# An Evaluation of the Revenue side as a source of fiscal consolidation in high debt economies

Ritwik Banerjee

AARHUS
UNIVERSITY
BUSINESS AND SOCIAL SCIENCES
DEPARTMENT OF ECONOMICS AND BUSINESS

# An Evaluation of the Revenue side as a source of fiscal consolidation in high debt economies

**Ritwik Banerjee**[*]

Aarhus University, Denmark

**Abstract**

Unsustainable levels of debt in some European economies are causing considerable strain in the Euro area. Successful debt consolidation in high debt economies is one of the most important important objective for the European policy makers. I use a dynamic general equilibrium closed economy model to compute the dynamic Laffer Curves for Portugal, Ireland, Greece and Spain for different class of taxes. The general equilibrium effects of the interaction of labor tax, consumption tax and capital tax is demonstrated. Location of each economy on its Laffer curve suggests that there exists a scope for considerable revenue generation by raising consumption and labor tax rates but no such possibilities exist for capital tax rate. Thus revenue generation with certain tax rates as instruments, may hold a key to successful and sustained debt reduction.

**JEL Classification :** E60, E62, H30

**Keywords:** Laffer Curve, Public Debt, Portugal, Ireland, Greece, Spain

# 1    Introduction

As Greece was aided by IMF and EU with two massive bailout packages, first in April 2010 and then again in October 2011, tension mounted on the streets of Athens. The lenders however sought even greater interest for Greek debt and as credit rating agencies downgraded the credit rating for Greece several times in quick succession, a sovereign default seemed inevitable. The triumvirate of IMF, European Commission and ECB extended the packages after laying down conditions on stringent austerity measures, structural reforms to improve competitiveness of the economy and privatization of government assets to finance part of the debt pile. These measures are set to bring modest success as Greek public debt is projected to reduce to 120 per cent of GDP by 2020. Presently the policy makers of the beleaguered economy are pushing through further painful structural reforms in order to meet the requirements set out for itself. Despite staving off immediate crisis, the critical question that the policy makers face is how to reduce debt in a successful and sustainable way in the longer horizon for the four high debt European economies - Portugal, Ireland, Greece and Spain.

The conventional wisdom (Alesina and Ardagna (2009); Alesina and Perotti (1996)) for fiscal consolidation favors expenditure cuts over revenue generation, despite weak evidences for the former. However the arguments of expenditure reduction have not typically been accompanied by analytically computing the frontiers of tax revenue generation. Dynamic Laffer Curves, of which there have been considerable interest in the recent past, provide us with a useful tool whereby economies can be calibrated and the tax revenue - tax rate frontier be computed. Mankiw and Weinzierl (2006) led the interest in this area by presenting a dynamic scoring analysis and showing how static scores of taxes fail to factor in important general equilibrium changes - of behavior changes and other general equilibrium changes through changes in revenues from other taxes. Dynamic scores have since then been analyzed by Leeper and Yang (2008) and later by Trabandt and Uhlig (2011)[1] - they compute scores for different class of taxes for US and Europe; and by

---

[1]This paper was conceived after a reading of the NBER Working Paper version of Trabandt and Uhlig (2011).

Strulik and Trimborn (2012) who compute scores for different components of capital taxes. Notice that dynamic score, which is the derivatives of dynamic laffer curve at the calibrated tax rate, measures to what extent a change in tax rate affects change in total tax revenue. It does not however show how the tax revenue changes when the tax rates are spanned over its complete measure. It is here that this paper makes a contribution since a policy maker is typically interested in knowing the range for which an increase in tax rate will lead to an increase in tax revenue.

In this paper I argue that in addition to the received wisdom of fiscal consolidation through expenditure reduction, revenue generation through an increase in certain class of tax rates should also be considered. I compute the dynamic Laffer curves for the four economies by calibrating a flex-price Cass-Koopmans style model and show that there exists some room for tax rate maneuverability. The rest of the paper is organized as follows. Section 2 discusses major lessons from successful debt reductions in the past and lays out why the expenditure reduction may have a limited scope in these economies. Section 3 talks about how these economies went on to accumulate public debt and how the tax rates and revenue evolved over the last decade. After having motivated the issue at hand with descriptive analysis of historical data, in Section 4 I lay out the model and the calibration details and in section 5 I discuss the main results.

## 2    Debt, taxes and some past lessons

Historically successful debt reduction strategies as analyzed by Nickel et al. (2010) can be characterized into two main classes. One, robust macroeconomic environments help economies "grow out of debt" in the long run and two, the economies work towards maintaining primary budget surpluses through decisive and lasting fiscal consolidation efforts. They argue that the past experiences of successful debt reduction reiterate the efficacy of the latter. However the former has almost always

---

After a preliminary draft was independently prepared, the author found out that Mathias Trabandt and Harald Uhlig had been working on a follow up as well, the working paper version being Trabandt and Uhlig (2012). However there are important differences in the model set up.

followed as a consequence o the latter. For instance in Denmark public debt was reduced from 80 per cent in 1994 to 26.8 per cent in 2007 with an overall change in debt ratio of 53%. In Ireland public debt ratio reduced from 94% of GDP in 1994 to 24.9% in 2004; even Portugal and Spain reduced debt by 10% and 30% respectively. Each of these episodes of successful debt reduction results in sustained growth in the medium to long run. Also, evidence suggests that expenditure based methods have been more successful than revenue based methods so far as reducing debt is concerned - fiscal adjustments through spending cuts on transfers and government wage bill was favored by Alesina and Perotti (1996) to that by tax increases. This finding was subsequently reconfirmed by Alesina and Ardagna (2009) with data from 1970-2007. More recently Apergis et al. (2012) critically examine Greece and provide econometric evidence that increase in tax revenue leads to increase in government expenditure leaving fiscal deficit unchanged. This positive unidirectional causal relation stated above was proposed by Friedman (1978).

However one must note that it is often empirically impossible to clearly identify the underlying policy changes as most expenditure cut induced fiscal consolidation has been accompanied by structural reforms. The structural reforms often lead to an improvement in employment and in turn in revenue and expenditure scenario since higher employment results in higher tax revenue and lower welfare expenditure. Also in the light of recent instances it is amply clear that there is an enormous political cost associated with forced government employment reduction and wage cut. It is widely believed today that given the enormity and complexity of the current problem, any sustainable fiscal consolidation will require a multi-pronged strategy.

To understand why a range of strategies should be employed in order to bring down public debt to sustainable levels, one may decompose public debt conceptually into three main structural components - primary balance, real growth differentials and interest payments (Cottarelli et al. (2010)). Cafiso (2012) argues that the best ways of bringing down debt is by tackling primary balance in the first place as that in turn may have a second order effect on other other two. Though debt structuring (see Cabral (2010)) and managing public expenditure are seen as the way forward,

their painful effects on unemployment and long term growth, particularly of the latter, are well known. The other option which has not been adequately explored is the possibility of raising tax revenue in these economies, through an increase in tax rate which have over the years seen a secular decline.

Figure 1: Central Government Debt as a Percentage of GDP
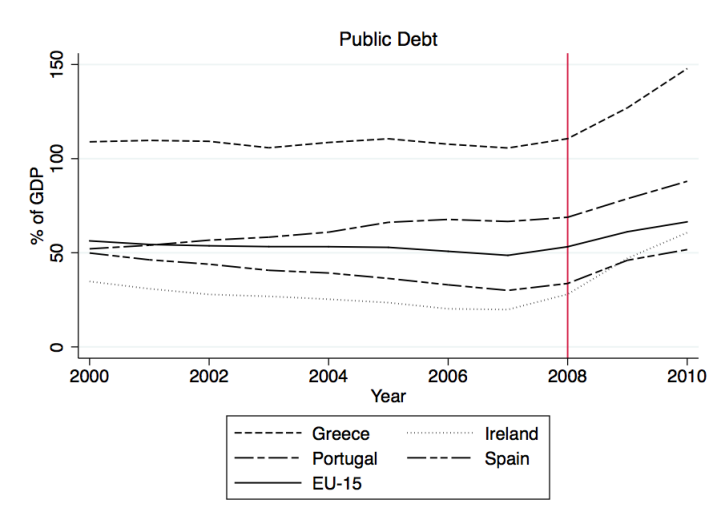


Source: OECD Stat.

