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Preprint

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Suggested Citation: Vasilev, Aleksandar (2016) : Optimal fiscal policy with utility-enhancing government spending, consumption taxation and a common income tax rate: the case of Bulgaria, ZBW - Deutsche Zentralbibliothek für Wirtschaftswissenschaften, Leibniz-Informationszentrum Wirtschaft, Kiel und Hamburg

This Version is available at:

<https://hdl.handle.net/10419/146939>

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Optimal fiscal policy with utility-enhancing government spending, consumption taxation and a common income tax rate: the case of Bulgaria

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October 7, 2016

Abstract

This paper explores the effects of fiscal policy in an economy based on indirect taxes, and taxing all income at the same rate. The focus of the paper is on the relative importance of consumption vs. income taxation, as well as on the provision of productive public services. To this end, a Real-Business-Cycle model, calibrated to Bulgarian data (1999-2014), was set up with a richer public finance side. Bulgarian economy was chosen as a case study due to its dependence on consumption taxation as a source of tax revenue. To illustrate the effects of fiscal policy, two regimes were compared and contrasted to one another - exogenous vs. optimal (Ramsey) policy case. The main findings from the computational experiments performed are: (i) The optimal steady-state (capital and labor income) tax rate is zero, as it is the most distortionary tax to use; (ii) The benevolent Ramsey planner provides the optimal amount of the utility-enhancing public services. (iii) The optimal steady-state consumption tax has to triple to finance the optimal level of government spending.

Keywords: consumption tax, income tax, general equilibrium, fiscal policy, Bulgaria

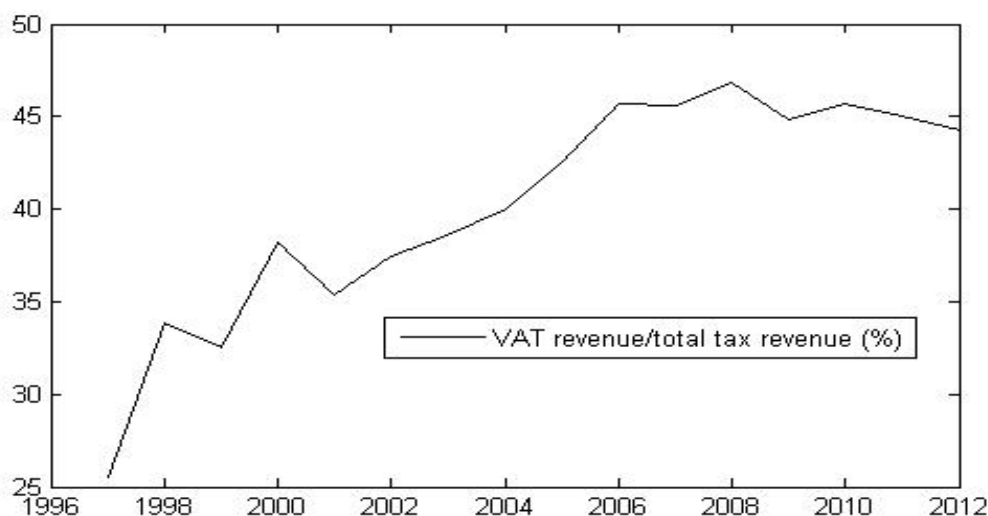
JEL Classification Codes: D58, E26, H26

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1 Introduction and Motivation

Since the early 1990s, many macroeconomic studies have investigated the effects of both exogenous and optimal fiscal policy in general equilibrium setups¹. The main focus of the computational experiments performed, however, has been predominantly on the effects of government purchases, public investment and taxes. The literature overemphasized the distinction between capital and labor income taxation, and abstracted away from consumption taxation given the absence of a federal sales tax in the US.

Figure 1: Fiscal importance of VAT revenue in Bulgaria (1997-2012)



Source: WDI (2015)

On the other hand, in Eastern Europe, the move is toward a common income tax rate, and reliance on indirect (consumption/VAT) taxation. Mostly due to the absence of sufficiently qualified tax administration in the early 1990s, Bulgaria, a small Eastern European economy, and a recent EU member-state, adopted a public finance model that was built on consumption-based taxation. As seen from Fig. 1 above, VAT revenue is the major source

¹For, example, Christiano and Eichenbaum (1992), Baxter and King (1993), MacGrattan (1994), Mendoza and Tesar (1998), and Chari, Christiano and Kehoe (1994, 1999), and many others

of tax revenue in Bulgaria (and most of Central and Eastern Europe, for that matter).² Post-1997, the share of VAT revenue in total government revenue increased until it levelled off at approximately 45% of total tax revenue after Bulgaria's EU accession in 2007.

