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SECTORAL MONEY SUPPLY EFFECTS IN UKRAINE

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Abstract: This paper examines the effects of anticipated and unanticipated money supply shocks over the 1999–2013 period across several sectors of the Ukraine's economy. It is found that the anticipated money supply shock contributes to output growth in agriculture, food processing and machine-building industries, with no impact for the steel industry. Unanticipated money shock is expansionary for the machine-building industry, while being restrictionary for agriculture. In general, our results reject the Monetary Neutrality Hypothesis (MNH).

Keywords: rational expectations, output, anticipated and unanticipated money supply

INTRODUCTION

Since it had been proposed in the early 1970s [Lucas 1972], the 'Monetary Neutrality Hypothesis' (MNH) suggest that under rational expectations anticipated changes in the money supply have no effect on real output, being translated into proportional changes of the price level. Only unanticipated changes in the money supply have real effects, as economic agents cannot distinguish between current, relative and absolute demand shifts.

Empirical tests of the MNH produced mixed results. Barro [1978] obtain that unanticipated money growth have effects on the U.S. output, while anticipated changes have no effect on output. Such effects are confirmed for the U.S. in several other studies, for instance Ravn and Sola [2004], Uhlig [2005], or Pragidis et al. [2013]. Among other countries, results in line with the theory of rational expectations are obtained for Brazil [Pragidis et al. 2013], Iran [Farahani and Abadi 2012], and Singapore [Maitra 2011]. Evidence in favor of the majority of rational expectations propositions are found for the panel of 41 countries [Apergis and

Miller 2004]. However, many empirical studies do not support assumptions of the rational expectations school. Except the U.S., unanticipated and actual changes in the money supply are found to be about equally poor as explanations of real output growth for other industrial countries [Darby 1980]. Other studies report that money still matters for business fluctuations [Chatterjee 1999]. The non-neutrality of money, at least in the short run, is found for India [Jha and Donde 2001/02], Mexico [Wallace and Shelley 2007], Pakistan [Bilquees *et al.* 2012], and Turkey [Yamak and Küçükkale 1998]. A negative short-run relationship between money supply and output is not ruled out as well, as it is found for Argentina and Brazil [Bae and Ratti 2008].

As mentioned by Devadoss [1991], money neutrality at the aggregate level does not necessarily imply that the hypothesis holds at the disaggregate level as well, assuming that input and/or output price rigidities vary across sectors. Consequently, aggregate level evaluation of monetary shocks can present a distorted picture of the disaggregate level effects.

The purpose of this paper is to review the theoretical underpinnings of monetary policy effectiveness and estimate their relevance for the Ukraine's economy, based on the decomposition of money supply into anticipated and unanticipated components. We test the MNH hypothesis for several sectors of the Ukraine's economy. The empirical results indicate that either anticipated or unanticipated money supply is positively correlated with aggregate output growth, while sectoral effects are quite heterogeneous.

In the next section, the theory underlying important differences between macroeconomic effects of anticipated and unanticipated money supply are discussed in detail. Then statistical methodology is outlined and empirical results are discussed. Finally, a brief summary and suggestions for future research are provided.

THEORETICAL ISSUES

Several very different theories explain effects of anticipated and unanticipated money supply. A seminal paper by Lucas [1972] explains a positive relationship between output and inflation by imperfect information regarding the aggregate price level, despite perfectly flexible prices and wages. The Lucas supply function with rational expectations implies that unanticipated money supply temporarily stimulates output, but eventually only causes inflation, as market participants become fully informed about prices. Anticipated changes in the money supply are neutral in respect to output, affecting only the price level.

Barro [1976] proposed the model that assumes that market participants with imperfect information cannot distinguish between aggregate and market-specific shocks. Because people do not observe the prices of all goods, but are focused on the prices in their sector of the economy, the unanticipated money supply shocks are misinterpreted as market-specific shocks and thus lead to output growth. A shift in relative demand away from the goods produced by other sectors is instrumental in an increase of output. However, the anticipated money supply shock results in proportional price changes in all sectors, with no effect on output to follow.