How did the public debt and tax rates evolve during the first decade of 21st century in Europe? The rise in debt-GDP ratio began from 2007 though its major escalation started in 2008. Figure 1 shows how Greece[2] and Portugal, whose debt-GDP ratio[3] was already at unsustainable levels, escalated by 40 percentage points and 20 percentage points respectively in the period 2008-10. Spain and Ireland suffered similar fate as a hitherto stable debt-GDP ratio saw a rapid rise - over 30 percentage points in the case of Ireland in the same period. The situation has come to such a passé today that for successful fiscal consolidation of EU, it is now believed that the required average total debt reduction per country will have to be to the tune of 37 percentage points of GDP. Already the long austerity drive, coupled with over 15% unemployment and a deep recession is resulting in societal tensions as is evident from reports from many of these countries.

---

[2]Apergis et al. (2012) provides an excellent account of the macroeconomic crisis in Greece.

[3]We use central government debt as reported by OECD Stat. as a measure of debt in this case

Figure 2: Government Revenue, Expenditure and Borrowing
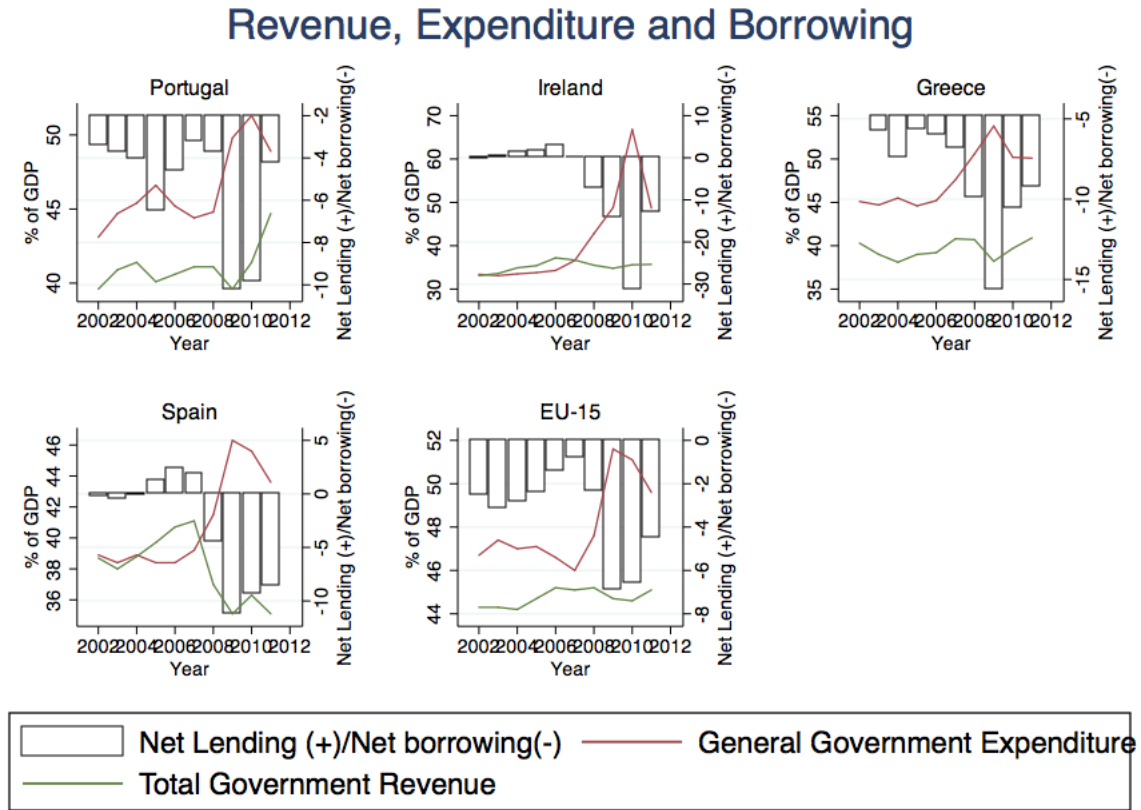


This paper does not concern itself with investigating the reasons for such sharp increase in debt-GDP ratio, nonetheless a look at Figure 2 gives a quick snapshot. As the financial crisis hit, government revenue fell in all countries, government expenditure continued to grow phenomenally. This was clearly the result of the expansionary stance taken by the governments financed by extraordinary levels of borrowing and this in turn blew the lid off the debt-GDP ratio.

Figure 3: Tax Revenue as a % of GDP

## Implied Tax Rates
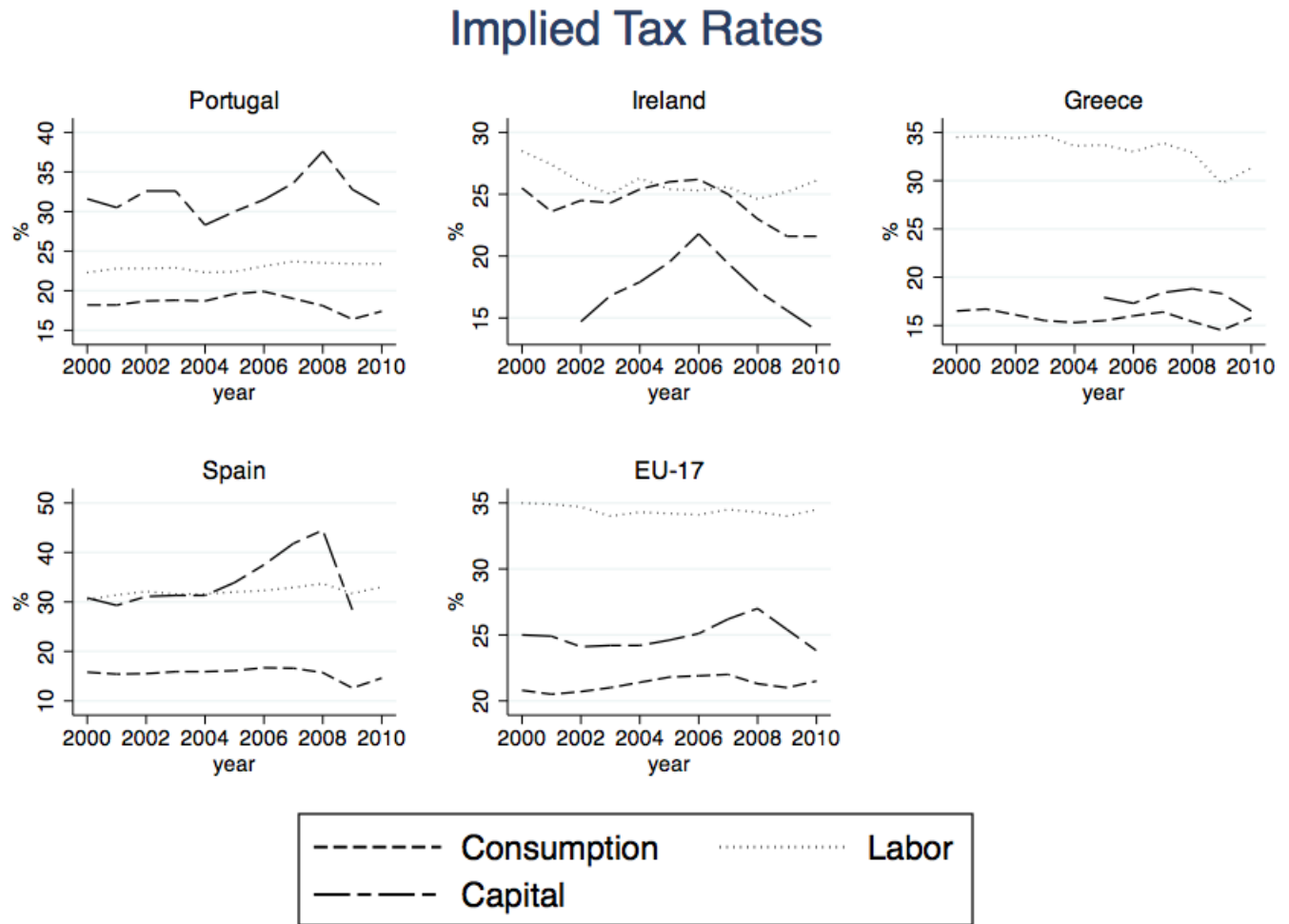


Now let us take a closer look at the national tax structures with data from Eurostat (2012). There has been a broad trend of declining tax rates in each of the countries under consideration - Portugal, Ireland, Greece, Spain when compared to the rest of Europe. Except for Greece the implied tax [4] rate for labor income is much less in these economies than the EU-17 average. Even in Greece the tax rate on labor income has declined by as much as 5 percentage points over the decade. Consumption tax rate has declined too post 2007-08 and in most of the above countries

