Fiscal and monetary effects in Ukraine: SVAR approach

Victor Shevchuk¹, Roman Kopych², Marianna Golynska³

Abstract

This paper investigates the impact of fiscal and monetary shocks on the output gap, producer price inflation (PPI) and the current account in Ukraine when applying SVAR model. On the basis of quarterly data for the 2000–2016 period, it has been found that the budget surplus is expansionary and anti-inflationary, with an improvement in the current account. The tightening of monetary policy, as measured by a decrease in the money supply with respect to the equilibrium trend, is associated with an improvement in the current account and a negative effect upon the output gap, while being neutral with respect to PPI. Our findings are in line with the predictions of the dependent economy model when considering the money-based expectations of the exchange rate. The evidence does indicate that a higher PPI makes a positive contribution to the current account, while there is a negative effect upon output. There is a favorable temporary effect of the current account upon the output gap, with a weak reverse causality running from the latter to the former. Monetary policy has standard anti-inflationary response, while being pro-cyclical. Also, it is worth noting that budget deficits are associated with an increase in the money supply. However, fiscal policy is independent of all endogenous variables.

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1 Introduction

Over the recent decade, the Ukraine's economy has experienced two harsh financial crises of 2008–2009 and 2014–2015, with the plunge of output below its trend to 11% and 8%, respectively (Fig. 1). Considering a possible link between the financial turmoil and macroeconomic policies, there appears to be a correlation between the money supply and the output gap. While excessive money supply can be blamed for a significant current account worsening in 2007–2008 and again in 2012–2013, the budget balance does not reveal any connections to the twin-deficit hypothesis.

Most international monetary and macro models predict that expansionary money supply shocks lead to a temporary increase in output (if any), worsening of the current account and a

¹ Corresponding author: Cracow University of Technology, Institute of Economy, Sociology and Philosophy, Warszawska 24, 31-155 Kraków, Poland, e-mail: vshevchuk@pk.edu.pl.

² Lviv National University named by Ivan Franko, Ukraine, Universytetska 1, 79-001 Lviv, Ukraine, e-mail: kopych_r@bigmir.net.

³ Lviv University of Trade and Economics, Tuhan-Baranovskoho 5, 79-005 Lviv, Ukraine, e-mail: marianna.yasinska@ukr.net.

higher price level (at least in the long run). Macroeconomic effects of the fiscal stimuli are similar, though with different timing and amplitude. A number of studies have empirically supported these standard predictions for both money supply (Canova and Menz, 2011; Favara and Giordani, 2009) and fiscal policy (Ilzetzki et al., 2013). However, it has not been ruled out that money supply is ineffective with respect to output, even in the short run (Uhlig, 2005), or it has restricted impact on economies with financial market constraints (Rojas-Suarez, 1992). Similarly, the so-called Non-Keynesian fiscal policy effects imply output expansion following budget deficit cut.



a) GDP and money supplyb) budget and current account balances(deviation from trend, %)(% of GDP)

Fig. 1. Ukraine: selected macroeconomic indicators, 2000–2016. *Note*: GDP and money aggregate M2 are de-trended with the Hodrick–Prescott filter. *Source*: Ukraine's Ministry of Finance, IMF *International Financial Statistics*.

The aim of this study is to examine the budget balance and money supply shocks upon producer price inflation (PPI), the current account and output gap in Ukraine. We implement structural vector auto-regression (SVAR) approach for modeling the inter-dependencies between fiscal and monetary policies and main macroeconomic indicators.

The rest of the paper is organized as follows. Section 2 provides a brief review of the related literature. Section 3 describes data and methodology. Section 4 discusses empirical results and Section 5 provides conclusions.

2 Related literature

Although in the majority of modern monetary models the stock of money has disappeared, it is hard to accept such approach not only because of the quantity theory orthodoxy, the balance sheet effects or liquidity constraints, but also because of numerous evidence in favor of real money supply effects on both industrial and developing countries (Canova and Menz, 2011). However, earlier studies concerning post-Soviet countries provide mixed evidence of the real effects of monetary policy (Starr, 2005). While earlier studies had found smaller (but similar) responses of CEE countries to the monetary policy shock than those found for the Western European countries (Anzuini and Levy, 2007), later ones report that the price responses imply the possibility of even stronger effects of monetary policy on prices than in the euro area countries, especially for lags which are longer than one year (Jarocinski, 2010).

The relationship between money and macroeconomic indicators is likely to be countryspecific. For example, it has been found that the balance of payments shocks is important in price level movements in Hungary, while nominal shocks are dominant in affecting prices in Poland; on the other hand, monetary shocks affect output in the short run in Hungary, while supply shocks dominate output movements in Poland (Dibooglu and Kutan, 2005). Standard features of monetary policy are found for the Czech Republic (Borys et al., 2009). Although the money-prices relationship is supposed to weaken once inflation lowers, money supply is likely to play a role in explaining inflation dynamics in Ukraine due to inflationary inertia, dollarization and unstable economic environment.