In the presence of nominal price and wage rigidities, a Keynesian assumption that the anticipated money supply does affect real macroeconomic variables is restored under the assumption of rational expectations. Fisher [1977] proposed a model with rational expectations that account for existence of long-term contracts, which are valid for period longer than the time it takes the monetary authority to react to macroeconomic shocks. As nominal wage is fixed over the length of the contract, a higher than expected money supply growth leads to a higher inflation and a fall in real wages. This, in turn, induces employers to hire more workers, which raises the output.

There are a few other mechanisms that imply non-neutrality of anticipated money supply: the Tobin effect implying that anticipated inflation reduces capital accumulation [Fischer 1979], myopia of households [Giraud and Tsomocos 2004], imperfect synchronization of price revisions [Caplin and Spulber 1987], a fixed cost of changing firms' pricing plans [Burstein 2006], money functioning in a centralized market [Williamson 2006]. A possibility of the contractionary anticipated increase in the money supply is demonstrated by Rojas-Suarez [1992] under assumptions of the money-based expectations of the exchange rate and financially-constrained producers.

For illustrative purposes, a simplified, stochastic version of an open economy model under rational expectations presents as follows (except interest rates, all variables are expressed in logarithms) [Marston 1985]:

$$y_t = c\left(p_t - E_{t-1}p_t\right) + c_1 E_{t-1}\left(p_t - p_t^* - e_t\right) + c_0, \tag{1}$$

$$y_t = g_p\left(e_t + p_t^* - p_t\right) - g_r\left[r_t^* + E_t e_{t+1} - e_t - \left(E_t i_{t-1} - i_t\right)\right] + g_y y_t^* + g_0, \tag{2}$$

$$m_t - p_t = y_t - k_1\left(r_t^* + E_t e_{t+1} - e_t\right), \tag{3}$$

where y_t, p_t, e_t are domestic output, price and exchange rate, respectively, y_t^* and p_t^* are foreign output and price, respectively, m_t is the aggregate money supply, i_t is the general price level, defined as a weighted average of domestic and foreign prices,

$$i_t = \gamma p_t + (1-\gamma)(e_t + p_t^*). \tag{4}$$

In Equation (1), the aggregate supply is increased by unexpected increases in the domestic price and anticipated appreciation of the real exchange rate. The former refers to a monetary surprise effect, when actual price is above its expected level, while the latter reflects the relative price of imported inputs.

Equation (2) describes the aggregate demand as a positive function of a depreciation of the real exchange rate and an increase in foreign output, with a rise in the expected real interest rate having a contractionary effect.

In Equation (3), the demand for money is increased by output, with income elasticity being set equal to one, while an increase in a nominal interest rate is of an opposite impact. The money supply is assumed exogenous. Although it is a well-established fact that changes in money growth occur prior to changes in output, the real business cycle (RBC) models predict just the opposite [Ahmed 1993]. Money responds to real shocks, such as technological innovations, environmental developments, energy prices, labour market conditions, government spending and taxes, through a change in banking sector deposits. In order to meet the increased transaction service in anticipation of the increase in output, the banking sector reacts by attracting additional funds to increase deposits, which expands the quantity of inside money. Another explanation refers to subjective expectations about future economic activity, which are materialized in asset prices and interest rates. In order to avoid interest rate instability, the central bank could be inclined to accommodate money demand shocks through changes in its monetary base (or outside money).

The aggregate money supply is the sum of deterministic and stochastic terms:

$$m_t = m_0 + \alpha v_{t-1} + u_t^m, \tag{5}$$

where m_0 is the anticipated component of the money supply, v_t and u_t^m are the unanticipated permanent and unanticipated transitory components of the money supply, respectively.

