. This result is counter-intuitive at first, but appears to be the result of multicollinearity. In particular, countries with low initial productivity levels relative to the US, are also countries with a low initial human capital stock in terms of both quantity and quality of schooling, while at the same time experiencing more rapid growth in the process of catching up with the richer OECD countries.

The alternative specification (Table 4) performs better. Although the coefficient on human capital becomes more significantly negative, the estimated coefficient of the interaction term involving human capital and a measure of the quality of education is positive and significant at the 1% level in the following three cases:

- (1) when public expenditure on education relative to GDP is included,
- (2) when the same indicator is used after correction for demographic structures,
- (3) when expenditure per student relative to GDP per capita is included.

A percentage increase in the average years of schooling can be expected to have a positive effect on productivity growth if a country spends on average at least 5% of its GDP on education, or at least 6.4% of its GDP after differences in demographic patterns have been accounted for. Likewise, an increase in the quantity of schooling will raise productivity growth when expenditure per student expressed as a fraction of GDP per capita amounts to 30% or more on average. In contrast, the pupil-teacher ratio, though having the predicted sign, does not contribute to the explanation of productivity growth differences between countries.

Table 3**The impact of expenditure on education: first specification**

Dependent variable: Growth in real GDP per worker				
	(a)	(b)	(c)	(d)
Growth rate of business sector capital stock	0.224** (4.33)	0.218** (4.18)	0.206** (2.78)	0.214** (3.97)
Log of initial human capital	-0.164 (0.98)	-0.138 (-0.8)	-0.063 (0.34)	-0.15 (0.88)
Initial GDP per worker relative to US	-0.255*** (2.78)	-0.271*** (2.89)	-0.358*** (3.31)	-0.323*** (3.06)
Public education expenditure	-0.035 (1.18)			
corrected for demographic		-0.042 (1.34)		
Expenditure per student for all levels of education			-0.008 (0.22)	
Ratio of students to teachers for primary education				-0.053 (1.67)
Time specific effects	Yes	Yes	Yes	Yes
Country specific effects	Yes	Yes	Yes	Yes
R ²	0.645	0.647	0.65	0.66

Note: t-values in parentheses.

* significant at 10%, ** significant at 5%, *** significant at 1%.

Table 4

The impact of expenditure on education: first specification

Dependent variable: Growth in real GDP per worker

	(a)	(b)	(c)	(d)
Growth rate of business sector capital stock	0.240*** (4.97)	0.235*** (4.75)	0.229*** (4.64)	0.206*** (3.74)
Log of initial human capital stock	-0.596*** (3.40)	-0.529*** (2.93)	-0.545*** (2.94)	0.524*** (2.62)
Initial GDP per worker relative to US	-0.290*** (3.44)	-0.258*** (2.99)	-0.251*** (2.93)	-0.254*** (2.85)
Interaction term with different indicators of resources invested in education				
Average public education expenditure	0.119*** (3.62)			
Average public education expenditure corrected for demographic patterns		0.083*** (2.83)		
Average expenditure per student for all levels of education			0.018 (2.79)	
Average ratio of students to teachers for primary education				-0.007 (0.78)
Time dummies	Yes	Yes	Yes	Yes
Country dummies	Yes	Yes	Yes	Yes
R ²	0.69	0.674	0.673	0.673

Note: t-values in parentheses.

* significant at 10%, ** significant at 5%, *** significant at 1%.

The above results suggest that countries with a relatively young population can expect more rapid productivity growth, as they experience a larger inflow of young, and generally better qualified, persons into the labour force. In addition, the results are a first indication that traditions regarding spending on education may help explain differences in the countries' abilities to produce one productive unit of productive human capital. It does not appear advisable to raise spending per student by lowering the number of students per teacher (in primary education) though. So the positive effect may be attributable to one or more of the following factors:

- (1) high student enrolment, in particular in tertiary education,
- (2) generous teachers' compensation which may help in attracting qualified teachers,
- (3) high spending on items other than teachers' salaries which may be an asset in a rapidly changing society, in particular at higher levels of education.

Finally, the robustness of the outcomes was tested by running the same regressions on a sub-sample of countries. It turned out that the significance of the coefficients reflecting the average quality of education in the second specification were sensitive to the omission of the lowest income countries (Spain and Greece). It therefore appears that systematic differences between countries in the amounts invested in education do not explain productivity growth differences between the richest OECD countries.

4. Conclusions

The relationship between school resources, education quality and productivity growth is controversial. Hanushek and Kim (1995) concluded that the quality of education, measured by students average performance on standardized international tests in mathematics and science, contributed significantly and positively to productivity growth. However, they also argued that financial resources allocated to education have only a weak or insignificant impact on student performance on such tests. These findings were subsequently contested by Lee and Barro (2001), who showed that school resources are positively related to student performance.

The results presented in this paper suggest a small positive role for education policies, in particular government spending on education. Holding the average years of schooling constant, countries which on average invest more of their wealth in education appear to raise the productivity of their human capital. However, the results are not very robust, so the controversy whether or not a more generous public funding of educational systems improves a country's performance remains.

The studies of Hanushek and Kim (1995), Dessus (2000), and Barro and Lee (2001) all concluded that a lower ratio of students to teachers in primary education student performance and on economic growth. When concentrating on the richer countries only, this relationship appears to be weaker. Whereas some developing countries experience an increase of the class sizes as a result of increased enrolment during periods of high economic growth, most OECD countries saw a decrease as a result of the slowdown in population growth. These decreases in class size have not contributed much to the quality of education.

Finally, this paper did not find a positive link between the initial educational attainment of the adult population at the beginning of each five year period and the growth rate of GDP per worker over that period. This finding may be explained by the strength of the catch-up effect, which is determined by factors other than initial levels of human capital (for example, EU membership and the institutional reforms taking place within this context). Alternatively, it may be due to the specification of the model, the chosen estimation method or the quality of the data.

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FISCAL POLICIES AND ECONOMIC GROWTH IN EUROPE: AN EMPIRICAL ANALYSIS

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1. Introduction

Assessing the factors underlying long-run economic growth is undoubtedly one of the most important issues of applied macroeconomics. Among these factors, a firmer understanding of the role of discretionary fiscal policy decisions in shaping growth prospects is of particular importance, given the direct control of governments over these decisions. Stylised facts support the hypothesis that fiscal policies, and notably the size of the government, have a significant effect on long-term economic growth prospects. For instance, in examining the data for the current Member States of the European Union (EU) – excluding Luxembourg over the last three decades, a negative correlation between both government spending and taxation and trend per capita economic growth is evident in most countries (see Table 1). Negative correlations between tax revenue and trend growth are particularly notable for Belgium, France, Italy and Austria, with the same negative correlation for these countries in terms of government expenditure. More generally, some evidence of a negative relationship between government size and trend economic growth in most EU Member States emerges from a purely descriptive analysis of the data, with the noteworthy exceptions of Denmark, Germany, Spain, Portugal and the UK.

In general, the thrust of theoretical evidence and stylised facts for developed countries, as exemplified above by the EU, confirms that fiscal policy, and in particular government size, is of importance, but the evidence on the type and magnitude of its effects has not been definitive to date. Although some clear evidence exists that distortionary taxes and

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generous unemployment benefit schemes can adversely affect the labour supply decision (and thereby hinder growth)¹, the growth impact of an aggregation of somewhat heterogeneous public expenditure items is not clear. For instance, Temple (1999) in a recent survey concludes that existing studies disagree on the relationship between government consumption and growth on the whole. Public investment expenditure – often argued to be the most productive public spending item – represents only a small fraction of overall government spending in developed countries. More generally, the presence of non-linear effects of fiscal policy, such as the non-monotonic relationship between government spending/taxation and economic growth alluded to by Barro (1990), Bertola and Drazen (1993) and Giavazzi *et al.* (2000), among others, can also hamper a clear theoretical prediction for public finance effects on economic growth which applies uniformly to all countries.

Table 1**Correlation with trend GDP growth per capita**

Country	Correlation between government expenditure and trend growth	Correlation between government revenue and trend growth	Period
Belgium	-0.79	-0.94	1971-00
Denmark	-0.22	0.01	1972-00
Germany	-0.67	0.20	1971-00
Greece	-0.67	-0.35	1972-00
Spain	-0.10	-0.03	1971-00
France	-0.94	-0.92	1972-00
Ireland	-0.68	-0.46	1971-00
Italy	-0.84	-0.98	1973-00
Netherlands	-0.74	-0.80	1973-00
Austria	-0.87	-0.85	1971-00
Portugal	0.26	0.36	1975-00
Finland	-0.67	-0.54	1972-00
Sweden	-0.55	-0.51	1972-00
United Kingdom	-0.07	0.34	1971-00

Note: The trend growth rate for Germany is corrected for the large structural break associated with reunification in the early 1990s. See the Appendix for a description of the data used in this study.

¹ For a detailed review of the channels via which taxation affects economic growth, see van den Noord (2002); for a review of the role of the welfare state in economic performance, see Atkinson (1995) and Slemrod (1995).

