How Do Laffer Curves Differ Across Countries?☆

Mathias Trabandt[a,b], Harald Uhlig[c,d]

[a]*Mathias Trabandt, European Central Bank, Directorate General Research, Monetary Policy Research Division, Kaiserstrasse 29, 60311 Frankfurt am Main, Germany*

[b]*Sveriges Riksbank, Research Division*

[c]*Harald Uhlig, Department of Economics, University of Chicago, 1126 East 59th Street, Chicago, IL 60637, USA*

[d]*NBER, CEPR, CentER, Deutsche Bundesbank*

Abstract

Trabandt and Uhlig (2011) have recently characterized Laffer curves for labor and capital taxation for the U.S., the EU-14, and individual European countries. This paper broadens and extends the cross-country analysis. First, we allow for monopolistic competition which generates an improved model-data comparison across countries. This has also implications for the Laffer curves. Second, we discuss the various sources of differences across countries for the shape of the Laffer curve in more detail. Third, we compare Laffer curves for the average sample 1995-2010 with those in 2010. Fourth, we calculate maximum affordable interest rates on outstanding government debt. Fifth, the introduction of human capital has dramatic effects for the labor income tax Laffer curve across countries. Sixth, we perform a cross-country analysis on consumption taxes.

Keywords: Laffer curve, taxation, cross country, monopolistic competition, human capital

JEL Classification: E0, E13, E2, E3, E62, H0, H2, H3, H6

☆This version: November 25, 2011. Prepared for the NBER conference "Fiscal Policy after the Financial Crisis" held at IGIER-Bocconi University, Milan. The authors are grateful to Alan Auerbach, Alberto Alesina, Axel Boersch-Supan, Francesco Giavazzi, Laurence Kotlikoff and Valerie Ramey for useful comments and discussions. The views expressed in this paper are solely the responsibility of the authors and should not be interpreted as reflecting the views of Sveriges Riksbank or the ECB.

Email addresses: mathias.trabandt@googlemail.com (Mathias Trabandt), huhlig@uchicago.edu (Harald Uhlig)

1. Introduction

Trabandt and Uhlig (2011) have recently characterized Laffer curves for labor and capital taxation for the U.S., the EU-14, and individual European countries. In the analysis, a neoclassical growth model featuring "constant Frisch elasticity" (CFE) preferences is used. The results suggest that the U.S. could increase tax revenues considerably more than the EU-14 while the degree of self-financing is much larger in the EU-14 than in the U.S. In addition, Trabandt and Uhlig (2011) calculate Laffer curves for individual European countries. However, focus, details and extensions are much directed to the comparison of the U.S. and the aggregate EU-14 economy. This paper broadens and extends the cross-country analysis of Laffer curves along the following dimensions and questions.

First, the model in Trabandt and Uhlig (2011) is refined by allowing for intermediate inputs which are supplied by monopolistically competitive firms. As shown below, this results in an even better model-data comparison. More precisely, the baseline model used in Trabandt and Uhlig (2011) overstates labor tax revenues and understates capital tax revenues relative to the data. In the adapted model with intermediate inputs, the presence of a markup on wages reduces the labor tax base and thereby aligns data and model labor tax revenues much better. At the same time, aggregate profits increase the capital tax base to the extend that they are subject to capital taxation. Overall, the introduction of intermediate inputs moves countries closer to the peak of the labor tax Laffer curve and somewhat farther away from the peak of the capital tax Laffer curve.

Second, we analyze and discuss the various sources of differences across countries in the shape of the revenue-to-tax rate relationship in more detail. To calculate Laffer curves one needs to assign values to preference and technology parameters. We retain the benchmark in Trabandt and Uhlig (2011) and assume that all structural parameters for technologies and preferences are the same across countries. Thus, differences of Laffer curves arise solely due to differences in fiscal policy i.e. the mix of distortionary taxes, government spending and government debt. Which part of this mix accounts most for the differences between countries? It appears that labor income and consumption taxes are important for accounting for most of the cross-country differences with

respect to Laffer curves. In other words, it is the so-called labor wedge that appears to be of central importance for the shape of the labor and capital tax Laffer curves accross countries.

Third, we shed light on the the following question: what are the implications of the substantial tax and revenue shocks of the last three to four years? We do so by extending the sample in Trabandt and Uhlig (2011) from 1995-2007 to 1995-2010. More importantly, we compare Laffer curves for the average sample 1995-2010 with those in 2010. It appears that the vast the majority of countries have moved closer to the peaks of their labor and capital income tax Laffer curves and Laffer hills respectively. The movements to the peaks are sizeable for some countries such as e.g. the United Kingdom, the Netherlands and Ireland for labor taxes. Denmark has moved even more beyond the peaks of their Laffer curves.

Fourth, we use the model to attempt to answer the following question: what is the maximum interest rate on outstanding government debt that the government could afford without cutting government spending? To answer this question, we calibrate the model in terms of fiscal policy to the year 2010. Then, we calculate the implied peak of the Laffer curve and compute the maximum interest rate on outstanding government debt in 2010 that would still balance the government budget constraint. According to the results, the USA can affort the highest interest rate if labor taxes are moved to the peak of the Laffer curve. Interestingly, Ireland can afford the highest interest rate if capital taxes are raised to generate maximum revenues. Perhaps most interesting are the results for the Laffer hill, i.e. the combined labor and capital tax increases. There, the USA, Germany, Ireland, the Netherlands and Spain are the countries that can bear the highest interest rates. By contrast, Belgium, Denmark, Sweden, United Kingdom, Italy and France are the countries who can afford the lowest interest rates.

Fifth, We compare the distance to the peak of Laffer curves across countries in the baseline model with the one when human capital accummulation is added to the model. Interestingly, the capital tax Laffer curve is affected only very little across countries when human capital is introduced. By contrast, the introduction of human capital has rather dramatic effects for the labor income tax Laffer curve. All countries except the USA and Ireland are pushed on the slippery slope sides of their labor tax Laffer curves once human capital is accounted for. Intuitively, higher labor

taxes lead to a faster reduction of the labor tax base since households work less and aquire less human capital which in turn leads to lower labor income.

Sixth, we perform a cross-country analysis on consumption taxes. Trabandt and Uhlig (2011) show that the consumption tax Laffer curve has no peak. There, the analysis is done for the U.S. and the aggregate EU-14 economy only. Here, we extend the consumption tax analysis to individual countries. The range of maximum additional tax revenues (in percent of GDP) in the baseline model is roughly 40-90 percent while it shrinks to 11-22 percent in the model with added human capital. Higher consumption taxes affect equilibrium labor by increasing the labor wedge. As above, human capital amplifies the reduction of the labor tax base triggered by a higher labor wedge. Overall, maximum possible tax revenues due to consumption taxes are reduced massively, although at fairly high consumption tax rates.

The paper is organized as follows. Section 2 provides the model. The calibration and parameterization of the model can be found in section 3. Section 4 provides and discusses the results. Finally, section 5 concludes.

