

TAX PARAMETERS IN THE PORTUGUESE ECONOMY: PART I – INDIRECT TAXES*

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In the first of two twin papers, we focus on indirect taxes and formally discuss the correspondences between statutory and effective tax rates in the Portuguese economy. These correspondences depend on the details of the Portuguese tax law, on a wealth of data information, and on certain priors about the values of behavioural parameters in the economy. For each of the different tax margins, we choose a specification of the tax base that is standard in tax policy evaluation exercises, albeit necessarily only an approximation to the true tax base. In addition to the general correspondences, we present our own estimates of the effective tax rates at the different tax margins. More importantly, however, using the information in this paper, practitioners of tax policy evaluation can obtain their own estimates of the relevant tax parameters.

1. INTRODUCTION

The objective of this series of two papers is to establish the mapping between statutory and effective tax rates in the Portuguese economy. Ultimately, we address the question of how changes in statutory tax rates induce changes in effective tax rates. This is a critical question from the perspective of tax policy evaluation.

From time to time, the topic of tax reform re-enters the political arena. Tax reform proposals are invariably phrased in terms of changes in the statutory tax rates (see, for example, Cavaco Silva (1999), where the former Portuguese Prime Minis-

ter presents a comprehensive tax reform package for Portugal). This is understandable since statutory tax rates are under the direct jurisdiction of the legislative powers. Furthermore, statutory tax rates are easily available and readily understood by the general public.

From the standpoint of the practitioner of tax policy evaluation, the formulation of tax reform proposals in terms of statutory tax rates presents several challenges. In general terms this is because, from the perspective of tax policy evaluation, statutory tax rates are close to irrelevant (see, for example, Primarolo (2000), where the Paymaster General of the UK's Treasury addresses this point in the context of tax harmonization in the EU).

In fact, for the economic analysis of the incentives to work, consume, save and invest that are induced by the tax code what matters most is economic behaviour at the margin. As such, ideally, the proposed tax rate changes should be framed in

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terms of changes in the marginal tax rates. These, however, are notoriously difficult to obtain. Therefore, an approximation that is often used in tax policy evaluation is the effective tax rate.

The relationship between statutory and effective tax rates is a rather complex matter. It depends, first and foremost, on the details of the tax law, which was clearly not written by nor for economists or policy analysts. It also depends on behavioural parameters for the economy that are often difficult to identify and that, at any rate, reflect the priors of the tax policy analyst. Furthermore, it depends on data information which is either not available or comes from varied and not necessarily compatible sources.

The effective tax rate, τ , can be defined simply as the ratio between total tax revenues, T , and the tax base from which they were obtained, B , i.e.,

$$\tau = \frac{T}{B}.$$

Observed tax revenues, however, are the result of a myriad of tax rules. In reality, statutory tax rates, t , along with deductions, D , and tax credits, CR , are the instruments of tax legislation. A highly stylised description of how these three variables come together to determine tax revenues, in general, is

$$T = t(B - D) - CR.$$

Note that only when there are no credits and no deductions are effective and statutory tax rates equal, i.e., $\tau = t$.

In this highly simplified framework, changes in statutory tax rates lead to changes in effective tax rates according to

$$\frac{\partial \tau}{\partial t} = 1 - \frac{D}{B}.$$

Notice how this mapping is independent of the existence of credits. The effective tax rate, however, is not, i.e., $\partial \tau / \partial CR \neq 0$. Note also that, if there are no deductions but credits are non-zero, then the correspondence is one-to-one, even though effective and statutory tax rates differ by CR/B . In that case,

$$\tau = t - \frac{CR}{B}.$$

In addressing the relationship between the statutory tax rate and the effective tax rate from the perspective of tax policy evaluation there is an additional complication. Both the use of analytical instruments and the level of aggregation at which the analysis is done require a degree of abstraction and generalization, which would not be present in a framework of individual tax accounting. This means that many of the finer details of the tax law have to be ignored as the true tax base is approximated using aggregate macroeconomic data. This approach is well suited for mainstream tax policy analysis along the lines of, for example, Auerbach and Kotlikoff (1984, 1987), Ballard, Fullerton, Shoven and Whalley (1985), Bovenberg (1986), Fullerton and Gordon (1983), Goulder and Summers (1989), Goulder and Thalmann (1993), Kotlikoff (1995), Pereira (1994, 1999) and Shoven and Whalley (1984).