Compared to consumption-based taxation, income taxation in Bulgaria is of much smaller importance for the budget: for example, over the period 2007-2014, taxation of individuals constitutes 9-11 % of overall tax revenue. In order to attract foreign investors, and the decrease the incentive to declare income as the one that is levied at a lower rate, as of 2008 both capital and labor income, as well as corporate profits are taxed at the same flat rate of 10%. Such an important institutional constraint poses a slightly different public finance problem, as compared to the ones discussed in the literature. Instead of choosing three tax rates, the fiscal authority is setting a common income tax rate, and a tax rate on consumption.³ The specification here is an important variation of the problem in the literature, which is relevant for policy-makers both in the EU, as well as in Eastern Europe, where the economies are based around low income taxes and higher indirect taxes.

The paper then proceeds to characterize optimal fiscal policy in the context above and then to evaluate it relative to the exogenous (observed) one. Similar to earlier literature, e.g. Judd (1985), Chamley (1986), and Zhu (1992), allowing for fiscal interventions in an RBC framework creates interesting trade-offs: On the one hand, spending on productive government services directly increases household's utility. On the other, the proportional taxes on labor and capital are known to distort incentives to supply labor in the private and public sectors, and to accumulate physical capital. Therefore, higher taxes reduce consumption, which in turn lowers welfare - both directly, and indirectly by generating less consumption revenue which could be spent on utility-enhancing public services. However, in contrast to

²VAT as a share in total tax revenue increased in importance after its introduction and implementation in 1994 from 25% of total tax revenue to 35% in the years following the currency board implementation (in 1997), where the increase was due to the macroeconomic stability that was achieved by fixing the Bulgarian lev (BGN) to the German mark at parity.

³Earlier Ramsey setups abstract away from consumption taxation due to an indeterminacy problem: In the household's marginal rate of substitution, there is a term containing two taxes $(1 - \tau^l)/(1 + \tau^c)$, but only the ratio can be determined.

income taxes, consumption taxation is non-distortionary, as it is a tax on demand.⁴

The public finance problem discussed in this paper is to choose consumption and (labor and capital) income tax rate to finance both productive and redistributive government expenditure, while at the same time minimizing the allocative distortions created in the economy, as a result of the presence of proportional taxation. The main findings from the computational experiments performed are: (i) The optimal steady-state (capital and labor income) tax rate is zero, as it is the most distortionary tax to use; (ii) The benevolent Ramsey planner provides the optimal amount of the utility-enhancing public services. (iii) The optimal steady-state consumption tax has to triple to finance the now much higher government spending.

The rest of the paper is organized as follows: Section 2 describes the model framework and describes the decentralized equilibrium system, Section 4 discusses the calibration procedure, and Section 4 presents the steady-state model solution. Sections 5 proceeds with the optimal taxation (Ramsey) policy problem, and evaluates the long-run effects on the economy. Section 6 concludes the chapter.

2 Model Description

There is a representative households which derives utility out of consumption, leisure and public services. The time available to households can be spent in productive use or as leisure. The government taxes consumption spending and levies a common tax on all income, in order to provide utility-enhancing public services and government transfers. On the production side, there is a representative firm, which hires labor and capital to produce a homogenous final good, which could be used for consumption, investment, or government purchases.

⁴In the optimal fiscal policy framework, consumption tax rate, despite being a choice variable, turns out to be determined residually to balance the budget constraint.

2.1 Households

There is a representative household, which maximizes its utility function:

$$\sum_{t=0}^{\infty} \beta^t \left\{ \ln c_t + \gamma \ln(1 - h_t) + \phi \ln g_t^c \right\}, \quad (2.1)$$

where c_t denotes household's private consumption in period t , h_{it} are non-leisure hours in period t , g_t^c is the per-household consumption of public services, $0 < \beta < 1$ is the discount factor, $\gamma > 0$ is the relative weight that the household attaches to leisure, and $\phi > 0$ is the relative weight that the household attaches to the consumption of public services.⁵

The household starts with an initial stock of physical capital k_0 , and has to decide how much to add to it in the form of new investment. Every period physical capital depreciates at a rate δ , $0 < \delta < 1$. The law of motion for physical capital is then

$$k_{t+1} = i_t + (1 - \delta)k_t, \quad (2.2)$$

and the real interest rate is r_t , hence the before-tax capital income of the household in period t equals $r_t k_t$. In addition to capital income, the household can generate labor income. Hours supplied to the representative firm are rewarded at the hourly wage rate of w_t , so pre-tax labor income equals $w_t h_t$.