2. Model

We use the baseline model in Trabandt and Uhlig (2011) and refine it here to allow for intermediate inputs which are supplied by monopolistically competitive firms. As shown below, this results in an even better model-data comparison. Time is discrete, $t = 0, 1, \ldots, \infty$. Households maximize

$$max_{c_t,n_t,k_t,x_t,b_t} \quad E_0 \sum_{t=0}^{\infty} \beta^t \left[u(c_t, n_t) + v(g_t)\right]$$

subject to

$$\begin{aligned} (1+\tau_t^c)c_t + x_t + b_t &= (1-\tau_t^n)w_t n_t + (1-\tau_t^k)[(d_t-\delta)k_{t-1} + \phi\Pi_t] \\ &\quad +\delta k_{t-1} + R_t^b b_{t-1} + s_t + (1-\phi)\Pi_t + m_t \\ k_t &= (1-\delta)k_{t-1} + x_t \end{aligned} \tag{1}$$

where c_t, n_t, k_t, x_t, b_t, m_t denote consumption, hours worked, capital, investment, government bonds and an exogenous stream of payments. The household takes government consumption g_t, which provides utility, as given. Further, the household receives wages w_t, dividends d_t, profits Π_t from firms and asset payments m_t. The payments m_t are income from an exogenous asset or "tree", see Trabandt and Uhlig (2011) for the details. The household obtains interest earnings R_t^b and lump-sum transfers s_t from the government. It has to pay consumption taxes τ_t^c, labor income taxes τ_t^n and capital income taxes τ_t^k on dividends and on a share ϕ of profits.[1]

Competitive final good firms maximize profits

$$max_{k_{t-1},z_t} \quad y_t - d_t k_{t-1} - p_t z_t \tag{2}$$

subject to the Cobb-Douglas production technology, $y_t = \xi^t k_{t-1}^{\theta} z_t^{1-\theta}$, where ξ^t denotes the trend of total factor productivity. p_t denotes the price of an homogenous input, z_t, which in turn is produced by competitive firms who maximize profits

$$\max_{z_{t,i}} = p_t z_t - \int p_{t,i} z_{t,i} di \tag{3}$$

subject to $z_t = \left(\int z_{t,i}^{\frac{1}{\omega}} \, di \right)^{\omega}$ with $\omega > 1$. Intermediate inputs, $z_{t,i}$, are produced by monopolistically competitive firms which maximize profits

$$\max_{p_{t,i}} p_{t,i} z_{t,i} - w_t n_{t,i}$$

subject to their demand functions and production technologies:

$$\begin{aligned} z_{t,i} &= \left(\frac{p_t}{p_{t,i}} \right)^{\frac{\omega}{\omega-1}} z_t \\ z_{t,i} &= n_{t,i} \end{aligned}$$

[1] We allow for partial profit taxation due to the various deductions and exemptions that are available for firms and households in this regard.

In equilibrium, all firms set the same price which is a markup over marginal costs. Formally, $p_{t,i} = p_t = \omega w_t$. Aggregate equilibrium profits are given by $\Pi_t = (\omega - 1)\, w_t n_t$.

The government faces the budget constraint,

$$g_t + s_t + R_t^b b_{t-1} = b_t + T_t \tag{4}$$

where government tax revenues are given by

$$T_t = \tau_t^c c_t + \tau_t^n w_t n_t + \tau_t^k [(d_t - \delta) k_{t-1} + \phi \Pi_t] \tag{5}$$

The paper focuses on the comparison of balanced growth paths. It is assumed that $m_t = \psi^t \bar{m}$ where ψ is the growth factor of aggregate output. A key assumption is that government debt as well as government spending do not deviate from their balanced growth pathes, i.e. $b_{t-1} = \psi^t \bar{b}$ and $g_t = \psi^t \bar{g}$. When tax rates are shifted, government transfers adjust according to the government budget constraint (4), rewritten as $s_t = \psi^t \bar{b}(\psi - R_t^b) + T_t - \psi^t \bar{g}$.

2.1. The Constant Frisch Elasticity (CFE) preferences

As Trabandt and Uhlig (2011), we work with constant Frisch elasticity preferences (CFE) of the following form:

$$u(c, n) = \log(c) - \kappa n^{1+\frac{1}{\varphi}} \tag{6}$$

if $\eta = 1$ and by

$$u(c, n) = \frac{1}{1-\eta} \left(c^{1-\eta} \left(1 - \kappa(1-\eta) n^{1+\frac{1}{\varphi}} \right)^{\eta} - 1 \right) \tag{7}$$

if $\eta > 0, \eta \neq 1$, where $\kappa > 0$. See Trabandt and Uhlig (2011) for a proposition, proof and properties of these preferences.

In equilibrium households choose plans to maximize utility, firms solve their maximization problems and the government sets policies that satisfy its budget constraint.

3 Calibration and parameterization

The model is calibrated to annual post-war data of the USA, the aggregate EU-14 economy and individual European countries.

The sample covered in Trabandt and Uhlig (2011) is 1995-2007. Here we extend the sample to 2010 using the same data sources. We update all data, except taxes and tax revenues due to data availability reasons. For most of the analysis in this paper, we assume that the 2008-2010 observations for taxes and revenues are the same as in 2007. See subsection 3.1 for an alternative approach that focuses on the year 2010.

We refine the calculation of transfers in the data compared to Trabandt and Uhlig (2011). In the data, there is a non-neglible difference between government tax revenues and government revenues. This difference is mostly due to "other government revenue" and "government sales". We substract these two items from the measure of transfers defined in Trabandt and Uhlig (2011).

US and aggregate EU-14 tax rates, government expenditures and government debt are set according to the upper part of table 1. We also calibrate the model to individual EU-14 country data for tax rates, government spending and government debt as provided in table 2. Although we allow fiscal policy to be different across countries, we restrict the analysis to identical parameters across countries for preferences and technology, see the lower part of table 1 for the details.

These structual parameters are chosen such that model implied steady states are close to the data. In particular, figure 1 provides a comparison of the data vs. model fit for key great ratios, hours as well as transfers and tax revenues. Overall, the fit is remarkable given the relatively simple model in which country differences are entirely due to fiscal policy.

Most of the structual parameter values in the lower part of table 1 are standard and perhaps uncontroversial. However, it should be pointed out here, that we set the gross markup, $\omega = 1.4$ and the share of profits subject to capital taxation, $\phi = 0.3$. We do so to obtain a reasoble fit for the labor- and capital tax revenue to GDP ratios. The baseline model used in Trabandt and Uhlig (2011) overstates labor tax revenues and understates capital tax revenues. In the adapted model with intermediate inputs, a gross markup $\omega > 1$ reduces the labor tax base. At the same

time, profits increase the capital tax base, but too much unless we set the share of profits subject to capital taxes, $\omega = 0.3$.

3.1. The year 2010

At the end of our sample, government spending and government debt have risen substantially as a fallout of the financial crisis, see table 2. We are particularly interested in characterizing Laffer curves for the year 2010. Unfortunately, we lack data for tax rates for the year 2010, although we do have data for government spending and debt in 2010.

We propose to use the government budget constraint of the model as a step forward to charaterize Laffer curves for the year 2010. More precisely, we let labor taxes in 2010 adjust to balance the government budget in 2010. That is, we calculate the implied labor tax given government debt and government consumption in 2010 as well as average (1995-2010) model implied government transfers.

Table 2 contains the resulting labor tax rates across countries. According to the model, in the US and EU-14 labor taxes need to be 4-5 percentage points higher to balance the government budget in 2010 compared to the sample average. However there is substantial country specific variation. While e.g. labor taxes in Germany and Italy remain litterally unchanged, those in the United Kingdom, Ireland and the Netherlands increase by 10 or more percentage points.

4. Results

4.1. Sources of differences of Laffer curves

What accounts for the differences between the USA Laffer curves and (individual) EU-14 Laffer curves? To answer this question, we proceed as follows. As before, we calibrate the model to country specific averages of 1995-2010, see table 2, keeping structural parameters as in table 1. Next, we compute Laffer curves.

Results are reported in tables 3 and 4 labelled "Baseline". All other columns report results if in the USA calibration, fiscal instruments are set to country specific values (each at a time).

It appears that labor income and consumption taxes are important for accounting for cross-country differences. In other words, it is the so-called labor wedge that appears to be of central importance for the shape of the labor and capital tax Laffer curves across countries.

Interestingly, observe that maximal additional tax revenues are similar for labor and capital income taxes. This result is in contrast to Trabandt and Uhlig (2011) which is due to intermediate inputs and profit taxation in the present paper.

Note that imposing the USA debt-to-GDP ratio across countries has no effect in this *particular* experiment. A different debt-to-GDP ratio, *given all else equal*, will result in different transfers in the status quo equilibrium. Since the model features Ricardian equivalence, the results are the same as in the baseline case.