Ultimately, a lack of clear theoretical indications for the effects of public finance variables on growth, combined with a need to quantify impacts, contributes to making this an issue which needs to be addressed empirically. Within the empirical literature, however, the role of public finances in affecting economic growth remains somewhat controversial. Recent developments in estimating growth models with public finance elements have contributed to a sizeable body of empirical studies on this subject. However, a clear consensus does not exist regarding the relationship between government spending/taxation and economic growth within this empirical literature. It has even been posited that, in general, although theory predicts that changes in tax rates affect investment and growth in the long-run, in practice tax policy is an ineffective instrument to influence growth (Mendoza *et al.* 1997). This lack of agreement of results can be attributed at least in part to problems that plague existing empirical studies on economic growth, including parameter heterogeneity, the presence of outliers, controlling for the cycle, model uncertainty, endogeneity, measurement error and error correlation.

In this study, we review the methodological issues – and the treatment of econometric problems – surrounding the empirical assessments of the determinants of economic growth. We further work on the role of public finances in accounting for economic growth in the more specific context of current EU Member States, a generally homogeneous panel of countries for which a reasonably good quality data set is available. After reviewing stylised facts for the EU, we empirically evaluate fiscal effects on growth, making use of dynamic panel estimation techniques, along the lines of Caselli *et al.* (1996), which control for the several econometric estimation problems. We use of annual estimates of trend economic growth, rather than period averages.² Our findings tend to support the hypothesis that a robust negative relationship between government size and trend growth indeed exists for EU countries. Moreover, it provides some support for the notion that improvements in the government budget balance for the EU in the past have tended to support long-term economic growth.

The paper is organised as follows. Section 2 reviews relevant issues for estimation, and is structured into two subsections. First, we review the

² These trend estimates should in principle reflect long-term factors, and in practice do not represent a radical departure from past practice in that these filters used to calculate trend are somewhat akin to a weighted moving average. Hiebert *et al.* (2002) also use similar estimators of trend growth.

recent related literature, then assess methodological problems inherent in an empirical assessment of the determinants of economic growth and some potential remedies. Section 3 presents our methodology, proposing some methodological refinements to counteract the most pressing problems inherent in these exercises. Section 4 presents the results of the analysis, then Section 5 concludes.

2. Recent evidence and methodological issues

2.1 Recent empirical evidence on fiscal policy and growth

Ideally, Solow equations for representative economy would be used for evaluating the determinants of long-term economic growth. However, data constraints have meant that multi-country analysis is needed to obtain robust empirical results. In a seminal paper, Barro (1991) examined the determinants of economic growth in a cross-section of countries. He found a positive relationship between the initial level of human capital and the growth rate of real per capita GDP and a negative relationship between the initial level of real per capita GDP and economic growth. Among the determinants of growth, the share of government consumption in GDP – a proxy for government size – was found to be negatively related to growth, whilst public investment was found to have no significant impact on growth. In the wake of Barro, several authors have pursued this line of research, attempting to infer the role of fiscal policies in economic growth by estimating growth equations. These equations, also known as Barro equations, are regressions which relate economic growth to a number of variables, typically the initial levels of income, a number of steady-state variables and *ad hoc* variables (including policy variables like government expenditure, taxes, etc.).

This literature has produced contrasting results and no definitive agreement on the impact of fiscal policies on growth has yet emerged. In earlier empirical investigations, growth regressions were estimated on a cross-section of countries, in line with Barro (1991). In recent years, however, a trend toward the use of panel data and advanced time series methods has emerged, in line with a growing consensus on relatively superior properties of panel data (see for example Bond *et al.*, 2001 and Temple, 1999). Despite similarities in specifications, the findings of these studies have been mixed. Along with peculiarities of the estimation methods and design of estimated equations, this also partially relates to the

time span and country coverage of the data themselves. An assessment of some representative studies from the recent literature indicates that dynamic panel estimation is among the most reliable estimation methods currently available, and that the size of government is of importance in determining long-term economic growth.³

Cross-country regressions show in general a negative but extremely fragile relationship between government size and growth. In a critical contribution to the growth literature, Levine and Renelt (1992), based on extreme bounds analysis, argue that, though negative, the coefficient of government consumption is not robust in cross-country regressions. Moreover, based on a sensitivity analysis of results to the variables included in regressions, they are unable to find a robust cross-country relationship between a diverse collection of fiscal policy indicators and economic growth. Easterly and Rebelo (1993), however, attribute the failure to obtain significant correlation between tax revenues and growth to potential endogeneity of fiscal policy to the scale of the economy. They note in this respect that Wagner's Law postulates an elasticity of government size and income greater than unity. More generally, Sala-i-Martin (1997) argues that, extreme bound analysis may be an inappropriate way to check for robustness, and finds that a substantial number of variables included in cross-country regressions are strongly related to growth. Nevertheless, his analysis suggests that no measure of government spending (including investment) appears to affect growth significantly.

The most recent empirical literature, mainly based on panel data regressions, show that economic growth is significantly affected by fiscal policies, although there remains some lack of agreement on the sign of the effects. On one hand, Caselli *et al.* (1996) find a robust positive contribution of the government spending ratio (net of military and educational spending) to growth. In a similar way, Kneller *et al.* (1999) find that public expenditure and taxation only affect growth if they are productive and distortionary, respectively; productive government expenditure is found to positively affect growth, whereas distortionary taxation is found to be harmful for growth. With this distinction they argue that both sides of the government budget should be considered in estimating the impact of fiscal policy on growth, as the growth-enhancing

³ For a recent review of empirical literature examining the role of policies in long-term economic growth, see Bassanini *et al.* (2001).

effects of productive expenditure are offset by their financing. On the other hand, Fölster and Henrekson (2001) argue that selecting a relatively homogeneous panel of countries (OECD) and controlling for econometric problems such as heteroscedasticity reveals a robust negative relationship between government size and economic growth. Unlike Kneller *et al.* (1999), however, they do not explicitly control for the entire government budget constraint. Bassanini *et al.* (2001) also find some evidence supporting the hypothesis that government size has an impact on growth. They find that public investment has a positive impact on growth, whilst government size, either proxied by government consumption or total tax burden, affects growth negatively.

2.2 *Problems with estimation and potential remedies*

Several problems hamper standard estimators in much of the existing empirical literature on fiscal policies and economic growth, and have consequently hindered the capability of researchers to come to firm empirical conclusions. The main problems – heterogeneity, simultaneity bias, omitted variable bias, measurement issues and model uncertainty – are addressed in sequence below.

Heterogeneity

A first key problem involves the heterogeneity of the sample. As noted by Temple (1999), cross-sectional multiple regression analyses rely on the assumption that individual cross-sectional units are drawn from a common surface. The problem of *observed* differences across cross-sectional units, along with the associated problem of outliers unduly affecting estimation results, can be curbed by estimations based on a group of countries with similar characteristics. If the differences are measurable, one could also control for them in the equation specification. Even if heterogeneity across economies is stemmed to some extent by analysing a cluster of countries, however, some *unobservable* variation among countries in the panel is likely to remain. A prominent example in this respect is the initial level of technology in individual countries, which is not directly quantifiable. Nevertheless, one can control for this and any other unobservable heterogeneity fixed through time by introducing a different time-invariant intercept for each country. Estimation can be conducted by expressing the data in terms of deviations from means at the cross-section level or any kind of transformation that eliminates the

time-invariant intercept. Also, unobserved panel heterogeneity can also be curbed at the source by the selection of a homogenous grouping of countries in the sample.

Nevertheless, the above correction may be insufficient as country heterogeneity can arise not only in the intercept but also in the slope of the explanatory variables. For example, the effect of fiscal variables on growth could differ across countries. Some relatively recent techniques have been developed by Pesaran and Smith (1995) and Pesaran *et al.* (1999) which allow for heterogeneous slopes, and represent one way to tackle this issue. Pesaran and Smith (1995) and Pesaran *et al.* (1999) give an account of such methods, which include the Mean-Group estimator and the Pooled Mean-Group estimator. Mean Group estimators are based on averaging estimators from individual country equations, and Pooled Mean Group estimators in principle distinguish between short and long term effects, imposing common coefficients for the long-term slopes, while allowing for heterogeneity in the short-term dynamics and country-specific variances. Very few growth studies to date have employed these techniques, with the notable exceptions of Lee, Pesaran and Smith (1997) and Bassanini and Scarpetta (2002).

The incorrect treatment of country specific effects results in inconsistent estimators. The reason is that growth equations are in fact dynamic equations, where the lagged dependent variable is a regressor. In this case individual effects create some specific problems. To illustrate these problems, take a standard growth equation of the following form:

$$g_{it} = \alpha y_{it-1} + \beta_1 x_{it}^1 + \beta_2 x_{it}^2 + \mu_i + \varepsilon_{it} \quad (1)$$

where g_{it} is the per capita income growth rate, the dependent variable for country i in period t , y_{it-1} is per capita income for country i in period $t-1$ (expressed in logarithm), x_{it}^1 is a set of weakly exogenous regressors, while x_{it}^2 is a set of strictly exogenous regressors. In addition, μ_i represents the unobserved country-specific effects. Expression (1) can therefore be rewritten as:

$$y_{it} = (1+\alpha)y_{it-1} + \beta_1 x_{it}^1 + \beta_2 x_{it}^2 + \mu_i + \varepsilon_{it} \quad (2)$$

which clearly is a dynamic equation with a lagged-dependent variable on the right hand side.

