



## General Equilibrium Effects of Lower Labor Tax Burden in Croatia\*

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**Abstract:** This paper examines the effects of lower labor tax burden in Croatia by using Computable general equilibrium (CGE) model. It is a 5-sector (households, firms, government, investors and foreigners) model and economy is disaggregated on three highly aggregated sectors. One of the major advantages of CGE modeling is the evaluation of the overall effects of policy changes, shocks and reforms in the economy. We do this by lowering taxes on labor and simulating changes of all endogenous variables in the model simultaneously. Lastly, we provide sensitivity analysis results. Our results suggest that it is possible to encourage domestic production by reducing taxes on labor, but the potential effects on unemployment should be revised as to get more accurate estimates.

**Keywords:** CGE; small open economy; Croatia; taxes on labor; general equilibrium effects

**JEL Classification:** C63, C68, H20

### Introduction

Labor market can be highly affected by labor taxation. Additionally, these changes affect overall economic performance. According to European Commission (2010) tax systems of the EU members should be “growth-friendly” and raising taxes on labor should be avoided as in the past they raised the unemployment costs. However, tax burden on labor in the EU is still at relatively high level especially in comparison with relatively low taxes that are less damaging to growth (i.e. consumption taxes,

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recurrent property taxes and environmental taxes) (Wöhlbier, 2014, p. 7). When it comes to Croatia, Urban (2009) highlights several features of Croatian tax system: marginal tax rates are very high at almost all levels of income, the tax wedge is at a similar level to those in surrounding countries and long-term development of Croatia will depend on reducing the tax burden.

In this paper we analyze effects of lower labor tax burden in Croatia using computable general equilibrium model (CGE) that assumes utility and profit maximization, with precise assumptions about the economic environment (Diamond and Viard, 2008). They are especially valuable because they can give important insights about the interaction between labor (and any other) tax policy and pre-existing tax system (Löschel and Conrad, 2002).

The paper is organized in two main parts. First part provides a brief review of theoretical and empirical findings regarding the literature that focuses on empirical implications of labor taxation on labor market and labor market implications within CGE models. Even if this paper focuses on general equilibrium effects of lower labor taxes, these effects are mostly the result of spillover effects from labor market. This is why the focus of literature review is put on labor market effects. Second part of the paper presents benchmark and sensitivity analysis results.

## **Review of Theoretical and Empirical Findings**

There has been considerable debate over the effects of lower tax burden on labor market. According to economic theory, decrease in labor tax increases real wage and leads to lower rate of unemployment. In literature, this is known as “tax wedge” which represents difference between net income adjusted for consumer prices and gross income adjusted for producer prices. Every increase of tax wedge shifts Price setting curve in familiar WS-PS model downwards and *vice versa* (Tica, 2010). But, Manski (2012) points out that profession does not give clear answer to the question on how income tax rates affect labor supply. He argues that tax increase dips after-tax income and dips the balance towards choosing more leisure and less work. But this sets a worker into a different range of the income-leisure trade off and if at newly established range person prefers income over leisure, he will choose to work more. His findings are supported by the pioneer in the field, Robbins (1930) who constructed a simple model with demand curves and argued that effects of tax on labor can go in either direction depending on the elasticity of demand. Davis and Henrekson’s (2004) empirical paper reveals that higher tax rates on labor income and consumption expenditures lead to less working hours spent on market, but more work time in the household sector, larger underground economy and smaller value added and employment shares in industries that rely heavily on low wages and low skill labor inputs.

Meghir and Phillips (2008) provide a summary of empirical estimates of taxation on welfare and work effort. According to them there may be significant welfare costs

of taxation and taxation can generate important distortions. For example, hours of work are relatively inelastic for men, but are a little more responsive for married women and lone mothers. On the other hand, participation is sensitive to taxation and benefits for women. A study performed by Bocconi University (2011) analyses the role and impact of labor taxation policies. Authors conclude that targeted tax policies (on specific groups on labor market, i.e. married woman, lone mothers, low skilled workers, etc.) seem to be superior to overall linear decrease of labor taxes. On the other hand, Bovenberg (2006) explores the link between tax policy and labor market performance and concludes that their relationship primarily depends on nontax institutions. The impact of taxes on wages and unemployment depends on how wages are established and on welfare and unemployment benefits. Blundell's (1995) paper considers different types of labor groups and how theirs' hours of work and labor force participation are likely to respond to tax reforms. Pissarides (1998) uses four partial equilibrium models to investigate the effect of employment tax cuts on unemployment and wages.

