

**German Advisory Group**  
**Institute for Economic Research and Policy Consulting**

Technical Note [TN/02/2016]

**Economic impact of the recent decrease in  
social security contributions  
– Technical description of the model –**

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**Economic impact of the recent decrease in social security contributions**  
**– Technical description of the model –**

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**Contents**

1.	A short description of the model .....	4
2.	The model experiment.....	5
3.	Parameterization of the model.....	8
4.	References.....	9

## 1. A short description of the model

In the Policy Briefing PB/09/2016 “Economic impact of the recent decrease in social security contributions – A model based analysis” we employ the model presented in detail in Engler, Ganelli, Tervala and Voigts: Fiscal Devaluation in a Monetary Union, IMF Working Paper No. 14/201. It is a model of the “New Keynesian dynamic stochastic general equilibrium (DSGE)” class comprising two countries that trade goods and bonds with one another. We deviate from that model in that we assume the **exchange rate** to be **flexible** between the two countries, which are Ukraine and the rest of the world. The two countries’ central banks influence their respective inflation rates by changing the nominal rate of interest, which affects the real rates of interest (because prices are reacting slowly to any kind of shock) which in turn affect the savings and consumption decision of households. In addition, they react to changes in the nominal exchange rate in order to keep its volatility low. Furthermore, the terms of trade are affected by monetary policy action which incurs consumption-switching effects between goods produced in the two economies.

There are two types of households in the model which we need in order to understand how monetary policy affects inflation<sup>1</sup>: The **first type of households** are “capitalists” who own the firms of their respective country and are able to **make explicit consumption and savings decisions** which depend on a) their wealth and b) the real rate of interest. An increase in wealth results in an increase in consumption. A reduction in the real rate of interest incurs a reduction in savings and an increase in consumption. This increase in consumption increases aggregate demand for goods so that **firms**, who are assumed to use labor as their only input to production, need to adjust their labor input to serve that additional demand. The firms need to pay higher wages to be able to increase hours worked which drives up their marginal costs so that they increase their prices which drives up the rate of inflation. This is the basic transmission mechanism through which the central bank affects the business cycle and inflation when they reduce the real rate of interest.

The **second type of households** are “hand-to-mouth” consumers who do not save at all but immediately **use all their income for consumption**. Because in the scenario just described the real wage and hours rise, their consumption rises too giving an additional boost to aggregate demand.

As domestic and foreign firms produce differentiated goods, any change in relative prices affects the relative demand for those goods. For example when domestically produced goods become relatively cheaper than imported goods (i.e. the domestic terms of trade deteriorate), domestic and foreign consumers switch demand away from foreign goods and towards domestic goods. The central bank can deteriorate the terms of trade when it reduces the interest rate because this incurs a depreciation of the nominal exchange rate.

The **government** raises taxes to pay for expenditure worth 20 percent of the countries’ respective gross domestic products. The revenue is generated, i.a., through a payroll tax on wages which is paid by firms, a value added tax and income taxes on wages and profits. Any revenue the government does not need is returned to households in the form of lump-sum transfers.

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<sup>1</sup> We abstract from firms’ capital accumulation which is also instrumental in determining the effects of monetary policy on the real economy. However, the basic insights do not change much when we concentrate on consumption decisions.

Another important modification to the model of Engler et al. (2014) takes account of the fact that a sizable fraction of the Ukrainian economy is hidden from tax collectors. We introduce this aspect in a simple way by assuming that a quarter of the firms' wage bill is paid out to workers without paying payroll taxes. It is conceivable that in response to the massive reduction in payroll taxes this shadow economy will shrink as firms see their overall tax bill decline. Unfortunately we can only assume a specific, arbitrary reduction of the shadow economy in the model as we do not have any benefits of a "de-shadowing" in the model. After all, legalizing a formerly untaxed activity still implies an increase in taxes for this formerly illegal activity, no matter what the tax rate is.

## 2. The model experiment

On 1 January 2016, the Ukrainian payroll tax rate was reduced from an average value of 44% to 22%. As the payroll tax base was increased, it is not exactly clear to what extent the firms' effective payroll tax rate was reduced. We therefore assume that the payroll tax revenue was reduced by 3% of GDP. In our experiment we assume that this is fully financed by a reduction in government spending. Furthermore, we assume that initially 25% of the wage bill is hidden from the treasury ("shadow economy"). In variant A of our analysis, which is the baseline, we assume this share to be constant. In variant B, where some de-shadowing takes place, it falls by 4 percentage points.

In the model, **the payroll tax reduction** reduces the firms' production cost which induces them to reduce prices to the extent that they face price competition which incurs a fall in aggregate prices. Please note that this constitutes a fall in inflation below the average inflation rate of zero which we assume in the model which is clearly below the inflation rates observed in Ukraine. However, our results can be interpreted as a fall below the rate of inflation observed in the absence of the tax cut.

The tax cut implies an increase in Ukrainian firms' profits and a rise in real wages so that "capitalists" and "hand-to-mouth" consumers increase consumption and thereby boost aggregate demand for domestically produced goods. Furthermore, the deflationary pressure implies a reduction in the nominal and the real rate of interest (due to the central bank's reaction) which causes the nominal exchange rate to depreciate.