Finally, a word about data information and data sources. In the computation of the effective tax rate, every attempt was made to use all available information from 1990 to 1998. By using this time frame, we guarantee the use of the most recent tax data available. By using averages for this period, we attempt to capture long-term trends in the economy and thereby avoid business cycle effects and the effects of any other spurious economic events. Also, in the computation of the effective tax rate, it was inevitable to use data from different sources. This posed some compatibility problems between national account and public account data. As a quintessential example of this, there is no readily available data, on a national account basis, for tax revenues at the different tax margins we consider. Such a disaggregation only seems to exist on a public account basis. As such, the strategy we follow consists in using national account data (INE *Contas Nacionais*, several issues, and DGEFA, 1999) for the aggregates, and then using public account data (DGEP, 1999) to approximate the shares of each of the tax margins in total revenues.

In the first of a two part series, we focus on indirect taxes and we explore the relationship between statutory and effective tax rates at the most significant indirect tax margins in the Portuguese economy (Pereira and Rodrigues (2001) focuses on direct taxes). Indeed, value-added and excise taxes are considered in great detail. We present several

tables that document the technical details on the correspondences between statutory and effective tax rates at the different margins. We highlight not only the mathematical mapping but also the data information and the economic parameters necessary to establish such mappings. As such, the accompanying text is essentially a guided tour of the different tables complemented with a detailed reference to sources. For a comprehensive description of the Portuguese tax system, in legal terms, the reader is referred to CEF (1997) and KPMG (1997).

2. VALUE-ADDED AND EXCISE TAXES

2.1. General aspects

In Portugal, from 1990 to 1998, we estimate that value-added and excise tax revenues averaged 14.2% of GDP evaluated at market prices.

Under the Portuguese tax legislation (CIVA), the value-added tax (VAT, hereafter) is designated *imposto sobre o valor acrescentado*. All goods and services marketed and sold, whether produced domestically or imported, are liable to VAT as long as they are purchased for use within Portuguese territory. This implies that exports are, in effect, exempt from VAT.

In general terms, VAT is a tax on the purchase of final goods, and follows the general pattern of value-added taxes in most European countries. Being a value-added tax means that only the value that is added through an entrepreneurial activity to the inputs acquired is liable to this tax. Through a chain method, sellers then collect VAT on the value of the good or service sold, deduct the VAT they paid on their inputs and hand over the difference to the Treasury. It follows that, while the seller is the one that is held accountable to the Treasury for the VAT revenues, the incidence generally lies with the economic agents that purchase these final goods. This is because these goods and services will not be resold or incorporated in a new good or service that will be placed on the market and, as such, no VAT rebate is due on these purchases.

In addition to the VAT, the Portuguese tax system considers excise taxes, i.e., special indirect taxes levied on the consumption of specific goods. That is the case of alcohol and alcoholic beverages

(*imposto sobre bebidas alcoólicas e sobre o álcool* or IBAA), on the purchase of new automobiles (*imposto automóvel* or IA), on petroleum products (*imposto sobre produtos petrolíferos* or ISP), and finally, on tobacco (*imposto sobre o tabaco* or IST).

In practice, VAT is levied *ad valorem* as the last surcharge, i.e., the tax base is the total amount (including other taxes) that would be charged to a buyer if no VAT existed. As an example, for imported goods and services this would include import duties, where applicable. Moreover, goods that are subject to excise taxes are liable to VAT on an already engrossed tax base. These are two instances of double taxation in the Portuguese tax code (see Pereira and Rodrigues (2001) for other cases).

In addition to households, firms and the public sector also purchase goods and services that are liable to VAT and, in some cases, to excise taxes. Accordingly, we disaggregate total value-added and excise tax revenues, T_{VATET} , by five macroeconomic aggregates - private consumption, C , public consumption, CG , private investment, I , public investment in infrastructure and in transportation equipment, IG , and public investment in education, IH . That is,

$$T_{VATET} = T_{VATET,C} + T_{VATET,CG} + T_{VATET,I} + T_{VATET,IG} + T_{VATET,IH}$$

2.2. Value-added and excise taxes on private consumption spending

We estimate that VAT and excise tax revenues derived from private consumption expenditure activities, $T_{VATET,C}$, totalled 11.416% of GDP evaluated at market prices for the 1990-1998 period.