The effects of various tax policies on different aspects of labor market are also studied using Computable General Equilibrium (CGE) models. For example, Gelauff *et al.* (1991) use CGE model to determine that temporary increase of world trade and higher value added tax rates do not affect the equilibrium unemployment rate in the long run. A higher replacement rate of unemployment benefits increases unemployment and a tax reform containing lower marginal and average tax rates reduce unemployment. Sørensen (1997) investigates structural unemployment in Europe and simulates a CGE model to conclude that a tax shift away from low skilled labor may raise aggregate employment and welfare while increasing the progressivity of the labor income tax. A dynamic CGE analysis of Danish tax reform is in the main focus of Knudsen *et al.* (1998) paper. The reform is strict Pareto improvement in the sense that all current and future generations are better off after the reform. Hutton and Ruocco (1999) apply multi-country CGE model to examine to what extent modifications of tax systems in the EU contributed to changes in labor market. Several findings emerged, but their main conclusion indicates that labor market of different EU countries react to changes in rates of VAT and personal income tax.

Bovenberg *et al.* (2000) develop CGE model to explore various tax cuts aimed at combating unemployment and raising labor supply. Their findings suggest that in-work benefits are best method to fight national unemployment. Diamond and Viard (2008) present results of CGE model in overlapping generation (OLG) framework and find that, even deficit-financed tax cuts increase long-run output. Additionally, authors conclude that tax cuts often reduce the welfare of future generation while increasing the welfare of current generations. Hernández (2012) uses CGE model to show that elimination of payroll taxes produces one percentage point decrease in the unemployment rate but when substituted by other taxes, there is no effect. A CGE simulation is used for assessing the effects of the flat tax, as shown by Boratyński and Borowski (2012) on the example of Poland. Annabi *et al.* (2013) assess the impact of

particular tax benefit on labor supply, GDP and income distribution in Canada using CGE microsimulation model. At the macro level, results suggest that tax benefit has modest positive impacts on labor supply and GDP, as well as a decline in low-income rates and income inequality. At the micro level, tax benefits affect labor market participation of low and medium skilled sole workers in the family. There is also a considerable amount of empirical literature that examines indirect effects of policy change or macroeconomic shock on labor market, e.g. Ballard *et al.* (1985), Melo and Tarr (1992), Bussolo *et al.* (2008), Fraser and Waschik (2013), Ferreira *et al.* (2008) etc.

## General Equilibrium Effects

### *Preliminary Remarks*

Simulation results of the possible impacts of lower tax burden on labor - (paid by firms not employees) on various variables (factor prices, income, consumer prices, production, consumption, export, import and government consumption) and economic structure in this paper are based on model derived in Nadoveza and Penava (2016). It should be noted that labor taxes used in this model may include other taxes on production. Mentioned taxes are taken from CBS (2015) which reports other taxes on production defined as taxes on the ownership and use of land, buildings and other facilities, taxes on the use of fixed assets, taxes on the total wage bill and payroll taxes, taxes on pollution etc. minus subventions on productions. These taxes are divided among labor and capital taxes according to their approximated share in government revenues calculated from MFin (2016).

Simulations are carried out in two steps. At the first stage developed model has to replicate data presented in Table 1. Afterwards, established equilibrium is perturbed by lowering taxes on labor. The change of labor taxes affects firms' production decisions which have impact on all endogenous variables in the model simultaneously and the new equilibrium is established after the policy shock. Essentially, CGE simulation results offer comparative statics exercise. Since these models provide a sense of potential structural and other important changes in an economy, they practically serve as laboratories in which is possible to test potential policy reform decisions effects in controlled conditions, without the need for "live" experiments which are common in Croatia. In this context, these models have high practical value and can serve as useful academic exercise.

Regarding the data, CGE models are largely based on input-output tables which are used for construction of Social accounting matrix (SAM) of an economy. Our simulations are based on Croatian Social accounting matrix (Table 1) which rely on 2010 Croatian I-O tables assembled and published by Croatian Bureau of Statistics (CBS). We use also other data sources to fill the gaps in SAM. According to usual requirements of SAM, data presented in Table 1 are seen as snapshot of established equilibrium in 2010 in Croatia.