The problems of estimation of this equation could be addressed in two ways. First, it could be assumed that the unobserved country-specific effects are a component of the error term – known as the random effects method. In this case, any correlation between the individual effects and the regressors would lead to biased coefficient estimates. Under a dynamic specification, it is clear that the lagged dependent variable would be correlated with the unobserved individual effects, since the current value of the dependent variable would itself be dependent on the individual effects. The alternative would be to use any type of fixed effect technique, eliminating time-independent effects by taking some kind of difference (first differences, within group transformations, etc.). In this case, however, the error term would have some lags and therefore will be correlated with the lagged dependent variable, thus leading to biased estimates. Several solutions have been proposed in the literature. The most popular is to use a Generalised Method of Moments (GMM) as proposed by Arellano and Bond (1991), where all the differences of the regressors correlated with the error term (endogenous and lagged-dependent variable) are instrumented using (all) lags from period $t-2$ of the observed variables in levels. More recently a Maximum-Likelihood (ML) estimator has been proposed by Binder *et al.* (2001) which does not depend on the initial conditions as maximum likelihood estimators usually do in this case (see, for instance, Anderson and Hsiao, 1982).

Furthermore, for the asymptotic validity of the panel estimators, it is necessary to have a sample of countries characterised by the absence of interdependencies and cross-correlations. This in practice hardly holds, since in an increasingly globalised world most countries are subject to similar shocks. This problem is addressed in the literature by including a set of time dummies as regressors.⁴ This procedure also controls for the existence of other country-invariant factors omitted from the regression, which could easily drive both the dependent and independent variables over time.

⁴ The inclusion of time dummies is equivalent to transforming the variables into deviations from time means. This transformation explicitly controls for common shocks such as trade or technological shocks hitting several economies in a given period. This transformation should correct for a great deal of the unobserved cross-correlation patterns present in the error structures of different countries included in the panel.

Simultaneity

A second and more difficult issue to remedy is that of inconsistent estimators resulting from simultaneity bias. Standard regression analysis using ordinary least squares relies on the assumption that all explanatory variables are exogenously determined and thus not correlated with the error term. In growth regressions, this assumption is often violated, since most of the variables entering the economic system interact and feedback on each other when there are changes in the economy. Failing to account for such feedbacks across variables would inexorably lead to biased estimates. If over the sample there appears to be a positive correlation between government revenues and economic growth rates, a failure to account for such simultaneity in the relationship would lead to upward-biased estimates of the coefficients on tax revenues, what may lead to coefficients close to zero. The issue of simultaneity bias can be addressed either by using instrumental variables or alternatively by estimating a system of simultaneous equations, explicitly allowing for feedbacks across the endogenous variables entering the system. In a panel context, most studies have made use of the former (instrumental variables).

One of the most likely sources of simultaneity is business cycle effects (see, for example, Easterly and Rebelo, 1993, for a discussion) and the tendency of government expenditure to be positively correlated with the level of GDP per capita. As noted by Fölster and Henrekson (2001), a typical business cycle correlation might be associated with the operation of automatic stabilisers in government budgets – implying for instance that a fall in growth is associated with a fall in tax revenue accompanied by a rise in government expenditure (given unemployment-related outlays). To date, this control for the cycle has most often been obtained by taking five or ten-year averages of data, accompanied occasionally by the use of additional variables such as unemployment to control for the cycle. One alternative avenue – not pursued to date as far as we have ascertained – is the use of annual ‘trend’ or ‘potential’ output estimates, which alleviate the need to take period averages. These estimates are readily available from international institutions, and are based on a more formal derivation of long-term output than the relatively crude use of period averages, which implicitly embody a deterministic shift in growth every five years, which clearly might not coincide with the actual length of the business cycle for all cross sectional units of the panel. As a corollary, one is left with a longer time series – allowing for a less binding constraint on degrees of

freedom despite a more limited and more homogenous number of cross-sectional units.

Omitted variable bias

A third problem leading to inconsistent estimators relates to the existence of omitted variables correlated with the regressors included in the regression, which is closely related to the issue of multicollinearity across regressors. In practice it is hard to come by all factors that could enter a growth regression without at the same time creating problems of multicollinearity. Most studies, including ours, deal with the issue of omitted variable bias by including country-specific effects, which would capture all time-invariant structural factors characteristic of each country. Moreover, the issue of multicollinearity, though generally recognised, is hardly dealt with in the literature given difficulties in remedying this problem. For instance, Easterly and Rebelo (1993) find that initial per capita income levels are highly correlated with government expenditure shares of GDP. As a result, when both variables are included in the same regression, the latter becomes insignificant. In contrast, when initial income levels are omitted the fiscal policy variable becomes significant. This problem appears to be particularly acute across fiscal policy variables, since both revenues and expenditure figures tend to co-move over time. Regarding the latter issue, as alluded to in Section 2.1, Kneller *et al.* (1999) argue that most growth studies dealing with the link between fiscal policy and growth have rendered conflicting results by failing to control for both sides of the government budget constraint in the regression. As a result, when variables from only one side of the budget constraint are included in the regression, such estimates are likely to be biased, since they would be capturing the indirect effect that the omitted element from the other side of the budget has on growth through its impact on the included fiscal variable. Accordingly, they argue that only neutral fiscal categories such as unproductive expenditure and non-distortionary taxation should be omitted from any regression. However, what they propose may be infeasible in practice if the fiscal categories included in the regression are highly correlated to each other.

Measurement issues

A fourth problem relates to the measurement of variables, particularly those related to policy. In terms of government taxation, the relevant factors affecting long-term growth prospects are marginal tax rates. Given, however, the complexity of tax systems in industrialised

countries, often with substantial use of exemptions, deductions and credits, the calculation of a homogeneous marginal tax rate comparable across countries is virtually impossible. This has led some, such as Padovano and Galli (2001), to estimate marginal tax rates from regressions. The estimated marginal tax rates produced by these simple regressions of tax revenues on GDP with some intercept shifts, however, are themselves subject to significant error given econometric problems, not least potentially severe omitted variable bias. Another substitute for actual marginal tax rates is the use of effective tax rates. As these effective tax rates are calculated as the ratios between the tax revenues from particular taxes and the corresponding tax bases obtained from national accounts (see, for instance, Martinez-Mongay, 2000), tax revenues in GDP may represent a viable proxy for them. Moreover, taking into account potential problems of tax compliance, government tax revenues remain a reasonable proxy for marginal tax rates.

Model uncertainty

An additional concern is the issue of the present uncertainty in both the selection of which explanatory variables should enter the regression and the specification of the correct functional form underlying the relationship. When applying simple cross-section techniques, the problem of limited degrees of freedom is well known. In contrast, in a panel framework, we are not bound to a trade-off in terms of gains in explanatory power by including many regressors versus a more parsimonious specification. Common practice in the literature is the choice of an *ad hoc* set of explanatory variables without rigorous theoretical grounds. This runs the risk of leaving out from the regression important growth determinants, while including irrelevant ones. Whilst Levine and Renelt (1992), using extreme bounds analysis, find that most variables are very “fragile” – and the only robust variables in the Barro equations are initial income and investment – the temptation to adopt a very parsimonious specification must be tempered by the potential for the problem of omitted variable bias discussed above.⁵

The uncertainty associated with the functional form underlying the relation between fiscal policy and growth may also lead to incorrect inferences. It is common practice in the literature to assume either a linear

⁵ An avenue of research may be the use of Bayesian methods to deal with the problem of uncertainty. However, the choice of priors in terms of the choice of regressors and functional form may condition the final outcome.

or log-linear specification, while on theoretical grounds there may be a U-inverted type of relationship between government size and growth as advocated by Barro (1990). This functional form would imply the existence of a threshold level of government spending beyond which a systematic negative relation appears to exist between government size and growth.⁶

3. Method

In this section we first present the variables included in our specification to analyse the long-run effects of fiscal policy instruments on growth for EU countries (excluding Luxembourg) over the last three decades. We then outline the estimation procedures we adopt for our analysis and the way these procedures deal with the problems pointed out in the preceding section.

3.1 Selection of variables

We follow Mankiw *et al.* (1992) for the basic specification to which we add fiscal policy instruments in order to proxy for the long-run effects that fiscal policy may have on growth.⁷ The basic specification thus comprises lagged levels of per capita GDP to account for conditional convergence effects along the transitional path. In addition, we include the private physical capital investment share of GDP and the average years of education in the working-age population. These variables should account for the flow of physical capital and the stock of human capital respectively, which both determine the steady state positions of each country. To account for the fact that growing populations as well as a higher rate of technological progress and depreciation of physical and human capital require greater physical and human capital accumulation to keep the level of capital endowment per effective worker constant, we adjust the population data in the same way as Mankiw *et al.* (1992). The resulting data are obtained taking the natural log of the sum of the growth rate of

⁶ See Romero de Ávila and Strauch (2001) for an explicit estimation of such threshold effects in the EU over the last 30 years.

⁷ The descriptive statistics for our data are contained in Table 2, and data sources in Appendix Table 1.

Table 2**Descriptive statistics for dataset**

Series	Obs	Mean	Std Deviation	Minimum	Maximum
DLGDP_PPP_HP	420	0.022365	0.015441	-0.194538	0.075411
LPRIVINV_GDP	420	2.937.084	0.166321	2.448.625	3.408.415
SCHOOL	420	9.635.223	1.648.927	5.800.000	13.613.773
LPOPMRW	420	-2.915.334	0.111340	-3.124.079	-1.275.145
TOTALEXP_GDP	407	39.16	7.91	19.31	58.71
TAXREV_GDP	409	32.02	6.24	16.37	46.07
SURPLUS_GDP	407	-4.54	4.36	-23.21	4.39

Note: For a more detailed description of the data and a description of the codes, see the Appendix.

population plus 0.05 as a rough measure of the technological progress and depreciation rates. This is a common assumption given the inherent difficulty in determining the true rates of depreciation and technological progress across countries. We also include a common trend and timedummies that may account for common shocks similarly affecting all EU countries in a given period (e.g. the oil shock in the early 1970s).