In Portugal, households consume a wide variety of goods and services, many of which are taxed at different rates. This is for two reasons. First, as referred to above, alcoholic beverages, petroleum products⁽¹⁾, automobiles and tobacco are all liable to specific excise taxes. Second, different categories of goods are effectively subject to different VAT rates.

The general VAT rate, which we denote by $t_{VAT,5}$, is 17%. The tax code considers another four

(1) Even though all petroleum products are subject to some form of excise taxes, we focus only on unleaded gasoline. Henceforth, we use gasoline and petrol interchangeably.

Table 1

VALUE-ADDED AND EXCISE TAXES ON PRIVATE CONSUMPTION

In statutory terms

$$T_{VATET,C} = [t_{VAT,1}\tilde{\theta}_{HH,1} + t_{VAT,2}\tilde{\theta}_{HH,2} + t_{VAT,3}\tilde{\theta}_{HH,3} + t_{VAT,4}\tilde{\theta}_{HH,4} + (1 + t_{VAT,5})\tau_{alcohol}\tilde{\theta}_{HH,alcohol} + (1 + t_{VAT,5})\tau_{tobacco}\tilde{\theta}_{HH,tobacco} + (1 + t_{VAT,5})\tau_{autos}\tilde{\theta}_{HH,autos} + (1 + t_{VAT,5})\tau_{petrol}\tilde{\theta}_{HH,petrol} + t_{VAT,5} \cdot (\tilde{\theta}_{HH,alcohol} + \tilde{\theta}_{HH,tobacco} + \tilde{\theta}_{HH,autos} + \tilde{\theta}_{HH,petrol} + \tilde{\theta}_{HH,rest})] \cdot (C^{MP} - T_{VATET,C}) \quad (1)$$

In effective terms

$$T_{VATET,C} = \tau_{VATET,C} C^{FC} \quad (2)$$

$$\tau_{alcohol} = ETR_{alcohol} (1 + t_{VAT,5}) / [\theta_{HH,alcohol} C^{MP} - (1 + t_{VAT,5}) ETR_{alcohol}] \quad (3)$$

$$\tau_{tobacco} = ETR_{tobacco} (1 + t_{VAT,5}) / [\theta_{HH,tobacco} C^{MP} - (1 + t_{VAT,5}) ETR_{tobacco}] \quad (4)$$

$$\tau_{autos} = ETR_{autos} (1 + t_{VAT,5}) / [(\theta_{HH,autos} C^{MP} + \theta_{Firms,autos} I^{MP} + \theta_{PS,autos} CG^{MP}) - (1 + t_{VAT,5}) ETR_{autos}] \quad (5)$$

$$\tau_{petrol} = ETR_{petrol} (1 + t_{VAT,5}) / [(\theta_{HH,petrol} C^{MP} + \theta_{Firms,petrol} I^{MP} + \theta_{PS,petrol} CG^{MP}) - (1 + t_{VAT,5}) ETR_{petrol}] \quad (6)$$

How a change in the statutory general VAT rate alters the effective tax rate $\tau_{VATET,C}$

$$\frac{\partial \tau_{VATET,C}}{\partial t_{VAT,5}} = \tilde{\theta}_{HH,rest} + \tilde{\theta}_{HH,autos} (1 + \tau_{autos}) + \tilde{\theta}_{HH,petrol} (1 + \tau_{petrol}) + \tilde{\theta}_{HH,alcohol} (1 + \tau_{alcohol}) + \tilde{\theta}_{HH,tobacco} (1 + \tau_{tobacco}) \quad (7)$$

Data

$$T_{VATET} = 0.142Y^{MP}, C^{MP} = 0.649Y^{MP}, T_{VATET,C} = 0.11416Y^{MP},$$

$$ETR_{alcohol} = 0.159\%Y^{MP}, ETR_{autos} = 0.8566\%Y^{MP}, ETR_{petrol} = 2.752\%Y^{MP}, ETR_{tobacco} = 0.7418\%Y^{MP}$$

Parameters

$$\tilde{\theta}_{HH,1} = 0.08740, \tilde{\theta}_{HH,2} = 0.17595, \tilde{\theta}_{HH,3} = 0.02364, \tilde{\theta}_{HH,4} = 0.11086, \tilde{\theta}_{HH,rest} = 0.44924$$

$$\tilde{\theta}_{HH,alcohol} = 0.01239, \tilde{\theta}_{HH,autos} = 0.10436, \tilde{\theta}_{HH,petrol} = 0.02735, \tilde{\theta}_{HH,tobacco} = 0.00687$$

See Table 2 for an average household's nominal budget shares.

