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VAT base broadening when the location of some consumption is mobile

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Abstract

If consumption can take place offshore for some items (such as banking services), the general presumption in favour of a broadly based VAT at a single rate (in the no labour–leisure choice case) breaks down. For such items, consumption taxes (VAT) are shifted backward to domestic producers while for non-mobile consumption taxes are shifted forward to consumers, and a broadly based single rate VAT will distort. Border tax propositions no longer hold, and income and sales taxes are no longer equivalent. No data are available which classifies consumption activity into mobile/non-mobile, so numerical calculations are presented for a stylized economy showing the configuration of optimal tax rates these features can yield. We provide examples of cases where a move from a narrow based tax to a lower rate equal yield broadly based tax is welfare worsening. This

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underscores the theme of the paper that in such cases a broadly based single rate VAT is typically not first best policy.

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1. Introduction

Recent papers on base broadening in the VAT have shown how traditional arguments in favour of a broadly based VAT at a low uniform rate can break down; if there is an underground economy (Piggott and Whalley, 2001); household production with market provided inputs enter (Sandmo, 1990), labour (or all factors of production) are internationally mobile (Lockwood et al., 1994), or other non-traditional elements appear. This short paper discusses the implications of another consideration for the appropriate design of the value added tax (VAT), whether there is choice of location of consumption for a subset of goods.

The motivation is tax treatment of such items as banking services, which if taxed domestically can be consumed off shore, and tourism services which are free of domestic tax when consumed abroad. If an economy is characterized by both forms of consumption, then in the small open economy case taxes on immobile consumption are passed forward to consumption while those on mobile consumption are passed backward to domestic producers (assuming there is no complete specialization). A uniform rate VAT, even with no labour–leisure choice, will be distortionary; income and sales taxes are no longer equivalent; and traditional border tax propositions break down. An optimal structure of consumption taxes with rates differing by commodity is called for.

No general propositions can be obtained as to what form the rate structure of a sales tax should take in such circumstances. There are also no firm data available on economies which enable a clear division between mobile and immobile consumption to be made, and so we use numerical simulation techniques to explore what might be involved. But we are able to show that it is simple to construct cases where a move from a narrow based sales tax to an equal yield broadly based VAT lowers welfare, and so taken alongside other recent papers, our results do bring into further question the usefulness of VAT base broadening. We also relate our discussion both to recent literature on cross border shopping (Nielsen, 2001) which is typically partial equilibrium and analyzes a single commodity in a multicountry Nash framework; and to the discussion of VAT base broadening with an informal sector due to Piggott and Whalley (2001) to which this analysis is related.

2. A simple VAT model with mobile consumption

To see the implications of choice of location of consumption for the design of a VAT, we consider a small open economy which is a taker of goods prices on world markets. In the two good case we consider,

one good can only be consumed at home (the immobile consumption good), and the other good can be consumed either abroad or at home (the mobile consumption good). A tax on consumption of the immobile good will be fully passed forward to consumers, while a tax on consumption of the mobile good will be passed backward to producers.

Thus, if $\bar{P}_M$ and $\bar{P}_{\mathrm{NM}}$ are the given world prices of the mobile and immobile consumption goods domestic prices to producers and consumers (superscripts P and C) are given by

$$P_M^P = \frac{\bar{P}_M}{1+t_M} \text{ and } P_{\mathrm{NM}}^P = \bar{P}_{\mathrm{NM}}, \tag{1}$$

$$P_M^C = \bar{P}_M \text{ and } P_{\mathrm{NM}}^C = (1+t_{\mathrm{NM}})\bar{P}_{\mathrm{NM}}. \tag{2}$$

The base for consumption taxes on good M becomes output Y_M since offshore consumption is tax free. For simplicity, if we assume there are both fixed and mobile factors ($\bar{F}$ and L) involved in the production of M and NM so as to rule out specialization in production,

$$Y_i = g_i\left(\bar{F}_i, L_i\right), \quad i = M,\mathrm{NM}. \tag{3}$$

In equilibrium, a market clearing wage, w^*, will be determined such that

$$w = P_i^P \frac{\partial g_i\left(\bar{F}_i, L_i\right)}{\partial L_i}, \quad i = M,\mathrm{NM} \tag{4}$$

and

$$L_M + L_{\mathrm{NM}} = \bar{L}. \tag{5}$$

Net trades, NT_i, are given by

$$\mathrm{NT}_i = C_i - Y_i, \quad i = M,\mathrm{NM} \tag{6}$$

where the C_i is consumption of the two goods derived from utility maximizing behaviour given the domestic prices.