4.2. Laffer curves: average 1995-2010 vs. 2010

We compute Laffer curves and the Laffer hill for a 1995-2010 vs. 2010 calibration. That is, the model is either calibrated in terms of fiscal policy to the average of 1995-2010 or to the year 2010, see table 2. Structural parameters are set as in table 1.

Figure 2 shows the resulting Laffer curves for the USA and EU-14 economy. Further cross-country results for the average 1995-2010 vs. year 2010 calibration are available in figure 3 and in table 5.

According to the results, that the vast the majority of countries have moved closer to the peaks of their labor and capital income tax Laffer curves and Laffer hills respectively. The movements to the peaks are sizeable for some countries such as e.g. the United Kingdom, the Netherlands and Ireland for labor taxes. Note that Denmark has moved even more beyond the peaks of their Laffer curves.

4.3. Laffer curve and interest rates

What is the maximum interest rate on outstanding government debt that the government could afford without cutting government spending? Put differently, how high can interest rates on government debt be so that fiscal sustainability is still preserved if countries move to the peak of their Laffer curves?

To answer this question we pursue the following experiment. We calibrate the model in terms of fiscal policy to the year 2010, see table 2. Structual parameters are set as in table 1. We calculate Laffer curves for labor and capital taxation as well as the Laffer hill for joint variations of capital and labor taxes. Keeping model implied government transfers and government consumption to GDP ratios at their 2010 levels, we calcuate the interest rate that balances the government budget at maximal tax revenues.

For the calcuations, we focus on balanced growth relationships ignoring transition issues for simplicity. Consider the scaled government budget constraint along the balanced growth path:

$$\left(\overline{s/y}\right)_{2010} + \left(\overline{g/y}\right)_{2010} = \left(\overline{b/y}\right)_{2010} (\psi - \bar{R}_{Max}) + \left(\overline{T/y}\right)_{Max} \tag{8}$$

where $\left(\overline{T/y}\right)_{Max}$ denotes the maximum additional tax revenues (expressed in % of baseline GDP) that results from moving from the 2010 status quo to the peak of the Laffer curve. We solve for $\bar{R}_{Max} = 1 + \bar{r}_{Max}$ that balances the above government budget constraint.

Table 6 contains the results. According to the results, the USA can affort the highest interest rate if labor taxes are moved to the peak of the Laffer curve. Interestingly, Ireland can afford the highest interest rate if capital taxes are raised to generate maximum revenues. Perhaps most interesting are the results for the Laffer hill, i.e. the combined labor and capital tax increases. There, the USA, Germany, Ireland, the Netherlands and Spain are the countries that can bear the highest interest rates. By contrast, Belgium, Denmark, Sweden, United Kingdom, Italy and France are the countries who can afford the lowest interest rates.

For the above analysis, some caveats should be kept in mind. First, the interest rate on outstanding government debt deviates from the one on private capital but does not crowd out private investment. In other words, it is implicitly assumed that the interest rate payments due to the higher interest rate are paid lump-sum to the households and thereby do not affect household consumption, hours or investment. Second, the maturity of government debt in the model is one year and therefore shorter than the average maturity of government debt across countries. Third, transitional issues are ignored. Fourth, the steady state real interest rate equals 4 percent and

represents therefore the lower bound for $\bar{r}_{Max}$. Fifth, the interest rates are real interest rates, not nominal interest rates. Sixth, the present analysis assumes unchanged government consumption.[2]

4.4. Baseline model vs. human capital accumulation

We compare the distance to the peak of Laffer curves for the above baseline model and the above baseline model with added human capital accumulation. More specifically, we assume that human capital is accumulated following the second generation case considered in Trabandt and Uhlig (2011). The model is calibrated to the average of 1995-2010 for fiscal variables. Standard parameters for technology and preferences are set as in table 1. Parameters for human capital accumulation are set as in Trabandt and Uhlig (2011).

Figure 4 shows the comparison for the US and EU-14. Further cross-country results are contained in figure 5. Interestingly, the capital tax Laffer curve is affected only very little across countries when human capital is introduced. By contrast, the introduction of human capital has rather dramatic effects for the labor income tax Laffer curve. With the parameterization provided in table 1 as well as those parameters provided in Trabandt and Uhlig (2011) for human capital, all countries except the USA and Ireland are pushed on the slippery slope sides of their labor tax Laffer curves. This result is due to two effects. First, human capital turns labor into a stock variable rather than a flow variable as in the baseline model. Higher labor taxes induce households to work less and to aquire less human capital which in turn leads to lower labor income. Consequently, the labor tax base shrinks much more quickly when labor taxes are raised. Second, the introduction of intermediate inputs moves countries closer to the peaks of their labor tax Laffer curves already in the baseline model compared to Trabandt and Uhlig (2011). This effect is reinforced when human capital is introduced.

4.5. Consumption taxes

We compute maximum additional tax revenues that are possible from increasing consumption taxes. We do this in the above baseline model and in the model with added human capital accumulation as in the previous subsection. The model is calibrated to the average of 1995-2010

[2]For related work on these issues, see e.g. Bi (2010) and Bi et al. (2010).

for fiscal variables. Standard parameters for technology and preferences are set as in table 1. Parameters for human capital accumulation are set as in Trabandt and Uhlig (2011).

The upper panel of figure 6 shows the comparison for the US and EU-14. Further cross-country results are shown in the lower panel of the same figure. As documented and examined in Trabandt and Uhlig (2011), the consumption tax Laffer curve has no peak. However, the introduction of human capital has important quantitative effects across countries. The range of maximum additional tax revenues (in percent of GDP) in the above baseline model is roughly 40-90 percent while it shrinks to 11-22 percent in the model with added human capital. Higher consumption taxes affect equilibrium labor by increasing the labor wedge similar to labor taxes. Human capital amplifies the reduction of the labor tax base triggered by a higher labor wedge by the same argument as in the previous subsection. Overall, maximum possible tax revenues due to consumption taxes are reduced massively, although at fairly high consumption tax rates.

5. Conclusion

Trabandt and Uhlig (2011) have recently characterized Laffer curves for labor and capital taxation for the U.S., the EU-14, and individual European countries with focus, details and extensions much being directed to the comparison of the U.S. and the aggregate EU-14 economy. This paper broadens and extends the cross-country analysis of Laffer curves along the following dimensions and questions.

First, the model in Trabandt and Uhlig (2011) is refined by allowing for intermediate inputs which are supplied by monopolistically competitive firms. We document that this results in an even better model-data comparison. Overall, the introduction of intermediate inputs moves countries closer to the peak of the labor tax Laffer curve and somewhat farther away from the peak of the capital tax Laffer curve.

Second, we discuss the various sources of differences across countries in the shape of the Laffer curve in more detail. It appears that labor income and consumption taxes (i.e. the labor wedge) are important for accounting for most of the cross-country differences with respect to Laffer curves.

Third, we compare Laffer curves for the average sample 1995-2010 with those in 2010. We show that the vast the majority of countries have moved closer to the peaks of their labor and capital income tax Laffer curves and Laffer hills respectively.

Fourth, we answer the question: what is the maximum interest rate on outstanding government debt that the government could afford without cutting government spending? According to the model, the USA, Germany, Ireland, the Netherlands and Spain are the countries that can bear the highest interest rates. By contrast, Belgium, Denmark, Sweden, United Kingdom, Italy and France are the countries who can afford the lowest interest rates.

Fifth, the introduction of human capital has rather dramatic effects for the labor income tax Laffer curve across countries. All countries except the USA and Ireland are pushed on the slippery slope sides of their labor tax Laffer curves once human capital is accounted for.

Sixth, we perform a cross-country analysis on consumption taxes. We document that the range of maximum additional tax revenues (in percent of GDP) in the baseline model is roughly 40-90 percent while it shrinks to 11-22 percent in the model with added human capital, although the underlying consumption taxes are fairly high in both cases.

References

Bi, H., 2010. Sovereign default risk premia, fiscal limits, and fiscal policy. Unpublished Manuscript.