Solutions of the three-equation system (1)─(3) for exchange rate, price and output as functions of the money supply provide with the following expressions:

$$e_t = \bar{e} + m_0 + \frac{\alpha}{A_2} v_{t-1} + \frac{A_1(1+k_1)}{A_2 A_0} u_t^m, \tag{6}$$

$$p_t = \bar{p} + m_0 + \frac{\alpha}{A_2} v_{t-1} + \frac{(g_p + g_r a)(1+k_1)}{A_2 A_0} u_t^m, \tag{7}$$

$$y_t = \bar{y} + \frac{c(g_p + g_r a)(1+k_1)}{A_2 A_0} u_t^m, \tag{8}$$

where $A_0 = ck_1 + (g_p + g_r a)(1 + c + k_1),$

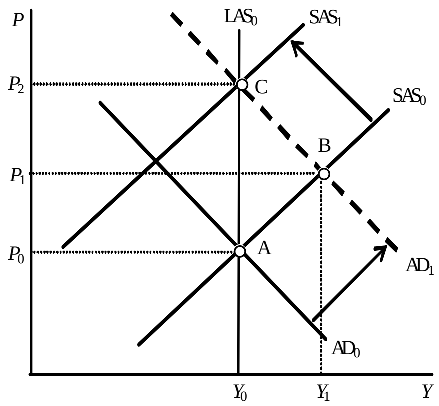
$A_1 = c + g_p + g_r a > 0,$

$A_2 = 1 + k_1(1-\alpha) > 0,$

$\bar{e}$, $\bar{p}$, and $\bar{y}$ are constants which are functions of the non-stochastic terms in Eqs. (1)─(3).

Macroeconomic effects of unanticipated and anticipated changes in the money supply are illustrated within the Y─P space on Figure 1. The curve labelled AD describes combinations of income (Y) and the price level (P) that give equilibrium in the goods and money markets. The aggregate long-run and short-run supply schedules are presented by the curve labelled LAS and SAS, respectively. The temporary increase in the money supply u_t^m brings about a depreciation of the domestic currency, so that the aggregate demand increases (a rightward shift of the demand schedule from AD_0 to AD_1), despite a rise in the price of domestic output. As wages are fixed during the contract period or there is a money illusion among workers due to incomplete information, aggregate supply also increases due to a lower producer's real wage. Consequently, output and price level are increased (p. B). Beyond the current period, the expansionary effect on the economy is lost, because in the absence of further unanticipated money supply shocks macroeconomic variables return to their equilibrium levels (p. A). It is worth noting that such a result is predicted by either the New Keynesian sticky-wage models, or the New Classical models [Ahmed 1993].

Figure 1. Macroeconomic effects of the money supply shocks



Source: based on Marston [1985]

Fully anticipated increase in the money supply $(\alpha = 1)$ is associated with a proportional increase in the exchange rate (equation (6)) and the domestic price (equation (7)), with output unchanged (equation (8)). Following an anticipated increase in the money supply, a rightward shift of the aggregate demand AD curve is combined with an upward shift of the aggregate short-run supply SAS schedule, with a new equilibrium achieved for exchange rate and price level (p. C).

It is not ruled out that the anticipated money supply growth is negatively correlated with output, as it is the case under money-based expectations of the nominal exchange rate in an economy with financial constraints [Rojas-Suarez 1992]. Such a non-conventional outcome is facilitated by a decrease in the real money supply brought about by an increase in the price level in excess of a corresponding increase in the anticipated money supply. The restrictionary effect is further strengthened by a substantial inflationary pass-through resulting from the exchange rate depreciation (it implies a low value of γ in Equation (4)).

DATA AND STATISTICAL METHODOLOGY

The empirical analysis uses Ukraine's quarterly series for the sample period 1999Q1─2013Q4 on the money supply (m_t), the nominal effective exchange rate (e_t), the real gross domestic product (y_t) and output across several sectors of the Ukraine's economy (agriculture, food processing, machine-building and steel industries), consumer price inflation (cpi_t), the government expenditure (g_t), the world market prices for crude oil (oil_t), metals ($metal_t$) and agricultural raw materials ($praw_t$). All data are taken from the IMF *International Financial Statistics* online database and the database of Ukraine's State Committee of Statistics (www.ukrstat.gov.ua). We use the logarithm of the time series. Except e_t, cpi_t, oil_t, $metal_t$ and $praw_t$, all other time series are seasonally adjusted with the Census X-12 method.