---

[4]Eurostat (2012) defines implied or implicit tax rate as the ratio of total income over total tax revenue under that head.

this decline was sharp when compared to EU-17. Not surprisingly as shown in Table 1, Portugal is ranked 19th and Greece 21st in labour tax revenue, while Ireland is ranked 25th and Spain 27th in consumption tax revenue among all countries in EU-27 [5]. The overall tax revenue (including social security contribution) as a percentage of GDP remained at 31.5% for Portugal, 28.2% for Ireland, 31% for Greece and 31.9% for Spain, much lower than EU-27 average of 35.6% in 2010. Portugal in fact exhibits 8th lowest tax burden in EU-27. It currently has no wealth tax and in 2004 abolished gift and inheritance taxes. In Ireland, the proportion of total tax receipt coming from labor income is only 41.4%, much lower than EU-27 average of 47.3%. Further, in 2009 Ireland's total tax revenue to GDP reached the lowest value and remained at the same level in 2010 and this decline was mainly driven by a fall in VAT, personal income tax, other taxes on products (including import duties) and corporate income taxes. Similar trend of lower tax rates is also observed in Greece, as the implicit tax rate on consumption remained at 15.8% much lower than EU-27 average of 21.3%, ranking second lowest in whole of Euro area. Even the ITR on capital declined from 18.8% in 2008 to 16.5% in 2010 and remained well below the EU-27 average of 23.3%. In addition to this, there is no wealth tax after 2010 reforms. Economy of Spain also conforms to these tax rate trends, as it exhibits the lowest level of consumption tax revenue as a percentage of GDP at 8.7% well below 11.9% of EU-27. Similarly implicit tax rates on capital experienced a large decline from a peak of 44.5% in 2007 to 28.4% in 2009 (values for 2010, NA). In addition to this post 2008 crisis, implicit tax rates on corporate income collapsed from 63.3% in 2007 to 24.7% in 2009.

---

[5]EU-14 comprises of Austria, Belgium, Denmark, Finland, France, Greece, Germany, Ireland, Italy, Netherlands, Portugal, Spain, Sweden, United Kingdom. EU-15 comprises of EU-14 and Luxembourg. EU-27 comprises of EU-15 and Poland, Czech Republic, Cyprus, Latvia, Lithuania, Slovenia, Estonia, Slovakia, Hungary, Malta.

Table 1: Tax Revenue as a percentage of GDP Structure by type of tax base

|  | Labor | Capital | Consumption |
|---|---|---|---|
| Portugal | 12.9 (19) | 6.9 (11) | 11.7 (14) |
| Ireland | 11.7 (23) | 6.5 (14) | 10.0 (25) |
| Greece | 12.4 (21) | 6.5 (13) | 12.1 (11) |
| Spain | 16.7 (14) | 7.4 (10) | 8.7 (27) |

Source: Eurostat (2012)

Note: Figures in parenthesis represents ranking, which is calculated in descending order "1" indicates the highest value in EU-27

The above snapshot suggests that even in these debt ridden economies with rapidly rising public expenditure and falling tax-GDP ratio, tax rates have consistently decreased[6] . This brings us to the question we are interested in. Does tax rate increase merit a relook so far as debt-reduction strategies are considered? Will an increase in tax rate necessarily lead to an increase in tax revenue? If so, what kind of a tax increase can the economies under consideration absorb?

Laffer curve is one instrument through which we can locate an economy in a tax rate-tax revenue panel. We can assess where the economy is located vis-a-vis the peak of the Laffer Curve. Thereby we can answer if there is a possibility of increase in tax revenue with a *ceteris paribus* increase in tax rate after taking into account potential slowdowns in growth rate by computing a dynamic steady state Laffer curves. These reflect the locus of tax revenue after controlling for the loss in revenue due to the adverse impact on growth. Though Corsetti and Muller (2012) conjecture that "there is equally little evidence to suggest that fiscal policy is on the wrong side of the Laffer curve", dynamic laffer curves for debt ridden European economies have not been computed before. We solve a simple, closed dynamic model and compute this and then precisely locate the four debt

---

[6]Our calculation shows that a simple measure of Average Personal Income Tax rate, obtained from an average of tax rate for Single parent without children, One-earner married couple with two children and two-earner married couple with two children, has steadily decreased. The decrease ranges from 1.4 percentage points in Greece to 1.7 percentage points in Ireland.

ridden economies, Greece, Portugal, Ireland and Spain in their respective dynamic Laffer Curves for different taxes and draw policy conclusions from there.

# 3    Model and Calibration

A standard dynamic closed economy model, with labor capital and consumption taxes, is solved and the steady state values of consumption, capital and labor supply are computed. In our simple set up households maximize their utility with respect to consumption and leisure, firms produce output using a Cobb Douglas technology and governments run a balanced budget[7] where the tax revenue that it earns is used for lump sum transfer to the households and for providing with public goods which in turn enter the utility function of the households.

Formally the model may be written as-

$$\max_{c,l} \int_0^\infty \left( \ln c - \kappa l^{1+\frac{1}{\psi}} + \xi G^{1-n} \right) e^{-\rho t} dt$$

$$\text{subject to} \quad \dot{a} \;=\; (1-\tau_w)wl + (1-\tau_r)ra - (1+\tau_c)c + T, \;\; a(0) = a_0$$

where $c$, $l$ , $a$ are period consumption, leisure and assets; $\tau_c, \tau_r, \tau_w, T, w, r$ are consumption tax, capital tax, income tax, lump sum tax[8], wage and rental rate respectively; the constraint denotes the asset accumulation equation; the parameters $\psi, \rho, \kappa$ and $\xi$ denote the Frisch elasticity of labor supply, time preference rate, weight on disutility of labor and weight on government consumption. The model crucially rests on the assumption that government consumption $G$, enter the household

---

[7]In this case government running a balanced budget can be thought of as an infinite period present value budget balanced, though explicit characterization makes it difficult to solve. Also that brings in an additional element of debt dynamics. That may be a future work though where the debt position of each of these countries are compared against the steady state debt levels obtained through numerical solution of a dynamic model.

[8]The role of lump sum tax here is to balance the budget. Allowing for debt, while makes the model realistic, the analysis becomes analytically intractable.

utility separably from consumption and leisure[9]. Furthermore households' preference has a constant Frisch elasticity of labor supply and the inter temporal elasticity of substitution for consumption is unity. Our utility function is a particular form of the general Constant Frisch Elasticity (CFE) utility function which appears in Trabandt and Uhlig (2011). It is this specification which yields unit inter temporal elasticity of substitution.

The standard first order conditions give us the Euler equation

$$\dot{c} = c((1-\tau_p)r - \rho)$$

The firms maximize their profit and markets clear. We can then define the competitive equilibrium as the set of variables $c, k, l, r, w$ which solve the following equations -

$$r = \alpha k^{\alpha-1} l^{1-\alpha} - \delta$$

$$w = (1-\alpha)k^{\alpha} l^{-\alpha}$$

$$\dot{k} = (1-g)k^{\alpha} l^{1-\alpha} - c - \delta k$$

$$\dot{c} = c((1-\tau_p)r - \rho)$$

$$l^{\frac{1}{\phi}} = \frac{w(1-\tau_w)}{c(1+\tau_c)(1+\frac{1}{\psi})\kappa}$$

We analytically derive the steady state values $l_{ss}, k_{ss}, c_{ss}$ and numerically verify them. The steady state revenue is then given by -

$$R_{ss} = \tau_w w l_{ss} + \tau_r r k_{ss} + \tau_c c_{ss}$$

A detailed solution of the model is given in the Appendix.

---

[9]Christiano and Eichenbaum (1992) was one of the first papers to use this preference. It can be interpreted as the entire government expenditure being used to produce public goods which in turn enter the preferences of the individuals.

The model is calibrated to the data of the four economies we are interested in - Portugal, Ireland, Greece and Spain for the year 2007. European Union -14 has also been included so that it serves as a reference point for the results we obtain from calibrating the individual economies. The calibrated values of consumption, labor and capital tax rates for the year 2007 are obtained from Trabandt and Uhlig (2011). In order to capture the institutional heterogeneity among the four economies we use parameterization specific to each economies and they are reported in Table 3.