Bi, H., Leeper, E. M., Leith, C., 2010. Stabilization versus sustainability: Macroeconomic policy tradeoffs. Unpublished Manuscript.

Trabandt, M., Uhlig, H., May 2011. The Laffer curve revisited. Journal of Monetary Economics 58 (4), 305–327.

6. Tables and Figures

Variable	US	EU-14	Description	Restriction
			Fiscal Policy	
τ^n	28.1	41.0	Labor tax rate	Data
τ^k	36.7	33.0	Capital tax rate	Data
τ^c	4.6	17.0	Consumption tax rate	Data
$\overline{b/y}$	66.2	67.3	Annual government debt to GDP	Data
$\overline{g/y}$	18.0	23.1	Gov.consumption+invest. to GDP	Data
$\overline{s/y}$	5.3	11.1	Government transfers to GDP	Implied
			Trade	
$\overline{m/y}$	3.6	-1.2	Net imports to GDP	Data
			Technology	
ψ	2	2	Annual balanced growth rate	Data
θ	0.35	0.35	Capital share in production	Data
δ	0.06	0.06	Depreciation rate of capital	Data
$\bar{R}-1$	4	4	Annual real interest rate	Data
ω	1.4	1.4	Gross markup	Data
ϕ	0.3	0.3	Share of profits subject to capital taxes	Data
			CFE preferences	
η	2	2	Inverse of IES	Data
φ	1	1	Frisch labor supply elasticity	Data
κ	2.32	2.32	Weight of labor	$\bar{n}_{us} = 0.25$

Table 1: Baseline calibration and parameterization for the US and EU-14 benchmark model. Numbers expressed in percent where applicable. Sample: 1995-2010. IES denotes intertemporal elasticity of substitution. CFE refers to constant Frisch elasticity preferences. $\bar{n}_{us}$ denotes balanced growth labor in the US which is set to 25 percent of total time.

	$\bar{\tau}^n$			$\bar{\tau}^c$		$\bar{\tau}^k$		$\overline{b/y}$		$\overline{m/y}$		$\overline{g/y}$		$\overline{s/y}$	
	∅	2010[a]	2010[b]	∅	2010[a]	∅	2010[a]	∅	2010	∅	2010	∅	2010	∅	2010
USA	28	28	33	5	4	37	38	66	92	4	4	18	20	5	5
EU-14	41	41	45	17	17	33	34	67	83	-1	-1	23	25	11	11
GER	41	42	42	16	17	24	25	64	83	-3	-5	21	21	10	10
FRA	46	46	47	18	17	36	39	63	82	-0	2	27	28	11	11
ITA	47	48	48	14	14	35	39	111	119	-1	2	22	23	14	14
GBR	28	30	40	16	15	46	45	48	80	2	3	22	26	11	11
AUT	50	50	52	20	19	24	23	66	72	-3	-5	21	21	16	16
BEL	49	49	54	17	18	42	40	104	97	-4	-3	24	26	15	15
DNK	48	48	51	35	34	52	59	49	44	-5	-6	28	32	23	23
FIN	48	47	55	27	25	31	29	45	48	-6	-3	25	27	16	16
GRE	40	40	45	15	15	16	15	105	143	10	8	21	21	9	9
IRL	27	28	41	26	26	21	23	48	96	-13	-19	19	23	8	8
NET	44	45	58	20	20	29	26	58	63	-7	-8	27	32	6	6
PRT	32	34	35	21	21	24	28	61	93	9	7	23	24	9	9
ESP	36	37	40	14	15	31	36	54	60	3	2	22	24	9	9
SWE	56	55	56	26	27	41	42	54	40	-7	-6	30	31	16	16

Table 2: Individual country calibration of the benchmark model for the average (∅) sample 1995-2010 and for the year 2010. Country codes: Germany (GER), France (FRA), Italy (ITA), United Kingdom (GBR), Austria (AUT), Belgium (BEL), Denmark (DNK), Finland (FIN), Greece (GRE), Ireland (IRL), Netherlands (NET), Portugal (PRT), Spain (ESP) and Sweden (SWE). See table 1 for abbreviations of variables. All numbers are expressed in percent. *a* - due to data availability reasons, the year 2007 value for tax rates has been assumed to remain in 2008-2010 for most of the analysis in this paper. *b* - we deviate from *a* in sections XX and XX by letting labor taxes in 2010 adjust to balance the 2010 government budget. More precisely, we calculate the 2010 labor tax given government debt and consumption in 2010 as well as average (1995-2010) model implied transfers.

Max. add. tax revenues (in % of baseline GDP)							
		Start with US and impose country calibration for...					
	Baseline	$\bar{\tau}^n$	$\bar{\tau}^k$	$\bar{\tau}^c$	$\overline{b/y}$	$\overline{g/y}$	$\overline{m/y}$
USA	4.9	4.9	4.9	4.9	4.9	4.9	4.9
EU-14	1.4	2.0	5.2	2.9	4.9	5.4	5.4
GER	1.9	2.0	5.9	3.1	4.9	5.2	5.6
FRA	0.7	1.2	5.0	2.8	4.9	5.8	5.3
ITA	0.6	1.0	5.1	3.3	4.9	5.3	5.4
GBR	2.9	4.9	4.3	3.1	4.9	5.3	5.1
AUT	0.3	0.6	5.9	2.6	4.9	5.2	5.6
BEL	0.3	0.7	4.6	2.9	4.9	5.5	5.7
DNK	0.0	0.9	3.8	1.0	4.9	6.0	5.7
FIN	0.3	0.8	5.4	1.8	4.9	5.6	6.0
GRE	1.6	2.1	6.4	3.2	4.9	5.2	4.5
IRL	5.0	5.2	6.0	1.9	4.9	5.1	7.0
NET	1.7	1.4	5.5	2.6	4.9	5.9	6.0
PRT	2.3	4.0	5.8	2.4	4.9	5.4	4.6
ESP	2.3	3.0	5.3	3.3	4.9	5.3	5.0
SWE	0.0	0.1	4.6	1.9	4.9	6.2	6.0

Table 3: Labor tax Laffer curve: sources of differences across countries. The table provides maximal additional tax revenues (in percent of baseline GDP) if labor taxes are varied. "Baseline" refers to the results when the model is calibrated to country specific averages of 1995-2010, see table 2. Parameters for technology and preferences are set as in table 1. All other columns report results if in the US calibration, fiscal instruments are set to country specific values (each at a time).

Max. add. tax revenues (in % of baseline GDP)							
		Start with US and impose country calibration for...					
	Baseline	$\bar{\tau}^n$	$\bar{\tau}^k$	$\bar{\tau}^c$	$\overline{b/y}$	$\overline{g/y}$	$\overline{m/y}$
USA	3.5	3.5	3.5	3.5	3.5	3.5	3.5
EU-14	2.1	2.2	4.0	2.2	3.5	3.7	3.7
GER	3.3	2.2	5.4	2.3	3.5	3.6	3.9
FRA	1.5	1.8	3.5	2.1	3.5	4.0	3.7
ITA	1.6	1.7	3.7	2.4	3.5	3.7	3.7
GBR	1.4	3.4	2.2	2.3	3.5	3.7	3.5
AUT	2.2	1.5	5.3	2.0	3.5	3.6	3.8
BEL	0.9	1.6	2.7	2.1	3.5	3.8	3.9
DNK	0.0	1.7	1.3	1.0	3.5	4.1	3.9
FIN	1.6	1.6	4.3	1.4	3.5	3.9	4.1
GRE	3.5	2.3	6.5	2.3	3.5	3.6	3.2
IRL	4.9	3.5	5.7	1.5	3.5	3.5	4.6
NET	2.9	2.0	4.6	2.0	3.5	4.0	4.1
PRT	3.0	3.1	5.3	1.9	3.5	3.7	3.2
ESP	2.6	2.7	4.2	2.4	3.5	3.7	3.5
SWE	0.6	1.2	2.8	1.5	3.5	4.2	4.1

Table 4: Capital tax Laffer curve: sources of differences across countries. The table provides maximal additional tax revenues (in percent of baseline GDP) if capital taxes are varied. "Baseline refers" to the results when the model is calibrated to country specific averages of 1995-2010, see table 2. Parameters for technology and preferences are set as in table 1. All other columns report results if in the US calibration, fiscal instruments are set to country specific values (each at a time).

