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This article examines the effects of fiscal devaluation on the trade balance of a country with a small open economy. It is assumed that typically such countries are price-takers which means low price elasticity of exports and imports. If this assumption is true, then it's impossible to make impact on trade balance through the price mechanism and, accordingly, fiscal devaluation will not have significant effects. To confirm or reject this hypothesis it is necessary to determine causal relationships between changes in fiscal devaluation indicator and trade balance dynamics. Applying a series of causality tests to Ukrainian data the authors argue that dynamics of trade balance causes changes in VAT and social security contributions. Opposite causality wasn't detected. This fact is treated as evidence of fiscal devaluation inefficiency in Ukrainian-like economies on the one hand and as price-taking characteristics of Ukraine on the other hand. The potential null effect of fiscal devaluation was confirmed with SVAR modeling.

JEL classifications: E62, F32, F41.

Keywords: Fiscal devaluation, Hsiao causality test, Price-takers, Small open economy, Trade balance.

Introduction

Recently statements have begun to appear in business and academic publications about fiscal devaluation as an instrument for improving a country's trade balance. Having originated into the economically developed world, this concept actively 'migrates' in developing countries today. Not so long ago, it started to be discussed in Ukraine where it is now regarded as a promising innovative instrument for fostering export. But it seems that under Ukrainian conditions, the implementation of fiscal devaluation raises more questions than answers. That's why it's worth taking a closer look at fiscal devaluation in conditions of economies such as the Ukrainian economy.

The world economic downturn and restrictions of monetary policy as an instrument of economic regulation have led to a new round of debate on fiscal instruments of support

exporters in the eurozone countries. Since these countries have limited space for monetary stimulation (a traditional instrument – the exchange rate devaluation – can't be used by a member of the monetary union), this is the place where the idea to simulate the effect of currency depreciation by tax policy measures was created. This idea was called 'fiscal devaluation'. The ability to mimic the effects of currency devaluation by means of fiscal policy instruments makes this topic extremely important among scientists and policymakers today, when monetary instruments are limited because of monetary union membership or fixed exchange policies which are rather widespread.

However, the issue of fiscal devaluation efficiency in conditions of different economies remains sparsely studied. Using the case of Ukraine, the authors analyze casual links between fiscal devaluation measures, which are defined as the gap between employers' social security contributions (SOC) and VAT, and the state of trade balance. Thus, the hypothesis investigated is that in small open economies such as Ukraine's fiscal devaluation can have zero effect. The practical contribution consists of an answer to the question – is it possible with the help of fiscal policy (in the form of increased VAT rates and decreased SOC) to make an impact on the level of domestic prices and, therefore, on the trade balance of a country with a small open economy. In case of positive answer it can be concluded that the instrument of fiscal devaluation is applicable to economies like Ukraine's. If the alternative hypothesis confirmed (exports prices are set exogenously and domestic fiscal policy doesn't affect them), then fiscal devaluation should be excluded from the list of feasible fiscal instruments. The article is structured as follows. The first section analyzes fiscal devaluation theory and previous empirical results of studies of its effects on an economy. The next section is an explanation of the main hypothesis of the study and the methods used for testing. The third section presents empirical results obtained from testing the hypothesis. The last section gives a summary of findings and some implications for policy.

Theoretical issues and previous literature

Discussion of fiscal devaluation theory has a relatively long history. At first the idea regarding the ability to mimic the effect of currency devaluation by means of fiscal instruments was proposed by J. M. Keynes (1931). However, a new round of discussions about the feasibility of fiscal devaluation and its potential effects started along with the establishment of functioning monetary unions and a significant liberalization of world trade. Accordingly, to achieve the study objectives it is necessary to analyze the existing literature regarding fiscal devaluation.

Historically, the first theory was the so-called 'Keynesian' fiscal devaluation version. Taking into account the functioning of a monetary system under gold standard conditions which made currency devaluation unfeasible, J. M. Keynes (1931) proposed an alternative. He suggested the application of ad valorem customs tariff to all imports together with the same size export subsidies to all national exports. This combination results in an imports cost rise for domestic consumers and creates cost advantages for exporters. However, the measures proposed by Keynes (1931) have a pronounced protectionist nature. The application of such mechanisms in the context of international trade liberalization will likely create political pressure from trading partners as a consequence. On the other hand, Krugman and Obstfeld (1997) argue that in 'small' country conditions, i. e. a country that cannot have a significant impact on world market prices, such a policy will lead to significant economic losses. According to their research, for a country that has an impact on world prices (has a significant share in world trade), the effect of a customs the duty is a wedge-shaped spreading of domestic and foreign market prices. As a result, there is an increase of domestic prices of the country, which introduces the duty (but not on duty full-size) and decrease of world prices. When a 'small' country imposes customs duties, its share in goods procurements on the world

market is very small at the outset, therefore reducing its imports has little effect on the world price. Actually the world price of imported goods can be considered as an exogenously given variable. This negates the expected effect of terms of trade improving. Use of export subsidies also worsens trade conditions, and that's why such a combination of foreign trade policy instruments can have a very dubious effect on the state of trade balance and economic growth in general.

Thus, the case of a country with a small open economy, which has no significant impact on world prices, the so-called price-taking country, is a subject for separate examination concerning the expected effects of fiscal devaluation for such countries.

To contemporary version of fiscal devaluation treats the structure of tax system as a source of export stimulation. In academic circles, actively discussed the mechanism of fiscal devaluation, consisting of two main blocks: the VAT increase as the main consumption tax and the reduction of SOC paid by employers. The basic idea of fiscal devaluation is pretty simple and can be summarized as follows. Employers' SOC are a burdensome tax, having a destructive impact on employment as proven in a number of economic researches (Daveri and Tabellini 1997, Nickel 2004, OECD 2011) and through it – on economic growth. Reduction of such contributions in the future could stimulate a decline in the illegal sector of the labor market and, most importantly, reduce the cost of production in the national economy, including export sectors. This means that exporters will be able to sell their products somewhat cheaper abroad; meanwhile goods on the domestic market should also fall in price.

At the same time, the value added tax as the main consumption tax is increased with a triple purpose. First, the transition from taxation on an 'origin' basis to a taxation on a 'destination' basis, which corresponds to the principle of equity in taxation. Second, the VAT imposed on imports automatically makes them more expensive, while exporters receive a VAT refund. Third, VAT acts as a compensator for budget revenues that will be lost due to

the reduction of SOC of employers. The initial conditions needed are: a monetary policy inefficient for export stimulation, manifested in a tightening of the nominal exchange rate; rigidity of nominal wages in the economy, manifested in slow and disproportionate reaction of nominal wages on the change in prices of consumption. It is important to note that this assumption suggests that fiscal devaluation has short-term effects.

The literature, analyzed in this study, can be divided into two parts: one part is devoted to the analysis of fiscal devaluation impact on the economy of different country groups, and the second attempts to answer the question of whether a government can influence trade balance dynamics through prices (in particular through currency devaluation) or if prices are set exogenously.

One of the most cited articles referring to the impact of indirect taxation on foreign trade is the seminal study of Krugman and Feldstein (1989). This study refuted the opinion that VAT as tax, which, due to the fact that it is charged on imports, while exports have zero VAT rate, can be considered as an instrument for promoting export competitiveness on world markets. Zero VAT rate is considered as a necessary element of the VAT administration process, without which the latter would become a tax on exports – a protectionist measure that will eventually lead to a reduction in both exports and imports. From the standpoint of fiscal devaluation it is incumbent to focus on the claim that the VAT can be considered as a substitute for direct taxes, because it is not neutral in terms of foreign trade. Such tax reform can lead to redistributive effects that can stimulate short-term improvement in trade balance. Due to the fact that such a shift increases the tax burden on tradable goods, compared to nontradables, resources in the long-run remove from tradables sector, thus reducing the competitiveness of economy in general. Applying simple model, which includes three different products and two periods, justified the conclusion that shift in taxation from income

tax to VAT in the short-term has an ambiguous effect on a country's net export, but in the long-run such reform with great probability leads to a reduction of net export.