Next, the household's problem can be now simplified to

$$\sum_{t=0}^{\infty} \beta^t \left\{ \ln c_t + \gamma \ln(1 - h_t) + \phi \ln g_t^c \right\} \quad (2.3)$$

s.t.

$$(1 + \tau^c)c_t + k_{t+1} - (1 - \delta)k_t = (1 - \tau^y)w_t h_t + (1 - \tau^y)r_t k_t + g_t^t + \pi_t, \quad (2.4)$$

where τ^c is the tax on consumption, τ^y is the proportional income tax rate ($0 < \tau^y < 1$), levied on both labor and capital income, π_t are the claims to firm's profit, and g_t^t denotes

⁵The log-separable class of utility functions was chosen to greatly simplify the algebra that is to follow, without affecting the main results of the paper in a major way.

government transfers. The problem generates the following optimality conditions:

$$c_t : \frac{1}{c_t} = \lambda_t(1 + \tau^c) \quad (2.5)$$

$$k_{t+1} : \lambda_t = \beta\lambda_{t+1}[1 + (1 - \tau^y)r_{t+1} - \delta] \quad (2.6)$$

$$h_t : \frac{\gamma}{1 - h_t} = \lambda_t(1 - \tau^y)w_t \quad (2.7)$$

$$TVC : \lim_{t \rightarrow \infty} \beta^t \lambda_t k_{t+1} = 0, \quad (2.8)$$

where λ_t is the Lagrangean multiplier attached to household's budget constraint in period t .

The interpretation of the first-order conditions above is standard: the first one states that for each household, the marginal utility of consumption equals the marginal utility of wealth, corrected for the consumption tax rate. The second equation is the so-called "Euler condition," which describes how the household chooses to allocate physical capital over time. Next, at the margin, each hour spent working for the firm should balance the benefit from doing so in terms of additional income generates, and the cost measured in terms of lower utility of leisure. The last condition is called the "transversality condition" (TVC): it states that at the end of the horizon, the value of physical capital should be zero.

2.2 Firm

There is a representative firm in the economy, which produces a homogeneous product. The price of output is normalized to unity. The production technology is Cobb-Douglas and uses both physical capital, k_t , and labor hours, h_t , to maximize static profit

$$\Pi_t = Ak_t^\alpha h_t^{1-\alpha} - r_t k_t - w_t h_t, \quad (2.9)$$

where A denotes the level of technology. Since the firm rents the capital from households, the problem of the firm is a sequence of static profit maximizing problems. In equilibrium, there are no profits, and each input is priced according to its marginal product, *i.e.*:

$$k_t : \alpha \frac{y_t}{k_t} = r_t, \quad (2.10)$$

$$h_t : (1 - \alpha) \frac{y_t}{h_t} = w_t. \quad (2.11)$$

2.3 Government

In the model setup, the government is levying taxes on labor and capital income, as well as consumption in order to finance spending on utility-enhancing government purchases. The government budget constraint is as follows:

$$g_t^c + g_t^t = \tau^c c_t + \tau^y [w_t h_t + r_t k_t] \quad (2.12)$$

Government consumption-to-output ratio would be chosen to match the average share in data, and government transfers would be determined residually in each period so that the government budget is always balanced.

2.4 Dynamic Competitive Equilibrium (DCE)

For a given level of technology A , average tax rates $\{\tau^c, \tau^y\}$, initial capital stock k_0 , the decentralized dynamic competitive equilibrium is a list of sequences $\{c_t, i_t, k_t, h_t\}_{t=0}^{\infty}$ for the household, a sequence of government purchases and transfers $\{g_t^c, g_t^t\}_{t=0}^{\infty}$, and input prices $\{w_t, r_t\}_{t=0}^{\infty}$ such that (i) the household maximizes its utility function subject to its budget constraint; (ii) the representative firm maximizes profit; (iii) government budget is balanced in each period; (iv) all markets clear.