Table 1: Social accounting matrix (SAM) for Croatia (2010)

SAM	Goods			Sector			Factors		Households	State	Net taxes on goods	Labor taxes	Capital taxes	Customs	Income tax	Investments	RoW	Total
	Industry	Services	Agriculture	Industry	Services	Labor	Capital											
Agriculture				4359	7919	2751			8713	0						1912		25653
Industry				4578	70850	47977			74816	0						55973		254195
Services				3165	42916	81768			122721	69585						10138		330292
Agriculture	25702																1931	27633
Industry		25055															43718	293773
Services			323292														25909	349201
Labor				2611	41935	114679												159225
Capital				9699	12688	81621												104008
Households								159225	104008	29970								293203
State											10746	2456	645	344	35962			50154
Net taxes on goods	-48	4011	6783															10746
Labor taxes				27	522	1907												2456
Capital taxes				7	137	501												645
Customs	-2	128	217															344
Income tax									35962									35962
Savings									50991	-49401								66432
RoW				3188	116805	17997												137991
Total	25653	254195	330292	27633	293773	349201	159225	104008	293203	50154	10746	2456	645	344	35962	68022	137991	2143505

Source: author calculations based on CBS (2014), CBS (2016), CBS (2015), CNB (2015), MFin (2016), Urban (2009), Babic (2008), ZABA (2012), HZZ (2016)

Some of the parameters in the model are predetermined and some are calibrated in the model. A whole list of parameters and their comparison with realized (published) values can be seen in Nadoveza and Penava (2016, p. 6-7). Also, as sensitivity analysis results in mentioned study showed mild sensitivity to Phillips coefficient (in benchmark model it is assumed that Phillips parameter takes the value of  $-0.1$  ( $\alpha = -0.1$ ) which is upper bound estimated in Blanchflower (2001)), we later stretched it from  $-1$  to  $-0.01$ .

Other model assumptions include fixed labor and capital supply. Government transfers to households and government savings are also assumed to be fixed. This means that government has to adjust its consumption when its revenues change. Exchange rate is also fixed and serves as the *numeraire* due to relatively stable exchange rate in Croatia.

### *Benchmark Model Results*

As already mentioned, in benchmark model it is assumed that Phillips  $\alpha$  equals to  $-0.01$ . Figure 1 shows the simulated benchmark effect of lower labor taxes in Croatia. Simulated percentage change is presented on the vertical axis, while horizontal axes shows the amplitude of the change (i.e.  $0.9 * t_l$  means that new labor tax has decreased by 10% in comparison with initial labor tax).

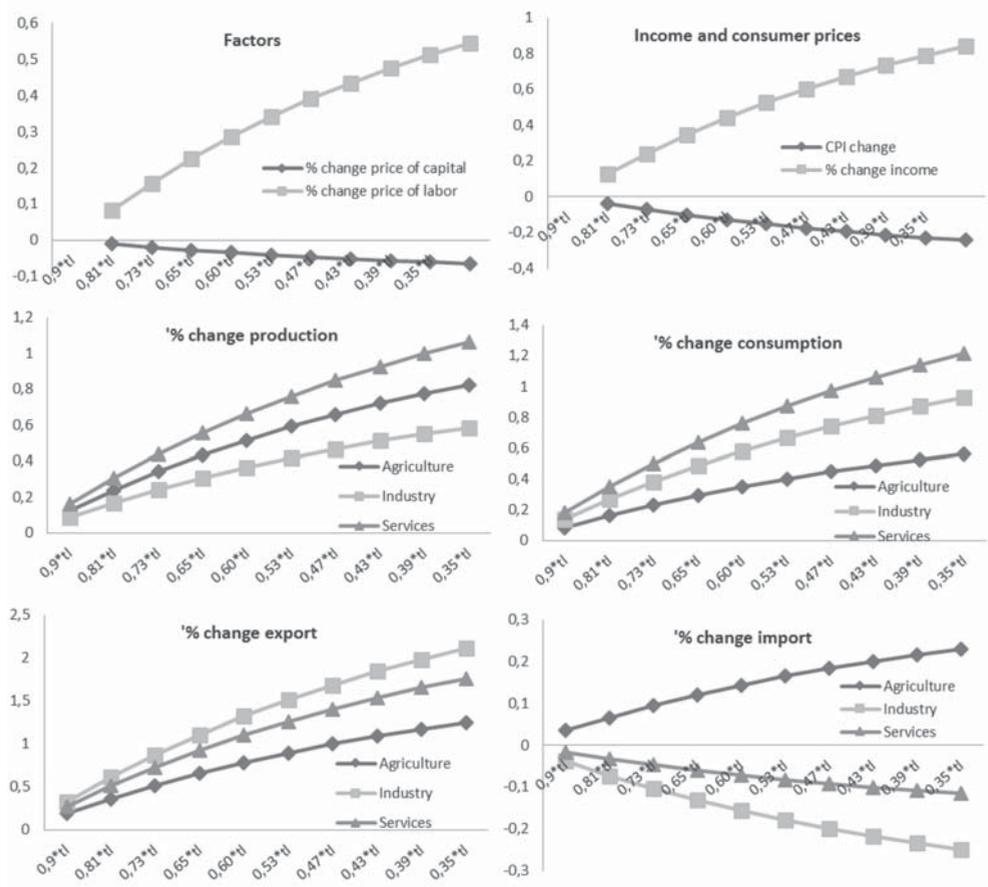
As it can be seen from Figure 1 lower taxes on labor increase the price of labor (due to increased demand for labor) and decrease the price of capital. The prices of final goods decrease while household's income increases due to increase of wages which more than compensates the decrease of income owed to lower prices of capital.