Lipinska and Von Thadden (2009) indirectly investigate the problem of fiscal devaluation. They apply DSGE-model of two monetary union countries to study unilateral shifts in the tax system from direct towards indirect taxes. Because of model specification, which includes price rigidity, but competitive labor market with flexible wages, they find that the effects of shifting from direct taxes to indirect ones are not significant.

One of the first comprehensive works, where the mechanism of fiscal devaluation was described in detail, is the research of de Mooij and Keen (2012). This paper is a brief analysis of preconditions for fiscal devaluation in eurozone countries, namely: increasing budget deficits and public debt; the current policy of fiscal consolidation; the necessity to improve exporters' competitiveness on international markets. As the traditional mechanism of export fostering – currency devaluation – in the euro area is not applicable, fiscal devaluation is considered as an alternative way for the European governments. At the same time the key importance for effectiveness of fiscal devaluation is given to nominal rigidities in prices and exchange rate. Using a regression analysis of panel data for 30 OECD countries over the period from 1965 to 2009 the authors concluded that in short-run tax shift from SOC to VAT at the rate of one percent of GDP increases net exports of the euro area countries by 3,44% of GDP. For OECD countries that are not members of the euro area this effect is less obvious. Following this conclusion, it is logical to assume that the effects of fiscal devaluation in countries with small open economies will differ significantly from those described in the study for the OECD countries. De Mooij and Keen (2012) also argue that the effectiveness of fiscal devaluation strongly depends on the nature of the VAT increase, which is used to ensure budget neutrality of reform. In the article arise such issues as whether policy makers should increase basic of reduced VAT rate, how the tax base coverage should be changed.

Separately, some possible difficulties for fiscal devaluation implementation are analyzed: the increased VAT component of the fiscal devaluation reduces the value of non-labor income to consumers, whether from transfers or capital income, which will not be compensated by a decrease of SOC for these types of income; the presence of tradables and nontradables in an economy that will cause a shift towards the production of the latter, as they are potentially more labor intensive (such a shift will not stimulate trade balance improvement). Special attention is paid to the problem of coordination during realization of fiscal devaluation measures. The point is that implementation of fiscal devaluation at the same time in several countries that are trading partners significantly reduces the efficiency of fiscal devaluation for each individual country. It's worth mentioning that this study covers only developed countries that have modern sophisticated system of institutions and interact effectively with external partners, while the analysis of fiscal devaluation potential for developing countries without powerful positions in the world was not studied.

Commenting on the article of de Mooij and Keen (2012), Poterba (2013) conducts theoretical formalization of budget neutral fiscal devaluation through the interaction of supply and demand on the labor market. Thus, the supply of labor depends on the real wage after taxes, $(1-\mathrm{r}_{\mathrm{PIT}})w/(1+r_{VAT})p$, where w – nominal wage, p – nominal output price, $\mathrm{r}_{\mathrm{PIT}}$ – the rate of personal income tax, which is included for completeness, r_{VAT} – the VAT rate. Labor demand depends on the real wage facing the firm, $w(1+r_{SCR})/p$, where r_{SCR} – rate of employers' social contributions. Budget neutral fiscal devaluation consists in decrease of r_{SCR} and increase of r_{VAT}. Therefore, the potential effect of a fiscal devaluation on the labor market is a short-term employment increase. The author also considers the possibility of targeted fiscal devaluation, i. e. reduction of employers' SOC for those sectors of economy, which need to improve foreign markets competitiveness the most. Although such a policy is likely to

lead to additional distortions, it will enable a lower increase in VAT to ensure budget neutrality.

A study of fiscal devaluation conducted by IMF experts (Fiscal monitor 2011) is interesting respecting theoretical analysis of fiscal devaluation impact on labor markets in countries that implements such policies. One of the departure points for fiscal devaluation is an equilibrium on labor market when SOC affect the demand side of the market and consumption taxes (VAT) make impact on supply side of the market. In this paper the authors presented a simplified graphical model of labor market equilibrium which illustrates the nature of short-term increase in employment in the case of fiscal devaluation implementation. However, mainly issues of the interior design of the tax reform were addressed in the research. For instance, the authors concluded that a reduction of employers' SOC should be focused on lower level wages and realized through the lowering of upper wage bounds for such contributions charge, while increasing the basic or additional VAT rates (especially if they are high enough already) stimulates tax evasion. Meanwhile very important questions concerning possible drawbacks of fiscal devaluation realization in world-wide market scale are unclear.

The research of Farhi *et al*. (2011) assumed an operation of national economy in terms of the dynamic New Keynesian open economy environment, one of the assumptions of which is the presence of short-term nominal price rigidities in economy. The authors conducted a theoretical analysis of different fiscal devaluation options feasibility. On that basis it was concluded that there exists a combination of fiscal tools, which is able to replicate the effects of currency devaluation if the latter is held constant. The choice of such instruments according to the article depends on the structure of market assets in the national economy, the currency of public debt denomination, as well as the nature of the devaluation (expected or unexpected). Besides that, the researchers conclude that scenarios of fiscal devaluation

realization must be accompanied by the gradual reduction of consumption taxes and increasing of income taxes. It should be noted that the article conducted a comprehensive analysis of fiscal devaluation specifics as from the standpoint of economic agents, and from the standpoint of the national and international economy. At the same time, there is a considerable room for studying the problems of fiscal devaluation implementation in practice, taking into account the realities of functioning economic systems of individual countries.

The study of Franco (2011) analyzed the main reasons for fiscal devaluation in Portugal. Together with a justification of fiscal devaluation's theoretical aspects the author describes classic New Keynesian model of open economy, which contains two countries (country and abroad) as well as two sectors of goods (tradables and nontradables). The paper evaluated a number of VAR equations with Portuguese data and then modeled the impact of decreased SOC and compensatory increase of VAT on exports and imports. The results indicate a possibility of a short-term trade balance increase by means of fiscal devaluation.

Of a special interest in Franco (2011) is the extension of fiscal devaluation model to the case of a country that is price-taker on foreign markets and can't affect either the volume or the price of its own exports. In such a situation, the positive effects of fiscal devaluation are minimized; moreover, fiscal devaluation may even be harmful for the economy. In this regard, the research of countries' ability to make impact on the quantity and quality of its own exports on the world market is an important task for a comprehensive analysis of fiscal devaluation.

European Commission Taxation Papers Working Paper N.36 (2013) is the most comprehensive research of fiscal devaluation, which includes theoretical and empirical components. The theoretical part includes a detailed description of basic preconditions and assumptions of fiscal devaluation, such as price and nominal exchange rate rigidities and description of the major difficulties that may arise during the fiscal devaluation.

The empirical part of the study consists of macro- and microsimulation analysis of fiscal devaluation effects on the economies of France, Italy, Spain and Austria. It's should be pointed out also the analysis of effects in conditions of joint fiscal devaluation implementation in trading partners. At the same time, the situation when country is unable to affect the price and quantity of exports is only casually mentioned in the study, leaving a significant gap for research unfilled.

Koske (2013) analyzed the potential advantages and disadvantages of a fiscal devaluation policy and discussed conditions under which such a policy could produce extended effects. The main thesis of this study is that the fiscal devaluation creates mostly temporary effects, while any permanent real effects are negligible. Thus, fiscal devaluation can't be used as a substitute for deep structural reforms on financial and commodity markets, as well as the labor market. It should be noted that the author analyzes conditions necessary for the effectiveness of fiscal devaluation, and focuses on the price elasticity of exports. Improving trade balance, which is the main objective of fiscal devaluation, is more palpable, as exports and imports of the country are more sensitive to fluctuations in respective prices. Accordingly, if for any reason such sensitivity is absent or greatly limited the effectiveness of fiscal devaluation is questionable. At the same time, these price effects are stronger and more resilient in the face of nominal exchange rate rigidity, which is a necessary condition for the effectiveness of fiscal devaluation.