3 Data and Model Calibration

To compute the size of VAT evasion in Bulgaria, we will focus on the period after the introduction of the currency board (1999-2014). Data on output, consumption and investment was collected from National Statistical Institute (2015), while the real interest rate is taken from Bulgarian National Bank Statistical Database (2015). The calibration strategy described in this section follows a long-established tradition in modern macroeconomics: first, the discount factor, $\beta = 0.937$, is set to match the steady-state capital-to-output ratio in Bulgaria, $k/y = 3.491$, in the steady-state consumption-Euler equation (2.6). The labor share parameter, $\alpha = 0.429$, was obtained as the average value of labor income in aggregate output over the period 1999-2014. This value is slightly higher as compared to other studies on developed economies, due to the overaccumulation of physical capital, which was part of the ideology of the totalitarian regime, which was in place until 1989.

The relative weight attached to the utility out of leisure in the household’s utility function, γ , is calibrated to match that in steady-state consumers would supply one-third of their time endowment to working. This is in line with the estimates for Bulgaria as well over the period studied. The weight on public services, $\phi = 0.5$ was set to reflect the fact that people value private consumption twice more than public consumption (Vasilev 2013).⁶ The depreciation rate of physical capital in Bulgaria, $\delta = 0.05$, was taken from Vasilev (2015). It was estimated as the average depreciation rate over the period 1999-2014. Finally, the average income tax rate was set to $\tau^y = 0.1$. This is the average effective tax rate on income between 1999-2007, when Bulgaria used progressive income taxation, and equal to the proportional income tax rate introduced as of 2008. Finally, the tax rate on consumption is set to its value over the period, $\tau^c = 0.2$. Table 1 below summarizes the values of all model parameters used in the paper.

Table 1: Model Parameters

Parameter	Value	Description	Method
β	0.937	Discount factor	Calibrated
α	0.429	Capital Share	Data average
$1 - \alpha$	0.571	Labor Share	Calibrated
γ	1.121	Relative weight attached to leisure	Calibrated
ϕ	0.500	Relative weight attached to public services	Set
δ	0.050	Depreciation rate on physical capital	Data average
τ^y	0.100	Average tax rate on income	Data average
τ^c	0.200	VAT/consumption tax rate	Data average

4 Steady-State

Once the values of model parameters were obtained, the steady-state equilibrium system solved, the "big ratios" can be compared to their averages in Bulgarian data. The results

⁶This parameter becomes relevant only in the optimal policy framework. Robustness checks were performed, and it turned out the value of ϕ does not change the qualitative results.

are reported in Table 2 on the next page. The steady-state level of output was normalized to unity (hence the level of technology A differs from one, which is usually the normalization done in other studies), which greatly simplified the computations. Next, the model matches consumption-to-output and government purchases ratios by construction; The investment ratios are also closely approximated, despite the closed-economy assumption and the absence of foreign trade sector. The shares of income are also identical to those in data, which is an artifact of the assumptions imposed on functional form of the aggregate production function. The after-tax return, where $\bar{r} = (1 - \tau^y)r - \delta$ is also relatively well-captured by the model. Lastly, given the absence of debt, and the fact that transfers were chosen residually to balance the government budget constraint, the result along this dimension is understandably not so close to the average ratio in data.

Table 2: Data Averages and Long-run Solution

Variable	Description	Data	Model
y	Steady-state output	N/A	1.000
c/y	Consumption-to-output ratio	0.674	0.674
i/y	Investment-to-output ratio	0.201	0.175
k/y	Capital-to-output ratio	3.491	3.491
g^c/y	Government cons-to-output ratio	0.151	0.151
g^t/y	Government transfers-to-output ratio	0.220	0.074
wh/y	Labor income-to-output ratio	0.571	0.571
rk/y	Capital income-to-output ratio	0.429	0.429
h	Share of time spent working	0.333	0.333
A	Scale parameter of the production function	N/A	1.095
\bar{r}	After-tax net return on capital	0.056	0.067

5 The Ramsey problem (Optimal fiscal policy under full commitment)

In this section, the government will assume the role of a benevolent planner, who takes into account that the representative household and the firm behave in their own best interests, taking fiscal policy variables as given.⁷ The instruments under government's control in this section are consumption and income tax rate, and public consumption. Government transfers will be held fixed at the level from the exogenous policy case. It is assumed that only proportional taxes are allowed and that the government can credibly commit to those. Thus, only a second-best outcome is feasible. However, the emphasis on the second-best theory makes the setup more realistic, and thus can be taken as a better approximation to the environment in which policymakers decide on a particular fiscal policy.