In the single representative consumer case, the household budget constraint is given by

$$P_M^C C_M + P_{\mathrm{NM}}^C C_{\mathrm{NM}} = w\bar{L} + R + T \tag{7}$$

where R is rent and is given by the return to the fixed factors

$$R = \left(P_M^C Y_M - wL_M\right) + \left(P_{\mathrm{NM}}^P Y_{\mathrm{NM}} - wL_{\mathrm{NM}}\right) = \left(P_M^P Y_M + P_{\mathrm{NM}}^P Y_{\mathrm{NM}}\right) - w\bar{L}, \tag{8}$$

and T is tax revenue ($t_M P_M^P Y_M + t_{\mathrm{NM}} \bar{P}_{\mathrm{NM}} C_{\mathrm{NM}}$).

The model set out above, while simple, has a number of implications for the design of the VAT which differ from those of a competitive no labour–leisure small open price taking economy. Most if not all standard propositions that relate to the VAT in these cases break down, and so clear guidance on appropriate policy depends on specifics of functional forms and parameters.

2.1. A broadly based VAT

A well-known proposition for a small open economy is that a uniform rate non-distortionary VAT minimizes the dead weight loss of raising any given target tax revenue, T^*. In an economy with mobile consumption, this no longer follows.

This is because the effect of a tax at the same rate on the two goods is to generate a distortion in relative consumer and producer prices from world prices. It follows from Eqs. (1) and (2) that if $t_M=t_{\mathrm{NM}}=t$, then

$$\frac{P_M^C}{P_{\mathrm{NM}}^C}=\frac{\bar{P}_M}{(1+t)\bar{P}_{\mathrm{NM}}} \text{ and } \frac{P_M^P}{P_{\mathrm{NM}}^P}=\frac{\bar{P}_M}{(1+t)\bar{P}_{\mathrm{NM}}} \tag{9}$$

and these relative price ratios while equal will differ from relative world prices. An optimal non-uniform rate structure will apply, with rates depending on demand and production side elasticities and other parameters.

2.2. Equivalence of income and sales taxes

A further proposition for a conventional economy is that a uniform rate sales tax on both goods and a uniform rate income tax are equivalent in their impact. This is because each tax applies in a non-discriminatory manner to one of the two sides of the budget constraint.

In the presence of mobile consumption, however, this proposition also breaks down. This is because a tax on income (labour income plus rent plus transfers) applies equally to all items on the right hand side of the budget constraint (6), while a tax on consumption applies unequally to the two consumption goods due to the backward shifting of taxes on mobile consumption.

2.3. Non-neutrality of border tax adjustments

A further proposition in a conventional small open price taking economy is that a move from an origin (consumption) to a destination (production) based tax at the same rate should be neutral in its impact. This proposition is discussed in Whalley (1979) and Lockwood et al., 1994 who both show how a move from one basis to the other is equivalent to a change in the exchange rate (relative country price levels) and can be directly accommodated by such an adjustment. In the presence of mobile consumption a broadly based consumption and production tax are no longer equivalent because of the distortionary impact of a uniform rate consumption tax. A move between the origin and destination bases for a VAT or sales tax will distort trade, production, and consumption.

Lockwood et al. (1994) also show how international mobility of labour (or all factors for that matter) implies that the neutrality of tax basis switches breaks down since taxes cannot be shifted backward. There are parallels between this result and our analysis, but we deal with mobility of consumption decisions.

The model set out in Eqs. (1)–(8) can also be elaborated on in a number of ways which add additional richness, although none of these features will affect the basic model characteristic that uniform rate sales taxes no longer characterize optimal policy. One elaboration is through the introduction of a non-traded goods sector along with the traded mobile and non-mobile consumption goods. Another is through the

introduction of additional labour–leisure choice of consumers. Yet another is to introduce intertemporal structure into the model.