Empirical testing of rational expectations hypotheses are associated with numerous difficulties, including identification of money supply components and choice of appropriate estimators. There are several approaches for testing the MNH: (i) a two-step procedure, (ii) a joint estimation procedure, with the money forecasting equation and output being estimated as a simultaneous system, (iii) the Beveridge─Nelson decomposition. Following Barro [1978], a two-step procedure implies that initially current money supply is regressed on its lagged values, the past unemployment, and a current fiscal variable. Then forecasted values are used as a measure of anticipated money supply, with the difference between actual and anticipated money supply being interpreted as a measure of unanticipated money supply. The difference between actual and expected money growth is viewed as an alternative to estimating a long distributed lag on actual money growth rates [Darby 1980].

Assuming that the aggregate money supply contains unobserved permanent (anticipated) and transitory (unobserved) components, consisting of a random walk (with drift) and stationary autoregressive process with mean zero, the Beveridge─Nelson decomposition [Beveridge and Nelson 1981] is as follows:

$$\phi(L)\left[\Delta m_t - \eta\right] = \theta(L)\varepsilon_t, \tag{9}$$

where the permanent component is defined by

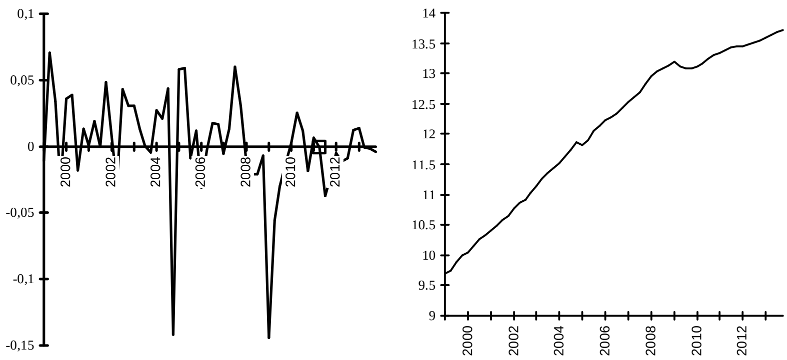
$$\Delta \nu_t = \eta + \psi(1)\varepsilon_t, \quad \psi(L) = \theta(L)\phi(L)^{-1}, \tag{10}$$

and the transitory component is defined by

$$u_t^m = \tilde{\psi}(L)\varepsilon_t, \quad \tilde{\psi}(L) = -\sum_{k=j+1}^{\infty}\psi_k. \tag{11}$$

Applying the Box–Jenkins methodology, it is found that the money supply follows the ARIMA(1,1,3) structure. The forecast residuals represent the unanticipated component of the broad money supply (Fig. 2a). The anticipated money supply component is estimated through in-sample one period ahead forecast (Fig. 2b). The anticipated and the unanticipated components of m_t are denoted by ν_t and u_t^m respectively. A strong negative monetary surprise had occurred in 2004Q4 and 2009Q1, in the wake of serious crisis developments in the Ukraine's economy. In both cases, the primary motivation behind a sharp decrease in the money supply was a stabilization of the foreign exchange market, following an outbreak of substantial downward exchange rate pressure.

Figure 2. Unanticipated and anticipated components of the money supply, 1999–2013



a) an unanticipated component; b) an anticipated component;

Source: own calculations

Several criticisms in respect to the rational expectations hypothesis refer to the fact that (i) money surprise last for too long and (ii) conclusions do not hold under reasonable alternative ways of testing [Ahmed 1993]. In order to test an assumption that the inside money (banking deposits) is a better proxy for the money supply effects than the outside money (the monetary base), we used the difference between the money aggregate M2 and the monetary base as a measure of the former.