Thus, the fiscal devaluation operates through the price mechanism, and all the possible benefits for the national economy are determined by this mechanism's functioning. However, for developing countries critical realities are hidden behind a coherent theoretical framework of the fiscal devaluation which, ultimately, may negate any positive effects. First of all, it's necessary to pay attention to two fundamental assumptions of this theory: 1) monetary policy can't be implemented due to lack of capacity to regulate exchange rate, which may occur

inside a monetary union or within fixed exchange rate regime; 2) exporters react to fiscal devaluation by decreasing prices, and these, reduced export prices determine the demand for export products in the world.

The idea of fiscal devaluation was created in countries that are monetary union members and are not free to use the nominal exchange rate for short-term economic stimulation. The reasons for monetary policy inactivity here are in the institutional field. But the possibilities and consequences of fiscal devaluation may significantly differ for the countries where monetary policy is limited for other reasons. For instance, in Ukraine monetary policy also can't have a significant impact on the economy, because of *de facto* fixed nominal exchange rate. There are two main reasons for conducting fixed exchange rate policy in Ukraine: critical imports and the rising external debt of the government. In other words, the reason for exchange rate rigidity lies in the economic plane. If fiscal devaluation is implemented in countries with a Ukrainian economic model, export prices may decline[1], and import prices are guaranteed to rise, including critical import prices, which can't be abandoned or replaced by domestic production. Thus, import and export characteristics that restrict currency devaluation also restrict fiscal devaluation. If fiscal devaluation should copy its monetary analogue, it also extends on the negative effects. Thus, in countries, where the limitations of monetary policy in stimulating exports and domestic output are caused by structural economic problems, the possibility for fiscal devaluation will be limited also. First of all, these are countries that are forced to accept external prices for goods and services (price-takers) and which have a large proportion of critical import. Ukraine is exactly such country, however this is typical for many countries with small open economies.

Now on the price mechanism functioning. The idea that exporters are able to affect demand for their products, manipulating prices is rather controversial. The discussion here goes beyond the fiscal devaluation and turns to the question: 'What factors determine a

country's volume of exports ?' The polemics on this issue have been actively conducted since the 1970s and were intended to determine whether a country with a small open economy is capable by changing prices to adjust the volume of exports, or if export is determined by the income of importing countries. The latter hypothesis has received far more empirical evidences than the former. In other words, the export prices of countries like Ukraine are determined by external demand, rather than the supply of goods inside the country.

The problem is that in international trade Ukraine acts as a 'double price-taker'. On the one hand, it's hard to change the volume of exports setting prices as exports and the corresponding prices are not determined by supply side. Contrarily, prices are determined by outside world (demand side). On the other hand regarding a number of trade positions which are very weighty, it's hard to influence the price of imports, because it is critical for Ukraine. These features of the Ukrainian economy will lead to a situation where the effect of fiscal devaluation will be much weaker than expected.

Considering the indicated points, an important objective is to study the possible effects of fiscal devaluation in price-taking countries. Namely the problem is the following: do countries like Ukraine tend to improve their trade balances in response to the increase of VAT burden and decrease of employers' social contributions?

The debates concerning the relationship between prices and trade balance of a country are conducted in the plane of determining price and external demand elasticities of the exports in small open economies. The seminal work on this issue was an article by Riedel (1988) in which the author in contrast to existing ideas claimed that for low developed economies (LDC) price elasticity of exports is much higher than the external demand elasticity. That is a change in prices for domestic products (through currency devaluation, for example) can have an impact on the volume of exports. According to the author, the erroneous results in previous studies were caused by ignoring the supply side in elasticities calculations. At the same time

Riedel (1998) conducts an empirical analysis of just one of the LDCs (Hong Kong), while analysis of data for a number of low developed countries leads to the opposite conclusion. The article Faini *et al.* (1992) empirically proved the importance of demand factors in determining export volumes, although attention is drawn to the importance of supply-side factors (price) in such analysis. In the paper Muscatelli *et al.* (1995) researchers, applying somewhat different empirical technique to a group of Asian Newly Industrialised Economies (NIEs) came to the same conclusion as most previous studies – the factor of external demand has a much stronger effect on exports volume than the supply factor (price changes). This refutes the small country assumption, made earlier in Riedel (1988). To summarize, besides studies mentioned here there was much research conducted to identify the influential factors determining country's trade balance with the application of different techniques and specifications regarding price and external demand elasticities. The results are pretty mixed. However, the determination of these parameters is a very important task for understanding of possible fiscal devaluation effects in countries like Ukraine.

Theoretical model, empirical methodology and data

Theoretical model of fiscal devaluation impact on the economy is appropriate to analyze through the real exchange rate, which is calculated by the formula:

$$\mathrm{ER_r}=\mathrm{ER_n}\times\frac{\mathrm{P_{ext}}}{\mathrm{P_{int}}}, \quad (1)$$

where $\mathrm{ER_r}=\mathrm{ER_n}\times\frac{\mathrm{P_{ext}}}{\mathrm{P_{int}}}$ – the nominal exchange rate (national currency / foreign currency);

P_{ext} – price index of country's major trading partners;

P_{int} – price index of a country.

The nominal exchange rate devaluation (ER_n) leads to the rising of real exchange rate, which cause export prices decrease and makes imports more expensive. Theoretically that results in improved competitiveness of national products on the world market. Under the

conditions of currency devaluation impossibility the ratio of world and domestic prices can be the source of improving competitiveness in the world market.

A policy of fiscal devaluation aims to stimulate national exports due to the differences in world and domestic prices, which are created through the tax system. Fiscal devaluation has a complicated impact on the real exchange rate but it should be examined in the context of exports and imports separately.

Rising VAT rates directly affects the increase of import prices and duplicates the effect of currency devaluation on importers as it leads to an increase in the real exchange rate:

$$\mathrm{ER}_{\mathrm{r}_{\mathrm{imp}}}=\mathrm{ER}_{\mathrm{n}}\times\frac{\mathrm{P}_{\mathrm{ext}}+\Delta\mathrm{VAT}}{\mathrm{P}_{\mathrm{int}}} \quad (2)$$

where ΔVAT – the magnitude of import prices increasing caused by rising VAT rates.

At the same time inside economy SOC are decreased resulting, as is assumed in theory, in lower prices in both domestic and export sectors. It becomes possible due to refund of VAT to exporters, i. e. they are not affected by VAT increase. Thus, there is dubbing of currency devaluation effect on exporters. Appreciation of the real exchange rate becomes significant for exporters:

$$\mathrm{ER}_{\mathrm{r}_{exp}}=ER_n\times\frac{\mathrm{P}_{\mathrm{ext}}}{\mathrm{P}_{\mathrm{int}}-\Delta\mathrm{SOC}} \quad (3)$$

However, this theoretical scheme may not work if the country is a price-taker. Fiscal devaluation aims to adjust the balance of external and internal prices, but in these countries the price elasticity of imports and exports is low. In this case, the rise in import prices will have little effect on the volume of imports as import is critical (for instance energy goods for a country with poor natural resources). Meanwhile export prices will not drop significantly as they are exogenously given by the economic situation in external economic partners.