3. Some numerical analysis of appropriate VAT structure in the presence of mobile consumption

Most OECD economies exhibit some degree of non-uniformity in their sales/VAT rate structures. Commonly, a range of services, such as banking, insurance, and rental housing is either tax exempt or zero rated. Some countries explicitly zero rate food, sometimes limiting this to so-called basic foods (see Ab Iorwerth and Whalley (2002) for a discussion of Canadian treatment). A central policy issue with the

Table 1
Welfare impacts of alternative VAT treatment in stylized economies with mobile consumption

CES preferences σ=0.5	Cobb–Douglas preferences[a]	CES preferences σ=2.0
1. Base case with narrow VAT base		
L_M=100 and L_{NM}=50	L_M=100 and L_{NM}=50	L_M=100 and L_{NM}=50
Y_M=200 and Y_{NM}=100	Y_M=200 and Y_{NM}=100	Y_M=200 and Y_{NM}=100
C_M=225 and C_{NM}=75	C_M=225 and C_{NM}=75	C_M=225 and C_{NM}=75
P_M=1.0 and P_{NM}=1.0	P_M=1.0 and P_{NM}=1.0	P_M=1.0 and P_{NM}=1.0
t_M=0.25 and t_{NM}=0	t_M=0.25 and t_{NM}=0	t_M=0.25 and t_{NM}=0
w=1.0 and R=40	w=1.0 and R=40	w=1.0 and R=40
2. Calibration determined parameter values		
• Production $Y_i=\beta_i L_i^{\alpha i}$		
β_M=11.24682650 and β_{NM}=14.14213562		
α_M=0.625 and α_{NM}=0.500		
• Consumption–utility function		
$U=\left[\gamma_M^{\frac{1}{\sigma}} C_M^{\frac{\sigma-1}{\sigma}}+\gamma_{NM}^{\frac{1}{\sigma}} C_{NM}^{\frac{\sigma-1}{\sigma}}\right]^{\frac{\sigma}{\sigma-1}}$	$U=\left[\frac{C_M}{\gamma_M}\right]^{\gamma M}\left[\frac{C_{NM}}{\gamma_{NM}}\right]^{\gamma_{NM}}$	$U=\left[\gamma_M^{\frac{1}{\sigma}} C_M^{\frac{\sigma-1}{\sigma}}+\gamma_{NM}^{\frac{1}{\sigma}} C_{NM}^{\frac{\sigma-1}{\sigma}}\right]^{\frac{\sigma}{\sigma-1}}$
where $\gamma_M+\gamma_{NM}$=1	where $\gamma_M+\gamma_{NM}$=1	where $\gamma_M+\gamma_{NM}$=1
γ_M=0.75 and γ_{NM}=0.25	γ_M=0.75 and γ_{NM}=0.25	γ_M=0.75 and γ_{NM}=0.25
• Utility value and total income		
Utility value U=300	Utility value U=300	Utility value U=300
Total income I=300	Total income I=300	Total income I=300
3. Welfare impacts of alternative tax structure		
• Welfare gain (EV as % of income) from moving to optimal tax configuration		
Optimal tax rate structure		
t_M=0.1475 and t_{NM}=0.1893	t_M=0.1855 and t_{NM}=0.1151	t_M=0.2130 and t_{NM}=0.0645
Utility value U=300.8004	Utility value U=300.5057	Utility value U=300.2911
Total income I=314.6920	Total income I=308.8019	Total income I=304.1029
• Welfare impact of moving to uniform tax structure (EV as % of income)		
Uniform equal yield tax rate		
$t_M=t_{NM}$=0.1606	$t_M=t_{NM}$=0.1638	$t_M=t_{NM}$=0.1704
Utility value U=300.7856	Utility value U=300.4349	Utility value U=299.7152
Total income I=312.5263	Total income I=312.0450	Total income I=311.0379

[a] When share parameter in CES preferences are raised to the power $1/\sigma$ (to yield simpler demand functions) the limiting Cobb–Douglas form as σ approaches 1 is as shown.

VAT is thus how broad the coverage of the tax base should be. Most economists instinctively react in favour of base broadening proposals on the grounds they will lower rates and reduce distortions, but in the presence of mobile consumption things are no longer so clear.

Unfortunately, National Accounts Data in OECD economies are not organized in such a form that potentially mobile consumption expenditures can be easily identified. Consumption expenditures are organized by type (food, shelter, clothing) rather than using a classification which allows the degree of mobility of consumption to be directly assessed. Nonetheless, we are able to use numerical simulation to explore whether cases exist in which a narrow based tax on one good dominates a broadly based tax on both goods, and more generally what the optimal configuration of VAT rates across commodities looks like.

