

Effective tax rates in macroeconomics: A note

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Abstract

In various empirical studies so-called tax ratios (tax revenues expressed as a ratio of some aggregate tax base) are employed as approximations for tax burdens. The most difficult problem in calculating tax ratios is the way in which personal income tax revenues are attributed to labour and capital. We argue that the methodology of Mendoza, Razin, & Tesar (1994) is seriously flawed in this respect. Using information from national sources, we calculate more accurate tax ratios for eight OECD countries that differ substantially from those of Mendoza, Milesi-Ferretti, & Asea (1997) and which are also differently related to various economic variables.

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1 Introduction

In recent years, researchers and policymakers alike have expressed a keen interest in the effects of taxes on macro-economic performance. In various empirical studies so-called tax ratios are employed as approximations for tax burdens.¹ To calculate such ratios, tax revenues are expressed as a ratio of some aggregate tax base (e.g. labour income, capital income, consumption).

This line of research started with the seminal work of Mendoza, Razin, & Tesar (1994). These authors report that the tax ratio on capital income is generally negatively correlated with investment, whereas high consumption and labour income tax ratios coincide with less hours worked. Similarly, Daveri & Tabellini (2000) — using the updated data set of Mendoza, Milesi-Ferretti, & Asea (1997) — find that high labour taxes strongly contribute to current high unemployment levels in Europe. Their results suggest that, over a period of 30 years, the observed rise of about nine percentage points in the labour tax rate corresponds to a rise in unemployment of about four percentage points. These findings are often used to support a reduction in taxes on labour — preferably in a co-ordinated fashion — to stimulate employment growth.²

Calculating tax ratios is not a straightforward exercise, because several conceptual and practical problems have to be solved.³ The most important issue concerns the way in which personal income tax revenues are attributed to labour and capital. In this note, we argue that the methodology developed by Mendoza, Razin, & Tesar (1994) and updated by Mendoza, Milesi-Ferretti, & Asea (1997) is seriously flawed in this respect. Using information from national sources, we are able to calculate more accurate tax ratios for eight OECD countries that differ substantially from those presented by Mendoza, Milesi-Ferretti, & Asea (1997). In some cases, we also find correlations of these tax ratios with various economic variables that are substantially different from those reported by Mendoza, Razin, & Tesar (1994).

¹The terms implicit tax rates and effective tax rates are also used. As this terminology is confusing — after all, once a certain tax ratio has been calculated, it is explicit, and the concept of average tax rates might better be restricted to the analysis of tax burdens of individual taxpayers — we will consistently use the term tax ratios.

²The methodology developed in Mendoza, Razin, & Tesar (1994) has also been used in Razin, Sadka, & Swagel (1998) to test the effect of taxes on migration, in Mendoza, Milesi-Ferretti, & Asea (1997) to test for the impact of the tax structure on economic growth, and Mendoza & Tesar (1998) have employed the methodology to simulate the effect of US tax reforms on US and European welfare in a real business cycle model. Several other studies also use or develop tax ratios, see, for example, Lucas (1990), Eurostat (1997), the Directorate General II of the European Commission (1997), Kramer (1998), Valenduc (1998), and the OECD (2000).

³See Volkerink & De Haan (2000) for an extensive survey.

2 The Methodology of Mendoza et al. (1994)

Table 1 summarises the methodology employed by Mendoza, Razin, & Tesar (1994) to calculate tax ratios. The personal income tax ratio (τ_{per}) is defined as the ratio of revenues from taxes on income, profits, and capital gains of individuals (category 1100 in the OECD *Revenue Statistics*) to the tax base that consists of wages and salaries (W), the operating surplus of unincorporated enterprises (OSPUE) and the property and entrepreneurial income of households (PEI).⁴ This ratio (τ_{per}) is subsequently used to calculate the labour income (τ_{lab}) and capital income tax ratio (τ_{cap}).

Table 1 here.

The labour income tax ratio is defined as the product of the personal income tax ratio (τ_{per}) and wages and salaries (W) plus total social security contributions (2000) and taxes on payroll and workforce (3000) over the sum of wages and salaries (W) plus employers' social security contributions (2200).