The calculated effective tax rate

$$\tau_{VATET,C} = 0.21345$$

See Table 2 for the different effective tax rates for the several categories.

The calculated differential effect for the general VAT rate

$$\frac{\partial \tau_{VATET,C}}{\partial t_{VAT,5}} = 0.674022$$

Sources: DGEP (1999), INE (1997), INE *Contas Nacionais* Authors' calculations.

expenditure categories that benefit from progressively lower value-added tax rates, i.e., $t_{VAT,5} > t_{VAT,4} > t_{VAT,3} > t_{VAT,2} > t_{VAT,1}$. In what follows, we detail the composition of these four additional expenditure categories.

Category 4 encompasses goods like oils, fats, coffee, tea, cocoa, mineral waters, and restaurant tabs that are subject to a rate of $t_{VAT,4} = 12\%$. Also included in this category are general expenditures from Azores and Madeira on goods and services which, if sold on the continent, would pay the general VAT rate, $t_{VAT,5}$ but which enjoy a reduced rate of 12% in these regions. Category 3 is created to accommodate the fact that certain fish, meat, milk and dairy products pay a reduced rate of 5%. Similar products, however, like yoghurts pay 12%, and shellfish pay the general rate of 17%. We assume that the applicable rate for this category is $t_{VAT,3} = 6\%$. In turn, Category 2 is made up of goods and services like fruit, vegetables, grain, potatoes, water, electricity, public transportation, medicine, hotels and cultural shows that pay $t_{VAT,2} = 5\%$. Finally, goods belonging to category 1 pay the lowest VAT rate. Essentially, these are the goods and services that, if sold on the continent, would be liable to a value-added tax rate of $t_{VAT,2}$. This suggests that the islands of Açores and Madeira enjoy yet another special regime.

To proceed, we need to know the fraction of a representative household's budget that is spent on each of nine expenditure categories — five for VAT rates and four for goods subject to excise taxes in addition to the VAT. To retrieve these

budget shares, we resort to INE (1997), a 1994 household budget survey, and adjust the information therein to account for business cycle effects, since 1994 was a year of recession. Essentially, we have increased the shares of automobiles, gasoline and tobacco at the expense of foodstuffs. Therefore, the adjusted budget shares, $\theta_{HH,1}, \theta_{HH,2}, \theta_{HH,3}, \theta_{HH,4}, \theta_{HH,alcohol}, \theta_{HH,petrol}, \theta_{HH,tobacco}$, and $\theta_{HH,rest}$, presented as column five in Table 2 reflect our priors based on the available published information as to the fraction of household consumption expenditure valued at market prices, C^{MP} , that is allocated to each expenditure category.

The information that we have obtained on budget shares, naturally, is defined in terms of market prices. These market prices include, in addition to the factor cost, the excise tax and the VAT payments. This introduces the difference between consumption spending at market prices, C^{MP} , and at factor cost, C^{FC} , or net of tax payments. Dividing a macroeconomic variable, X , evaluated at market prices, X^{MP} , by the corresponding effective value-added and excise tax rate, $1 + \tau_{VATET,X}$, we obtain the variable evaluated at factor cost, $X^{FC(2)}$.

To pursue the calculation of effective tax rates per expenditure category, we need to transform the budget shares, at market prices, into real budget shares at factor cost. For alcoholic beverages, for example, the consumer pays an amount of

(2) Note that here we have ignored the subsidies component of the market price value, and thus we somewhat underestimate the true value of the factor cost variable

Table 2

TAX PARAMETERS RELATED TO THE TAXATION OF PRIVATE CONSUMPTION

Category j	τ_j	$t_{VAT,j}$	Budget shares in 1994 (INE)	$\theta_{HH,j}$	$\tau_{VATET,j}$
(1).....	-	4%	0.07491	0.07491	4.000%
(2).....	-	5%	0.16225	0.15225	5.000%
(3).....	-	6%	0.02065	0.02065	6.000%
(4).....	-	12%	0.13178	0.10232	12.000%
(Alcohol).....	23.999%	17%	0.01481	0.01481	45.079%
(Autos).....	12.214%	17%	0.07291	0.11291	31.290%
(Petrol).....	161.713%	17%	0.02855	0.06900	206.204%
(Tobacco).....	201.795%	17%	0.01099	0.02000	353.100%
(Rest).....	-	17%	0.48315	0.43315	17.000%

Sources: DGEP (1999), INE (1997), INE *Contas Nacionais*, Authors' calculations.