The effect of monetary policy upon the current account depends on the relative strength of familiar income absorption and expenditure switching effects. For several European countries, it has been revealed that the expenditure-switching effect is stronger, meaning that improvement in the current account is brought about by monetary contraction (Kim, 2001).

Most of the studies for the CEE countries report more conventional Keynesian features of fiscal policy (Ambriŝko et al., 2013; Kabashi, 2017). However, earlier findings are in favor of the inverse Non-Keynesian relationship between the budget deficit and output (Segura-Ubiergo et al., 2006). As proposed by Rojas-Suarez (1992), expansionary effects of both budget surplus and money supply contraction could be explained by the dependent-economy model with financial constraints under the assumption of the money-based expectations of a nominal exchange rate.

3 Data and statistical methodology

The data set is quarterly for the sample period of 2000–2016 and has been primarily collected from IMF International Financial Statistics (IFS) and Ukraine's State Committee of Statistics. As shown in Fig. 1, the cyclical component of real output (index, 1994=100) and money supply (money aggregate M2, million of hryvnas) is extracted by the Hodrick–Prescott filter. Both budget and current account balances are measured as % of GDP. To capture price effects producer price inflation (PPI) is used (%). All data were seasonally adjusted using the Census X12 procedure, except for PPI. Both ADF and PP stationarity tests indicate that all the macroeconomic variables are stationary at the 5% significance level (not reported).

Assuming that the VAR model of Ukraine's economy is represented by a structural-form equation in the form of $A_0X_t = A(L)X_{t-1} + B\varepsilon_t$, the reduced-form is as follows:

$$X_{t} = A_{0}^{-1}A(L)X_{t-1} + A_{0}^{-1}B\varepsilon_{t} = C(L)X_{t-1} + u_{t}$$
(1)

where X_t is the $n \times 1$ vector of the endogenous variables, A(L) is a polynomial variancecovariance matrix, A_0 is a non-singular matrix normalized to have ones on the diagonal and summarizes the contemporaneous relationships between the variables in the model contained in the vector X_t , C(L) is a matrix representing the relationship between lagged endogenous variables, L is the lag operator, ε_t is a $n \times 1$ vector of normally distributed, serially uncorrelated and mutually orthogonal white noise disturbances, u_t is a $n \times 1$ vector of VAR residuals with a zero mean and that are serially uncorrelated but could be contemporaneously correlated with each other.

Assuming that the reduced-form VAR disturbances are related to the structural disturbances as $A_0u_t = B\varepsilon_t$, the specification of our SVAR is as follows (in terms of the contemporaneous innovations):

$$bd = u_1, \tag{2}$$

$$m = a_1 b d + a_2 c a + u_2, \tag{3}$$

$$p = b_1 b d + b_2 m + u_3, (4)$$

$$ca = c_1 y + c_2 p + u_4, (5)$$

$$y = d_1 b d + d_2 m + d_3 p + d_4 c a + u_5, (6)$$

where *bd* is the budget balance (% of GDP), *m* is the money supply (%), *ca* is the current account (% of GDP), *p* is the PPI (%), *y* is the output gap (%).

All variables in equations (2)–(6) represent the first stage VAR residuals. As implementing new fiscal measures in response to specific macroeconomic developments, typically taking longer than three months, it is assumed that quarterly variables allow setting the discretionary contemporaneous responses of the budget balance to changes in other endogenous variables to zero (equation (2)). De-trended money supply is influenced by both budget and current account balances, reflecting realities of a *de facto* fixed exchange rate regime, as practised in Ukraine over the period of 2000–2013 (equation (3)). Producer price dynamics is affected by fiscal and monetary policies (equation (4)). The current account is a function of output and PPI shocks (equation (5)). Finally, domestic business cycle is influenced by all other endogenous variables in the current period (equation (6)).

Among exogenous variables, our SVAR includes a nominal effective exchange rate (index, 2010=100), present and lagged foreign direct investments (% of GDP), world metal and crude oil prices (index, 2005=100) and business cycle in Russia (%), while dummy variable is used to control the financial turmoil of 2008–2009 and 2014–2016. In estimation, we use two lags of each endogenous variables, as implied by most of lag length criteria.

4 Estimation results

The effects of macroeconomic shocks are analyzed through impulse-response functions and the forecast error variance decompositions (FEVDs). Fig. 2 presents the impulse-response functions for endogenous shocks. Table 1 shows the portion of the FEVD for endogenous variables.