The capital income tax ratio is defined as the product of the personal income tax ratio (τ_{per}) and the sum of the operating surplus of private unincorporated enterprises (OSPUE), plus taxes on income, profits, and capital gains of corporations (1200) plus taxes on property (4100), and taxes on financial and capital transactions (4400) over the operating surplus of the economy (OS).

The consumption tax ratio (τ_{con}) is the ratio of taxes on consumption — the sum of general taxes on goods and services (5110), excises (5121), and some other, in terms of revenue almost negligible, taxes — to the consumption tax base. The consumption tax base is the sum of private (C) and public final consumption (G) net of consumption tax revenues (5110 + 5121). Furthermore, the compensation of employees providing government services (GW) is excluded.

The most serious problem with the approach of Mendoza, Razin, & Tesar (1994) involves using the personal income tax ratio as an intermediate step in calculating labour and capital income tax ratios. Income from labour, capital income and transfers is included in the 'tax base' of personal income. It is assumed that the same average tax rates apply to all these income categories. This assumption is implausible, since some income components are largely exempted from taxation, and many OECD countries apply different statutory tax rates to

⁴The four-digit figures refer to the headings of the OECD Revenue Statistics classification of taxes, the abbreviations refer to variables from the OECD National Accounts. More information is provided in Table 1.

different sources of income. Furthermore, some OECD countries tax (most) social security benefits, most do not, however. Therefore, ideally, either the tax base of the personal income tax ratio has to include social security contributions in these countries in order to be comparable to the one in other countries, or the income tax paid by benefit recipients has to be separated out of the tax that is allocated to labour and capital income.

There are several ways to tackle this problem. For some countries, a more specific decomposition can be made on the basis of the OECD Revenue Statistics because category 1100 is divided into category 1110 (taxes on income and profits) and 1120 (taxes on capital gains). If a further breakdown of category 1110 is available, the amount of taxes on wages and salaries can be identified and used. Unfortunately, this option is available for only three countries. A second possibility is that national authorities or some other source provides data needed to split income in category 1100.

Another crucial issue is the choice of the proper tax base. Mendoza, Razin, & Tesar (1994) use wages & salaries and social security contributions as the base for the labour income tax ratio. Since the taxes are related to total labour costs of employers, it is preferable to include employers' contributions for private pension and welfare plans. We therefore use the sum of Compensation of Employees (CoE) and taxes on payroll and workforce (3000) as the base for the labour income tax ratio.⁵ We also exclude taxes paid by the self-employed as income by self-employed is earned by a combination of capital and labour. A consistent approach implies that for the capital income tax ratio the taxes on payroll and workforce (3000) should be subtracted from the operating surplus of the economy (OS) in calculating the base for the capital income tax ratio. Consistency also requires the base of the consumption tax ratio to be gross. Gross final consumption includes final government consumption expenditure (wages of government employees). These expenditures are not subject to VAT, but represent consumption spending by households according to National Accounts conventions, so they should be included in the consumption tax base.

Based on the foregoing analysis we propose a modified methodology to calculate tax ratios as shown in the lower part of Table 1.⁶

⁵In contrast to the item Wages and Salaries, the item Compensation of Employees consists of wages and salaries, employers' contributions to social security contributions, and employers' contributions to private pension and social welfare plans.

⁶For a discussion of the other minor differences between both approaches, we refer to Volkerink & De Haan (2000).

3 New Calculations of Tax Ratios

As mentioned in Section 2, the most fundamental problem in constructing tax ratios lies in the calculation of the *personal income tax ratio*. We have used information provided by Eurostat (1997) and Valenduc (1998) to correct for the methodological weakness of previous calculations. The use of these sources implies that the sample of countries is limited to 8 (for the capital income tax ratio) or 9 (for the labour income tax ratio). Calculations for the consumption tax ratio can be done for all OECD countries, but we only report the results obtained for the 9 countries for which we were able to calculate the labour income tax ratio.

Figures 1 to 3 compare our ratios with the tax ratios reported by Mendoza, Milesi-Ferretti, & Asea (1997).⁷ If the line is flat and at 100%, the tax ratios match; if the line exceeds 100%, the tax ratios of Mendoza, Milesi-Ferretti, & Asea (1997) are lower, and vice versa.⁸

Figures 1–3 here.