Table 2: Tax rates for 2007

|  | Labor Income Tax Rate | Capital Income Tax Rate | Consumption Tax rate |
|---|---|---|---|
| EU | 41.3 | 34.4 | 16.9 |
| Portugal | 34.4 | 27.6 | 21.5 |
| Ireland | 28.5 | 22.5 | 25.6 |
| Greece | 40.3 | 14.5 | 21.5 |
| Spain | 37.4 | 36.2 | 14.7 |

Source: 2007 tax rates are obtained from Trabandt and Uhlig (2010). For the methodological details of how the tax rates have been computed please refer to the Appendix of the paper quoted above.

Table 3: Parameter values

|  | $\alpha$ | $\delta$ | $\kappa$ | $G/y$ |
|---|---|---|---|---|
| EU-14 | 0.38 | 0.07 | 3.62 | 0.23 |
| Portugal | 0.39 | 0.10 | 3.39 | 0.23 |
| Ireland | 0.36 | 0.09 | 5.66 | 0.19 |
| Greece | 0.40 | 0.06 | 3.36 | 0.20 |
| Spain | 0.42 | 0.09 | 5.12 | 0.21 |

Source: Trabandt and Uhlig (2010)

There has been a persistent lack of consensus in the literature over the magnitude of Frisch

elasticity of labor. The micro estimates of Frisch elasticity are typically found to be less than 1. However as almost 85% of aggregate hours fluctuations come from employment fluctuations, elasticities of around 3 are needed to match data in a RBC model. Clearly the specified value of Frisch Elasticity plays a crucial role in determining the shape of the Laffer Curve we derive. In the recent past there has been some attempt to reconcile the differences thereof. Chetty et al. (2011) makes a careful attempt to address this and concludes that a reasonable calibration of Frisch elasticity of aggregate hours will be 0.75 as they find it consistent with observed differences in aggregate hours across countries with different tax systems. There is an increasing consensus towards lower values of Frisch elasticity. We use two near extreme values of Frisch elasticity with $\psi = 1$ and $\psi = 3$ and match the labor hours predicted by the model with the data[10]. Our model does well in terms of matching the mean labor hours in the data for $\psi = 1$ for all countries except Portugal. With this evidence and considering the majority of opinions, our policy recommendations will be based mostly on the assumption that $\psi = 1$ though we report Laffer curves for labor tax corresponding to both the values 1 and 3.

Table 4: Comparing labor choice with the data

|          | EU-14 | Greece | Ireland | Portugal | Spain |
|----------|-------|--------|---------|----------|-------|
| $\psi = 1$ | 0.24  | 0.28   | 0.23    | 0.31     | 0.24  |
| $\psi = 3$ | 0.16  | 0.21   | 0.17    | 0.24     | 0.16  |
| Data     | 0.20  | 0.25   | 0.21    | 0.23     | 0.24  |

Table 4 gives us a check about the consistency of the results obtained by comparing the predictions obtained from the model with the mean in the data. It reports the optimal labor choice predicted from the model and the corresponding value obtained from the data [11]. The model

---

[10]Our graphical analysis shows that $\psi = 3$ is close to the threshold level of the Frisch elasticity parameter which makes revenue neutral with respect to tax increases. It is important to note however that like much of the consensus in the disciplineTrabandt and Uhlig (2010) mentions $\psi = 1$ as their "preferred benchmark calibration".

[11]Normalised labor hours are obtained from weekly labor hours reported by OECD Stat.

predicted steady state solution for optimal labor hours for EU-14 is 0.24 with $\psi = 1$ and 0.16 with $\psi = 3$ while the data predicts it to be 0.20. It also confirms the fact that Greece, even with a very high tax rate, has high working hours. Overall our model does pretty well in matching the mean in the data, especially for $\psi = 1$. Setting the value of Frisch elasticity to 1 gives if anything an upward bias. Infact Chetty et al. (2011) concludes that the Frisch elasticity of aggregate hours in the US should be calibrated to 0.75. $\psi = 1$ gives a reasonable benchmark for Europe.

Finally the steady state values are analytically computed and then numerically verified using the relaxation algorithm developed by Trimborn et al. (2008). The relation algorithm is an efficient method of determining the transition process in growth models numerically. It can be used to compute a wide class of general equilibrium models. The transition process, which is a solution to a differential equation, is arrived at by using a trial solution which satisfies neither the slope condition nor the boundary conditions. Subsequently the corresponding error function is obtained and its first derivative is computed to improve the trial solution. At each point of iteration, the correction takes into account the deviation from the correct slope condition and also solves the static equation(s), until a predetermined threshold level of error is reached through a Newton type iteration.

# 4    Results

Figure 4 gives us the Dynamic Laffer curve for consumption tax. The shape of the Laffer curve is dictated by the fact that consumption can never drop to zero. So in increasing the tax rate on the consumption has some rationale if the objective is solely how to generate surplus revenue, as the relatively inelastic consumption (with respect to consumption taxes) will lead to an increase of tax revenue. The current consumption tax rate for each of the economies have been marked. A near constant slope implies a 10 percentage points (ppts henceforth) increase in consumption tax yields on an average a revenue increase of 15 per cent. A relatively steeper slope for Greece indicates that

up to 20 per cent revenue increase can be achieved by a 10 ppts increase in consumption tax rate at the current tax levels.

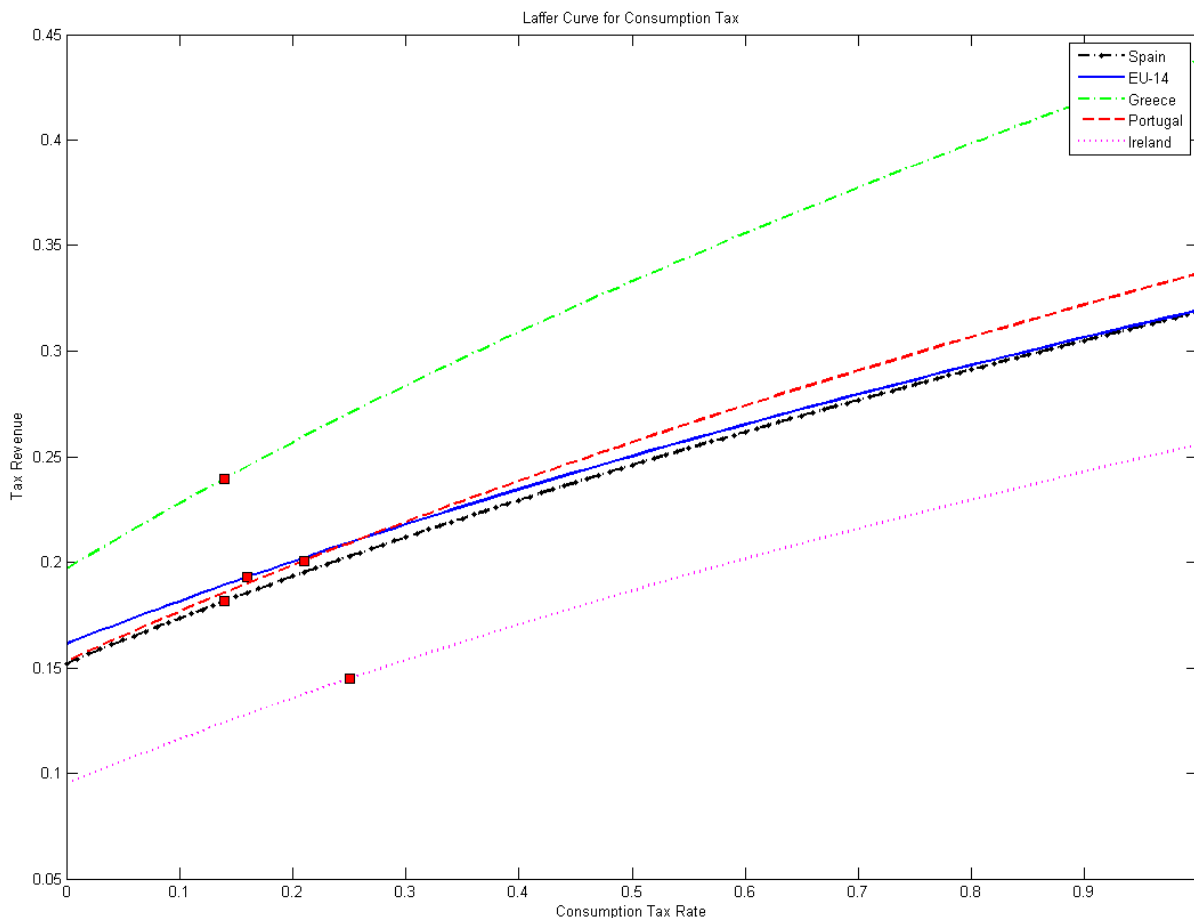Figure 4: Dynamic Laffer Curve for Consumption Tax