Thus, for price-takers the effect of fiscal devaluation will be minimal. Price-takers are countries that have a small share in world international trade, and for which the price

elasticity is much lower than external demand elasticity of exports for certain products. The same is applicable to imports, when consumption structure of the country contains a large share of imported goods which, in the case of price increase, is difficult to refuse or to establish domestic output without serious economic losses. In the case of Ukraine energy products play the role of critical imports, prices on which are determined outside of Ukraine. The majority of exports consist of raw materials or products with low added value (see Figure 1), prices of which also can't be influenced by Ukraine because of high competition on these markets and the low proportion of Ukrainian goods on these markets. To determine whether a country is price-taker and, accordingly, whether there is a possibility to obtain a positive effect from fiscal devaluation it is necessary to evaluate the function of supply and demand for exports and imports. After this, it is necessary to analyze the relevant price and demand factors elasticities. However, the estimation of such models is a complicated process because of the endogeneity problem. This study suggests approaching the problem from another angle. The idea of the study is to analyze causality between changes in the structure of the fiscal burden, which we define as the difference between VAT and SOC, and the level of net exports. Two alternative hypotheses will be tested: $H_0: (vat - soc) \rightarrow TB$ and $H_1: TB \rightarrow (vat - soc)$ where TB – the trade balance; vat – indicator of VAT; soc – indicator of employers' SOC. Hypothesis testing is conducted using Ukrainian data. In case of H_0 confirmation it can be argued that fiscal devaluation will have a positive effect in Ukraine and the country is not a price-taker as exports and imports have significant domestic prices elasticity. If the alternative H_1 hypothesis will be confirmed, primarily due to revenues from VAT, then fiscal devaluation will not have a significant effect and Ukraine is a price-taking country.

[Figure 1 here]

To identify casual relationships and to analyze the possible impact of fiscal devaluation on the trade balance of the country the following approach is proposed: 1) to test the generated data sets for stationarity; 2) to transform all the data in a stationary form and apply the Granger-causality test 3) to test data on the presence of cointegration; 4) in case of cointegration detection apply Hsiao test using long-term cointegration relationship; 5) having information about casual relationships between time series construct impulse response functions to a shock in the ratio of VAT and SOC.

The essence of the Granger causality test is to estimate a model of the form (4) for two stationary variables using OLS:

$$y_t = \alpha_0 + \sum_{k=1}^{k_1} \alpha_{11}^k y_{t-k} + \sum_{k=k_0}^{k_2} \alpha_{12}^k x_{t-k} + \upsilon_{1,t} \ , \qquad (4)$$

where $k_0 = 1$ and apply F-test for testing the null hypothesis H_0: $\alpha_{12}^1 = \alpha_{12}^2 = \cdots = \alpha_{12}^{k_2} = 0$. Confirmation of null hypothesis means, that the hypothesis that *x* is not the reason *y* can't be rejected. Changing variables in places we can test the hypothesis that *y* is not a reason *x*. If in both cases the null hypothesis is rejected, the two processes show a feedback relation.

The drawback of the Granger causality test is that its results strongly depend on the order of lags included in the regression. Therefore, including the incorrect number of lags in regression a researcher receives inconsistent results and can lead to erroneous conclusions. To mitigate this problem, Hsiao (1981) proposed a lag selection procedure, which is based on the final prediction error criteria. This approach implies assessment of two types of regressions:

$$y_t = \alpha_0 + \sum_{k=1}^{k_1} \alpha_{11}^{k_1} y_{t-k_1} + \upsilon_{1,t} \qquad (5)$$

$$y_t = \alpha_0 + \sum_{k=1}^{k_1} \alpha_{11}^{k_1} y_{t-k_1} + \sum_{k=1}^{k_2} \alpha_{12}^{k_2} x_{t-k_2} + \upsilon_{2,t} \qquad (6)$$

and selection the optimal number of lags for each variable basing on the final prediction error (FPE). Causality identification procedure is as follows:

1) for one of the variables, say *y*, are run a series of regressions of the fit (5) with prespecified interval of lags $k_1 \in [1; m]$. For each regression estimated FPE, regression, which produces the smallest value of FPE, contains the optimal lag (m*). Thus, FPE*y* (m*, 0) – the minimum value at that stage of a series of FPE, calculated as follows:

$$FPE_m = \frac{(T+m+1)}{(T-m-1)} \times \frac{SSE(m)}{T} \quad (7)$$

where T – the number of observations, SSE – sum of squared errors.

2) on the next stage estimated a series of regressions of the fit (6) subject to restrictions $k_1 = m*$, $k_2 \in [1; n]$. In other words, the number of lags for *y* fixed at m*, the number of lags for *x* is chosen through a selection of regression with the smallest FPE, which for regression (6) can be designated as FPEy (m*, n*). For regressions of the fit (6) FPE is calculated:

$$FPE_{m*,n} = \frac{(T+m*+n+1)}{(T-m*-n-1)} \times \frac{SSE(m*,n)}{T} \quad (8)$$

3) to determine the causality must be compared meanings of FPE y (m*, 0) and FPE y (m*, n*). If FPEy (m*, 0) > FPEy (m*, n*) it can be concluded that *x* Granger causes *y*, if FPEy (m*, 0) < FPEy (m*, n*) it can be concluded that *x* doesn't Granger cause *y*.

Analysis of causality using the Granger and Hsiao approaches takes into account only short-term relationships between variables, as they are transformed into a stationary form. For the separation of short-term, long-term causal relationships it is possible to use error correction model (ECM) modification of the Hsiao test. Cointegration tests and detected presence of common stochastic trend in time series suggest that one of the variables causes another one in the long-term. For instance, if in accordance with test results the number of cointegrating equations in the system is less than the number of variables, then those variables that do not contain long-term relationships in their dynamic models contain stochastic trends that drive other variables (Kirchgässner and Wolters 2007). Inserting long-term equilibrium

equation in regressions (5) and (6) and using standard Hsiao procedure, a researcher can identify short-term causality.

Determination of causality provides additional information to identify the matrix of structural shocks for SVAR-model. After imposing appropriate restrictions the function of responses to shocks in tax structure and trade balance can be derived. Thus it can be concluded whether a fiscal devaluation in Ukraine may have a positive impact on the trade balance.

To test proposed hypotheses based on Ukrainian macrostatistics quarterly time series were formed for the period from first quarter 2001 to second quarter 2013 for trade balance (TB) and the gap between employers' SOC and VAT. The difference between SOC and VAT should indicate the proximity of economy to actual fiscal devaluation, since reduction of this variable means the growth of VAT payments and declining of SOC. Later in the article this variable will be denoted as FD. Time series for indicators of interest were built in two variants – the absolute values (*TB, FD*) and GDP ratios (*tb, fd*). While analyzing absolute values of trade balance time series were converted to national currency equivalent at the current exchange rate on the cash market, then *FD* and *TB* time series have been transformed into prices of 2007 to get the real measures. All variables were seasonally adjusted with Census X12 filter, except variable *fd* as seasonality wasn't detected.

Estimation results

The first step in causality testing is the identification of time series integration order and the presence of a deterministic trend, as the Granger causality test requires stationary data. For that purpose each time series was tested for stationarity applying the DF-GLS test[2], with respective results summarized in Table 1. For each variable testing procedure stopped, when

it was possible to identify which category of processes variable presents – the trend-stationary (TS) or difference-stationary (DS) process. Test results indicate that the time series of trade balance in absolute and relative terms (*TB, tb*) are first order integrated (I (1)). Variable *fd* is I(0) and is stationary without any transformations, FD, considering test results is TS-process.