It follows that the tax ratios calculated by Mendoza, Milesi-Ferretti, & Asea (1997) inaccurately capture both the levels and the trend in tax ratios for the sample of countries and for the time-period analysed. Their ratios may be simple to calculate, but the price is rather high as in many cases the use of more detailed information yields strikingly different numbers. A drawback of our approach is that — due to data problems — it can only be applied for a limited number of countries.

As explained in the Introduction, many studies use tax ratios to test certain hypotheses. For instance, Mendoza, Razin, & Tesar (1994) report the correlations between their tax ratios and some macroeconomic variables. They conclude that the savings rate is generally negatively related to the tax ratio on capital income. They report a similar relation between this tax ratio and the investment rate. The authors furthermore find a negative correlation between the sum of the labour income and consumption tax ratio and hours worked. For France, Germany, Italy and the United Kingdom, we have been able to redo this analysis using our tax ratios instead. Table 2 shows the results. It follows that the correlation for the savings rate and the capital income tax ratio has a sign opposite to that reported by Mendoza,

⁷The data as used in Mendoza, Milesi-Ferretti, & Asea (1997) are accessible at <http://www.econ.duke.edu/~mendozae/taxdata.pdf>. Our data are accessible at <http://www.eco.rug.nl/medewerk/bjorn/pdf/TRtables.pdf>.

⁸Since we have used more recent OECD data, there might be some differences with the results obtained by Mendoza, Milesi-Ferretti, & Asea (1997). Especially for the end of the sample period statistics are often revised after one or more years.

Razin, & Tesar (1994) for France and Germany. For Germany and the United Kingdom, we also find that the correlation between this tax ratio and investment has the opposite sign.

Table 2 here.

4 Concluding Remarks

In this note we have argued that the construction of tax ratios, as pioneered by Mendoza, Razin, & Tesar (1994), and updated by Mendoza, Milesi-Ferretti, & Asea (1997) is seriously flawed. Especially the way personal income tax revenues are attributed to labour and capital is criticised. Using information from national sources, we calculate more accurate tax ratios for eight (nine) OECD countries that differ substantially from those reported by Mendoza, Milesi-Ferretti, & Asea (1997). This result is relevant also from a policy perspective, since the results of studies in which these tax ratios are calculated play a role in the policy debate. For instance, the findings of Daveri & Tabellini (2000) are often cited in support of a co-ordinated change in the tax system in the European Union. It is believed that lowering taxes on labour will stimulate employment growth. Of course, the conclusions of this type of studies depend critically on the data used as illustrated by our replication of the correlations reported by Mendoza, Razin, & Tesar (1994).

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Table 1: Tax Ratios: Mendoza et al. (1994) vs. Volkerink & De Haan (2000)

Mendoza et al. (1994)		
Personal income tax ratio	τ_{per}	$1100/(W + \text{OSPUE} + \text{PEI})$
Labour income tax ratio	τ_{lab}	$(\tau_{\text{per}} \cdot W + 2000 + 3000)/W + 2200$
Capital income tax ratio	τ_{cap}	$(\tau_{\text{per}} \cdot (\text{OSPUE} + \text{PEI}) + 1200 + 4100 + 4400)/\text{OS}$
Consumption tax ratio	τ_{con}	$(5110 + 5121)/[C + G - \text{GW} - (5110 + 5121)]$
Volkerink & De Haan (2000)		
Labour income tax ratio	τ_{lab}	$(\alpha \cdot 1100 + 2100 + 2200 + 3000)/(\text{CoE} + 3000)$
Capital income tax ratio	τ_{cap}	$(\beta \cdot 1100 + 1200 + 4000 + 5125 + 5212 + 6100)/(\text{OS} - 3000)$
Consumption tax ratio	τ_{con}	$(5000 - 5125 - 5212 - \text{other})/(C + G)$

Note: α : the fraction of the revenues from personal income taxation (1100) that can be attributed to (employed) labour income. β : the fraction of the revenues from personal income taxation (1100) that can be attributed to capital income. other: other revenues from category 5000 that cannot be attributed to taxes on consumption. More details are provided in Volkerink & De Haan (2000).