Figure 5 shows the dynamic laffer curves for capital tax when the value of Frisch elasticity of labor supply is unity. Spain has the highest and Greece has the lowest capital tax rate among the four countries analyzed here . However irrespective of that it is evident from the graph that the possibility of enhancing the tax revenue by increasing the capital tax rate is limited. In fact the tax revenue sharply drops for any tax rate above 50 per cent. The average tax rate for EU-14 itself is quite high and does not merit any increase. A caveat must be in place though - the model that

we calibrate does not incorporate the external sector. The result in the case of capital taxes may vary once that is incorporated as capital has a tendency to fly if adversely taxed. Having said that we note the closed economy model has been defended in the literature by viewing the tax structure in the light of ownership or residence based taxation instead of source based taxation. Then fiscal policy will not have much cross border effect.
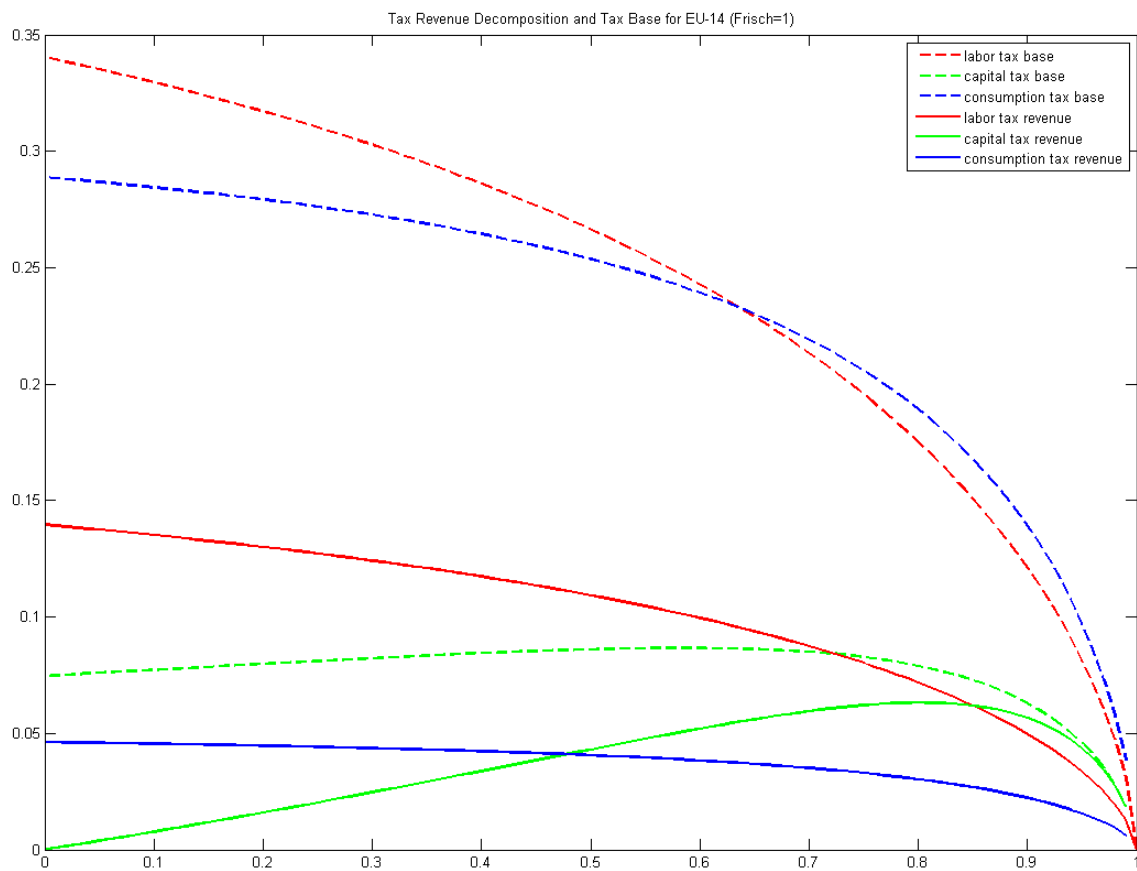
Figure 5: Dynamic Laffer Curve for Capital Tax
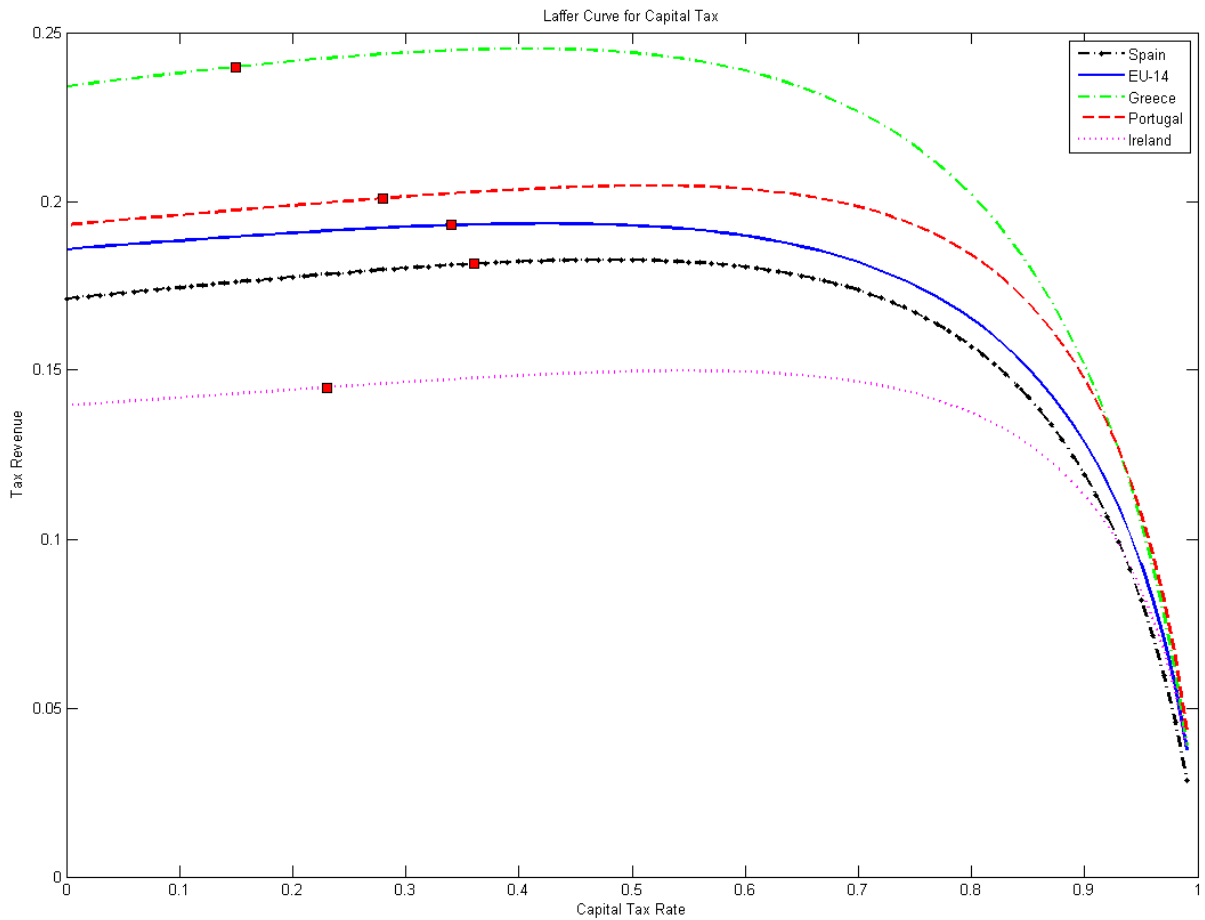


The peculiar shape of the Laffer curve for capital tax is better understood from Figure 6 which gives the tax revenue decomposition and tax base decomposition. As tax rate on capital increases,

steady state capital holding decreases, return to capital increases and wage rate decreases. This in turn leads to a decrease in steady state consumption and thus a decline in the consumption and labor tax base. Thus the shape of the Laffer curve is driven by the steep decline in the labor and consumption tax base following an increase in the capital tax rate. The loss in labor and consumption tax revenue far outweighs the increase in capital tax revenue.