	Vary Labor Taxes, $\bar{\tau}^n$ $\Delta\overline{T}_{Max}$		Vary Capital Taxes, $\bar{\tau}^k$ $\Delta\overline{T}_{Max}$		Vary $\bar{\tau}^n$ and $\bar{\tau}^k$ jointly $\Delta\overline{T}_{Max}$	
	∅	2010	∅	2010	∅	2010
USA	20.1	14.6	14.1	10.9	23.8	17.8
EU-14	4.0	2.1	5.9	4.5	7.2	5.1
GER	5.9	5.5	10.2	9.6	11.8	11.2
FRA	1.8	1.1	3.9	2.7	4.3	3.0
ITA	1.7	1.0	4.2	2.7	4.5	2.9
GBR	8.6	2.9	4.2	2.4	9.5	3.9
AUT	0.8	0.6	5.7	5.8	5.7	5.9
BEL	0.7	0.1	2.0	1.9	2.2	1.9
DNK	0.0	0.4	0.0	0.3	0.1	0.6
FIN	0.7	-0.0	3.8	3.0	3.9	3.4
GRE	4.9	3.1	11.2	10.2	11.9	10.4
IRL	17.7	9.5	17.3	13.6	25.4	18.0
NET	4.7	0.6	8.2	6.5	9.8	6.5
PRT	7.1	5.0	9.2	7.1	11.5	8.6
ESP	7.1	4.4	8.1	5.4	10.8	7.1
SWE	0.0	0.0	1.4	1.2	1.5	1.4

Table 5: Laffer curves and Laffer hill for 1995-2010 vs. 2010 calibration. The model is either calibrated to the average of 1995-2010 or to the 2010, see table 2. Parameters are set as in table 1. $\Delta\overline{T}_{Max}$ denotes the maximum additional tax revenues (in %) that results from moving from to the peak of the Laffer curve.

	Vary Labor Taxes, $\bar{\tau}^n$		Vary Capital Taxes, $\bar{\tau}^k$		Vary $\bar{\tau}^n$ and $\bar{\tau}^k$ jointly	
	$\Delta\overline{T/y}_{Max}$	$\bar{r}_{Max}$	$\Delta\overline{T/y}_{Max}$	$\bar{r}_{Max}$	$\Delta\overline{T/y}_{Max}$	$\bar{r}_{Max}$
USA	3.9	8.3	2.9	7.2	4.8	9.2
EU-14	0.8	5.0	1.7	6.1	1.9	6.3
GER	1.8	6.2	3.2	7.8	3.7	8.4
FRA	0.4	4.5	1.1	5.3	1.2	5.5
ITA	0.4	4.3	1.1	4.9	1.1	5.0
GBR	1.1	5.4	0.9	5.2	1.5	5.9
AUT	0.2	4.3	2.3	7.1	2.3	7.1
BEL	0.0	4.0	0.8	4.8	0.8	4.9
DNK	0.2	4.5	0.2	4.4	0.3	4.7
FIN	-0.0	4.0	1.3	6.7	1.5	7.1
GRE	1.0	4.7	3.4	6.4	3.4	6.4
IRL	3.1	7.2	4.4	8.6	5.9	10.1
NET	0.2	4.4	2.6	8.1	2.6	8.1
PRT	1.8	5.9	2.5	6.7	3.0	7.2
ESP	1.6	6.6	1.9	7.2	2.5	8.1
SWE	0.0	4.0	0.6	5.4	0.6	5.6

Table 6: Maximum additional tax revenue and interest rates for the labor and capital tax Laffer curve respectively Laffer hill. The model is calibrated to the year 2010, see table 2. Parameters are set as in table 1. $\Delta\overline{T/y}_{Max}$ denotes the maximum additional tax revenues (expressed in % of baseline GDP) that results from moving from the 2010 status quo to the peak of the Laffer curve. $\bar{r}_{Max}$ is the maximum net real interest rate that the government could afford on outstanding debt in the year 2010 if all additonal tax revenue is spent on interest rate payments. All numbers are in percent.

	Distance to Peak in Terms of Tax Rates (in %)			
	Vary Labor Taxes, $\bar{\tau}^n$		Vary Capital Taxes, $\bar{\tau}^k$	
	Baseline	Human Capital	Baseline	Human Capital
USA	29.9	3.9	32.3	30.3
EU-14	14.0	-16.0	29.0	28.0
GER	16.8	-10.2	39.4	39.4
FRA	8.4	-22.6	23.8	23.8
ITA	8.2	-22.8	24.1	22.1
GBR	22.7	-9.3	19.5	17.5
AUT	4.9	-27.1	32.2	30.2
BEL	4.3	-28.7	17.1	16.1
DNK	-6.5	-47.5	0.7	-1.3
FIN	4.6	-29.4	27.0	28.0
GRE	14.5	-15.5	42.4	34.4
IRL	33.7	13.7	47.7	54.7
NET	16.0	-10.0	36.3	41.3
PRT	19.1	-12.9	35.8	29.8
ESP	19.0	-10.0	31.6	28.6
SWE	-3.7	-39.7	15.9	18.9

Table 7: Distance to the peak of Laffer curves for baseline model and baseline model with added human capital accumulation (second generation, see Trabandt and Uhlig (2011) for details). Distance is measured in terms of tax rates. All numbers are expressed in percent. The model is calibrated to the average of 1995-2010 for fiscal variables. Standard parameters for technology and preferences are set as in table 1. Parameters for human capital accumulation are set as in Trabandt and Uhlig (2011).

	Vary Consumption Taxes: Distance to Peak in Terms of Tax Revenues (in % of GDP)	
	Baseline	Human Capital
USA	84.2	21.0
EU-14	60.1	16.5
GER	58.3	16.9
FRA	54.7	15.2
ITA	63.4	16.5
GBR	73.4	18.2
AUT	60.2	16.4
BEL	53.7	14.5
DNK	48.1	12.4
FIN	45.3	13.6
GRE	93.1	22.0
IRL	41.2	14.7
NET	39.3	13.3
PRT	85.0	20.8
ESP	72.2	18.7
SWE	37.1	11.4

Table 8: Maximum additional tax revenues due to consumption taxes. Baseline model versus baseline model with added human capital accumulation (second generation human capital accumulation growth model, see Trabandt and Uhlig (2011) for details). Additional tax revenues are measured in percent of baseline GDP. The model is calibrated to the average of 1995-2010 for fiscal variables. Standard parameters for technology and preferences are set as in table 1. Parameters for human capital accumulation are set as in Trabandt and Uhlig (2011).