The dependent variable, our measure of long-term growth, represents a departure from the measures used in studies to date. Specifically, we employ trend PPP-adjusted growth estimates based on the Hodrick-Prescott filter (the methodology used by the European Commission to calculate estimates of trend output) as an indicator of long-term growth rather than taking period averages. The use of this measure has the benefit that, although it remains based on a largely mechanical derivation, it represents a relatively more analytically grounded measure of the cycle than mechanical period averages. More importantly, basing the analysis on annual figures allows for an extension of the time series for each individual cross-sectional unit as well as for the selection of a more homogeneous sample without the cost of a reduction in overall sample size. Nevertheless, one important peculiarity of the HP-filter methodology is the choice of the smoothing parameter, which is an important determinant of trend output estimates. The smoothing parameter used in this study is that proposed by Bouthevillain *et al.* (2001) in their

recent paper examining cyclical adjustment methodology for public finances in EU countries ($\lambda=30$).⁸

We augment the basic specification with government expenditure as a measure of the size of the public sector and tax revenue as a proxy for the degree of distortionary taxation. Total government expenditure and total tax revenue are included first individually to capture both of these effects, and then expenditure is included jointly along with the surplus in the spirit of Kneller *et al.* (1999) in order to gauge the importance of the government budget constraint. In addition, the sign and magnitude of the budget balance as an explanatory variable may to some extent capture the role of expectations about fiscal sustainability.

3.2 Estimation procedure

To estimate our dynamic panel equation (2) we rely on GMM estimation along the lines of Caselli *et al.* (1996). As outlined in Section 2.2, this procedure accounts for several of econometric problems, such as endogeneity and correlated individual effects (resting on the assumption that valid instruments are used in estimation).⁹

To start with, we transform our estimation equation by taking first-differences in order to sweep out unobserved individual country effects that are a source of inconsistency in the estimates.

$$\Delta y_{it} = (1+\alpha)\Delta y_{it-1} + \beta_1 \Delta x_{it}^1 + \beta_2 \Delta x_{it}^2 + (\mu_i - \mu_i) + \varepsilon_{it} - \varepsilon_{it-1} \quad (3)$$

Then, as instruments for the variables that are correlated with the error term (lagged dependent variable and other endogenous variables, x_{it}^1) we use the lagged levels of the observed series, y_{it-3} to instrument for $y_{it-1} - y_{it-2}$ and x_{it-2}^1 to instrument $x_{it}^1 - x_{it-1}^1$. The original estimator of

⁸ In principle, the fact that explanatory variables which could potentially exhibit cyclicity in levels, but are not adjusted for the cycle will not be problematic if they are calculated as ratios to GDP (as long as the cycle in nominal GDP produces a commensurate and identical response in the variable of interest – for public finance variables, this is akin to assuming a unitary elasticity).

⁹ Rather than taking variables as deviations from period means, as done by Caselli *et al.* (1996), we rely on the inclusion of dummy variables for each time series unit in the panel to capture both time-variant and invariant individual effects.

Arellano and Bond (1991) makes use of all possible lags from $t-2$.¹⁰ We limit our instruments to the lags at $t-2$ or $t-3$ for two reasons. First, the decision to include a large number of instruments must be tempered by the use of a small sample. In this respect, generally these additional instruments may render important gains in efficiency, but may also be infeasible and inappropriate in panels with a small cross-sectional dimension, since the number of instruments would by far exceed the number of observations. Second, as shown by Arellano and Bond (1991) for a given small-sample cross-section dimension, the use of too many instruments might lead to *overfitting bias*. This appears to be corroborated by Judson and Owen (1999) who find that estimators that make use of only a limited number of moment conditions as instruments in levels appear to outperform those by Arellano and Bond (1991) for the small-sized samples in the cross-sectional dimension, such as ours.

In addition, by using levels of the dependent variable lagged by one additional period to instrument for the first-differenced term – the first instrument for $y_{it-1} - y_{it-2}$ is y_{it-3} – we account for the potential presence of measurement errors (see Blundell and Bond 1998).

In our estimation we also correct for the heteroscedasticity that may be present in the error structure by following the two-step procedure proposed by Arellano and Bond (1991).¹¹ They showed that if the error terms ε_i of the equation in levels are identical and independently distributed across countries and over time, also implying that the errors are homoscedastic in both the cross-section and the time dimensions, the variance-covariance matrix of the moment conditions is a square matrix. This matrix is equal to a matrix consisting of 2s in the main diagonal, -1 s in the first sub-diagonals and 0s elsewhere multiplied by a scalar – the variance of the error of the level equation. For the case in which the errors

¹⁰ Concerning the number of lags, our estimator is closer to that in Anderson and Hsiao (1982), which can be understood as an instrumental variable estimation procedure applied to the dynamic equation in differences. Anderson and Hsiao (1982) propose the use of the lagged observation, say, y_{it-2} or the lagged difference $y_{it-2} - y_{it-3}$, to instrument for $y_{it-1} - y_{it-2}$. Since $x_{it}^1 - x_{it-1}^1$ is also correlated with $\varepsilon_{it} - \varepsilon_{it-1}$, they propose the use of x_{it-2}^1 as instrument in levels or $x_{it-2}^1 - x_{it-3}^1$ as instrument in first differences. Anderson and Hsiao (1982)'s instrumental variable estimators have been shown to be consistent.

¹¹ Fölster and Henrekson (2001) show that the results from the regressions are easily reversed if one does not correct for heteroscedasticity. They make use of Weighted Least Squares to estimate the impact of government size on growth.

are heteroscedastic, this estimator is still consistent but is not efficient. For this purpose, they propose a two-step estimation procedure that accounts for heteroscedasticity. The first step assumes homoscedasticity, then in a second step the residuals obtained in the first step are used to construct a consistent estimate of the variance-covariance of the moment conditions.

In addition, Arellano and Bover (1995) show that when the lagged dependent variable and the endogenous regressors are highly persistent over time, the moment conditions in lagged levels are weak instruments for the variables in first differences.¹² As the persistence increases, the asymptotic variance associated with the difference estimator rises, reducing in turn the precision of the estimates. As a result, they propose a *system estimator*, which combines the regression in first differences in a system with the regression in levels. In effect, the instruments for the regression in first differences are those implied by the *difference estimator*, whereas the instruments for the regression in levels are the lagged differences of the variables involved. They suggest that only the most recent instruments in differences should be used for the specification in levels in order to avoid redundant instruments. The bias from weak instruments seems to be particularly important when the span of time series observations is short (Blundell and Bond, 1998), which is not a major issue in our case. This, together with the fact that our cross-sectional dimension is relatively small, prevented us from estimating a system at this stage.¹³

The consistency of these estimators relies on the validity of the instruments and on the absence of first-order autocorrelation in the errors ε_{it} (second-order autocorrelation in the errors of the first-differenced equation), $E(\Delta\varepsilon_{it}, \Delta\varepsilon_{it-2})=0$. Arellano and Bond (1991) present specification tests for the validity of the instruments. The first one is a Sargan test for over-identifying restrictions, which tests for the overall validity of the instruments, implying the absence of correlation between the instruments and the error term. The second one tests for the null hypothesis of the absence of second-order serial correlation in the residuals of the first-differenced equation.

¹² Blundell and Bond (1998) extended the system estimator primarily presented by Arellano and Bover (1995) to the case of endogenous regressors.

¹³ We also based our decision on the study carried out by Ziliak (1997) who finds that “the downward bias in GMM is quite severe as the number of moment conditions expands, outweighing the gains in efficiency”. Judson and Owen (1999) corroborate these findings.

Furthermore, a downward bias to the standard errors of the two-step difference estimator is well known for the case of panels comprised of a small cross-section. This often can lead to spuriously significant regressors. To correct for this, we apply the bias correction adjustment proposed by Windmeijer (2000). In sum, by using an estimator along the lines of Anderson and Hsiao (1982), computed in a way that is robust to the presence of heteroscedasticity, measurement errors and small-sample biases to standard errors should allow us to make more reliable inferences on the link between fiscal policy and growth.

4. Results¹⁴

The results from estimating equation (3) using annual data of trend per capita GDP growth are reported in Table 3 for four basic specifications: no policy variables, government expenditure, tax revenue, and expenditure and surplus. Government expenditure and tax revenue are proxies for the size of government and distortionary taxation, and the additional regression containing both expenditure and surplus is included to gauge the importance of fully specifying the government budget constraint along the lines of Kneller *et al.* (1999). In general, the instruments used appear to be valid on the basis of the Sargan test, while the results of the autocorrelation tests do not indicate major problems concerning the existence of second-order correlation that would lead to inconsistent estimates.

We begin with a benchmark regression containing no policy variables. In this regression, the private investment share in GDP, the stock of human capital and population growth consistently enter with the expected signs and generally are significant at the 1% confidence level. The coefficient on private investment share implies that a 10 percent increase in physical investment (measured as a share of GDP) would increase long-term growth by up to nearly two percent. A 10 percent increase in the average number of years of schooling would also increase trend per capita growth by around two percent. Population growth also enters consistently in a significant manner and with the expected negative sign.