$\theta_{HH,alcohol} C^{MP}$, which includes both kinds of taxes, but only consumes the equivalent to $\tilde{\theta}_{HH,alcohol} C^{FC}$, where $\tilde{\theta}_{HH,alcohol}$ is the share of *real* consumption, C^{FC} , that is allocated to alcohol.

Furthermore, note that if a household purchases a good valued at x , that is subject to an excise tax at an effective rate of τ and a statutory value-added tax rate of t , then the total amount paid will be $(1+t)(1+\tau)x$, which will include $[t+(1+\tau)]x$ in consumption taxes. This suggests that we define the effective value-added and excise tax rate as is computed by deflating the respective total expenditure, valued at market prices, as $\tau_{VATET} = t + (1+t)\tau$. Thus, total consumption expenditure, evaluated at factor cost, C^{FC} , is computed by deflating the respective total expenditure, valued at market prices, C^{MP} , by $1 + \tau_{VATET,C}$ the *effective* value-added and excise tax rate levied on total consumption expenditure.

Using alcoholic beverages as an example again, with an effective excise tax of $\tau_{alcohol}$ and a general VAT rate of $t_{VAT,5}$, nominal and real budget shares for alcoholic beverages are related according to

$$\theta_{HH,alcohol} C^{MP} = (1 + t_{VAT,5})(1 + \tau_{alcohol}) \frac{\tilde{\theta}_{HH,alcohol} C^{MP}}{1 + \tau_{VATET,C}}.$$

This formula suggests that one can easily determine the real budget share for any expenditure category j , $\tilde{\theta}_j$, as

$$\tilde{\theta}_j = \frac{\theta_j(1 + \tau_{VATET})}{(1 + \tau_j)(1 + t_{VAT,j})}.$$

The only missing information we still need, relates to the *effective* excise tax rates, the calculation of which we turn to next. Appealing to the definition of the effective tax rate, and using the alcoholic beverages expenditure category as an example once more, the effective excise tax rate, $\tau_{alcohol}$, that is levied on the real consumption of alcohol, $\tilde{\theta}_{HH,alcohol} C^{FC}$, can easily be computed as the ratio between excise tax revenues, ETR, and the relevant tax base, that is

$$\tau_{alcohol} = \frac{ETR_{alcohol}}{\tilde{\theta}_{HH,alcohol} C^{FC}}.$$

Note, however, that because the real budget share depends on the effective excise tax rate, i.e., $\tilde{\theta}_{HH,alcohol}(\tau_{alcohol})$, to determine a value for $\tau_{alcohol}$, one

must factor out this variable from the above equality. This yields equation (3) in Table 1.

For the remaining three kinds of goods that are subject to excise taxes — petroleum products, automobiles, and tobacco — the effective excise tax rates, τ_{petrol} , τ_{autos} and $\tau_{tobacco}$, respectively, are easily determined using the same procedure. Data on excise tax revenues refer to 1995 and were taken from INE, *Contas Nacionais*. Note, however, that while we assume that tobacco and alcoholic beverages are only consumed by households, gasoline and new automobiles are also purchased by firms and by the public sector. This fact suggests that, to calculate τ_{autos} and τ_{petrol} , the relevant tax bases must include the economy-wide purchases of each type of good. For new automobiles, in particular,

$$\tau_{autos} = \frac{ETR_{autos}}{\tilde{\theta}_{HH,autos} C^{FC} + \tilde{\theta}_{Firms,autos} I^{FC} + \tilde{\theta}_{PS,autos} IG^{FC}}$$

There is a wide selection of statutory tax rates to choose from when establishing the relationship between changes in statutory and effective tax rates. For illustration purposes, and because it is the most significant indirect tax margin, we choose to determine how a change in the general VAT rate, $t_{VAT,5}$, would induce changes upon the effective value-added and excise tax rate collected on private consumption purchases. The relevant partial derivative, $\partial\tau_{VATET,C}/\partial t_{VAT,5}$, is equation (7) in Table 2.