[Table 1 here]

To transform variables into the stationary form were taken first difference of *TB* and *tb* time series. Stationary form of variable *FD* was obtained by extraction of linear trend. Respectively were formed time series for variables *d_TB*, *d_tb*, *TR_FD*. Figure 2 displays dynamics of transformed variables and FD variable, which is stationary itself. Visual analysis of time series allows to identify a few outliers that should be taken into account in the analysis of causality. For variables that represent the dynamics of trade balance such points are the second quarter of 2005, the first quarter of 2009 and the second quarter of 2012. For variables that indicate the gap between VAT and SOC tax burden, such points are the third quarter of 2006, fourth quarter of 2009, third quarter of 2010 and third quarter of 2011. To avoid problems with the distribution of errors in constructed regressions and to obtain reliable coefficients in the analysis appropriate dummy variables should be introduced. Dummies can be conditionally divided into three types: mean-shift dummies – represent shocks which induce the change of average rate of process development or dramatically change the local mean; permanent intervention dummies – indicate the shocks that have a long-term impact on the process and change the trend of development; transitory shock dummies – represent short-term shocks that quickly leveled and do not affect the long-term trend of development (Juselius 2006, p. 102). Visual inspection of the data suggests that the shocks were either transitive or permanent. Thus, as a transitive shocks, applying dummy variables were introduced in analysis the third quarter of 2010 for *fd* and *TR_FD* (with the leveling influence in the first quarter of 2011) and the second quarter of 2012 for trade balance variables (with

the leveling influence in the third quarter of 2012). Other outliers were treated with permanent intervention dummies.

[Figure 2 here]

After data transformation and the introduction of dummy variables a series of Granger causality tests were conducted (see Table 2). For estimation of regression parameters an HAC estimator was used to mitigate the consequences of possible autocorrelation and heteroskedasticity, derive robust standard errors and therefore appropriate significance statistics for coefficients.

[Table 2 here]

Results of Granger causality tests basically argue that the null hypothesis of no causal relationship between trade balance dynamics and changes in SOC-VAT gap can be rejected. At the same time causality in the reverse direction can't be confirmed for at least 6 quarters horizon.

Testing causality of stationary time series, researcher analyzes the short-term relationships between variables. To separate short- and long-term effects it is necessary to run a VECM regression and based on the long-term equations conduct the Hsiao test. Before VECM construction it's necessary to test for cointegration, while time series should be non-stationary and have the same order of integration. Relative variables *tb* and *fd* do not meet these requirements because *fd* is I (0) variable. Test for cointegration can be applied to time series in absolute terms – *TB* and *FD*, as they become stationary after extracting stochastic and deterministic trend respectively. While testing for cointegration needs to be determined deterministic part of long-term relationship, as this could affect the outcome of testing. In this data case the decision must be made whether to include linear trend and dummy variables in the long-term equation. If the same deterministic components influenced both studied processes, then their effect will be canceled in a cointegration relationship and there is no

need to include them. Alternatively, if the trend or structural shifts determine the long term behavior of only one of the processes, it should be taken into account in the cointegration relationship (Juselius 2006, p. 109). Based on this logic, the linear trend was included in cointegration equation (CE), as it is characteristic only for *FD* variable. Dummies were not included in a long-term relationship. Some of them are transitive, thus affect only short-term dynamics by definition. In relation to permanent intervention dummies it is assumed that they have had an impact on the long-term dynamics of both time series and therefore they aren't introduced in CE. At the same time they are included as exogenous variables in that part of the equation that describes short-term dynamics. The results of testing for the presence and order of cointegration are presented in Table 3[3].

[Table 3 here]

The presence of one stochastic trend indicates that one of the variables is weakly exogenous and contains a stochastic trend that drives whole system (Kirchgässner and Wolters, p. 204). In other words, this is a variable that is the cause of long-term changes in other variables. Considering the adjustment coefficient in the VECM regression (see Table 4) such variable is just the trade balance.

[Table 4 here]

VECM indicates that long-term causality runs from the trade balance to a gap between VAT and SOC, and not vice versa. To isolate the short-term causality Hsiao test was performed taking into account long-term equilibrium relation, which is Cointegrating Equation from Table 4. Instead of regression (5), (6), regressions of type (7), (8) where z_{t-1} – the long-term equilibrium relation were constructed. All other aspects of the testing procedure are the same as was described in methodology (see Table 5).

$$\Delta y_t = \alpha_0 + \sum_{k=1}^{k_1} \alpha_{11}^{k_1} \Delta y_{t-k_1} + \delta z_{t-1} + \upsilon_{1,t} \quad (9)$$

$$\Delta y_t = \alpha_0 + \sum_{k=1}^{k_1} \alpha_{11}^{k_1} \Delta y_{t-k_1} + \sum_{k=1}^{k_2} \alpha_{12}^{k_2} \Delta x_{t-k_2} + \delta z_{t-1} + \upsilon_{2,t} \quad (10)$$

[Table 5 here]

Analysis of the short-term dynamics by applying the Hsiao test application also indicates that Ukraine's trade balance fluctuations cause fluctuations in the difference between VAT and SOC. Introduction of TR_FD variable doesn't improve FPE criterion for model of trade balance dynamics with lag order selected by Hsiao procedure (FPE_{TB}(m=1)< FPE_{TB}(m*=1,n=1)). In turn, the inclusion of trade balance dynamics with one lag in regression of fiscal devaluation indicator improves the model (FPE_{FD}(m=1)> FPE_{FD}(m*=1,n=1)). The same conclusion can be made from analysis of differenced variables coefficients in the VECM regression (see Table 4).

Time series analysis argues that the trade balance dynamics of Ukraine is an exogenous factor regarding fluctuations of VAT and employers' SOC. This information can be used to identify the structural shocks matrix of two processes. Accordingly two SVAR models for absolute and relative measures of trade balance and SOC-VAT gap were built. The order of lags was chosen using information criteria, and regressions also were tested for the presence of residuals autocorrelation. In these models restrictions on the matrix of structural shocks were imposed in such a way that the initial shock occurs in trade balance. Meanwhile there is no instantaneous response to changes in the indicator of fiscal devaluation, i.e. restrictions imposed according to previous results regarding causality. The results of responses to trade balance shocks for both types of models are displayed on Figure 3. It's worth noting that, changing the order of the impulses in the system of equations does not significantly affect the overall result – trade balance shocks have a significant impact on the level of VAT and SOC, while the reverse effect isn't observed.

[Figure 3 here]

Positive response of fiscal devaluation indicator to a one standard deviation shock in trade balance means, first of all, VAT revenues decrease because of import drop and

increased VAT refund obligations in respect with export growth. External trading positive shock also has positive impact on social security contributions as the economy is export-oriented though SOC response isn't as fast as for VAT revenues.

Conclusion

This study makes another contribution to the debate about the possible effects of fiscal devaluation on an economy. In particular, the case of Ukraine shows that for a small open economy causality may go not from the tax system to country's trade balance, but in the opposite direction. The reason for that is a low price elasticity of consumption, whether this is consumption of imported goods inside the country or consumption of exports by trade partners. Such countries are called price-takers. The result of such causality pattern is that equivalent fiscal burden shift from employers' SOC towards VAT will not have a significant effect on the country's trade balance. Actually it is indicated by modeling responses of trade balance to fiscal policy shocks with application of restrictions that were dictated by identified direction of causality.

In their article, de Mooij and Keen (2012) argued that there is almost no empirical evidence bearing on the likely trade impact of a fiscal devaluation or on trade impacts of tax reforms more generally, but subsequently empirical research in this field has significantly increased. The results of this study somewhat contradict the rest of the empirical literature. Basically, the simulation results indicate the presence of a short-term positive effect on the economy as a whole, and on the trade balance in particular. Meanwhile very often researchers mention that price-taking on international markets can significantly reduce the positive effect of fiscal devaluation. Some authors recognize the endogeneity problem in models and try to mitigate it with different approaches – the use of instrumental variables or a priori restrictions. The current study tried to initially separate the variables on exogenous and endogenous and based on these results carry on the discussion about the fiscal devaluation appropriateness in

countries with small open economies. In empirical literature available to us the positive effects of fiscal devaluation were identified for the advanced economies which are members of OECD or eurozone. Fiscal devaluation had the greatest effect in eurozone countries (de Mooij and Keen 2012, Franco 2011). These results, in our opinion, are explained by the significant power of these countries on international markets.