Note: classification of the OECD *National Accounts* and *Revenue Statistics*.

OECD Revenue Statistics

1100	Taxes on income, profits, and capital gains on individuals
1200	Taxes on income, profits, and capital gains on corporations
2000	Social security contributions
2100	Social security contributions of employees
2200	Social security contributions of employers
3000	Taxes on payroll and workforce
4000	Taxes on property
4100	Recurrent taxes on immovable property, land taxes etc.
4400	Taxes on financial and capital transactions etc.
5000	Taxes on goods and services
5110	General taxes (on goods and services)
5121	Excises
5125	Taxes on investment goods
5200	Taxes on use of goods and performance of activities
5212	Motor vehicles duties not paid by households
6100	Other taxes paid by corporations

OECD National Accounts

OS	Operating surplus of corporate and quasi-corporate enterprises
OSPUE	Operating surplus of private unincorporated enterprises
W	Wages and salaries
PEI	Property and entrepreneurial income
CoE	Compensation of employees
C	Private final consumption expenditure
G	Government final consumption expenditure
GW	Compensation of employees of producers of government services

Table 2: Tax Ratios and Macroeconomic Variables

	Savings/GDP		Investment/GDP		Hours		Averages		
	mean	corr ($\tau_{\text{cap}}, \text{S}$)	mean	corr ($\tau_{\text{cap}}, \text{I}$)	mean	corr ($\tau_{\text{lab}} + \tau_{\text{con}}, \text{H}$)	τ_{cap}	τ_{lab}	
Austria	0.07	0.37	—	—	—	—	0.17	0.18	0.37
Belgium	0.11	—	0.10	—	105.25	-0.70	—	0.15	0.43
Finland	0.03	-0.12	0.12	-0.05	—	—	0.18	0.18	0.35
France	0.08	0.78	0.10	-0.55	107.04	-0.72	0.27	0.16	0.38
Germany	0.08	0.15	0.19	0.07	108.68	-0.80	0.62	0.13	0.35
Ireland	—	—	—	—	—	—	0.16	0.18	0.29
Italy	0.14	-0.72	0.07	-0.58	101.15	0.56	0.17	0.13	0.43
The Netherlands	0.09	-0.03	0.12	-0.12	107.02	-0.62	0.31	0.14	0.44
United Kingdom	0.04	-0.16	0.11	0.31	103.33	-0.65	0.46	0.13	0.28

Note: Data from OECD (1998), Bureau of Labor Statistics (2000), and Volkerink & De Haan (2000).

Figure 1: Labour Income Tax Ratio: our data vs. Mendoza et al. (1997)