In obtaining this effect, it should be noted that the real budget shares, and the effective excise tax rates, τ_j , are considered known primitives that do not vary when the general statutory value-added tax rate changes. Furthermore, it is assumed that whatever changes occur in tax rates at the statutory level, the composition of a representative household's consumption bundle, in terms of the nine different expenditure categories, remains unchanged. This means that a change in the statutory tax rate only imparts changes to aggregate consumption through the effect it has upon the effective tax rate. To us, this top-down approach seems the most relevant when evaluating alternative tax policies at an aggregate level.

Table 3

VALUE-ADDED AND EXCISE TAXES ON OTHER SPENDING

In statutory terms

$$T_{VATET,I} = (I^{MP} - T_{VATET,I}) [t_{VAT,5} (\rho_I + \tilde{\theta}_{Firms,autos} + \tilde{\theta}_{Firms,petrol}) + \tilde{\theta}_{Firms,autos} (1 + t_{VAT,5}) \tau_{autos} + \tilde{\theta}_{Firms,petrol} (1 + t_{VAT,5}) \tau_{petrol}] \quad (8)$$

$$T_{VATET,CG} = (CG^{MP} - T_{VATET,CG}) \left[1 - \frac{Wages_{PS,CG}}{CG^{MP}} (1 + \tau_{VATET,CG}) \right] [t_{VAT,5} + \tilde{\theta}_{PS,petrol} (1 + t_{VAT,5}) \tau_{petrol}] \quad (9)$$

$$T_{VATET,IG} = (IG^{MP} - T_{VATET,IG}) \left[1 - \frac{Wages_{PS,IG}}{IG^{MP}} (1 + \tau_{VATET,IG}) \right] [t_{VAT,5} + \tilde{\theta}_{PS,autos} (1 + t_{VAT,5}) \tau_{autos}] \quad (10)$$

$$T_{VATET,IH} = (IH^{MP} - T_{VATET,IH}) \left[1 - \frac{Wages_{PS,IH}}{IH^{MP}} (1 + \tau_{VATET,IH}) \right] t_{VAT,5} \quad (11)$$

In effective terms

$$T_{VATET,I} = \tau_{VATET,I} I^{FC}, \quad T_{VATET,CG} = \tau_{VATET,CG} CG^{FC}, \quad T_{VATET,IG} = \tau_{VATET,IG} IG^{FC}, \quad T_{VATET,IH} = \tau_{VATET,IH} IH^{FC} \quad (12,13,14,15)$$

How a change in the statutory general VAT rate alters the effective tax rate

$$\frac{\partial \tau_{VATET,I}}{\partial t_{VAT,5}} = \rho_I + \tilde{\theta}_{Firms,autos} (1 + \tau_{autos}) + \tilde{\theta}_{Firms,petrol} (1 + \tau_{petrol}) \quad (16)$$

$$\frac{\partial \tau_{VATET,CG}}{\partial t_{VAT,5}} \left(1 - \frac{Wages_{PS,CG}}{CG^{FC}} \right) (1 + \tilde{\theta}_{PS,petrol} \tau_{petrol}) \quad (17)$$

$$\frac{\partial \tau_{VATET,IG}}{\partial t_{VAT,5}} = \left(1 - \frac{Wages_{PS,IG}}{IG^{FC}} \right) (1 + \tilde{\theta}_{PS,autos} \tau_{autos}), \quad \frac{\partial \tau_{VATET,IH}}{\partial t_{VAT,5}} = 1 - \frac{Wages_{PS,IH}}{IH^{FC}} \quad (18,19)$$

Data

$$I^{MP} = 0.215Y^{MP}, \quad T_{VATET,I} = 0.0184Y^{MP}, \quad CG^{MP} = 0.111Y^{MP}, \quad T_{VATET,CG} = 0.00471Y^{MP},$$

$$IG^{MP} = 0.038Y^{MP}, \quad T_{VATET,IG} = 0.00380Y^{MP}, \quad IH^{MP} = 0.065Y^{MP}, \quad T_{VATET,IH} = 0.00092Y^{MP},$$

$$\theta_{PS,autos} = 0.10735, \quad \theta_{PS,petrol} = 0.0218, \quad \rho_I = 0.32, \quad \theta_{Firms,autos} = 0.06848, \quad \theta_{Firms,petrol} = 0.02283,$$

$$\frac{Wages_{PS,CG}}{CG^{MP}} = 0.7269, \quad \frac{Wages_{PS,IG}}{IG^{MP}} = 0.3535, \quad \frac{Wages_{PS,IH}}{IH^{MP}} = 0.9025$$