The policy implications for countries with small open economies are that the fiscal devaluation is unlikely to have any stimulating effect on domestic output or foreign trade. On the one hand it limits the instruments of fiscal policy; on the other hand, such countries usually have fewer liabilities relative to nominal exchange rate, so sound measures would be the adoption of a certain type of a floating exchange rate. However, as practice shows, the economic problems of small open economy countries, including many developing countries, often lie outside the influence of fiscal and monetary policy. Therefore, a critical point is also a significant reduction of corruption, improving of economic infrastructure, ensuring the transparency of the tax system, and reducing of administrative barriers to business. This policy increases the efficiency as monetary instruments, of well as those of fiscal instruments that do not apply to fiscal devaluation.

A significant problem point of this research is that during the study period in Ukraine a structural shift in VAT taxation or SOC was not observed. The basic VAT rate was a constant 20%, and SOC rates varied insignificantly. This forced data manipulation, which are only an approximation of real fiscal devaluation. The presence in the study period of one or more significant tax burden shifts would increase the reliability of the findings and improve their economic interpretation. For further verification of the hypothesis put forward in this article additional information is needed, which can be extracted from the panel data. A promising avenue of research is to develop a statistical database for the small open economies, which with high probability are price-takers. The presence of structural changes in

the ratio of VAT and SOC is also desirable. Utilization of panel data will give more robust results regarding causality. This direction of research is promising, both in terms of general discussion on the possibilities of fiscal devaluation, and in terms of identifying new patterns of foreign trade development in developing countries.

Notes

1. Reduction of prices can't be guaranteed, as exporters can simply increase profitability, including in the price expected return to the old system of taxation or realizing the impossibility of rapid expansion of their products consumption at reduced prices.
2. Time series were tested in parallel with KPSS-test, the results of which practically coincide with the results of DF-GLS test.
3. The order of lags was chosen using information criteria. For VAR-specification optimal number of lags equals 2 in accordance with AIC and HQC criteria, according to BIC-criterion – 1 lag. Cointegration tests indicate the presence of one stochastic trend for models with one and two lags. For further analysis we operate a model with one lag, as it has better statistical properties.

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Table 1. Results of DF-GLS unit root test

		DF-GLS (H0: ρ=1, t-Stat.)	
		Level	First difference
TB	Included trend and intercept	-2.41	-7.14***
	Included intercept	-1.23	
FD	Included trend and intercept	-5.67***	
	Included intercept	-4.48***	
tb	Included trend and intercept	-2.51*	-5.81***
	Included intercept	-1.45	
fd	Included trend and intercept	-5.66***	
	Included intercept	-5.33***	

Note: *, ** and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

Table 2. Results of Granger causality tests

	Null Hypothesis			
Lag	*d_tb* does not Granger Cause *fd*	*fd* does not Granger Cause *d_tb*	*d_TB* does not Granger Cause TR_*FD*	*TR_FD* does not Granger Cause *d_TB*
1	0,0339	0,4826	0,000	0,7205
2	0,03	0,625	0,000	0,709
3	0,022	0,565	0,000	0,185
4	0,032	0,334	0,000	0,261
5	0,039	0,396	0,000	0,391
6	0,072	0,564	0,000	0,281

Table 3. Results of cointegration test between TB and FD (1 lag)

	Unrestricted Cointegration Rank Test (Trace)			Unrestricted Cointegration Rank Test (Maximum Eigenvalue)		
Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	Prob.**	Eigenvalue	Max-Eigen Statistic	Prob.**
None *	0.439339	32.22161	0.0071	0.439339	27.77468	0.0024
At most 1	0.088482	4.446922	0.6769	0.088482	4.446922	0.6769

Notes: * denotes rejection of the hypothesis at the 0.05 level

**MacKinnon-Haug-Michelis (1999) p-values

Table 4. VECM regression results with basic tests statistics

Cointegrating Equation		
FD (-1)	1.000000	
TB (-1)	-0.105084 [-1.85185]*	
T	-162.5582 [-4.74650]	
C	-1258.727	
Error Correction:	D_FD	D_TB
Cointegrating Equation	-0.757537 [-5.45266]	-0.016498 [-0.06365]
D_FD (-1)	-0.002647 [-0.02235]	0.165745 [0.75026]
D_TB (-1)	0.153476 [2.38438]	0.140587 [1.17073]
C	572.1699 [2.52134]	-349.7251 [-0.82605]
DUM_FD_0904	6649.217 [4.35655]	-3515.856 [-1.23475]
DUM_FD_1003	6194.185 [5.47936]	-2592.173 [-1.22909]
DUM_FD_1103	5645.135 [3.36056]	3034.345 [0.96823]
DUM_TB_0502	-1533.544 [-1.00913]	-7888.581 [-2.78244]
DUM_TB_0901	-3588.241 [-2.22911]	7702.109 [2.56469]
DUM_TB_1202	1041.606 [0.88370]	11827.32 [5.37854]
Adj. R-squared	0.763130	0.481784
Residuals correlation	0.05	
Roots of Characteristic Polynomial	1.000000 0.348429 0.348429 0.212597	
Joint VEC Residual Normality Tests (Jarque-Bera)	p = 0.56	
Joint VEC Residual Heteroskedasticity Test (White Including Cross Terms)	p = 0.99	
VEC Residual Portmanteau Tests for Autocorrelations	Lag(1): Adj. Q-Stat = 2.247 (p=NA); Lag(2): Adj. Q-Stat = 5.71 (0.22); Lag(3): Adj. Q-Stat = 9.119 (0.33); Lag(4): Adj. Q-Stat = 13.916 (0.30); Lag(5): Adj. Q-Stat = 14.49 (0.56); Lag(6): Adj. Q-Stat = 15.29 (0.75)	

Note: * - t-statistics in [ ]

Table 5. Results of Hsiao test with employing long-term equilibrium equation

Lags (m,n)	d_TB – controlled variable, TR_FD – manipulated variable		TR_FD – controlled variable, d_TB – manipulated variable	
	FPE_{TB}(m)	FPE_{TB} (m*,n)	FPE_{FD} (m)	FPE_{FD} (m*,n)
1	7382246,377	7697222,222	2125686,436	1944765,575
2	7882011,605	8201385,453	2236023,815	2023512,187
3	8436853,002	8382820,785	2387356,573	2167556,246
4	8861111,111	9008547,009	2553281,944	2253762,417
5	9479665,072	9554668,305	2738172,967	2419828,734
6	10109819,12	10301661,13		

Figure1. Percentage of raw materials exports and imports of fuel and energy minerals for Ukraine