Also, the bivariate Blanchard–Quah decomposition is used as an alternative way of extracting anticipated and unanticipated components of the money supply [Blanchard and Quah 1989]. The effects of money supply shocks on output are classified as temporary while the effects of aggregate supply shock are assumed to be permanent, both restrictions being consistent with the MNH. The main advantage of this methodology is that the structural VAR approach is closely based on economic theory while allowing the data to determine the short run dynamics. Overall, the process of empirical illustration of economic theories is extended towards the quantification of structural parameters, though this is not aimed at thorough empirical testing of such theoretical concepts as the MNH [Dunn 2002].

As the Augmented Dickey─Fuller (ADF) and the Phillips─Perron (PP) tests testify that all variables, except unanticipated money supply, are non-stationary in levels and become stationary upon first differencing, output equations for the aggregate (GDP) and disaggregate sectoral data are estimated in first differences.

EMPIRICAL RESULTS

Using the anticipated and unanticipated components of the money aggregate M2 from the Beveridge─Nelson decomposition, estimates for aggregate output growth are as follows (t-statistics in parenthesis):

$$\begin{array}{lllll} y_t = & 0.116 v_t & +0.205 u_t^m & -0.133 e_{t-1} & +0.150 metal_t . \\ & \left(3.02^{*}\right) & \left(2.41^{**}\right) & \left(-2.13^{**}\right) & \left(5.13^{*}\right) \end{array} \tag{12}$$

$$R^2 = 0.41 \quad DW = 1.82 \quad ADF = -7.38^{*}$$

According to the coefficient of determination R^2, independent variables explain 41% of the variability of aggregate output growth, measured as the first differences of the logarithm of GDP. The Durbin─Watson statistics (DW) does not indicate the presence of first order serial correlation in residuals. The ADF test rejects the null hypothesis of the unit root in residuals at the 1% level of statistical significance[1].

As predicted by the rational expectations theory, the unanticipated money supply contributes to output growth. Our results indicate that a 1% unexpected increase in the money supply will result in a 0.3% increase in output growth. However, the anticipated money supply has an expansionary effect as well. Despite the fact that the value of the coefficient on v_t is about a half of that of the coefficient on u_t^m, there is no neutrality of anticipated money supply in respect to output growth. Among other factors, GDP growth is stimulated by the exchange rate appreciation and higher world prices for metals. Quite surprisingly, there is no any specific effect of the 2008─2009 financial crisis. A realistic explanation is that the exchange rate depreciation had absorbed all the adverse external shocks associated with the crisis developments.

The outcome from our estimations of sectoral money supply effects is reported in Tables 1─4. Residuals of all equations are white noise, indicating that they are appropriate estimates of sectoral output growth. For both of decomposition methods — Beveridge─Nelson and Blanchard─Quah, column I contains estimates of money supply that is the monetary aggregate M2, while column II refers to the money supply measure based on the ‘outside’ money, i. e. money aggregate M2 minus monetary base.

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[1] * means statistical significance at the 1% level, ** at the 5% level, and *** at the 10% level.

Table 1. Determinants of machine-building output growth

Variables	Beveridge–Nelson		Blanchard–Quah	
	I	II	I	II
v_t	0.411 (2.54^{**})	0.357 (2.57^{**})	0.528 (3.28^{*})	0.448 (3.31^{*})
u_t^m	1.114 (3.92^{*})	0.637 (2.71^{*})	1.082 (3.65^{*})	0.522 (2.10^{**})
e_{t-1}	0.405 (1.98^{***})	0.381 (1.75^{***})	0.266 (1.26)	0.245 (1.12)
cpi_{t-1}	–0.776 (-2.25^{**})	–0.650 (-1.94^{***})	–0.963 (-2.76^{*})	–0.778 (-2.32^{**})
R^2	0.26	0.20	0.25	0.19
DW	2.08	2.18	2.02	2.06
ADF	-7.94^{*}	-7.26^{*}	-8.25^{*}	-7.16^{*}

Source: own calculations

Regardless of specification of the money supply measures and the type of its decomposition into anticipated and unanticipated components, the anticipated money supply positively affects output growth in the machine-building industry (Table 1), food processing industry (Table 3), and agriculture (Table 4). The machine-building industry is the only sector of the Ukraine's economy where there is a strong contemporaneous effect of the unanticipated money supply on output growth (the value of coefficient on u_t^m is much larger if compared with the estimate for aggregate output). Money surprise is of negative effect for agriculture (Table 4), while there is no statistically significant impact for the machine-building and food-processing industries. For the steel industry, monetary neutrality is observed for both anticipated and unanticipated money supply components, as no evidence is found, at any lag, of a significant effect of money supply shocks on output growth.