# Figure 6: Decomposition of Tax Revenue for changes in capital tax rates

## (a) Tax Revenue Decomposition and Tax Base for EU-14 (Frisch Elasticity=1)



Tax Revenue Decomposition and Tax Base for EU-14 (Frisch=1)

## (b) Tax Base Decomposition for EU-14 (Frisch Elasticity=1)



Tax Base Decomposition for EU-14 (Frisch=1)
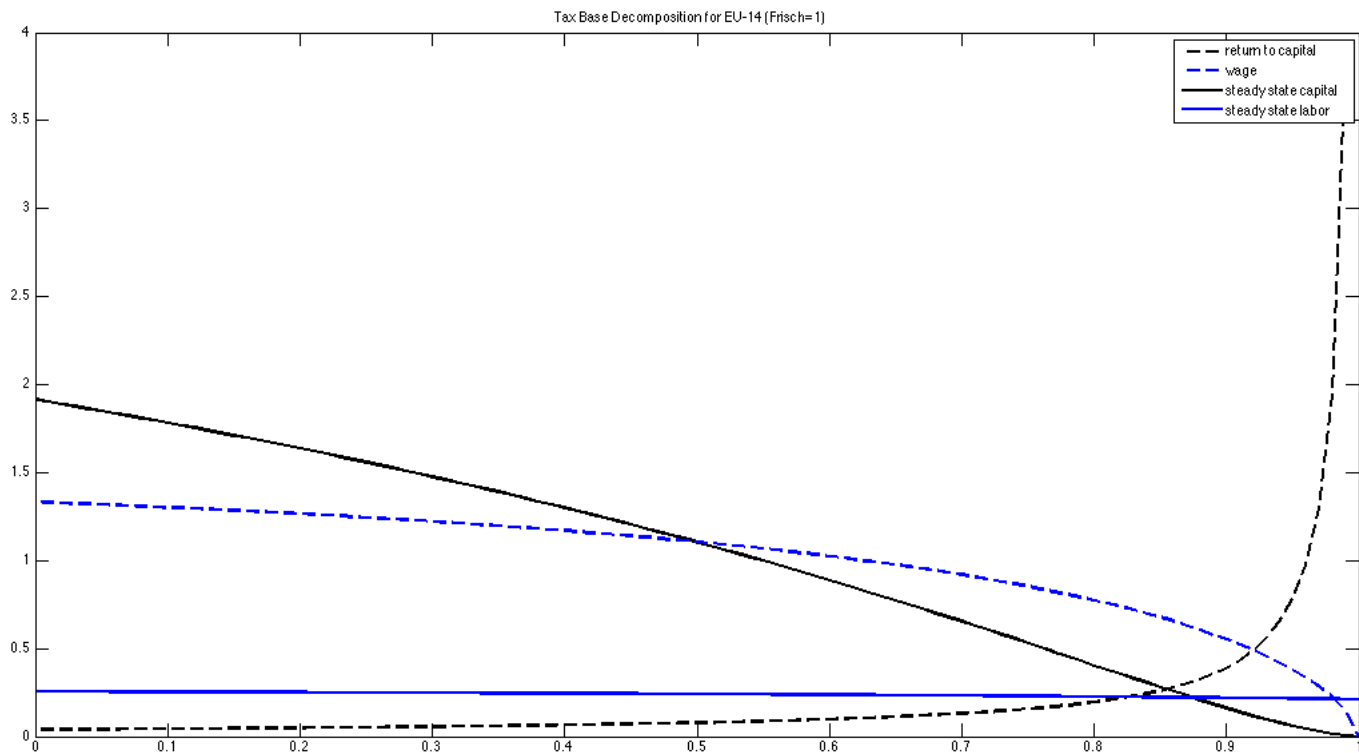
Capital Tax Rates in x-axis in Sub Figure (a) and (b)

Figure 7-11 gives us the dynamic laffer curves for income tax for each of the economies. Each panel computes the laffer curve for Frisch elasticity equals one and three. Greece has the highest labor income tax among them at over 40 per cent and low preference for leisure as the steady state labor hours is the highest. The labor hours for the alternative values of Frisch has been plotted for Greece. We find that while Spain and Portugal can only raise the tax revenue by 12 per cent and 12.5 per cent respectively by a 10 ppts increase in income tax rate at current level of taxes. The corresponding figure for Greece and Ireland is 13 per cent and 14 per cent respectively. This suggests that there exists a possibility of a substantial increase in tax revenue through an increase in the labor income tax rate, particularly for Greece and Ireland. Even if such a tax increase were to take place, Irish economy in particular will continue to be sufficiently to the left of the Laffer peak.

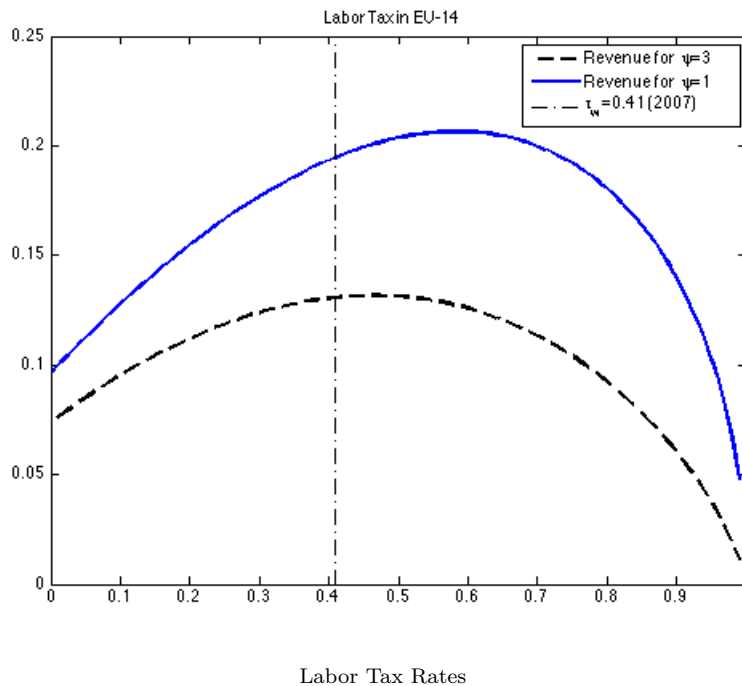Figure 7: Dynamic Laffer Curve for Labor Income Tax : EU-14



Labor Tax Rates

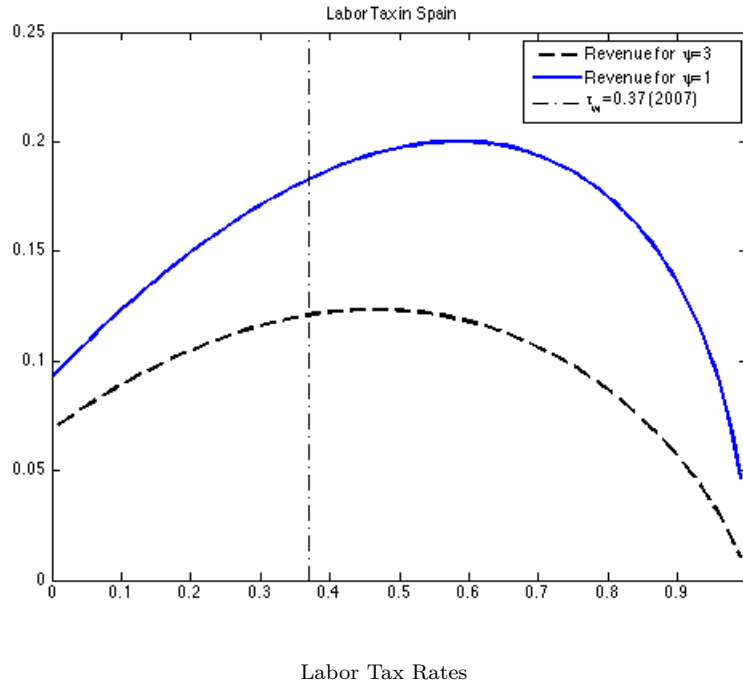Figure 8: Dynamic Laffer Curve for Labor Income Tax : Spain