It is important to emphasize that each set of fiscal policy instruments implies a feasible allocation that fully reflects the optimal behavioral responses of the representative household and stand-in firm. The difference from the analysis performed so far in the chapter, is that in Ramsey framework, the government chooses all instruments, instead of taking them as being exogenous. At the same time, the government also optimally chooses the allocations of agents, as dictated by the dual approach to the Ramsey problem as in Chamley (1986).⁸ It is also assumed that the government discounts time at the same rate (β) as the representative household. The constraints which the government takes into account when maximizing the household's welfare include the government budget constraints, and all the optimal responses of both the household, and the firm. These are summarized in the DCE of the exogenous fiscal policy case. In other words, the choice variables for the government are $\{c_t, h_t, k_{t+1}, w_t, r_t\}_{t=0}^{\infty}$ plus the two tax rates $\{\tau_t^c, \tau_t^y\}_{t=0}^{\infty}$. The initial conditions for the state variable $\{K_0, \}$ as well as the sequence of government transfers $\{g_t^t\}_{t=0}^{\infty}$ and the fixed level of total factor productivity A are taken as given.

Following the procedure in Chamley (1986), the Ramsey problem will be transformed and

⁷The exposition follows closely Vasilev (2013), pp. 134-141.

⁸In contrast, in the primal approach all the policy variables and prices are solved as functions of the allocations, thus the government decides only on the optimal allocation.

simplified, so that the government chooses after-tax interest rate \tilde{r}_t and wage rate \tilde{w}_t directly, instead of setting tax rates and prices separately, where

$$\tilde{r}_t \equiv (1 - \tau_t^y)r_t \quad (5.1)$$

$$\tilde{w}_t \equiv (1 - \tau_t^y)w_t \quad (5.2)$$

Thus, the transformed government budget constraint becomes

$$\tau_t^c c_t + Ak_t^\alpha h_t^{1-\alpha} - \tilde{r}_t k_t - \tilde{w}_t h_t = g_t^c + g_t^t \quad (5.3)$$

Once the optimal after-tax returns are solved for, the expression for the before-tax real interest rate and wage can be obtained from the DCE system. Solving for optimal income tax rates is then trivial. The Ramsey problem then becomes

$$\max_{\{c_t, h_t, k_{t+1}, g_t^c, \tilde{w}_t, \tilde{r}_t, \tau_t^c\}} E_0 \sum_{t=0}^{\infty} \beta^t \left\{ \ln c_t + \gamma \ln(1 - h_t) + \phi \ln g_t^c \right\} \quad (5.4)$$

s.t.

$$\frac{1}{c_t} = \beta E_t \frac{1}{c_{t+1}} [1 - \delta + \tilde{r}_{t+1}] \quad (5.5)$$

$$\frac{\gamma}{1 - h_t} = \frac{\tilde{w}_t}{(1 + \tau_t^c)c_t} \quad (5.6)$$

$$Ak_t^\alpha h_t^{1-\alpha} = c_t + k_{t+1} - (1 - \delta)k_t + g_t^c \quad (5.7)$$

$$\tau_t^c c_t + Ak_t^\alpha h_t^{1-\alpha} - \tilde{r}_t k_t - \tilde{w}_t h_t = g_t^c + g_t^t \quad (5.8)$$

Set up the Lagrangean

$$\begin{aligned} \mathcal{L} = & \max_{\{c_t, h_t, k_{t+1}, g_t^c, \tilde{w}_t, \tilde{r}_t, \tau_t^c\}} E_0 \sum_{t=0}^{\infty} \beta^t \left\{ \ln c_t + \gamma \ln(1 - h_t) + \phi \ln g_t^c \right. \\ & + \lambda_t^1 [-c_{t+1} + c_t(1 - \delta + \tilde{r}_{t+1})] \\ & + \lambda_t^2 [\gamma c_t(1 + \tau_t^c) - (1 - h_t)\tilde{w}_t] \\ & + \lambda_t^3 [Ak_t^\alpha h_t^{1-\alpha} - c_t - k_{t+1} + (1 - \delta)k_t - g_t^c] \\ & \left. + \lambda_t^4 [\tau_t^c c_t + Ak_t^\alpha h_t^{1-\alpha} - \tilde{r}_t k_t - \tilde{w}_t h_t - g_t^c - g_t^t] \right\} \quad (5.9) \end{aligned}$$

where government transfers are held constant at the level from the exogenous policy.