¹⁴ All the calculations have been done using the DPD program of Arellano and Bond for OX.

Table 3

Estimation results

	No policy variables	Government expenditure	Tax revenue	Expenditure and surplus
PARAMETER ESTIMATES (AND T-STATS)				
LPRIVINV_GDP	0.00189 16***	0.00152 10.9***	0.00315 22.6***	0.00068 4.13***
LSCHOOL	0.00220 29.3***	0.00214 40.6***	0.00281 48.2***	0.00217 35.2***
LPOPMRW	-0.00173 -5.54***	-0.00084 -6.01***	-0.00310 -19.8***	-0.00068 -5.17***
TREND	0.01997 129***	0.01922 102***	0.02276 113***	0.01869 100***
LTOTALEXP_GDP		-0.00095 -9.03***		0.00006 1.47
LTAXREV_GDP			-0.00107 -10.3***	
SURPLUS_GDP				0.00146 2.92***
SPECIFICATION TESTS				
SARGAN TEST	1.17E-10 [1.000]	2.27E-12 [1.000]	-2.68E-13 [1.000]	-1.24E-14 [1.000]
AR(2) TEST	1.820 [0.069]*	1.909 [0.056]*	1.916 [0.055]*	1.876 [0.061]*
OBS	392	387	389	385

Notes: The dependent variable is purchasing-power parity adjusted GDP per capita. One, two and three asterisks indicate rejection of the null hypothesis at the 10%, 5% and 1% respectively. All variables are transformed into first differences to remove the country-specific effects. GDP per capita lagged differences are instrumented by the level lagged three periods for robustness in the presence of measurement error. Likewise, the other variables were instrumented by the levels lagged two periods. The AR(2) is a test for the presence of second-order correlation in the error structure. The test is asymptotically distributed as a standard normal distribution. The Sargan test is distributed as χ^2_{J-K} , where J stands for the number of moment restrictions, GMM instruments, and in turn the number of columns of the matrix of instruments while K is the number of regressors.

In the second and third column of the Table, we augment the basic specification by including government expenditure and tax revenue, proxies for government size and distortionary taxation. The estimated coefficients of each policy variable included separately point to a similar negative effect and statistically significant impact of government size on long-term growth. Specifically, a 10 percent increase in either total government expenditure or tax revenue as a share of GDP would decrease growth by about one percentage point. These specifications do not explicitly control for the financing element of the budget constraint, which may result in biased estimates of the coefficient on government expenditure. Specifically, controlling for the financing of government expenditure should reveal a positive relationship, as long as government expenditure is productive on average. Potentially severe problems of multicollinearity would most likely arise from a simultaneous inclusion of both government expenditure and tax revenue in the same regression, as these variables are bound to co-move over the long-term in the absence of explosive behaviour for the deficit. Taking into account this consideration, the budget surplus is included as a control variable for the government budget constraint. This inclusion leads to the result that government expenditure is no longer a significant determinant of long-term growth. Interestingly, improvements in the budget balance ratio have a significant growth-enhancing impact. This suggests a positive effect of EU governments improving their budgetary positions and a limited role for additional government expenditure in boosting the trend growth rate of the economy.

Similar analysis is carried out by using five-year averaged data as an alternative way of controlling for the cycle rather than using annual trend growth. This set of regressions yields insignificant coefficients of explanatory variables accompanied by very high standard errors.¹⁵ Although this is most likely influenced by the relatively small cross sectional dimension when compared with other studies in the literature, it may also cast some doubt on the appropriateness of using five-year averages to analyse the relationship between trend growth and fiscal policy variables, since by averaging we disregard potentially important information in the time dimension. When this information is excluded from the sample, there may not be enough variability in the averaged regressors as to be able to explain even a small part of the variability of growth rates

¹⁵ The results based on five-year averages of all variables are available from the authors upon request.

in the sample. In addition, these results can be partly attributed to the poor performance of the difference estimator for the case when the time dimension is very small as demonstrated by Blundell and Bond (1998).

5. Conclusions

This paper examines the empirical relationship between government size/taxation and economic growth for EU countries and finds a robust negative relationship. Moreover, assessing the joint impact of the government budget balance along with public expenditures yields the result that budgetary improvements tend to enhance long-term economic growth whilst the long-term growth-enhancing impact of additional public expenditure on long-term growth prospects has been limited for EU countries over the period of analysis. The analysis is performed by estimating growth regressions for a panel of EU countries using a generalised method of moments estimator that eliminates standard problems in this literature such as endogeneity of the explanatory variables and correlated individual effects. The analysis in the paper also tackles other problems present in this literature, *e.g.* the presence of cyclical effects which are usually addressed by taking 5-year averages of the data. Instead, we estimate the regressions with annual data and control for the cycle by using trend growth as dependent variable. Our sample selection contributes to better account for the problem of heterogeneity of the coefficients across countries.

Despite the large volume of literature already existing on the subject, further research is still warranted on the assessment of fiscal policy variables on long-term growth. In particular, the problem of weak instruments leaves open scope for further evaluation of other instruments in the GMM analysis and the evaluation of system estimators. Another promising avenue in this respect is the use of a quasi-maximum likelihood (QML) estimators to assess this relationship. In particular, Binder *et al.* (2001) present a QML estimator which has some desirable characteristics. Lastly, an avenue of research which shows promise to further elucidate the role of fiscal policies in influencing long-term growth is a more systematic treatment of heterogeneous slopes, for example through the use of recently developed Pooled Mean Group estimators outlined in Section 2.2 developed by Pesaran and Smith (1995) and Pesaran *et al.* (1999).

APPENDIX

DATA SOURCES

Variable	Definition	Source
GDP_PPP_HP	Trend gross domestic product at 1995 market prices (obtained using HP filter, $\lambda = 30$), 1995 PPP US\$ divided by total population	European Commission, AMECO database Autumn 2001 Release
SCHOOL	Average years of education of the working age population	Barro and Lee (2001) and Bassanini and Scarpetta (2001)
LPOPMRW	Total Population, adjusted for technological progress and depreciation of capital (see Mankiw <i>et al.</i> , 1992)	European Commission, AMECO database, Autumn 2001 Release
PRIVINV_GDP	Gross fixed capital formation at current prices; total economy less gross fixed capital formation at current market prices, general government, as a percent of GDP at current market prices	European Commission, AMECO database Autumn 2001 Release
TOTALEXP_GDP	Total expenditure, central government (consolidated accounts) as a percent of GDP at current market prices	IMF Government Finance Statistics. Extended chaining Commission Autumn 2001 forecasts in AMECO
TAXREV_GDP	Total tax revenue, central government (consolidated accounts) as a percent of GDP at current market prices	IMF Government Finance Statistics, excludes non-tax revenue. Extended chaining Commission Autumn 2001 forecasts in AMECO
SURPLUS_GDP	Budgetary surplus/deficit, central government (consolidated accounts) as a percent of GDP at current market prices	IMF Government Finance Statistics (code 80), the difference between total revenue and grants minus total expenditure. Extended chaining Commission Autumn 2001 forecasts in AMECO

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COMMENTS ON SESSION III: FISCAL POLICY AND GROWTH

*Walpurga Köhler-Töglhofer**

First of all I would like to thank you for the invitation to this workshop. I very much appreciate the opportunity to debate on significant fiscal policy issues in this setting and the chance to gain new insights. I am impressed by the interesting approaches the individual papers have come up with, and by the “food for thought” they have provided.

By way of introduction, I would like to share with you a few words on the guiding issue behind this Session. Then I would like to offer a short response to growth theory that will be highly subjective and also highly selective. I plan to wind up my contribution with a short view on the empirical evidence.

What is the debate about?

Basically, it is about the implications that fiscal policy may have for long-term growth. It is a fact that growth produces prosperity, but it may be worth discussing whether fiscal policies do indeed play a key role in determining the long-run growth rate of economies. If they do, is the impact of fiscal policy instruments growth-enhancing, or does it rather have growth-retarding effects in the bottom line? How does the share of government expenditure in output, or the composition of government expenditure and revenue, affect the long-run growth rate? Let me refer to economic theory first.

What does growth theory tell us?

In *neoclassical models* in the tradition of Solow (1956) and Swan (1956), the answer to the question whether fiscal policy affects long-run growth is clearly “no”. Public-policy neoclassical growth models, for example Chamley (1986), consign the role of fiscal policy to that of

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determining the level of output rather than the long-run growth rate. The only explanation of growth that neoclassical theory accepts is exogenous technological progress and population growth. Any change in other parameters of the models is found to induce only transitory movements to a new steady state, without having any effect on long-run growth. Fiscal policy can affect only the transition path to the steady-state growth rate.

Although fiscal policies, like tax and expenditure measures, influence the saving rate or the incentive to invest in physical and/or human capital – and therefore the equilibrium factor ratios –, they cannot permanently sustain higher output growth. What they can sustain is a higher level of output and therefore of the standard of living. Sustainable growth requires a continued infusion of technical progress – in terms of improved capital productivity or labor skills. Such progress, by definition, arises outside the models.