This lower real rate encourages increased savings so that consumption grows over time while the lower prices and the depreciated exchange rate cause a switching away from foreign towards domestic goods. Aggregate output and the trade balance thus rise. The additional demand for labour incurs an increase in the nominal real wage so that hand-to-mouth households can increase consumption too. This increase in labour costs partially reverses the fall in firms' costs and aggregate prices fall somewhat less.

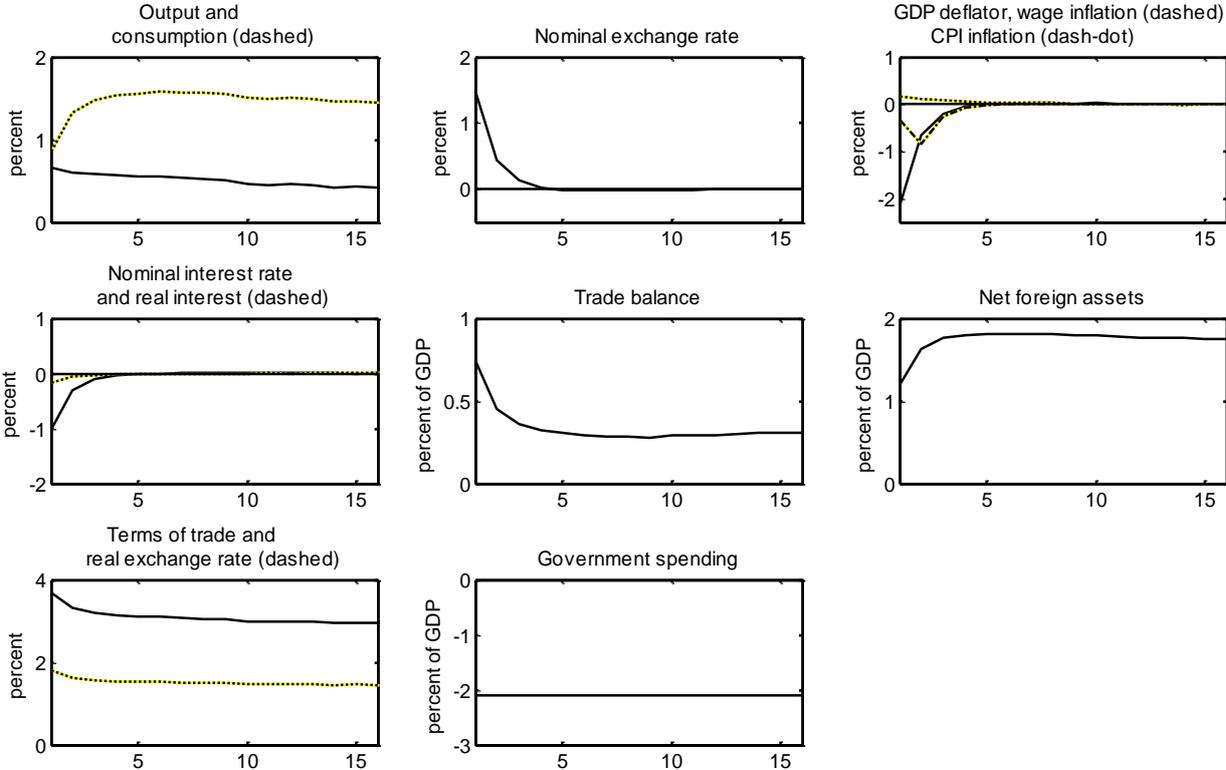
**The de-shadowing of the economy** (Variant B) mitigates the effect of the tax cut because it acts like a tax on the formerly untaxed wage bill and thus works exactly in the opposite direction.

**The reduction in government spending** causes its own dynamics. Ceteris paribus, it reduces aggregate demand, the demand for labour, marginal costs, prices and the real wage. The central bank reacts by reducing the nominal rate enough to reduce the real rate which boosts private consumption which partially replaces government spending (the so-called "crowding-in"). Because the crowding-in is partial, aggregate demand is lower due to the spending cuts so that the net effect on prices is negative. Furthermore, the reduction of the rate of interest depreciates the nominal exchange rate. Taken together, the price reduction and the fall in the currency's value depreciate the terms of trade and incur an expenditure-switching away from foreign and towards domestic goods so that the trade balance improves.

**The quantitative effects:** Figure 1 shows results for the joint effects of the SSC rate and government spending cut for variant A (without de-shadowing). **Immediately** after the payroll tax reduction and the government spending reduction output and consumption increase by more than 0.7%, and the trade balance relative to GDP improves by 0.7%, the nominal exchange rate depreciates by about 1.5% and the GDP deflator falls by 2%, the nominal interest rate by 1 percentage points. In the figure one can see that the necessary reduction in government spending to render the payroll tax reduction budget neutral is about 2% of GDP. **After several quarters**, the rate of inflation and the nominal interest rate return to the long-run values and thereby the supporting effects of the central bank action fades. However, output remains elevated by about 0.4 percent and consumption by 1.5%. The net asset position relative to GDP increased permanently by almost 2%.