Production of all sectors increases. It can be seen that increase is the largest in the services sector, while industry losses part of its share due to lower growth of production. This is logical since (by assumption) all markets have to clear and consumption of services increases the most after the change due to relatively large income elasticity. Most of the increased demand has to be met by similar increase of domestic production as a result of relatively small tradability of services. The smallest increase in consumption is seen for agricultural products (again due to its income elasticity).

Export of all sectors rises due to higher competitiveness of domestic goods owing to lower production costs. On the other hand import of services and industrial product decreases, while agricultural import increases. The latter owes to low factor substitution in agriculture which disables agricultural sector to reduce production costs significantly.

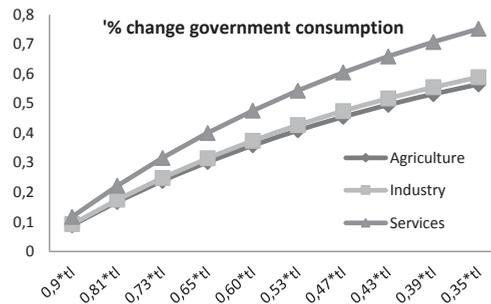
Despite lower revenues from labor tax and fixed government budget deficit constraint, government consumption for all goods increases. This is the result of net revenues growth due to higher consumption and household income which represent the base for consumption and income taxes. In other words, the generosity of mentioned taxes more than offsets labor tax revenues decrease.

Figure 1: Benchmark simulation results ( $\alpha = -0.1$ )