Endogenous growth theory tells us that a country's growth performance in the long run is endogenously determined by a set of variables that are responsive to and affected by fiscal policy. Increasing returns-to-scale on the production side, knowledge spillovers, learning-by-doing externalities or monopolistic power in markets for costly developed new goods are the factors determining endogenously driven growth. Investment in new capital, the implementation of new production techniques and the introduction of new products are the fundamentals of the growth process according to the new growth theory. Investment in physical as well as human capital can affect the steady-state growth rate in these models. Consequently, there is scope for at least some elements of tax systems and government expenditures to play a role in the growth process.

Some of the clearest and most direct conceptual links between fiscal policy and growth are to be associated with tax policy. Through its effects on the return on investment or the expected profitability of research and development, taxation affects what choices are made and, ultimately, the rate of growth – either temporarily, in neoclassical-type growth models, or permanently, in endogenous growth models. With distortionary taxes, private economic agents' allocative decisions will be different from those that would be made in the absence of such taxes. Paul van den Noord and Christopher Heady give an extensive overview of economic distortions resulting from labor and capital income taxation and indirect taxes, like VAT and excise taxes. Clearly not all distortions mentioned are of similar importance for growth considerations. However, of particular relevance in

this respect at present are perhaps the implications of open and integrating economies accompanied by the increasing mobility of production factors, since distortions may be exaggerated.

However, some tax distortions may be the result of growth-enhancing measures. They are then a consequence of economically useful measures aimed at correcting market failures, for example tax incentives that are meant to promote investment, research and development activities. By their very nature, these tax incentives create distortions; distortions that may well be outweighed by the benefits that can be reaped from their use. Without corrective public measures, such activities would be below their optimal levels.

Unambiguous effects result from income taxes – mostly they have a negative impact on the long-run growth rate because they reduce incentives to save, to accumulate human capital or to innovate. However, in an endogenous growth context, the growth effects of income taxation on (physical) capital are sensitive to the specification of the respective production technology; the ultimate impact of a capital income tax on growth depends on how the tax affects other factors, such as human capital, that cooperate with physical capital in the production process.

Since not all tax distortions are of the same relevance from a growth perspective, the structure of taxation has important implications for growth. A shift from an income tax to a consumption tax, which reduces the disincentive to save, is likely to boost capital accumulation. Of course, a consumption tax distorts labour/leisure choices, but these distortions can be considered as neutral with respect to the relative price of consumption today and tomorrow.

However, in discussing distortionary effects or efficiency aspects of taxation, we must not forget that taxes are multi-targeted instruments, with efficiency being just one argument. Tax policy is not only focused on raising the required revenue with the minimum amount of distortion to economic activity and at minimum cost of collection. Tax policy is about fairness, too. Fairness/equity may entail costs in terms of efficiency and growth, but it would be inappropriate to design tax systems or assess tax systems with only growth objectives in mind. Moreover, some new strands of research in growth theory shed a different light on the trade-off between redistribution and long-run growth. It is argued that redistributive taxation and social transfers can be growth-enhancing.

That the *financing* as well as the *spending side* are of importance for long-term growth was shown by Barro (1990). He provided a theoretical analysis by which fiscal policy can determine – in contrast to public-policy neoclassical papers – both the level of output and the steady-state growth rate. In this model, a higher tax rate ($\tau=G/Y$; G/Y is the government's expenditure ratio) reduces growth by reducing the after-tax rate of return. At the same time, however, it increases growth by increasing the future level of public services (or productive expenditures), which in turn raises the private marginal product of capital.

Following Barro, the relation between the size of the government ($G/Y=\tau$) and the per capita growth rate is non-monotonous or hump-shaped: at low values of τ , the growth rate of income-per-capita increases with the tax rate, since the positive effect of higher public spending on private capital's marginal product dominates. As the tax rate rises, the adverse impact of distorting taxation becomes more important, and the per capita growth rate eventually reaches a peak. For still higher values of τ , the taxation effect dominates, and the per capita growth rate declines with the tax rate.

Extensions of the Barro model show that both long-run growth and the utility of the representative consumer will be reduced if government expenditures are not restricted to the provision of productive inputs but are also used to finance transfers that directly enter the representative consumers' utility function or budget constraint. These additional government activities do not have a positive effect on the production sector but, must be financed by distortionary taxes which reduce the after-tax rate of return on capital and discourage saving, the reduced investment activity results in lower growth.

Several articles have been published since that pioneering paper, extending the analysis of taxation, public expenditure and growth, like Jones *et al.* (1993), and Mendoza *et al.* (1997).

To sum it up, from the theoretical perspective it is reasonably clear that fiscal policy can impact long-run growth, even though the predicted growth effects of taxation and government spending depend critically upon model specification. Furthermore, they are heavily dependent on the engine of growth, the process of human capital accumulation, tax regimes and the way the tax revenue is spent.

Is empirical evidence consistent with the predictions of growth theory?

Empirical evidence is not unambiguous. This is also one of the conclusions of Ana Lamo and Rolf Strauch, who review the main findings of the empirical literature in the context of fiscal policy's contribution to the European Growth Strategy. They are discussing a whole range of potentially productive, growth-enhancing government expenditures which, of course, have to be financed by distortionary taxes. They conclude that public infrastructure investment, education and R&D investment have positive effects on growth, albeit the magnitude of the impact of the various public expenditures is questionable. They also draw the conclusion that the composition within specific expenditure categories is of importance and that the relationship between growth and fiscal variables may be non-monotonic. While the effect is likely to be positive if public spending remains moderate, it could be expected to decrease and may even become negative if expenditure exceeds certain levels.

Kristal Buysse's contribution focused on long-run growth effects of educational expenditures. Empirical evidence with respect to this expenditure category is also inconclusive. Following her result there are some indications that spending on education may help explain differences in productivity growth.

However, estimations of growth equations have to cope with a number of specific methodological problems. Paul Hiebert and his colleagues give an extensive enumeration and explanation of methodological insufficiencies and problems in their paper. They highlight the most important methodological caveats in the empirics of growth. In their contribution they estimate the long-run effects of fiscal policy on growth for EU countries. They establish a robust negative relationship between government size and trend growth.

The paper focuses only on the effects of the overall revenue ratio and the overall expenditure ratio as a proxy for government size. They do not single out productive expenditures that increase the profitability of private investments through externalities or expenditures that have positive impact on human capital. However, taking into account that the growth effects of government consumption are different from those of productive expenditures it follows that for empirical investigations it may be of overall importance to distinguish between these two categories – although this distinction may in itself be problematic.

Relating their results to Barro (1990), it can be concluded that European governments might act on the right hand part of Barro's hump-shape curve. Any reduction of distortionary taxation would boost long-run growth, or in other words, long-run growth – or at least the steady-state level of income – could be increased by reducing government size.

However, economic growth is just one economic policy target, and it may be taken as a fact that it will conflict with other targets. Therefore, the result – to the extent that it is based on one target only – must be taken with a grain of salt, or must be interpreted with caution, taking into account the multi-dimensional targets of economic policy.

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COMMENTS ON SESSION III: FISCAL POLICY AND GROWTH

*Robert Tannenwald**

In evaluating these fine papers, let us first consider the goals of our profession. I consider myself to be an “applied public finance economist.” If I were to compose an oath for this calling, it would be:

- “I will do my best to enhance policymakers’ understanding of the tradeoffs inherent in the formulation and implementation of fiscal policies.”
- “I will attempt to quantify as accurately as possible the terms of these tradeoffs.”

1. The principal contributions of the papers as a whole

Each of the papers presented in this session furthers the first two of these three professional goals in one or more of the following ways:

It analyzes the impact in theory of alternative fiscal policies on economic growth. In the United States, some policymakers (especially at the subnational level) consider the stimulation of economic growth to be the paramount goal of fiscal policy. Some of these “pro-growth” advocates also believe as a matter of faith that any fiscal policy touted by business leaders as “pro-growth” is effective. Before helping such policymakers to appreciate the costs that they might incur in unbridled pursuit of growth, policy analysts would do well to explain how and why one would (or would not) expect alternative pro-growth policies to achieve their intended effect. As a whole the papers do an excellent job of explaining the channels through which fiscal policies should affect growth according to conventional ideology and economic theory and the conditions under which these effects should be the strongest. The paper presented by Lamo and Strauch especially focuses on this set of issues. The authors delve into these issues just deeply enough to convey to policymakers the wide array of conditions capable of frustrating even the most carefully designed pro-growth agendas.

* Federal Reserve Bank of Boston.

It presents and critiques empirical evidence concerning the impact of alternative fiscal policies on economic growth. All the papers summarize various components of the empirical literature on this issue and do a good job of explaining alternative tactics to overcome common econometric obstacles. Hiebert *et al.* and Buysse also do some original econometric analysis implementing some “state of the art” approaches to longstanding empirical problems. Hiebert *et al.* specify and estimate a new model of the impact of tax and spending levels and budget constraints on long-term growth, while Buysse presents some original work on the relationship between growth and human capital.

It points out several tax policy goals that, under certain circumstances, are incompatible with the stimulation of economic growth. Van den Noord, for example, discusses the distortions created by the tax policies of several OECD countries of such choices as the allocation of savings among alternative instruments, the international allocation of capital, business size and organizational form, work versus leisure, labor intensity of production, and mix of consumption. He also discusses the costs of alternative policies in terms of administrative simplicity and distributional equity. The general equilibrium model developed and presented by Pereira and Rodrigues attempts to quantify the tradeoffs between growth and efficiency of specific alternative public policies proposed in Portugal.