Labor Tax Rates

Figure 9: Dynamic Laffer Curve for Labor Income Tax : Greece
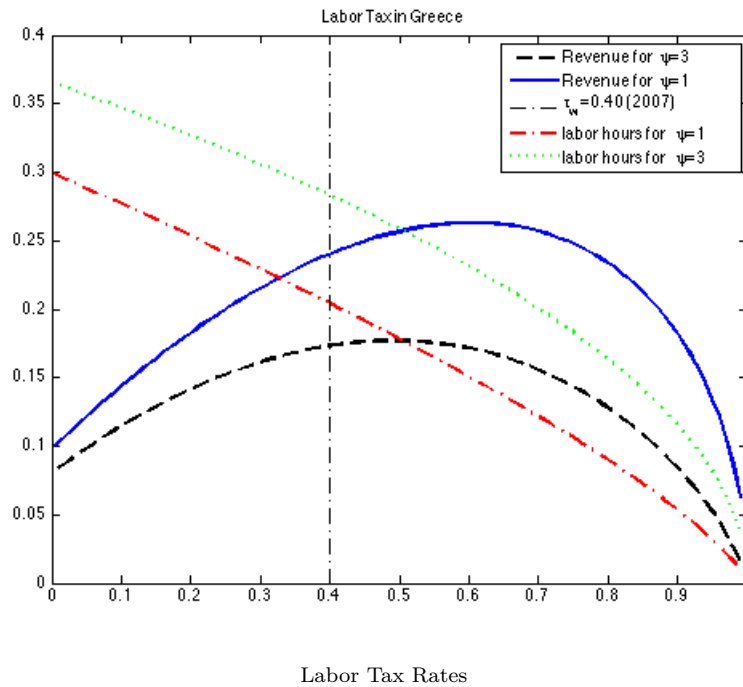


Labor Tax Rates

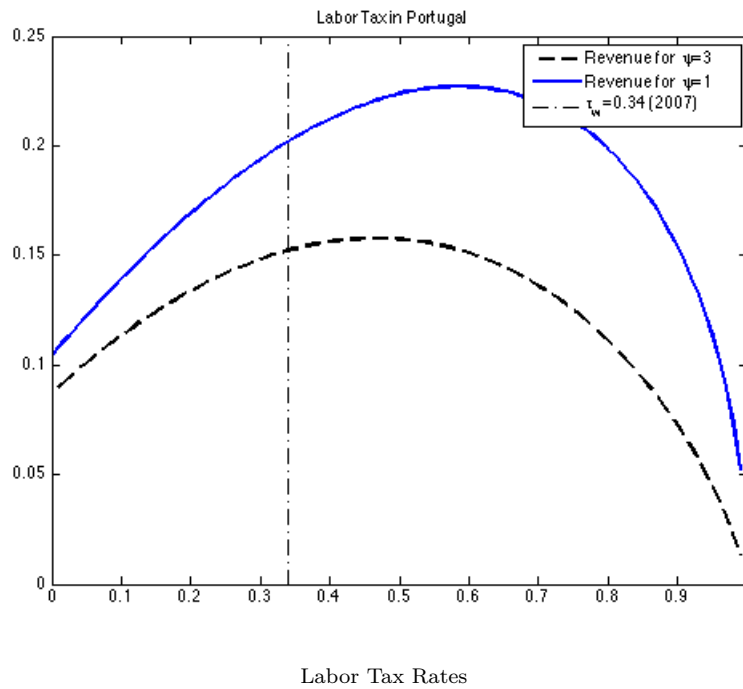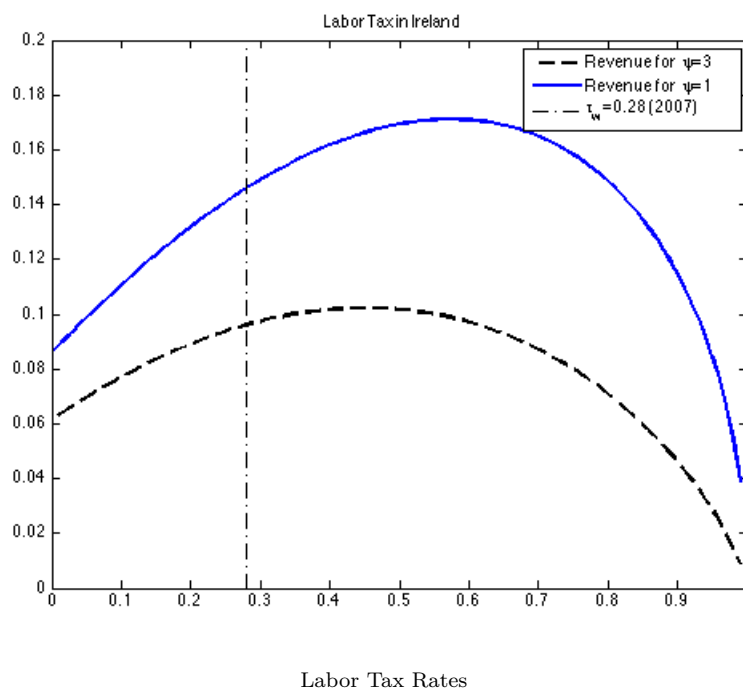Figure 10: Dynamic Laffer Curve for Labor Income Tax : Portugal



Labor Tax in Portugal

Labor Tax Rates

Figure 11: Dynamic Laffer Curve for Labor Income Tax : Ireland



Labor Tax in Ireland

Labor Tax Rates

21

# 5    Conclusion

In many debt ridden countries the governments have tried to incorporate the painful process of fiscal discipline, though mostly unsuccessfully. In fact as we have seen in many cases a public debt reduction led by shedding government expenditure through employment and pay cut has resulted in enormous socio-political tensions. The consequence of a marginal increase in income tax rate on the other hand is much less. We solve a simple dynamic model and compute the dynamic Laffer curve for capital tax, income tax and consumption tax for four highly indebted economies - Portugal, Ireland, Greece and Spain. Our analysis shows under reasonable parametrization, there exists a scope for maneuverability with tax rates for consumption and labor tax. All the economies are located to the left of the Laffer peaks for the income tax and potentially will be able to absorb marginal increase in tax rates. Thus this provides an avenue for generating much needed resources to tackle the primary deficit in the short run which along with structural changes led expenditure cuts will give the right strategy mix that can bring down the debt to sustainable levels.

# References

**Alesina, Alberto and Roberto Perotti**, "Fiscal Adjustments in OECD Countries - Composition and Macroeconomic Effects," IMF Working Papers 96/70, International Monetary Fund July 1996.

**Alesina, Alberto F. and Silvia Ardagna**, "Large Changes in Fiscal Policy: Taxes Versus Spending," Working Paper 15438, National Bureau of Economic Research October 2009.

**Apergis, Nicholas, James E. Payne, and James W. Saunoris**, "Tax-spend nexus in Greece: are there asymmetries?," *Journal of Economic Studies*, December 2012, *39* (3), 327–336.

**Cabral, Ricardo**, "The PIGS external debt problem," *VoxEU*, May 2010.

**Cafiso, Gianluca**, "Debt developments and fiscal adjustment in the EU," *Intereconomics: Review of European Economic Policy*, January 2012, *47* (1), 61–72.

**Chetty, Raj, Adam Guren, Day Manoli, and Andrea Weber**, "Are Micro and Macro Labor Supply Elasticities Consistent? A Review of Evidence on the Intensive and Extensive Margins," *American Economic Review*, May 2011, *101* (3), 471–75.

**Christiano, Lawrence J and Martin Eichenbaum**, "Current Real-Business-Cycle Theories and Aggregate Labor-Market Fluctuations," *American Economic Review*, June 1992, *82* (3), 430–50.

**Corsetti, Giancarlo and Gernot Muller**, "Has Austerity gone too far?," *VoxEU*, 2012.

**Cottarelli, Carlo, Lorenzo Forni, Jan Gottschalk, and Paoloi Mauro**, "Default in Today's Advanced Economies: Unnecessary, Undesirable, and Unlikely," IMF Staff Position Note 2010/12, International Monetary Fund September 2010.

**Eurostat**, "Taxation trends in the European Union," Technical Report, European Union Commission June 2012.

**Friedman, Milton**, "The Limitations of Tax Limitation," *Policy Review*, June 1978.

**Leeper, Eric M. and Shu-Chun Susan Yang**, "Dynamic scoring: Alternative financing schemes," *Journal of Public Economics*, February 2008, *92* (1-2), 159–182.

**Mankiw, N. Gregory and Matthew Weinzierl**, "Dynamic scoring: A back-of-the-envelope guide," *Journal of Public Economics*, September 2006, *90* (8-9), 1415–1433.

**Nickel, Christiane, Philipp Rother, and Lilli Zimmermann**, "Major public debt reductions: Lessons from the past, lessons for the future," Working Paper Series 1241, European Central Bank September 2010.

**Strulik, Holger and Timo Trimborn**, "Laffer strikes again: Dynamic scoring of capital taxes," *European Economic Review*, 2012, *56* (6), 1180–1199.