To do this we use traditional applied general equilibrium techniques of calibration to a base case followed by counterfactual equilibrium analysis. We use the same form of economy as set out in Section 2, using both CES and Cobb–Douglas preferences (in alternative experiments) and decreasing returns to scale (Ricardian) production to avoid specialization. We use a stylized base case in which output and consumption of the mobile and immobile goods implies share parameters in consumption of 0.75 and 0.25 and exponents on labour in production of 0.625 and 0.500. In the base case a 25% tax rate applies to mobile consumption. We use the GAMS solution software to solve for both calibrated parameter values and counterfactual equilibria.

Table 1 presents results for three cases, the first one where σ in CES consumption is 0.50, the second one where σ in (Cobb–Douglas) consumption is 1.00, the third one where σ in CES consumption is 2.00. In the third case, a move from a narrow based tax on non-mobile consumption to a broadly based tax on both goods is welfare worsening, in the other it is welfare improving. The base cases have the same consumption and utility values (even with different values of σ) since prices are set to unity. In this case the calibrated parameters remain the same. We consider two counterfactual equilibrium experiments for each of the model specifications. In one we compute optimal commodity tax rates; in the other we compare broadly based and narrowly based tax structures.

Optimal tax rate structures vary with σ. With σ=0.5 optimal tax rates are t_M=0.1475 and t_{NM}=0.1893, while with σ=2.0 optimal tax rates are t_M=0.2130 and t_{NM}=0.0645, t_M varies less than t_{NM}. And as noted above, when σ equals 2.0, a move to a broadly based tax is welfare worsening when σ equals 0.5 it is welfare improving. Fig. 1 reports the critical values of σ in these cases above which VAT base broadening is welfare worsening.

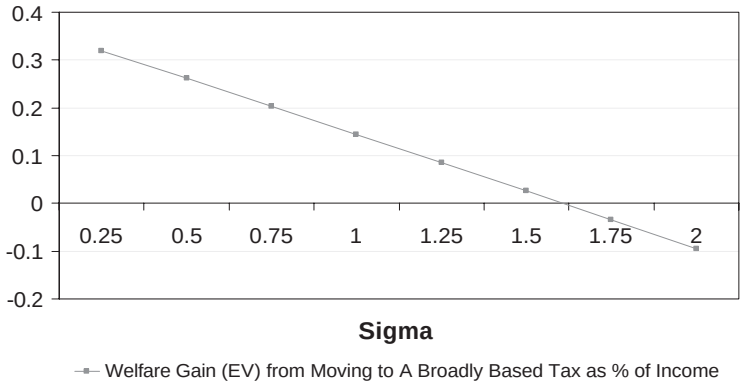

Fig. 1. Identifying the critical value of σ above which VAT base broadening is welfare improving.

These results and this simple model therefore suggest that a small departure from the standard model for the discussion of VAT base broadening can yield cases where base broadening is welfare inferior to the use of narrow based taxes, even though much of the VAT reform discussion is motivated by obtaining gains from base broadening. No algebraic or closed form results exist for the structure we use, but numerical results clearly point to caution on overly strong advocacy of broadly based single rate VAT structures. These findings are related to those in Piggott and Whalley (2001) for VAT base broadening in Canada in the presence of an informal sector and an underground economy. They are also relevant to discussion of commodity tax competition which is largely partial equilibrium and discusses Nash equilibrium for single commodity cases (see Nielsen (2001)).

4. Concluding remarks

This short paper discusses a case, seemingly neglected in literature, for which base broadening in a VAT involving a move to a uniform rate structure may be welfare worsening. When consumption of certain goods and services can move offshore (such as with banking and tourism), consumption taxes are shifted back to domestic producers of these items (assuming no specialization occurs). A broadly based VAT will therefore distort. The equilibrium structure we use is non-analytic and data are not available for actual economies on consumption of mobile and immobile types. We therefore use numerical simulation for hypothetical economies. We are able to relatively easily produce cases where base broadening is welfare inferior, and for the simple structure we use we are able to identify critical values of consumption side substitution elasticities above which such results occur. The implication seems to be caution in overly strong advocacy of broadly based VAT structures in the policy arena.

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