2. More detailed comments on each paper

2.1 “Tax Design, Economic Efficiency and Growth”

This paper provides an extremely useful overview and synthesis of recently undertaken comprehensive evaluations of the tax systems of several OECD countries. It compares and contrasts features of these tax systems primarily in terms of the degree to which they create or mitigate various types of tax distortions. Several characteristics of the authors’ analysis make this piece especially helpful to policymakers. First, when the authors create a “yardstick” against which to evaluate tax systems, they define the yardstick clearly. Second, while showing that a particular tax system might not “measure up well” according to a particular yardstick, the authors explain the rationale underlying the tax features responsible for the discrepancy between the ideal and the imperfect reality. Third, van den Noord acknowledges that policymakers, often recognizing the tradeoffs

that they face, have attempted to mitigate the distortions that they have created in pursuing other tax policy goals. By analyzing differences across countries in these ameliorative tactics, the author implicitly encourages policymakers to think about the conflicts they face and present them with ideas about how partially to reconcile them. Fourth, when noting distortions in the tax system of a given country, he identifies characteristics of the country that make the distortions especially severe (or mild). By so doing the author is conveying another important message to policymakers: “Formulate tax policy that best suits your country, given its peculiar traits and values. The tradeoffs you face depend on these characteristics. Do not simply adopt the ‘common’ practice or change your tax system because it is ‘out of line’”.

In addition to exhibiting these helpful analytical characteristics, the paper provides some useful indicators gauging the severity of non-neutrality with respect source of corporate financing and the labor/leisure choice. Of particular interest is their measure of marginal effective tax rates on corporate investment under alternative financing methods. Based on the “representative firm” approach developed by King and Fullerton (1984), perhaps such indicators could be included as explanatory variable in growth models. What if, for each country, marginal effective tax rates were computed for a wide range of firms from different industries and with different methods of financing? Perhaps data from the tax returns of actual businesses could be used to help construct truly representative firms (needless to say, in order to preserve confidentiality, revenue officials with clearance to view tax returns would have to do the computations). Marginal effective tax rates could be averaged within a country to produce a countrywide “average” marginal effective tax rate (AMETR). Neoclassical economic theory implies that AMETR would be a more accurate predictor of the impact of taxes on economic growth than other, cruder indicators, such as tax revenue, taxes as a percentage of personal income, or tax revenues as a percentage GDP. For attempts to use AMETR as an explanatory variable in models explaining variation in economic performance, see Papke (1987) and Tannenwald (1996).

2.2 *“The Contribution of Public Finances to European Growth Strategy”*

The key themes recurring throughout this paper are: 1) yes, public finances “matter”, that is, they do have an impact on growth, 2) how much

they matter is not at all clear, 3) how much people think that public finances “matter” depends not only on what theory of growth they embrace but a host of other conditions over which policymakers have little or no control, and 4) in order to understand how public tax and expenditure policies affect growth, one must avoid simplistic aggregate measures of tax burdens and spending burdens. Instead, one should focus on more disaggregated indicators of fiscal policy, such as the mix of taxes and spending, not just on levels.

Lamo and Strauch’s synthesis is so objective and clear that it is downright frightening. They point out the scary truth that, depending on which theory one embraces (Keynesian, neoclassical, rational expectations), how open the economy is, people’s interpretation of the long-term implications of a short-term policy shift, the anticipated adjustment in monetary policy, and many other factors, an analyst can rationalize almost any prediction. The authors’ paper puts into stark relief a real issue for the “applied public finance economist”: how does one avoid the common criticism, the source of most jokes about economists, that economists can not say anything definitive about anything? Yet, Lamo and Strauch have done exactly the right thing. Avoiding all temptation to satisfy the policymaker’s appetite for a “simple” answer, they provide a clear road map of the various assumptions one must make and the variety of empirical work that one must digest in order to make an informed policy decision. The truth hurts – not because it is sharp, but because it is cloudy.

Particular impressive is the authors’ discussion of the theory and evidence regarding the impact of public infrastructure investment on the growth process. From explaining why the public sector invests in infrastructure in the first place (components of infrastructure are natural monopolies), to explaining the various critiques of initial studies on this issue, to discussing reasons why the impact of public infrastructure investment should vary over countries and within a country over time, Lamo and Strauch are succinct and clear. They also appropriately stress the importance of the mix of public sector investing as a determinant of growth.

2.3 *Fiscal Policies and Economic Growth in Europe: An Empirical Analysis*

Among all the papers, Hiebert *et al.* provide the most comprehensive, systematic discussion of the econometric problems inherent in estimating the impact of various public sector characteristics on long-run economic growth. As Bartik (1994) has pointed out, many of the same problems identified by the authors in cross-country studies also are evident in interstate studies within the United States. However, while the authors are extremely adept at identifying potential sources of bias and imprecision, they convey the impression that in their own empirical investigation they have largely solved these problems. While I think that their analysis is first rate, I am concerned about some possible issues.

The authors' proxy for the degree of distortionary taxation is the ratio of total tax revenue of the central government to GDP. However, as van den Noord and Heady point out, differences in the structure, in addition to differences in levels, are important determinants of differences in the severity of the excess burden imposed by tax systems. Did the authors explore alternative methods of operationalizing excess burden? What if they were to try average measures of marginal effective tax rates, as discussed above? Is it really true, as the authors assert, that "Given...the complexity of tax systems in industrialized countries...the calculation of a homogenous marginal tax rate comparable across countries is virtually impossible."? While such a calculation would be difficult, it could be done with representative households and firms and the international cooperation of tax officials with access to computerized tax files. This should be a high priority of the public finance profession.

I am also somewhat puzzled by the authors' conclusion of "robust negative relationship" between government size/taxation and economic growth. When they include the budget surplus as a control variable for the government budget constraint, the coefficient on the government expenditure variable becomes statistically insignificant. I do not understand how this finding is consistent with a conclusion of a "robust negative relationship."

By utilizing a new measure of long-term economic growth, estimated "trend" growth, the authors introduce an interesting innovation that solves some of the econometric problems introduced by other measures, especially simultaneity bias. Still, estimates of trend growth rates are themselves controversial. Economists within the Federal Reserve System

constantly argue over the trend, or “potential” growth rate of the United States. At the heart of this controversy is uncertainty about trend growth in productivity. Consequently, while this innovation is useful, it might introduce as many problems as it solves.

2.4 Human Capital and Growth in OECD Countries: The Role of Public Expenditure in Education

Of all the empirical issues raised by fiscal policymakers, the cost-effectiveness of public spending on education is one of the most frequently discussed. Throughout the world, legislators are caught between rapidly escalating demand for education services and competing demands for uses of public funds, such as defense, health care, and income security. In order to gauge the optimal level of public education spending, policymakers need good estimates of the impact of school quality on economic growth. By evaluating the literature on this issue and providing fresh evidence concerning it, Buysse’s paper helps policymakers trying to compare the potential benefits of alternative allocations of scarce resources among competing uses.

Buysse’s analysis echoes themes sounded by the other presenters in this session. Estimates of the relative impact of the determinants of economic growth are rife with econometric problems, not the least of which is measurement error. The indicators available to researchers are too crude to capture all the separate factors that theoretically might impinge on growth. She notes that while measures of human capital should reflect both the quantity *and quality* of education, the latter is not accurately isolated from the former. After creating indicators that better isolate quality from quantity, she includes her quality estimates in growth models. Her analysis exemplifies a healthy distrust of crude, albeit readily available, indicators and presents some results casting doubt on educational strategies widely assumed to be effective, at least in the United States, such as lowering student/teacher ratios.

2.5 Tax Reform in the Context of Budgetary Restraint: A Note on the Portuguese Case

Pereira and Rodrigues have developed the ultimate tool of policy analysis. For a given set of assumed conditions and estimated relationships,

the policymaker can use their model to simulate the long-run impact of specific changes in fiscal policy on growth in output and economic welfare. Such models give the policymaker a capacity for quantitative estimates of the terms of tradeoffs entailed by specific policy initiatives. In this respect they have tremendous potential.

However dynamic general-equilibrium models – even those as carefully constructed and calibrated as Pereira’s and Rodrigues’ – also create the potential for serious misunderstanding. The results they produce depend heavily on assumptions buried deeply within them. Choices concerning parameter values, such as key elasticities, crucially shape outcomes. As other papers in this session have pointed out, estimates for key elasticities in growth models, as well as in models of allocative impacts, are “all over the map”, varying in sign and widely varying in absolute value. Which parameter estimate should the policy analyst use? The mean? Are some estimates more credible than others? The authors state that “whenever possible, parameter values are obtained from the available data sources or the literature or as implied by the conditions of a steady-state equilibrium.” Yet, since these sources frequently do not provide clear-cut direction, choices of parameter values are necessarily arbitrary to some extent. Shoven and Whalley (1984), in their review of applied general equilibrium modeling, note:

As far as elasticities are concerned, the key parameters tend to be labor supply, saving, and commodity-demand elasticities. In all of these areas, modelers typically encounter difficulties in selecting ‘appropriate’ values due to conflicting literature estimates and frequent changes in what seems to be the consensus among empiricists in the relevant areas (p. 1031).

The sensitivity of outcomes to other assumptions also needs to be explored, such as the myriad of alternative simplifying assumptions needed to make such models tractable and, given data limitations, to translate alternative fiscal policies into changes in marginal tax rates. In raising these concerns, I am not suggesting that the authors’ analysis is limited in practical use. On the contrary, the insights they provide are extremely useful to policymakers. I am suggesting, however, that, in using results such as those presented by the authors, policymakers need the conceptual and analytical tools to evaluate for themselves the reasonableness of the underlying assumptions.