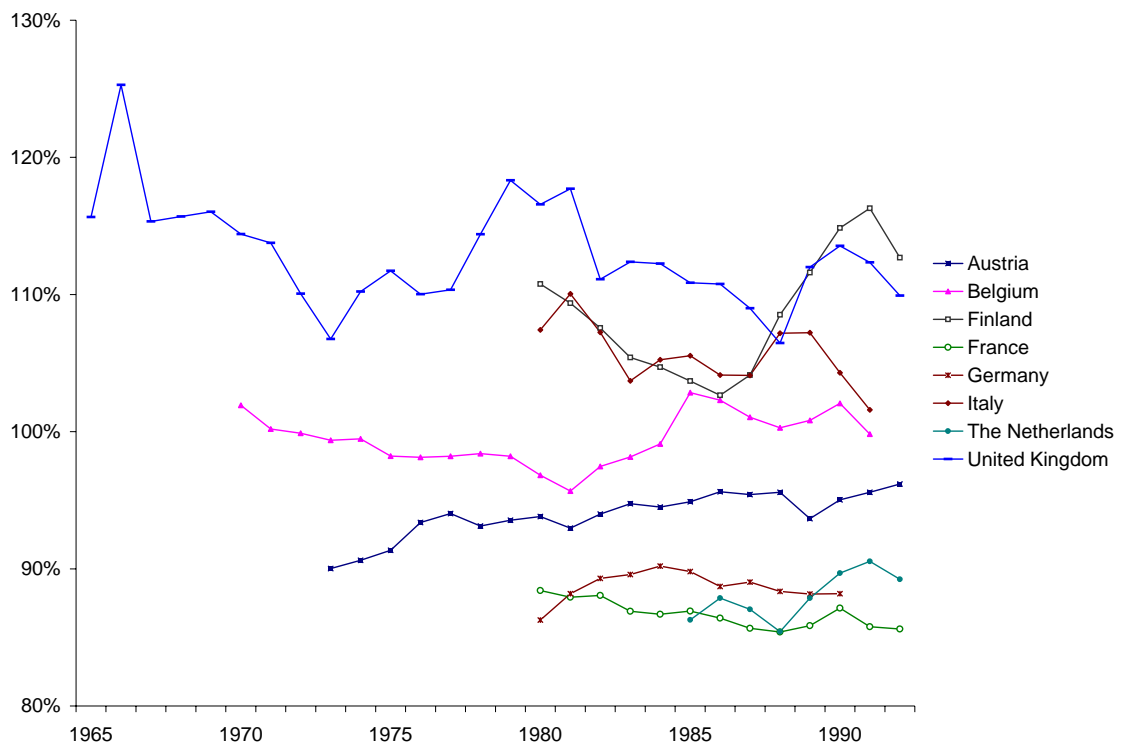


Figure 2: Capital Income Tax Ratio: our data vs. Mendoza et al. (1997)

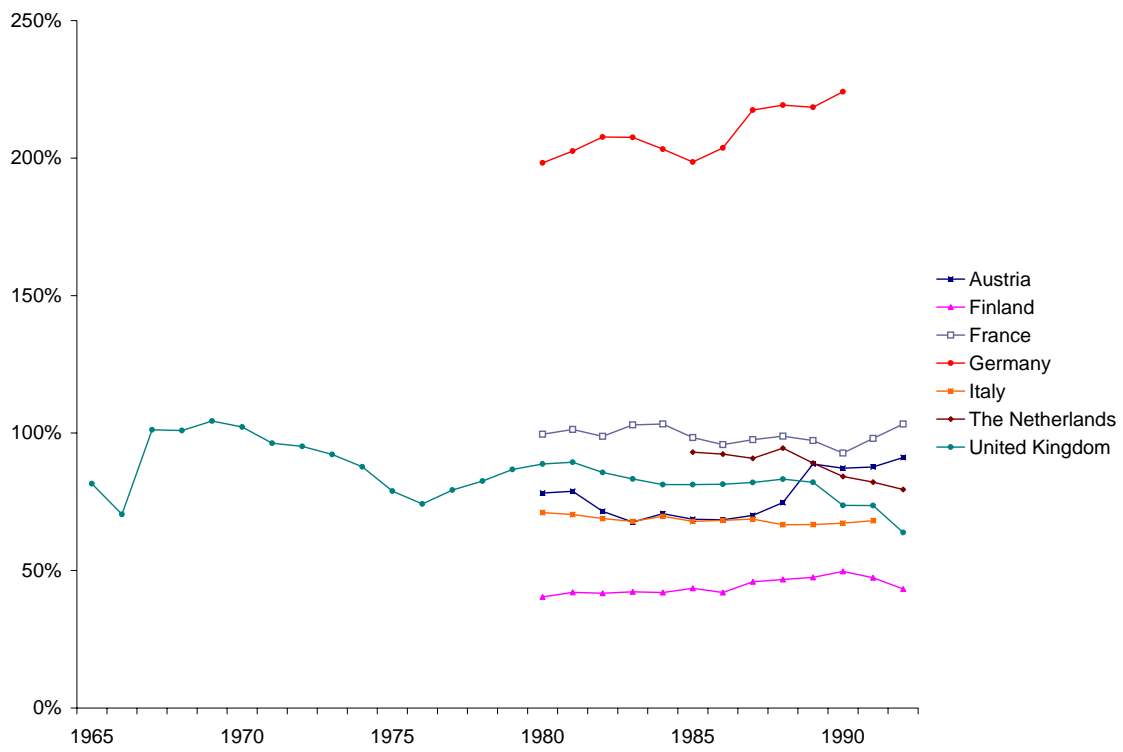


Figure 3: Consumption Tax Ratio: our data vs. Mendoza et al. (1997)