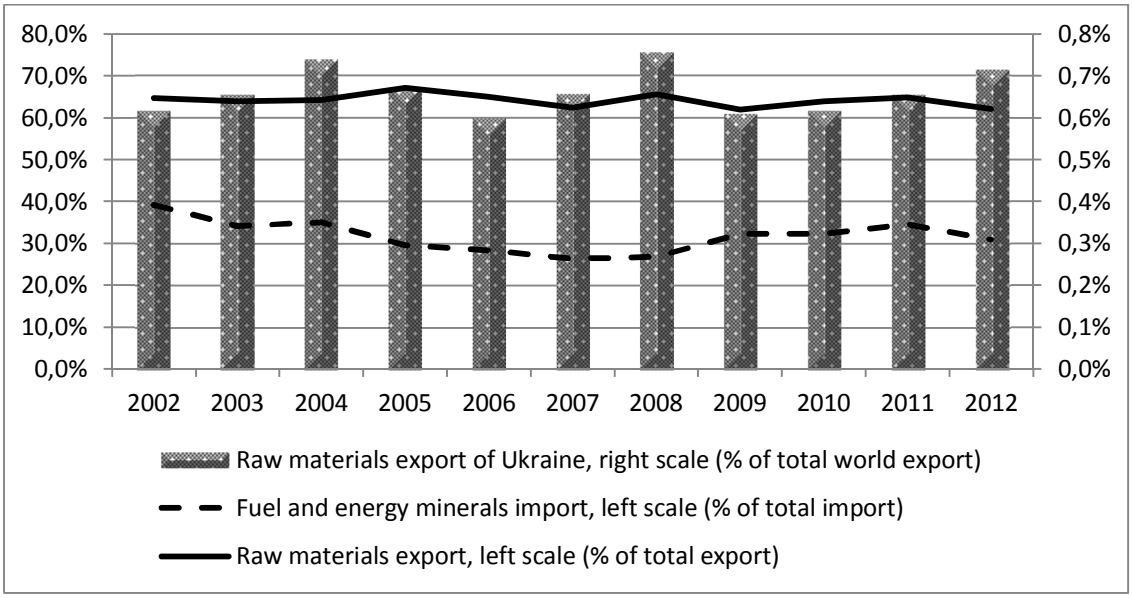


Figure 2. Dynamics of trade balance and SOC-VAT variables in stationary form

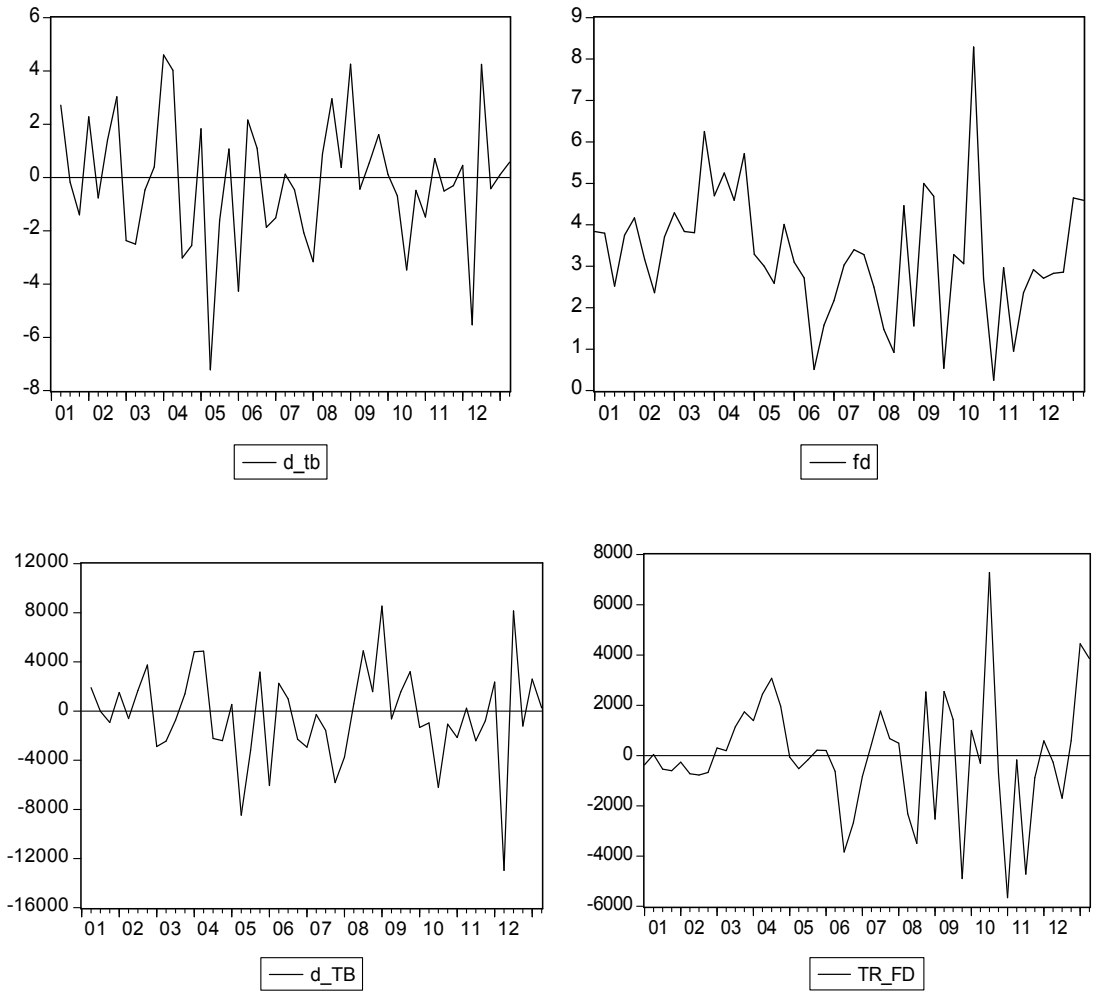
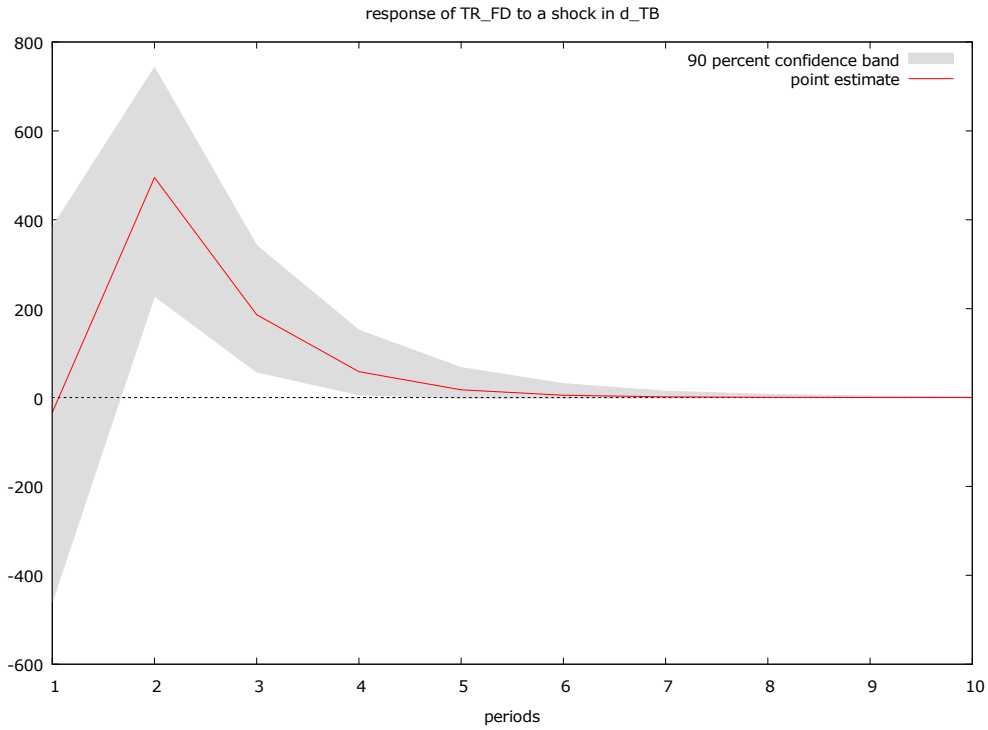
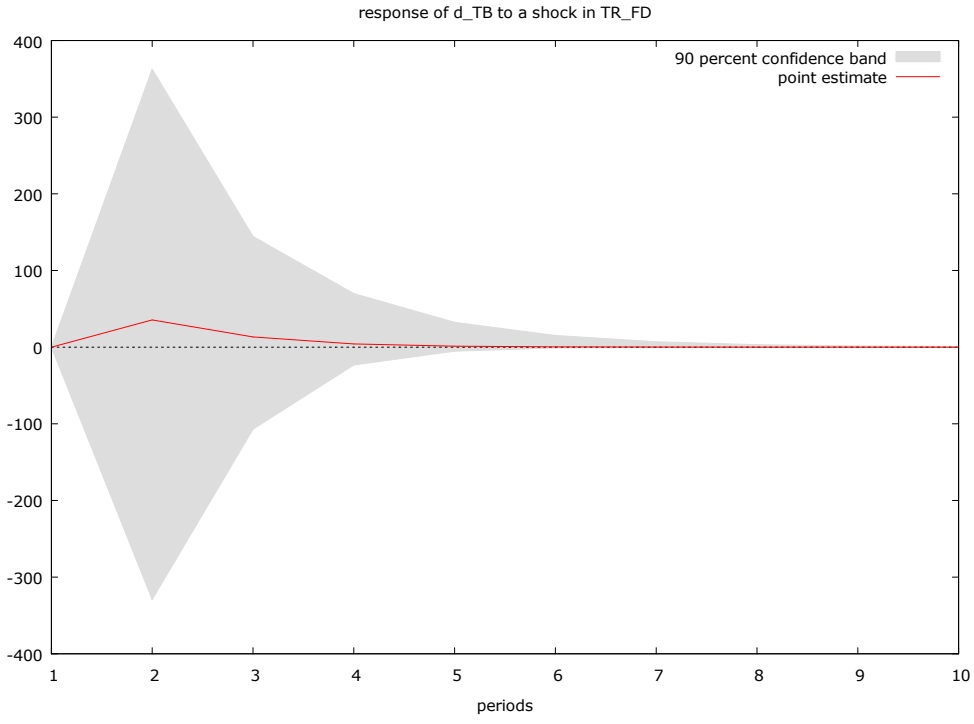
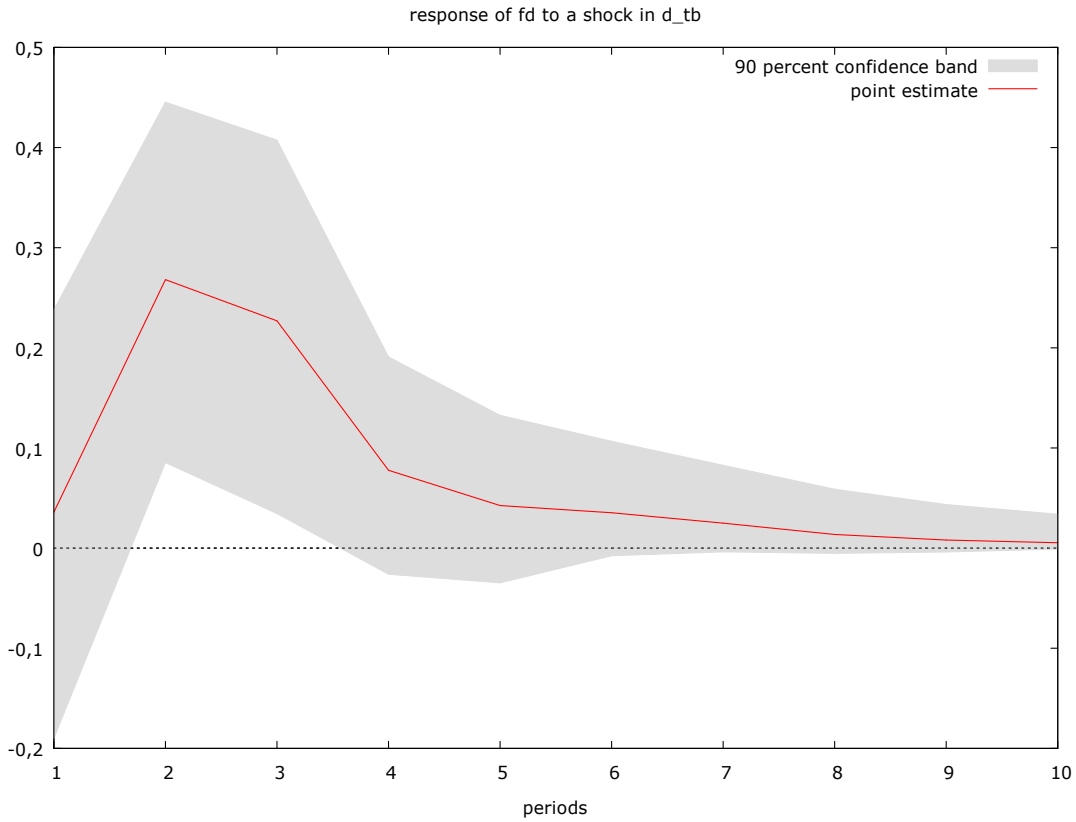