3. Where do we go from here?

As applied public finance economists, somehow we must help policymakers “digest” the wealth of observation, commentary, analysis, and synthesis presented in these papers. After reading them, a cynical commentator could conclude, “economists can’t tell us much definitively about the impact of alternative fiscal policies on economic growth”. The principal phrases that might linger in the ears of policymakers are “it depends on circumstances,” “the results are fragile,” “experts disagree on...”. Ultimately, however, the formulation of fiscal policy is an art, not a science, more like detective work than engineering. Having examined relevant theory and empirical evidence, policymakers must determine what they think will be the most probable outcome of a given tax or spending policy, that is, the extent to which the policy will further or impede the attainment of partially irreconcilable normative goals. To help policymakers make such decisions, applied public finance economists must attempt to identify the key theoretical and empirical issues that are responsible for different policy prescriptions and to explain them as clearly as possible. When policymakers vigorously support a particular policy, it is our job to make sure that they understand the theory and empirical evidence that they are implicitly embracing. When confused and exasperated policymakers demand us to give them the “right” answer, we must refrain from doing so, because there is no right answer, or, if there is one, damned if we know it. We must help them work out the right answer for themselves in terms of their own values and interpretations of existing evidence.

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COMMENTS ON SESSION III: FISCAL POLICY AND GROWTH

*Stefania Zotteri**

The papers of this session provide a rich and stimulating overview of many of the issues concerning the relationship between fiscal policy and economic growth.

Actually, the interesting paper by *Brunila et al.* refers to cyclical stabilisation issues rather than to growth ones; in particular, the analysis of this paper relies on the distinction between supply and demand shocks and stresses the potential trade-off between cyclical stabilisation and structural flexibility, where the latter stands for the responsiveness of the economy to permanent supply shocks.

The other five papers of this session focus on growth, making only some brief comments on the issue of stabilisation. These five papers are very heterogeneous: some of them refer to tax effects, some to public expenditure effects and others try to take into account the overall government budget effects on growth. Not surprisingly, the papers more focused on the role of the overall government budget are those referring to EU countries, that is countries which have to take into account the fiscal rules provided for in the Maastricht Treaty and in the Growth and Stability Pact. Moreover, some of the papers look at fiscal policy and growth from a general perspective and others, as the one on Portugal, are more like case studies.

If I were one of the authors of these five papers, I would organise a meeting with the other authors and ask them to work a little bit more on the papers, fill in some blanks and then publish a book made up of the papers themselves. A tentative title for this book could be: “Everything you always wanted to know about fiscal policy and growth, but were afraid to ask”. In my view this book could be made up of two parts. Part I is the more general part of the book where the authors can split the issue of the relationship between fiscal policy and growth into two sections: the first one focusing on the effects of fiscal policies on individuals and firms’ choices and the second one considering the growth implications of these

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The views expressed in the paper are those of the author and do not commit the Banca d’Italia.

changes in choices. Part II of the book can be made up of more specific empirical studies.

The index of the book could be as follows:

Part I: General issues on fiscal policy and growth (in Europe)

- The effects of taxes on agents' decisions (*van den Noord and Heady*)
- The effects of public expenditure on agents' decisions (*to be written*)
- The contribution of public finances to the European growth strategy (*Lamo and Strauch*)

Part II: Specific empirical studies on fiscal policy and growth (in Europe)

- Fiscal policies and economic growth in Europe: an empirical analysis (*Hiebert et al.*)
- The tax reform in Portugal (*Pereira and Rodrigues*)
- Human capital and growth in OECD countries: the role of public expenditure on education (*Buyse*)

Most of the first bit of Part I of the book is already well written by *van den Noord* and *Heady*. Their analysis focuses on the effects of taxation on different decisions such as: (i) the decision to save; they take into account the impact of taxation not only on aggregate saving, but also on its composition and on international saving flows; (ii) the business funding decision; the authors importantly underline that in practice no tax system in OECD countries is neutral with respect to corporate financing and investment decisions and that in most countries tax systems are biased in favour of debt financing; Italy is not an exception and it is now going back to the less neutral tax system which was in place before the 1998 tax reform; (iii) the decision whether to participate in the labour market and on how many hours to work once working.

The authors of the book could add a paper on the effects of public expenditure on agents' choices. They could consider for example public investment expenditure, investment contributions and other types of transfers (either earmarked or not).

Having this rich and broad base which is both theoretical and empirical, one could consider within Part I of the book the *Lamo* and *Strauch* contribution. It refers to EU countries, but still takes a rather general perspective. The authors analyse the European growth strategy

according to which the quality of public finances play a crucial growth-enhancing role via three mechanisms: (i) supporting macro-economic stability; (ii) making tax and benefit systems more employment friendly; (iii) changing the composition of public expenditures in favour of those expenditures which can stimulate physical and human capital accumulation and encourage technological progress.

They find evidence to indicate that public finances can be considered a source of endogenous growth even if considerable uncertainty remains as far as the size of their impact is concerned.

So, we end up considering Part II of the book where there is room for more specific analyses including those by *Hiebert et al.*, by *Pereira and Rodrigues* and by *Buyse*.

The paper by *Hiebert et al.* first reviews the methodological issues concerning the analysis of the empirical assessment of the determinants of economic growth and then provides a new contribution to a literature where there is no clear consensus on the relationship between government intervention and economic growth. In the paper, the sample refers to EU countries over the last three decades. According to my understanding of the paper, an important contribution of the analysis is the use of a new dependent variable for measuring long-term growth. Indeed, the authors build up annual estimates of trend economic growth, rather than using period averages. They refer to trend PPP-adjusted growth estimates based on the HP filter. As the authors themselves stress, this choice is not only more analytically grounded but also allows for the extension of the time series considered in analyses which typically use annual data.

The authors conclude that there is a negative robust relationship between government size and economic growth in EU countries. If I understood it correctly, this conclusion is obtained from an estimation which do not control for the financing element of the budget constraint (i.e. the way any measure is financed). When the budget surplus is included as a control variable for the government budget constraint, government expenditure is no longer significant and improvements in the budget balance have a significant growth-enhancing impact. This suggest a positive growth-enhancing role for improvements in the budgetary position of EU countries and a limited role for more government spending.

The paper by *Pereira and Rodrigues* could be the other paper belonging to Part II of the book. It is an interesting case study on the

Portugal tax shock which has been an important topic of the public debate for quite some time before the elections which took place last Sunday. This tax shock includes a reduction in the corporate income tax rate, a reduction in employer's social security contribution rate and in the personal income tax rate corresponding to the highest income bracket. The authors find out that the tax shock effects on growth crucially depend on the way the measures are financed. As intuitive, the strongest positive growth effects occur under lump sum taxes financing. Moreover, interestingly, positive growth effects go together with positive welfare effects when the tax shock is financed via a reduction in public spending. I wonder whether and how the conclusions about the tax package would be affected if the imperfections in the labour market were explicitly modelled. I am thinking about something in Daveri and Tabellini's fashion.¹

Then, *Buysse* presented an empirical analysis on the growth-enhancing role played by human capital. According to my understanding of the paper, it follows the Nelson-Phelps approach. This means that the level of human capital rather than its growth rate is one of the determinants of growth. The analysis also stresses the importance of accounting not only for the quantity, but also for the quality of human capital. As it generally happens both in empirical and in theoretical analyses concerning human capital and growth, human capital is identified with education. Nevertheless, as an issue for future research, I believe it is important to account for other components of human capital such as training. When training is accounted for as an investment in human capital, the interaction between the individual incentives to invest in schooling and the firm incentive to invest in training could be crucial.

Two final remarks before concluding.

First, it is apparent from Part II of the book, but it is also somewhat said in Part I, that both the revenue and the expenditure side of the government budget should be considered in evaluating the impact of fiscal policy on economic growth. Indeed, the growth-enhancing effects of any measure could be, at least partially, compensated by the effects of the financing side of the measure. This holds both for empirical and for theoretical analysis. We all know that it is very difficult in practice.

Secondly, when assessing the growth effects of fiscal policy, one should bear in mind that growth is only one of many policy targets. Here I

¹ Daveri, F. and G. Tabellini (2000), "Unemployment and Taxes", *Economic Policy*.

would like to mention one of the other important goals of fiscal policy: income redistribution. This leads to the equality-efficiency trade-off, where equality can be considered in terms of income distribution and efficiency in terms of growth. The well known Okun's leaky-bucket experiment can be used to test our attitude towards this trade-off.² Consider a programme for transferring money from the richest to the poorest families of a given economy; "the programme has an unsolved technological problem: the money must be carried from the rich to the poor in a leaky bucket. Some of it will simply disappear in transit, so the poor will not receive all the money that is taken from the rich. [...] Of course, the leak represents an inefficiency. The inefficiencies of the real world redistribution include the adverse effects on the economic incentives of the rich and the poor, and the administrative costs of tax collection and transfer programs" (Okun, 1975, pp. 91-92). The point is how much leakage we would accept and still support the redistribution programme. So in the end, while looking at the growth effects of fiscal policy, we should be aware of the relative importance of this growth target as compared to the other goals we want fiscal policy to track.

² Okun, A.M. (1975), *Equality and Efficiency: the Big Tradeoff*, Washington D.C., The Brookings Institution.