Source: Authors' calculations

Figure 2: Government consumption patterns - benchmark simulation results



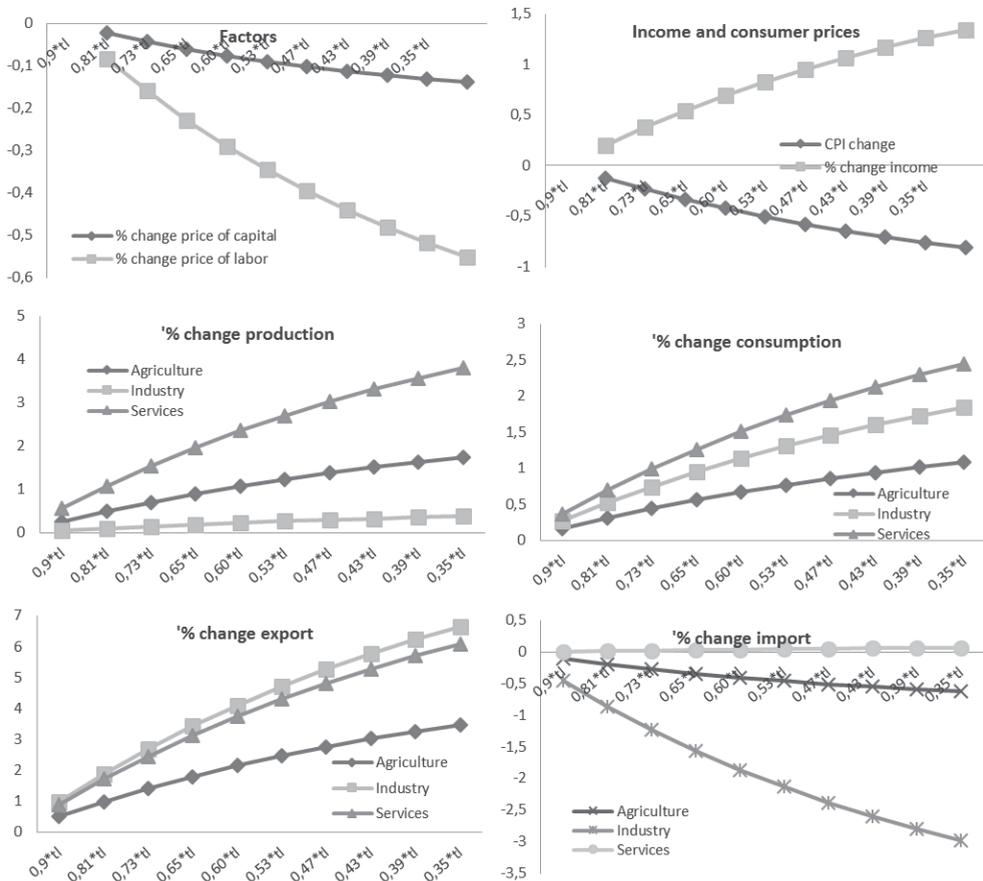
Source: Authors' calculations

### Sensitivity Analysis Results

#### Highly Responsive Labor Market

Assumption of highly responsive labor market means small Phillips parameter. Therefore, it is assumed here that Phillips  $\alpha$  is equal to  $-0.01$ . In CGE models intensity of change is usually not commented. To assess models' results robustness it is usually required that different parameter assumptions result with similar patterns of endogenous variables in the model. When assuming small Phillips parameter, i.e. high disinflation costs, small changes in real wages are consistent with large swings of unemployment. This is the reason behind similar patterns of all variables presented in Figure 3 and benchmark simulations in Figure 1. The difference arises

Figure 3: Sensitivity analysis results ( $\alpha = -0.01$ )

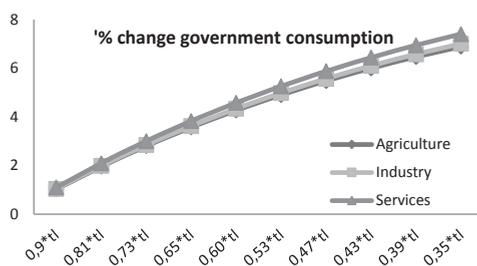


Source: Authors' calculations

in factor market prices and agricultural and services import changes. Here, labor price decreases due to unrealistically large response of the labor supply. Hence, it is possible to observe large increase of labor supply and increased willingness to work because consumer prices decrease largely exceeds deflation of labor prices. However, as unemployment falls significantly household income rises and all other variables movements resemble those presented in Figure 1.

Government consumption patterns presented in Figure 4 resemble those shown in Figure 2.

Figure 4: Government consumption patterns - sensitivity analysis results ( $\alpha = -0.01$ )