**Trabandt, Mathias and Harald Uhlig**, "How Far Are We From The Slippery Slope? The Laffer Curve Revisited," NBER Working Papers 15343, National Bureau of Economic Research, Inc 2010.

_ **and** _ , "The Laffer curve revisited," *Journal of Monetary Economics*, 2011, *58* (4), 305–327.

_ **and** _ , "How Do Laffer Curves Differ Across Countries?," Working Paper 17862, National Bureau of Economic Research February 2012.

**Trimborn, Timo, Karl-Josef Koch, and Thomas M. Steger**, "Multidimensional Transitional Dynamics: A Simple Numerical Procedure," *Macroeconomic Dynamics*, June 2008, *12* (03), 301–319.

**Appendix**

We model an infinite period, continuous time economy with households of unit measure, whose period utility depends on $c_t$, leisure $1-l_t$ and consumption of goods provided by the government given by $G_t$. The household faces an asset accumulation equation and is subjected to different taxes (given in the equation). The optimization problem is

$$\max_{c,l} \int_0^\infty \left( \ln c - \kappa l^{1+\frac{1}{\psi}} + +\xi G^{1-n} \right) e^{-\rho t} dt$$

$$\text{subject to} \quad \dot{a} = (1-\tau_w)wl + (1-\tau_r)ra - (1+\tau_c)c + T, \quad a(0) = a_0$$

$$\text{where} \quad \tau_c \quad \text{is} \quad \text{consumption tax}$$

$$\tau_r \quad \text{is} \quad \text{capital tax}$$

$$\tau_w \quad \text{is} \quad \text{income tax}$$

$$T \quad \text{is} \quad \text{lumpsum tax}$$

$$w \quad \text{is} \quad \text{wage}$$

$$r \quad \text{is} \quad \text{rental rate}$$

The firms rent capital and labor and produce according to a Cobb-Douglas production function in a perfectly competitive factor markets

$$y = k^\alpha l^{1-\alpha}$$

Government run a balanced budget and the budget equation is given by

$$\tau_w wl + \tau_r ra + \tau_c c = T + G$$

The continuous time Bellman equation may be formulated as follows

$$\rho V(a) = \max \ e^{-\rho t}\left(log(c) - \kappa l^{1+\frac{1}{\psi}} + \xi G^{1-n}\right) + \frac{d}{dt}V(a)$$

subject to asset accumulation equation

$$\dot{a} = (1-\tau_w)wl + (1-\tau_r)ra - (1+\tau_c)c + T_t, \quad a(0) = a_0$$

The following are the first order conditions

$$\text{with respect to } c: \ \frac{1}{c} = V_a(1+\tau_c) \tag{1}$$

$$\text{with respect to } l: \ \kappa(1+\frac{1}{\psi})l^{\frac{1}{\psi}} = V_a(1-\tau_w)w$$

$$\implies l^{\frac{1}{\phi}} = \frac{w(1-\tau_w)}{c(1+\tau_c)(1+\frac{1}{\psi})\kappa} \tag{2}$$

$$\text{with respect to the state variable } a: \ \rho V_a = V_a(1-\tau_p)r + \dot{a}V_{aa}$$

$$\implies V_a(\rho - (1-\tau_p)r) = \dot{a}V_{aa} \tag{3}$$

Differentiating equation equation (1) with respect to $t$ and then inserting in equation (3), we obtain the Euler equation is given by

$$\dot{c} = c((1-\tau_p)r - \rho)$$

In a freely competitive market the wages and rentals for capital may be calculated from the profit maximizing conditions of the firm.

$$r + \delta = \alpha k^{\alpha-1}l^{1-\alpha} \tag{4}$$

$$\text{and } w = (1-\alpha)k^\alpha l^{-\alpha} \tag{5}$$

26

Accounting identity would necessitate the following condition

$$
\begin{aligned}
Y &= c + \dot{k} + \delta k + G \\
\dot{k} &= (1 - g)y - c - \delta k
\end{aligned}
\tag{6}
$$

We get equation (6) from the assumption that $G = gY$.

Thus we have a complete characterization of the model given the capital market clears. The competitive equilibrium of the economy is given by the set of variables $c, k, l, r, w$ which satisfy the following equations

$$
\begin{aligned}
r &= \alpha k^{\alpha-1} l^{1-\alpha} - \delta \\
w &= (1 - \alpha) k^{\alpha} l^{-\alpha} \\
\dot{k} &= (1 - g) k^{\alpha} l^{1-\alpha} - c - \delta k \\
\dot{c} &= c((1 - \tau_p) r - \rho) \\
l^{\frac{1}{\phi}} &= \frac{w(1 - \tau_w)}{c(1 + \tau_c)(1 + \frac{1}{\psi})\kappa}
\end{aligned}
$$

The steady state characterization of the economy is given by

$$
\begin{aligned}
l_{ss} &= \left( \frac{(\rho + (1 - \tau_p)\delta)(1 - \alpha)(1 - \tau_w)}{(1 + \tau_c)(1 + \frac{1}{\psi})\kappa[(1 - g)(\rho + (1 - \tau_p)\delta) - \delta\alpha(1 - \tau_p)]} \right)^{\frac{\psi}{1+\psi}} \\
k_{ss} &= \left[ \frac{1}{\alpha} \left( \frac{\rho}{(1 - \tau_p)} + \delta \right) \right]^{\frac{1}{1-\alpha}} \left( \frac{(\rho + (1 - \tau_p)\delta)(1 - \alpha)(1 - \tau_w)}{(1 + \tau_c)(1 + \frac{1}{\psi})\kappa[(1 - g)(\rho + (1 - \tau_p)\delta) - \delta\alpha(1 - \tau_p)]} \right)^{\frac{\psi}{1+\psi}} \\
c_{ss} &= \left[ (1 - g)\frac{1}{\alpha} \left( \frac{\rho}{(1 - \tau_p)} + \delta \right) - \delta \right] \left[ \frac{1}{\alpha} \left( \frac{\rho}{(1 - \tau_p)} + \delta \right) \right]^{\frac{1}{1-\alpha}} \\
&\quad \left( \frac{(\rho + (1 - \tau_p)\delta)(1 - \alpha)(1 - \tau_w)}{(1 + \tau_c)(1 + \frac{1}{\psi})\kappa[(1 - g)(\rho + (1 - \tau_p)\delta) - \delta\alpha(1 - \tau_p)]} \right)^{\frac{\psi}{1+\psi}}
\end{aligned}
$$

The total revenue which accrues to the government is then given by

$$R_{ss} \quad = \quad \tau_w w l_{ss} + \tau_r r k_{ss} + \tau_c c_{ss}$$

**Economics Working Papers**

2013-09:     John Kennes and Daniel le Maire: Job Heterogeneity and Coordination Frictions

2013-10:     Peter Arendorf Bache and Anders Laugesen: Monotone Comparative Statics for the Industry Composition under Monopolistic Competition

2013-11:     Anders Frederiksen and Jesper Rosenberg Hansen: Trends in Sector Switching: Evidence from Employer-Employee Data

2013-12:     Mongoljin Batsaikhan and Norovsambuu Tumennasan: Price-Matching leads to the Cournot Outcome

2013-13:     Sylvanus Kwaku Afesorgbor: Revisiting the Effectiveness of African Economic Integration. A Meta-Analytic Review and Comparative Estimation Methods

2013-14:     Peter Arendorf Bache and Anders Laugesen: Trade Liberalisation and Vertical Integration

2013-15:     Kaleb Girma Abreha, Valérie Smeets and Frédéric Warzynski: Coping with the Crisis: Recent Evolution in Danish Firms' - International Trade Involvement, 2000-2010

2013-16:     Peter Arendorf Bache and Anders Laugesen: An Industry-Equilibrium Analysis of the LeChatelier Principle

2013-17:     Anna Piil Damm and Christian Dustmann: Does Growing Up in a High Crime Neighborhood Affect Youth Criminal Behavior?

2013-18:     Christian Bjørnskov and Jacob Mchangama: Do Social Rights Affect Social Outcomes?

2013-19:     Benoit Julien, John Kennes, and Moritz Ritter: Bidding for Clubs

2013-20:     Ina Charlotte Jäkel: Import-push or Export-pull?

2013-21:     Tor Eriksson, Jay Pan and Xuezheng Qin : The Intergenerational Inequality of Health in China

2013-22:     Martin Paldam: How do partly omitted control variables influence the averages used in meta-analysis in economics?

2013-23:     Ritwik Banerjee: An Evaluation of the Revenue side as a source of fiscal consolidation in high debt economies