Parameters

$$\tilde{\theta}_{PS,autos} = 0.0909, \quad \tilde{\theta}_{PS,petrol} = 0.0074, \quad \tilde{\theta}_{Firms,autos} = 0.0570, \quad \tilde{\theta}_{Firms,petrol} = 0.0081$$

The calculated effective tax rates

$$\tau_{VATET,I} = 0.09365, \quad \tau_{VATET,CG} = 0.04431, \quad \tau_{VATET,IG} = 0.11111, \quad \tau_{VATET,IH} = 0.01438$$

The calculated differential effects for the general VAT rate

$$\frac{\partial \tau_{VATET,I}}{\partial t_{VAT,5}} = 0.40530, \quad \frac{\partial \tau_{VATET,CG}}{\partial t_{VAT,5}} = 0.24377, \quad \frac{\partial \tau_{VATET,IG}}{\partial t_{VAT,5}} = 0.61396, \quad \frac{\partial \tau_{VATET,IH}}{\partial t_{VAT,5}} = 0.08454$$

Sources: AECOPS (1996), DGCP (1997), DGEP (1999), Authors' calculations.

2.3. Value-added and excise taxes on other spending activities

We estimate that VAT and excise tax revenues derived from private investment spending activities, $T_{VATET,I}$, averaged 1.841% of GDP at market prices for the 1990-1998 period.

We assume that all private investment expenditures, with the exception of automobiles, $\tilde{\theta}_{Firms,autos} I^{FC}$, petroleum products, $\tilde{\theta}_{Firms,petrol} I^{FC}$, and building or infrastructure investment, $\rho_I I^{FC}$ (AECOPS, 1996), are exempt from value-added tax (see equation 8 in Table 3). In addition, banks and insurance firms cannot deduct any of the VAT paid on their inputs. Clearly, the classification of petroleum products as private investment could be questioned. We use this approach because it is a particularly convenient way of capturing how an increase in the price of fuel affects production costs.

In turn, we estimate that value-added and excise tax revenues derived from public consumption, $T_{VATET,CG}$, public investment in infrastructure and automobiles, $T_{VATET,IG}$, and public investment in education, $T_{VATET,IH}$, averaged 0.471%, 0.380% and 0.092% of GDP at market prices respectively, for the period 1990-1998.

Looking at equation (9) in Table 3, we see that public consumption expenditures can be decomposed into three categories — public sector wages (excluding wages related to public investment and investment in education activities), petroleum products, and all the rest. The budget shares for

these categories were taken from *INE, Contas Nacionais* and DGCP (1997).

Wage expenditure is distinct from the remaining outlays in that it is exempt from value-added and other indirect taxes. Data on public sector wages, decomposed by economic activity, $Wages_{PS,CG}$, $Wages_{PS,IG}$ and $Wages_{PS,IH}$, were obtained residually after plugging in all the known parameters in equations (9-11) of Table 3. These values are broadly in line with those of *INE, Contas Nacionais*.

Consideration of other public spending categories is justified by different excise taxes inciding on such expenditures. These imply differentiated effective tax rates by expenditure category. In terms of public investment in infrastructure and automobiles, and public investment in education, all non-wage related expenditures are assumed to be subject to the general value-added tax rate. Note that, in addition to $t_{VAT,5}$ public spending on new automobiles is surcharged with an excise tax at the effective rate of τ_{autos} .

The mappings between changes in statutory and in effective tax rates are easily determined and result in equations (16-19) in Table 3. To obtain the effective value-added and excise tax on private investment spending, for example, all one must do is equalize expressions (8) and (12), equations for the calculation of total tax revenues in statutory and effective terms respectively. Note that, in calculating the differential effects, we assume that $Wages_{PS,CG} / CG^{FC}$, $Wages_{PS,IG} / IG^{FC}$ and $Wages_{PS,IH} / IH^{FC}$ remain invariant to changes in $t_{VAT,5}$.

3. SOME CONCLUDING REMARKS

In this paper, we focus on indirect taxes and we formally discuss the correspondences between statutory and effective tax rates in the Portuguese economy. Value-added and other indirect taxes are considered in great detail. The correspondences between statutory and effective tax rates depend on the details of the Portuguese tax law and on a wealth of data information, as well as on certain priors about the values of behavioural parameters in the economy. In addition to the general correspondences between statutory and effective tax rates, we present our own estimates of the effective tax rates at the different tax margins. In doing so, a detailed tax information was organized in a systematic way that is particularly useful for tax policy evaluation and the main characteristics of the Portuguese tax system, if not all its accounting details, were sketched and parameterised.