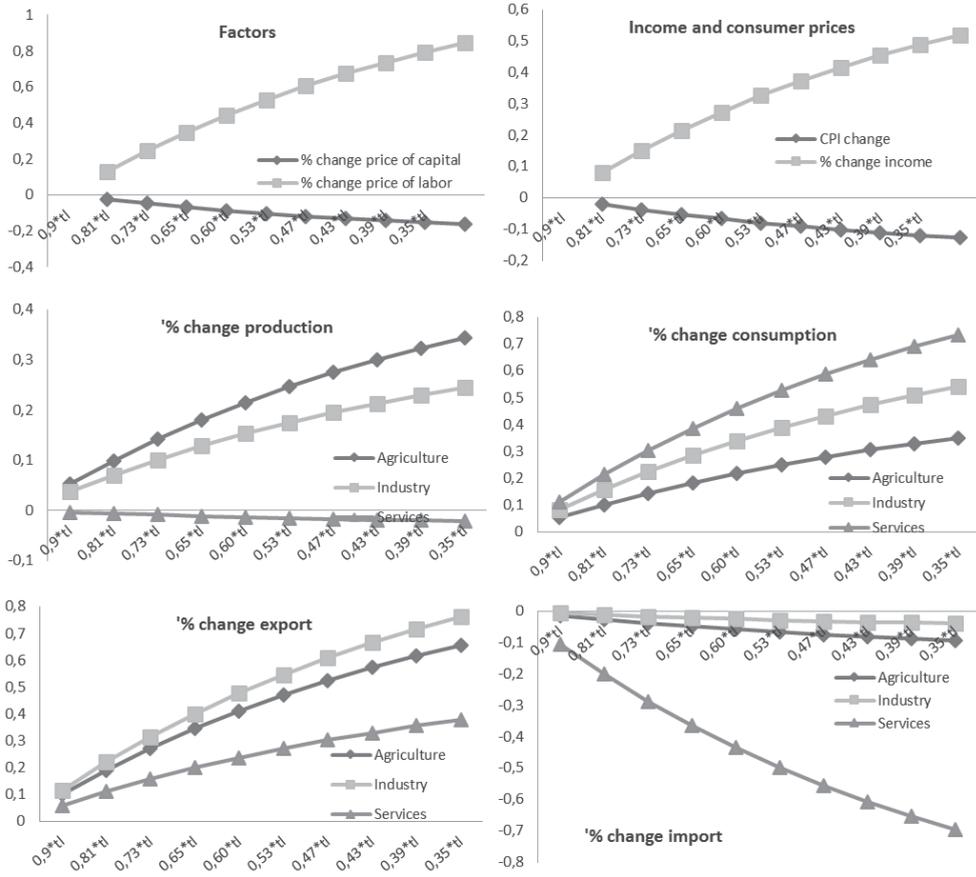
Source: Authors' calculations

### *Relatively Unresponsive Labor Market*

Assumption of relatively unresponsive labor market means relatively large Phillips coefficient. Therefore, Phillips  $\alpha$  is assumed to be  $-1$ . Again, Figure 5 shows similar patterns of all variables as benchmark Figure 1. The differences arise in production of services due to relatively inelastic supply of labor which prevents higher production. Again, agricultural import seems to be sensitive to Phillips parameter assumption. Additionally, it is possible to observe the decrease in production of services, due to large decrease in government demand for services (see Figure 6).

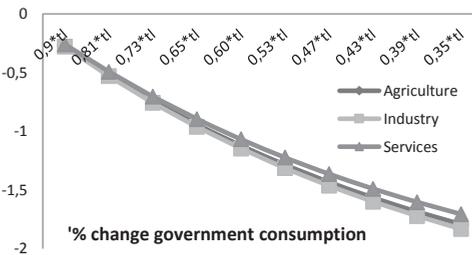
The largest difference in patterns and even direction is visible in government consumption patterns presented in Figure 6. Here, inelastic labor supply pulls the labor tax revenues down. However, this time budget revenues drop is not compensated by income and consumption taxes revenues growth.

Figure 5: Sensitivity analysis results ( $\alpha = -1$ )



Source: Authors' calculations

Figure 6: Government consumption patterns - sensitivity analysis results ( $\alpha = -1$ )



Source: Authors' calculations

## Conclusions

This paper has investigated the possible impacts of lower tax burden on labor on various variables and economic structure in Croatia using a CGE model. It should be noted that this analysis is only preliminary and is based on very restrictive assumptions. However the results seem intuitive.

The benchmark model analysis shows that lower taxes on labor have a positive effect on the price of labor and negative effect on the price of capital. The prices of final goods decrease, while household's income increases (increase in wages more than compensates the decrease of capital income). Also, production of all sectors increases. As the production costs reduce, the export of all sectors rises. On the other hand import of services and industrial product decreases, while agricultural import increases. The latter owes to low factor substitution in agriculture which disables agricultural sector to reduce production costs significantly. Finally, although the labor tax is lower, which implies lower government tax revenues, government consumption of all goods increases due to higher consumption and household income. However, the latter conclusion is not robust to different Philips curve parameters.

Overall, the results suggest that government should assess the potential effects of any tax reform on unemployment before policy change, because it seems that the assumption on the level of responsivity of labor market may significantly affect the budget revenues and expenditures. On the other hand, production and consumption showed robust growth regardless of the default value of Phillips parameter. This means that, in spite of the limitations of analysis, it is possible to encourage domestic production by reducing taxes on labor.

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