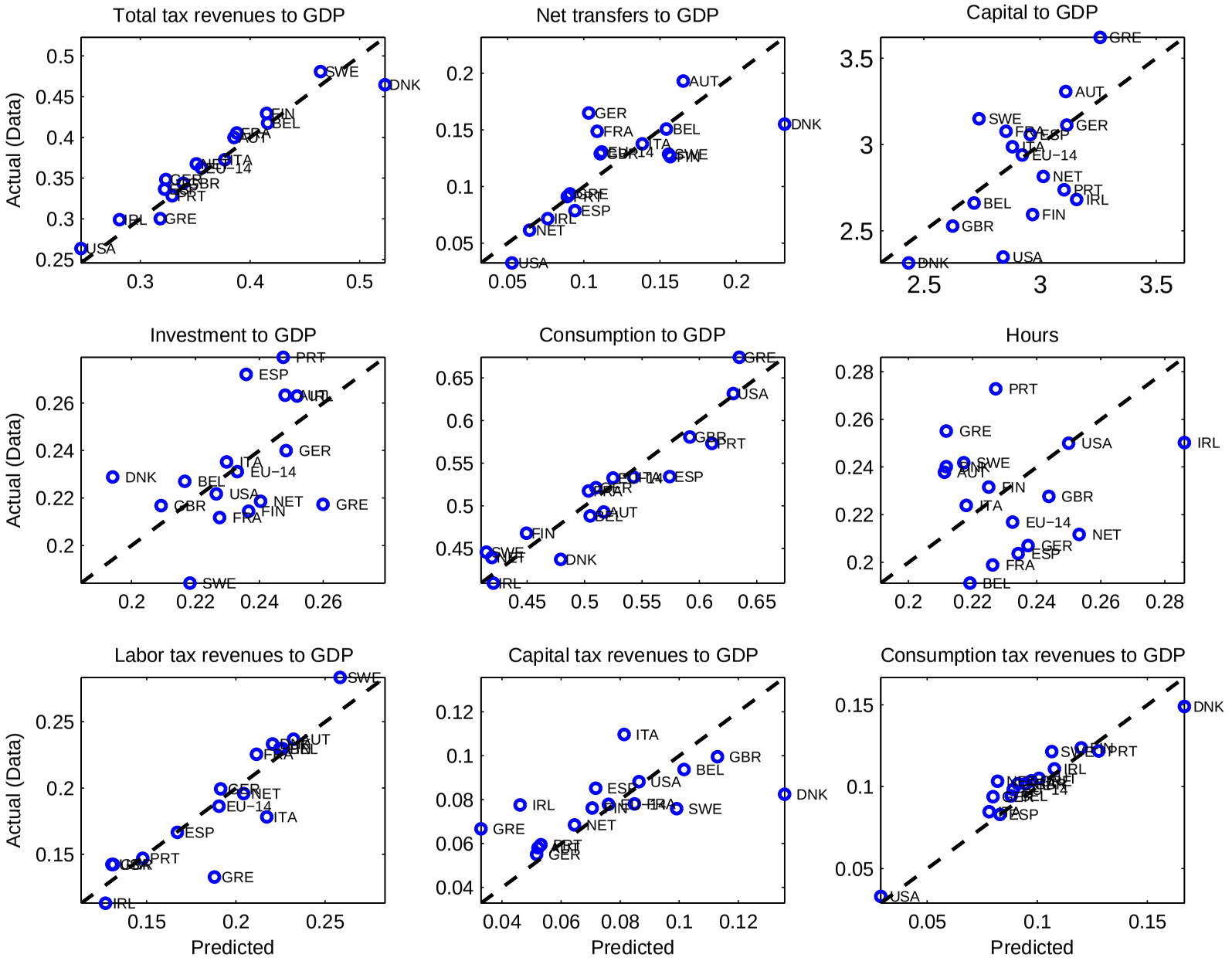


Figure 1: Comparison of 'actual' vs. 'predicted' variables. 'Actual' refers to data sample averages for 1995-2010. 'Predicted' refers to model implied steady state (balanced growth path) variables when the model is calibrated as in see table 2. Parameters for technology and preferences are set as in table 1. .

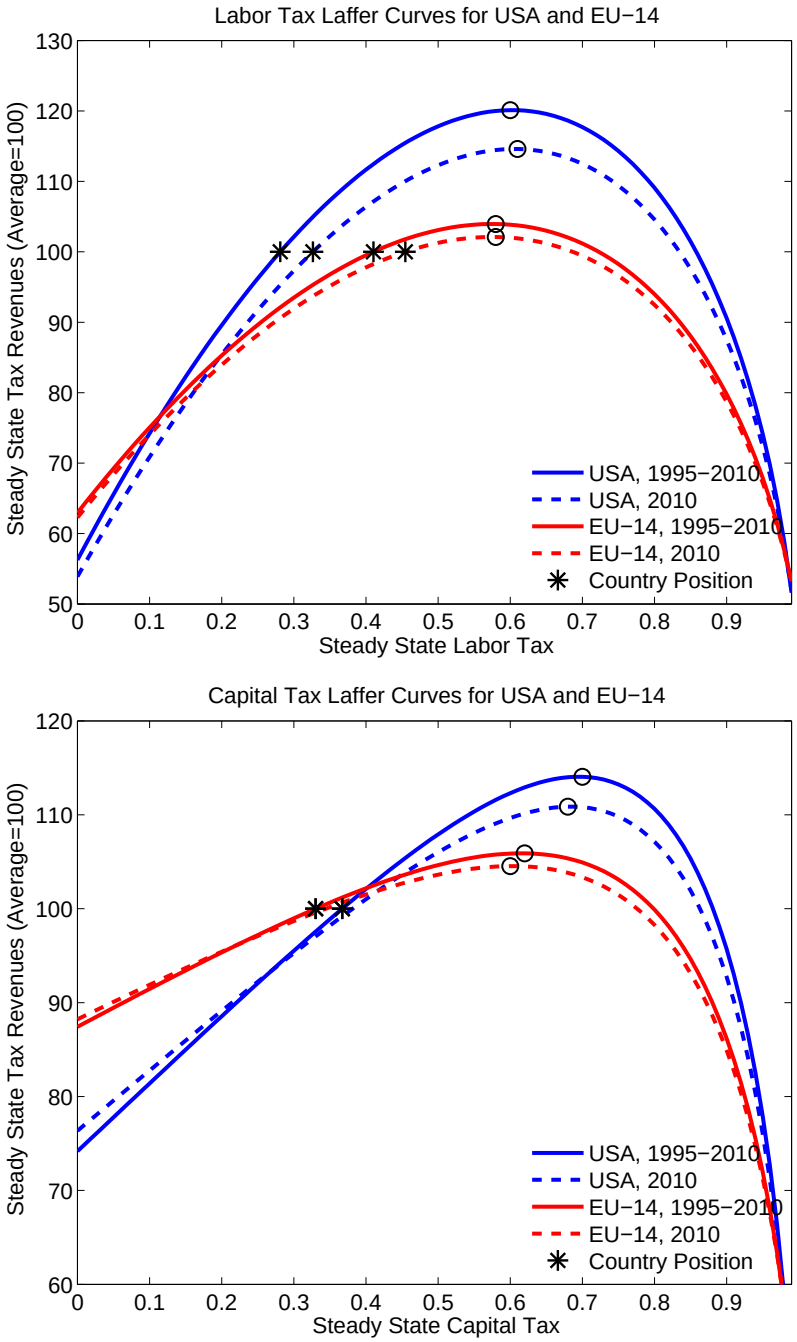


Figure 2: Comparing the US and the EU-14 labor and capital tax Laffer curve. The model is either calibrated to the average of 1995-2010 or to the 2010, see table 2. Parameters for technology and preferences are set as in table 1. Shown are steady state (balanced growth path) total tax revenues when labor taxes (upper panel) or capital taxes (lower panel) are varied between 0 and 100 percent. All other taxes and parameters are held constant. Total tax revenues at the average 1995-2010 or at the year 2010 tax rates are normalized to 100. Stars indicate positions of respective countries on their Laffer curves.