The first-order optimality conditions are as follows:

$$c_t : -\frac{\lambda_{t-1}^1}{\beta} + \frac{1}{c_t} + \lambda_t^1(1 - \delta + \tilde{r}_{t+1}) + \lambda_t^2\gamma(1 + \tau_t^c) - \lambda_t^3 + \lambda_t^4\tau_t^c = 0 \quad (5.10)$$

$$h_t : \frac{\gamma}{1 - h_t} + \lambda_t^2 w_t + \lambda_t^4[w_t - \tilde{w}_t] = 0 \quad (5.11)$$

$$k_{t+1} : -\frac{\lambda_{t-1}^3}{\beta} + \lambda_t^3[r_t + 1 - \delta] + \lambda_t^4[r_t - \tilde{r}_t] = 0 \quad (5.12)$$

$$g_t^c : \frac{\phi}{g_t^c} = \lambda_t^3 + \lambda_t^4 \quad (5.13)$$

$$\tau_t^c : \lambda_t^2\gamma = -\lambda_t^4 \quad (5.14)$$

$$\tilde{r}_t : \frac{\lambda_{t-1}^1 c_{t-1}}{\beta} = \lambda_t^4 k_t \quad (5.15)$$

$$\tilde{w}_t : \lambda_t^2(1 - h_t) = -\lambda_t^4 h_t \quad (5.16)$$

We can also add the equations for the auxiliary variables, namely

$$y_t = Ak_t^\alpha h_t^{1-\alpha} \quad (5.17)$$

$$y_t = c_t + k_{t+1} - (1 - \delta)k_t + g_t^c \quad (5.18)$$

$$i_t = k_{t+1} - (1 - \delta)k_t \quad (5.19)$$

$$r_t = \alpha \frac{y_t}{k_t} \quad (5.20)$$

$$w_t = (1 - \alpha) \frac{y_t}{h_t} \quad (5.21)$$

The full characterization of the long-run Ramsey equilibrium is summarized in Table 3 on the next page, where the same values for the parameters from the exogenous policy section (see Table 1) were used.

There are several additional important findings in the Ramsey equilibrium that can be inferred Table 3 on the previous page. First, as expected, total discounted welfare is higher under the Ramsey regime: As in Lucas (1990), parameter ξ is introduced to measure the consumption-equivalent long-run welfare gain of moving from the steady-state allocations in the exogenous policy case to the equilibrium values obtained under Ramsey policy. In other words, the value of ξ measures the share of steady-state consumption under the exogenous policy that the household has to be compensated with, in order to achieve the same level of utility as the one under the Ramsey policy. A fraction $\xi > 0$, which is the case reported in Table 3, demonstrates that the household enjoys 17% higher consumption under Ramsey, as

Table 3: Data Averages and Long-run Solution

Variable	Description	Data	Model (exo. policy)	Model (optimal)
y	Steady-state output	N/A	1.000	1.250
c/y	Consumption-to-output ratio	0.674	0.674	0.545
i/y	Investment-to-output ratio	0.201	0.175	0.183
k/y	Capital-to-output ratio	3.491	3.491	3.659
g^c/y	Government cons-to-output ratio	0.151	0.151	0.272
g^t/y	Government transfers-to-output ratio	0.220	0.076	0.059
wh/y	Labor income-to-output ratio	0.571	0.571	0.571
rk/y	Capital income-to-output ratio	0.429	0.429	0.429
h	Share of time spent working	0.333	0.333	0.472
A	Scale parameter of the production function	N/A	1.095	1.095
\bar{w}	After-tax wage rate	-	1.543	1.513
\bar{r}	After-tax net return on capital	0.056	0.067	0.067
τ^y	Income tax rate	0.100	0.100	0.000
τ^c	Consumption tax rate	0.200	0.200	0.608
ξ	Welfare gain (% cons.)	-	0.000	16.8

compared to the exogenous policy case.