As stated in Fig. 2, an improvement in the budget balance is followed by a short-term antiinflationary impact combined with an improvement in the current account, as suggested by the twin deficits hypothesis and a persistent pro-growth effect prevails. It means that Ukraine is characterized by the Non-Keynesian pattern of fiscal policy. Somewhat surprisingly, the budget surplus is associated with a prolonged decrease in the money supply. On the other hand, there is an expansionary reaction of fiscal policy to monetary tightening on impact, with a gradual reversal in 4 to 6 quarters. A positive shock to prices leads to an immediate improvement in the budget balance, while it takes time to establish the restricted monetary stance. Fiscal policy does not react to changes in the current account and business cycle, while monetary policy is pro-cyclical. Also, there is evidence of the current account monetary impact which is consistent with a fixed exchange rate regime.

In contrast to fiscal policy, a restricted monetary stance has no significant anti-inflationary effect, while a positive money supply shock leads to an immediate worsening of the current

account that is corrected in 3 quarters. However, there is a significant negative impact on output, up to 8 quarters after the shock. Within the framework of a dependent economy model (Rojas-Suarez, 1992), it supports the assumption of the money supply-based expectations of the exchange rate. If there is a high exchange rate elasticity of substitution in demand for traded and non-traded goods combined with a strong link between the supply of both goods



a) response of the budget balance



b) response of the money supply



c) response of producer price inflation



d) response of the current account



e) response of output

Fig. 2. Impulse response functions of endogenous variables. Note: Solid lines are the point estimates of the impulse-response mean. Dashed lines are the point estimates ± 2 standard deviations.

Responses to innovations in	Forecast horizons		
	4	8	16
<i>bd</i> to innovations in			
bd	92	90	90
m	1	2	2
р	5	5	5
са	1	2	2
у	0	1	1
<i>m</i> to innovations in			
bd	16	20	20
m	76	70	68
р	1	4	4
са	1	2	3
у	5	5	5
<i>p</i> to innovations in			
bd	14	13	14
m	2	2	2
р	66	65	64
са	17	19	19
у	1	1	1
ca to innovations in			
bd	3	4	5

Table 1. Forecast error variance decomposition.

m	2	2	3
р	15	15	15
са	79	78	77
У	0	0	0
ca to innovations in			
bd	14	20	20
m	6	11	11
р	5	5	5
са	2	3	3
у	73	61	61

and real money supply, it is possible to obtain a decrease in output against the backdrop of a weak (if any) inflationary impact.

After an inflationary shock, there is a significant improvement in the current account combined with a restricted impact upon the output gap, reaching a peak within a year. On the other hand, PPI accelerates in response to the current account shock, however there is no reaction to the output gap. As improvement in the current account is likely to have an expansionary effect upon output, the former seems to be neutral with respect to the latter.

Analysis of the FEVD indicates that shocks to fiscal policy account for 20% of the fluctuations in the output and 14% of the fluctuations in PPI (Table 1). However, there is no significant fraction of the budget balance justifying the current account developments. Nominal and real effects of money supply shock are less significant in both respects. However, fiscal and monetary policy together account for a significant (above 30%) proportion of output forecasts, while the combined value of this indicator for the PPI and the current account is 16% and 8%, respectively. The budget balance determines up to 20% of the variation in the money supply. Other endogenous variables do not play any role in the variation of money supply. It is also the case of fiscal policy.

Among other results, the PPI is driven mostly by the changes in budget balance (14%) and the current account (19%). In turn, inflationary developments are an influential factor of the variation in the current account (15%). The output gap is of marginal dependence on PPI and current account shocks, with their combined fraction in variance decomposition at just 8%. Comparing with the relevant empirical studies of the CEE countries, our results are consistent with earlier findings of the Non-Keynesian fiscal policy effects, as established by Segura-Ubiergo et al. (2006), while there is no support for a strong relationship between the money supply and prices, as it is found by Jarocinski (2010). Following Kim (2000), a short-lived inverse relationship between the money supply shock and the current account can be explained by the relative strength of the expenditure-switching effect compared to the income absorption effect. As there is a significant negative impact of the money supply on output in Ukraine, it is running counter to standard expansionary effects of money aggregates for the CEE countries, with the Czech Republic and Hungary being an example (Borys et al., 2005; Dibooglu and Kutan, 2005).

Conclusions

The main outcome of the empirical analysis is that the budget surplus is expansionary, antiinflationary and helpful for the current account adjustment. A decrease in the money supply seems to be expansionary as well, with a simultaneous short-lived improvement in the current account and neutrality with respect to PPI. Such fiscal and monetary policy effects are in line with the predictions of the dependent economy model under an assumption of the moneybased expectations of the exchange rate. Monetary policy has standard anti-inflationary response, but it is pro-cyclical with respect to GDP, while fiscal policy is independent of all endogenous variables. Our findings are of particular policy relevance in the context of ongoing debate on the merits of fiscal consolidation and monetary tightening as viable options for a sustainable macroeconomic stabilization in Ukraine, as well as considering important consequences of a recent switch to a 'pure' floating exchange rate regime since February 2014.

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