The information in this paper was recently put to good use by Pereira and Rodrigues (2000a, 2000b), in the context of an ongoing research project on tax reform in Portugal. More importantly, however, using the technical information in this paper, practitioners of tax policy evaluation can obtain estimates of the relevant tax parameters to be used in their own work.

REFERENCES

- Associação de Empresas de Construção e Obras Públicas, AECOPS, (1996), *Relatório da Construção*.
- Auerbach, A., and L. Kotlikoff, (1984), "Social Security and the Economics of the Demographic Transition", *Working paper*, The Brookings Institution.
- Auerbach, A., and L. Kotlikoff, (1987), *Dynamic Fiscal Policy*, Cambridge University Press.
- Ballard, C., D. Fullerton, J. Shoven, and J. Whalley, (1985), *A General-Equilibrium Model for Tax Policy Evaluation*, University of Chicago Press for the National Bureau of Economic Research: Chicago, IL.
- Bovenberg, L., (1986), "Capital Income Taxation in Growing Open Economies", *Journal of Public Economics*, 31: 347-346.
- Cavaco Silva, A., (1999), "Um Choque Fiscal Precisa-se", in *Diário de Notícias*, p. 41, June 18th.
- Centro de Estudos Fiscais, CEF, (1997), *The Portuguese Tax System*, Direcção-Geral de Contribuições e Impostos, DGCI, Ministério das Finanças.
- Direcção-Geral de Contabilidade Pública, DGCP, (1997), *Conta Geral do Estado*, Ministério das Finanças.
- Directorate-General for Economic and Financial Affairs, DGEFA, (1999), *European Economy – Statistical Annex: Long-Term Macroeconomic Series*, European Commission.
- Direcção-Geral de Estudos e Previsão, DGEP, (September 1999), *The Portuguese Economy – Statistical Annex*, Ministério das Finanças.
- Fullerton, D., and R. Gordon, (1983), "A Reexamination of Tax Distortions in General-Equilibrium Models", in *Behavioral Simulation Methods in Tax Policy Analysis*, ed. M. Feldstein, University of Chicago Press: Chicago, IL.
- Goulder, L., and L. Summers, (1989), "Tax Policy, Asset Prices, and Growth: A General-Equilibrium Analysis", *Journal of Public Economics*, 38: 265-290.
- Goulder, L., and P. Thalmann, (1993), "Approaches to Efficient Capital Taxation: Leveling the Playing Field vs. Living by the Golden Rule", *Journal of Public Economics*, 50: 169-196.
- Instituto Nacional de Estatística, INE, (1997), *Inquérito aos Orçamentos Familiares - 1994-1995*.
- Instituto Nacional de Estatística, INE, *Contas Nacionais*, several issues.
- Kotlikoff, L., (1995), "Privatization of Social Security: How it Works and Why it Matters", *Working paper 5330*, The National Bureau of Economic Research.
- KPMG, (1997), *European Tax Handbook*, KPMG, International Tax Services.
- Pereira, A., (1994), "On the Effects of Investment Tax Credits on Efficiency and Growth", *Journal of Public Economics*, 54: 437-462.
- Pereira, A., (1999), *A Reforma dos Sistemas de Segurança Social em Portugal: Uma Análise Dinâmica de Equilíbrio Geral*, Fórum de Administradores de Empresas, Lisboa.

- Pereira, A., and P. Rodrigues, (2000a), "On the Impact of a Tax Reform Package in Portugal", *mimeo*.
- Pereira, A., and P. Rodrigues, (2000b), "Strategies for Tax Reform in Portugal in the Context of the EMU", *mimeo*.
- Pereira, A., and P. Rodrigues, (2001), "Parâmetros Fiscais na Economia Portuguesa: Parte II – Impostos Directos", *Boletim Económico, Banco de Portugal* (forthcoming).
- Primarolo, D., (2000), "Troca de Informação Bancária é a Forma de Combater a Evasão", entrevista in *Diário Económico*, p. 4, 6 de Abril.
- Shoven, J., and J. Whalley, (1984), "Applied General-Equilibrium Models of Taxation and International Trade: An Introduction and a Survey", *Journal of Economic Literature*, 23: 1007-1051.