Next, private consumption in the optimal policy case is higher (even though the consumption share is lower, which is since output is now much higher), while private capital- and investment shares are higher, and thus the interest rate is lower. The model generates a zero steady-state optimal (capital and labor) income tax, which consistent with the findings in earlier studies, e.g. Judd (1985), Chamley (1986), and Zhu (1992). This leads to higher capital and labor in steady-state, and so higher output and investment. Under optimal fiscal policy, the steady-state of the model features lower private consumption, but much higher public consumption, so overall welfare increases despite the increase in hours.⁹ This is a direct result from the fact that the government internalizes the externality of the utility-

⁹Given the absence of income taxation, labor supply is undistorted under the Ramsey planner.

enhancing public services when maximizing household's overall utility. Finally, in order to finance the increased government consumption spending, consumption tax rate has to triple - from 20% to 60.8%. However, in contrast to the income tax, the consumption tax is non-distortionary. Also, as shown in Junior (2016, p.236), in this class of models there is no inverted U-relationship between the consumption tax rate, and tax revenue ("consumption Laffer curve"), since consumption taxation is a tax on demand, and not on supply (factors of production/inputs). The optimal policy suggests abolishing all direct taxation, which is akin to a "race to the bottom" result and adopt a public finance model that relies exclusively on indirect taxation. These results are new and could be of interest to policy makers, as previous research had ignored those important dimensions.

6 Conclusions

This paper characterized optimal fiscal policy and evaluated it relative to the exogenous (observed) one. The focus was on the optimal consumption and income tax rates, as well as the optimal provision of public services. To this end, a Real-Business-Cycle model, calibrated to Bulgarian data (1999-2014), was set up with a richer government spending side. To illustrate the effects of fiscal policy, two regimes were compared and contrasted to one another - exogenous vs. optimal (Ramsey) policy case. The main findings from the computational experiments performed in this chapter were: (i) The optimal steady-state (capital and labor income) tax rate is zero, as it is the most distortionary tax to use; (ii) The benevolent Ramsey planner provides the optimal amount of the utility-enhancing public services. (iii) The optimal steady-state consumption tax has to triple to finance the now much higher government spending.

References

Baxter, M. and R. G. King. (1993) "Fiscal policy in general equilibrium," *American Economic Review* 83, pp. 315-334.

Bulgarian National Bank (2015) Bulgarian National Bank Statistics. Available on-line at

www.bnb.bg. Accessed on Oct. 21, 2015.

Chamley, C. (1986) "Optimal taxation of capital income in general equilibrium," *Econometrica*, vol. 54, pp. 604-622.

Chari, V.V. and P. Kehoe. (1994) "Optimal Fiscal Policy in a Real Business Cycle Model," *Journal of Political Economy*, vol.102, no.4 (Aug.), pp. 617-652.

Chari, V.V. and P. Kehoe. (1999) "Optimal Fiscal and Monetary Policy," in Taylor, J. and Woodford, M. (eds.), *Handbook of Macroeconomics*, vol.1 (Amsterdam: North-Holland).

Christiano, L. and M. Eichenbaum. (1992) "Current real business cycle theories and aggregate labor market fluctuations," *American Economic Review* 82, 430-450.

Junior, C.J.C. (2016) *Understanding DSGE Models: Theory and Applications*, Vernon Press: Malaga, Spain.

Judd, K. (1985) "Redistributive Taxation in a Simple Perfect Foresight Model," *Journal of Public Economics*, vol. 28, pp. 59-83.

Lucas, R. (1990) "Supply-side economics: an analytical review," *Oxford Economic Papers*, 42(2), 293-316.

MacGrattan, E. (1994) "The macroeconomic effects of distortionary taxation," *Journal of Monetary Economics*, vol. 33(3), pp. 573-601.

Mendoza, E. and L. Tesar. (1998) "The International Ramification of Tax Reforms: Supply-Side Economics in a Global Economy," *American Economic Review* 88(1): 226- 245.

National Statistical Institute (2015) Aggregate Statistical Indicators. Available on-line at www.nsi.bg. Accessed on Oct. 21, 2015.

Vasilev, A. (2013) *Essays on Real Business Cycle Modelling and the Public Sector*, Unpublished PhD Thesis, University of Glasgow, UK.

Vasilev, A. (2015) "Welfare effects of an income tax reform: the case of Bulgaria," *Eastern European Economics* 53(2): 205-220, July.

WDI (2015) *World Development Indicators*. Available on-line at www.worldbank.org/data/wdi. Accessed on Oct. 21, 2015.

Zhu, X. (1992) "Optimal Fiscal Policy in a Stochastic Growth Model," *Journal of Monetary Economics*, vol. 58, pp. 250-289.