**Figure 1**

Variant A (Baseline): Dynamic effects of the reduction in payroll taxes

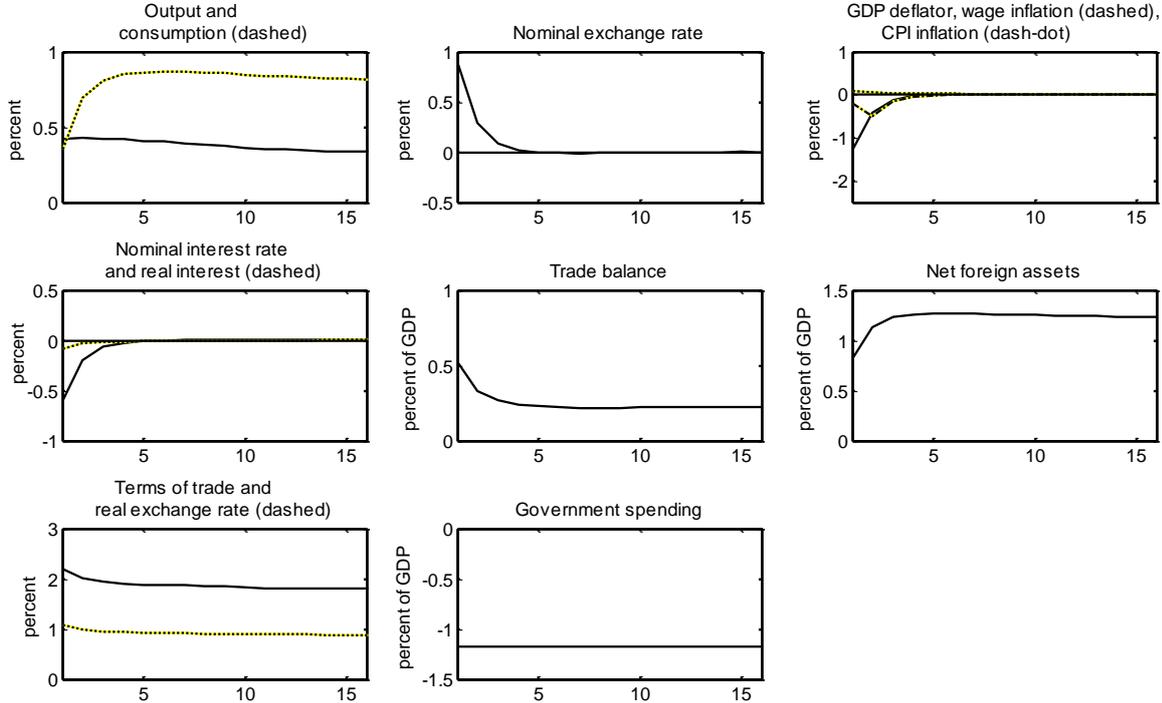


Source: Own calculations

Figure 2 presents results for variant B where we additionally assume a four percentage point reduction of the shadow economy. One can immediately see that all effects are smaller than under variant A. Output rises immediately by only 0.4% and 0.3% in the long-run. Consumption rises by 0.35% in the short-run and 0.8% in the long-run. The trade balance (relative to GDP) improves by 0.5% in the short term and by 0.2% in the longer term. The necessary reduction in government spending to keep the SSC rate cut budget-neutral is 1.2% of GDP.

**Figure 2**

Variant B (De-shadowing): Dynamic effects of the reduction in payroll taxes



Source: Own calculations

The reason for the smaller impact when the de-shadowing is considered is that de-shadowing implies an increase in the tax-base implying that less resources are transferred to the private sector so that consumption rises less. Furthermore, the deflationary pressure is smaller because the effective tax cut for firms is smaller and because the government spending cuts required for budget neutrality are smaller when a smaller tax cut needs to be offset. This further implies that a) the expenditure switching effect away from foreign and towards domestic goods is smaller and b) the central bank reacts less expansionary so that the private spending increase is smaller.

A note of caution is needed: The model we employ is well suited to model short- and medium-run dynamics, but it is not designed to model long-run growth dynamics. For that reason, the long-run effects should be taken with caution. However, as it is quite plausible that a reduction of wasteful government activity and distortionary taxes is able to boost private enterprise, our long-run results for output and private consumption are likely to underestimate the true effects.

### 3. Parameterization of the model

Size Ukraine (rest of the world):	0.01 (0.99)
Share hand-to-mouth consumers:	0.7
Substitution elasticity between domestic and foreign goods:	1.2
Discount factor:	0.99
Intertemporal elasticity of subst.:	1
Labor supply elasticity:	1
Elasticity of subst. between Ukrainian goods:	9
Elasticity of subst. between labor types:	9
Prices are re-set on average:	every two quarters
Wages are re-set on average:	every two quarters
Consumption tax rate:	0.2
Firms' payroll tax rate:	0.44
Households' payroll tax rate:	0.03
Income tax:	0.15

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