Figure 3. Impulse response functions of trade balance and fiscal devaluation indicator






response of fd to a shock in d_tb
90 percent confidence band
point estimate
0,5
0,4
0,3
0,2
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0
-0,1
-0,2
1
2
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8
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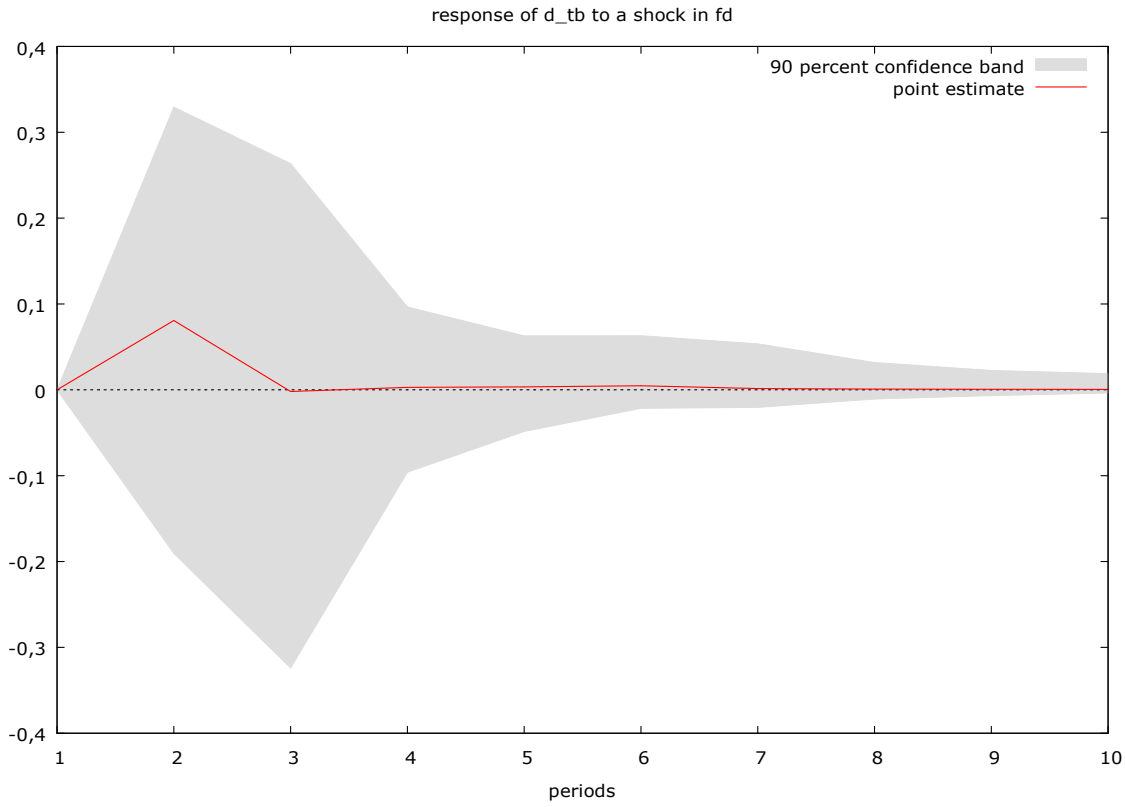
10
periods


response of d_tb to a shock in fd
90 percent confidence band
point estimate
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0,3
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0
-0,1
-0,2
-0,3
-0,4
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periods