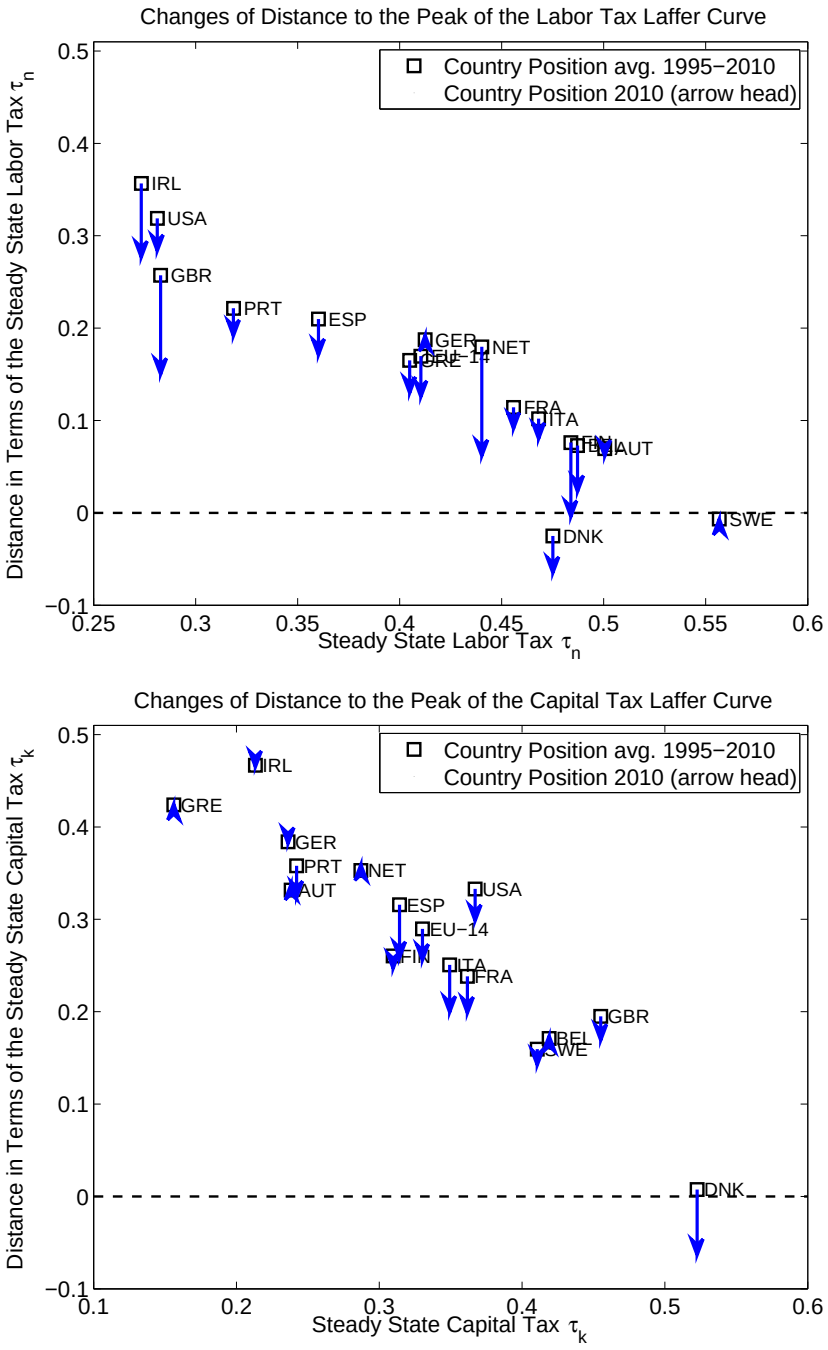


Figure 3: Distance to the peak of Laffer curves for average 1995-2010 vs. 2010 calibration. The model is either calibrated to the average of 1995-2010 or to the 2010, see table 2. Parameters for technology and preferences are set as in table 1. Horizontal axis shows calibrated tax rates. Vertial axis shows distance to the peak in terms of tax rates.

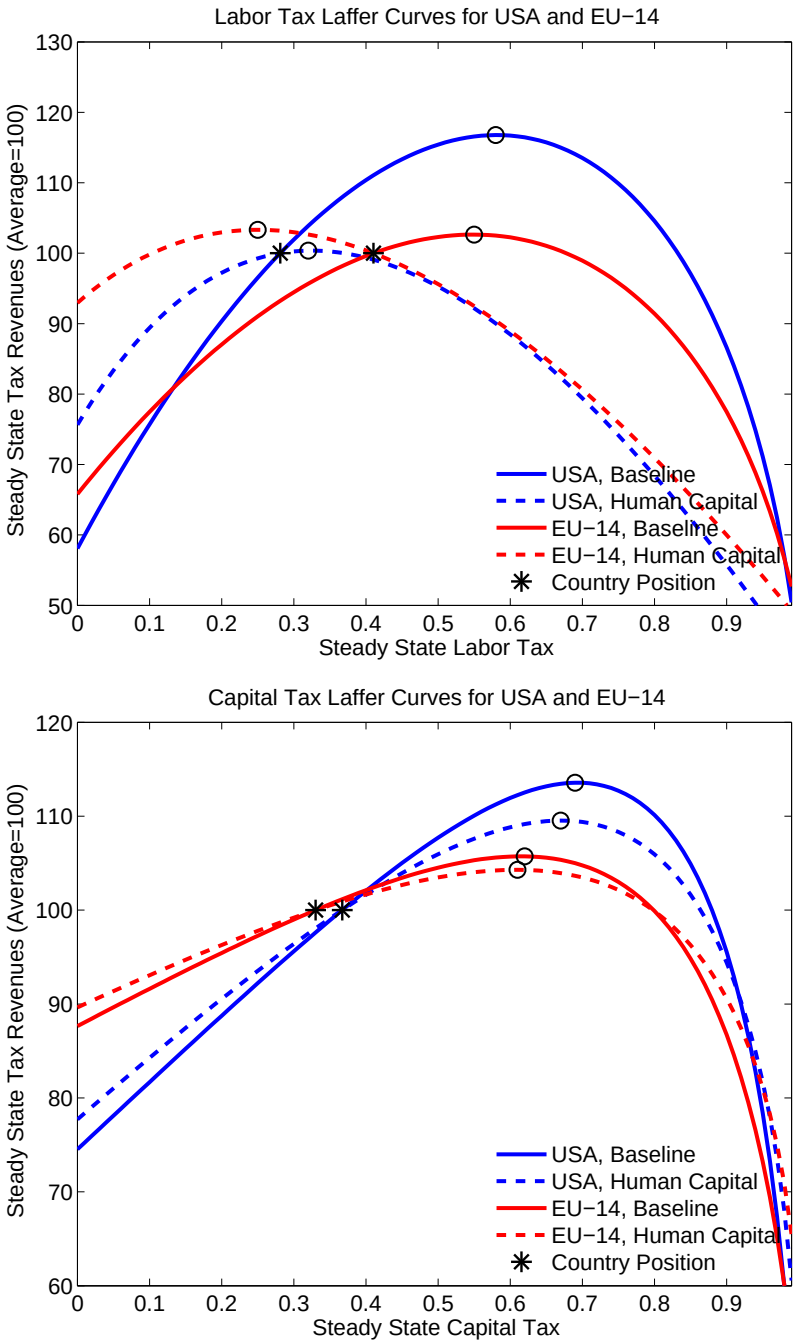


Figure 4: Labor and capital tax Laffer curves: the impact of endogenous human capital accumulation. Shown are steady state (balanced growth path) total tax revenues when labor taxes are varied between 0 and 100 percent in the USA and EU-14. All other taxes and parameters are held constant. Total tax revenues at the average tax rates are normalized to 100. Two cases are examined. First, the benchmark model with exogenous growth. Second, the benchmark model with a second generation version of endogenous human capital accumulation (see Trabandt and Uhlig (2011) for details). The model is calibrated to the average of 1995-2010 for fiscal variables. Standard parameters for technology and preferences are set as in table 1. Parameters for human capital accumulation are set as in Trabandt and Uhlig (2011).

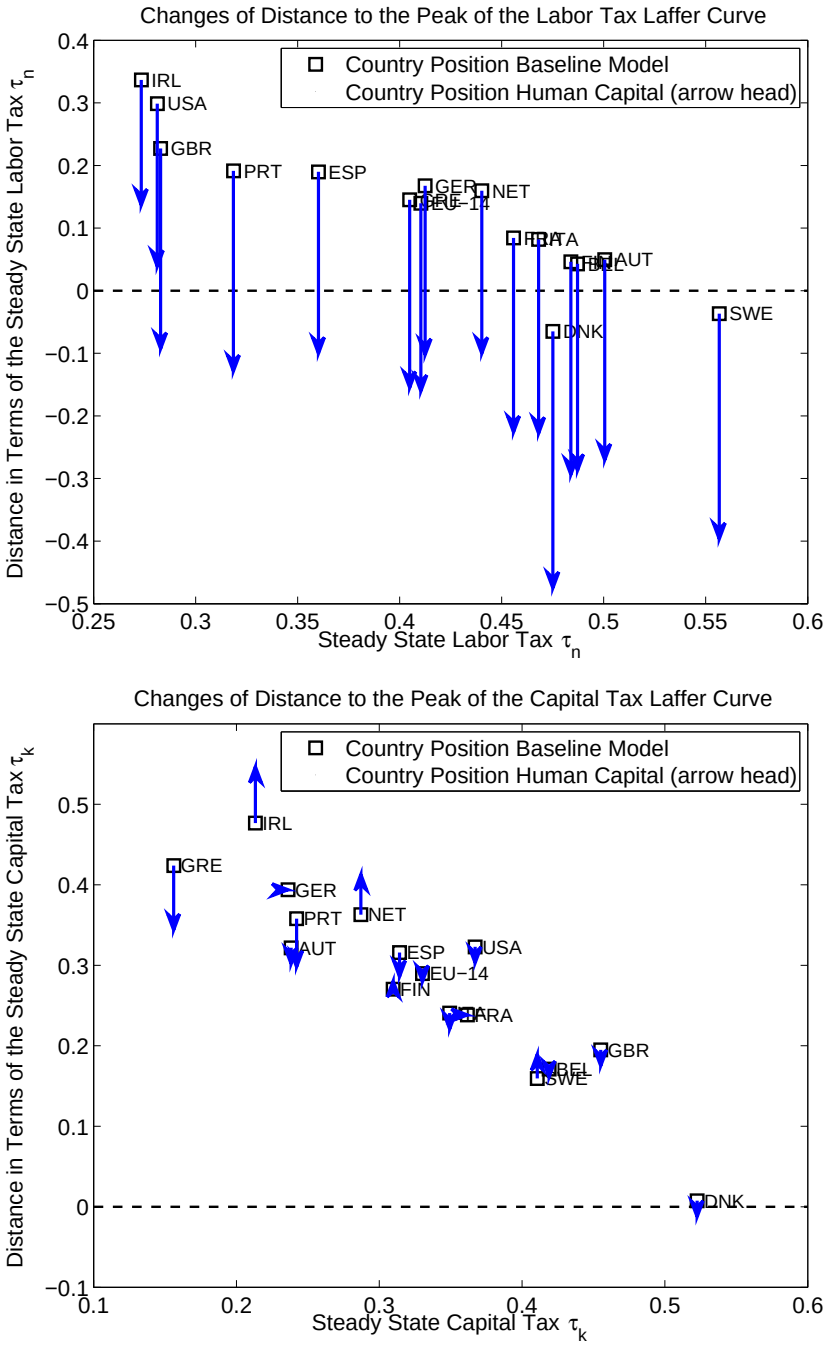


Figure 5: Distance to the peak of Laffer curves for baseline model and baseline model with added human capital accumulation (second generation, see Trabandt and Uhlig (2011) for details). The model is calibrated to the average of 1995-2010 for fiscal variables. Standard parameters for technology and preferences are set as in table 1. Parameters for human capital accumulation are set as in Trabandt and Uhlig (2011). Horizontal axis shows calibrated tax rates. Vertial axis shows distance to the peak in terms of tax rates.

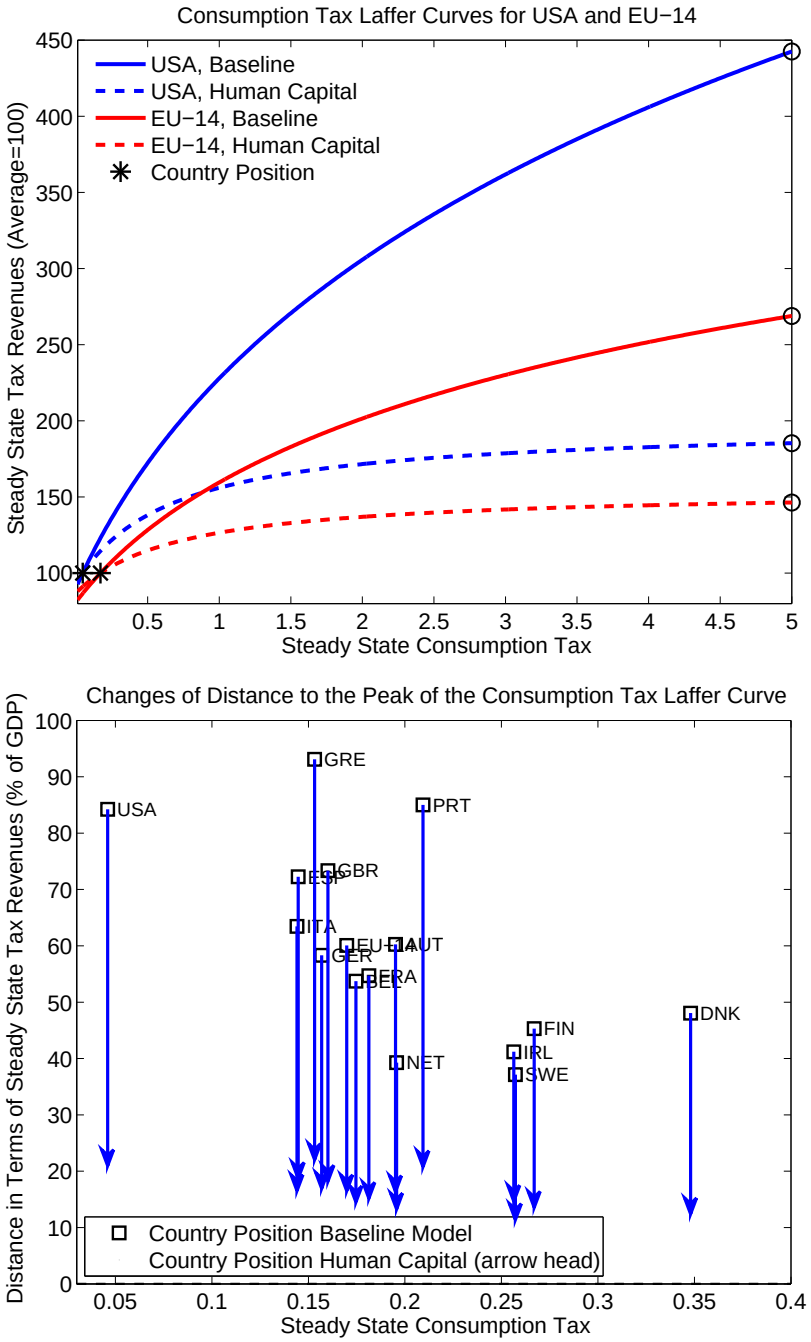


Figure 6: Upper panel: Consumption tax Laffer curve in the USA and EU-14: the impact of endogenous human capital accumulation. Shown are steady state (balanced growth path) total tax revenues when consumption taxes are varied between 0 and 500 percent. All other taxes and parameters are held constant. Total tax revenues at the average consumption tax rate are normalized to 100. Two cases are examined. First, the benchmark model with exogenous growth. Second, the benchmark model with a second generation version of endogenous human capital accumulation (see Trabandt and Uhlig (2011) for details). The model is calibrated to the average of 1995-2010 for fiscal variables. Standard parameters for technology and preferences are set as in table 1. Parameters for human capital accumulation are set as in Trabandt and Uhlig (2011).
Lower panel: Distance to the peak of Laffer curves for baseline model and baseline model with added human capital accumulation. Horizontal axis shows calibrated tax rates. Vertial axis shows distance to the peak in terms of tax revenues (in percent of GDP).