As the unanticipated money supply growth is negatively correlated to the agricultural output growth, it creates a problem for conventional explanations that attribute u_t^m effects to a favorable monetary surprise, even though negative money supply effects are not lacking in the case of other components of the money supply. Devadoss [1991] finds that the anticipated money supply has the adverse impacts on the U.S. agricultural output over the first three quarters, but then it cuts off relatively quickly. Explanation refers to a rapid price/flexible costs squeeze, which causes a decrease in agricultural output. As the adjustments are possible (such as reduced input use), the negative impacts are relatively short lived. However, the effect of unanticipated money supply is positive and prolonged in time, in line with the rational expectations theory. Sounders and Bailey [1986] explain the same negative relationship between the money supply and the U.S. nominal gross farm product by a strong positive impact of money supply on agricultural prices.

Table 2. Determinants of steel output growth

Variables	Beveridge–Nelson		Blanchard–Quah	
	1	2	3	4
v_t	0.120 (1.31)	0.120 (1.31)	0.123 (1.41)	0.119 (1.60)
u_t^m	–0.194 (–0.78)	–0.194 (–0.78)	–0.076 (–0.32)	–0.136 (–0.78)
e_{t-1}	0.441 (2.82^*)	0.441 (2.82^*)	0.456 (2.98^*)	0.452 (2.98^*)
$metal_t$	0.175 (2.12^{**})	0.175 (2.12^{**})	0.164 (1.96^{***})	0.163 (1.98^{***})
crisis	–0.232 (-6.49^*)	–0.252 (-6.94^*)	–0.228 (-6.79^*)	–0.229 (-7.01^*)
R^2	0.53	0.53	0.53	0.54
DW	1.91	1.91	1.90	1.91
ADF	-7.35^*	-7.18^*	-7.45^*	-7.42^*

Source: own calculations

The result for GDP — that suggests an elasticity of –0.13 between output growth and nominal exchange rate — does not hold for sectoral data. Contrary to the estimates for aggregate output, the exchange rate depreciation contributes to output growth in the machine-building industry. The same positive relationship is obtained for the steel industry, but no exchange rate effect is detected for food processing industry and agriculture. Coefficients on e_{t-1} in specifications for output growth in the food processing industry are negative and large enough, but they lack statistical significance (however, exclusion of the lagged exchange rate leads to a higher degree of serial correlation observed in the residuals). As for agriculture, all the coefficients on e_{t-1} turned out to be small and insignificant ones. When an alternative definition of money supply is used, similar results are obtained.

Inflation is restrictionary in the estimates for machine-building output growth (the coefficient on cpi_{t-1} is negative and significant at the conventional levels for all specifications), but it is neutral in respect to output in other sectors. It is worth mentioning that there is no evidence of any significant effects of inflation on Ukraine's GDP growth (equation (12)).

As suggested by the *crisis* dummy, the steel industry had been heavily affected by the 2008–2009 financial crisis, but other three sectors went unaffected. The result is intuitively appealing as the steel industry had been the largest source of export revenues over the pre-crisis decade, but its importance has been on a decline during the 2013–2014 period, as it has not caught up on the deep slump after the 2008–2009 financial crisis.

The food processing industry benefited from good harvests of 2001 and 2013, as it is revealed by the *harvest1* dummy. Also, there is the reverse relationship between an index of agricultural raw materials prices and food processing output growth, which implies an improvement of supply conditions for the food processing industry due to a weaker demand for exports of domestically-produced agricultural commodities (wheat, corn, sunflower seeds, sugar) and cheaper imports of such important inputs, as cocoa or palm oil.

Table 3. Determinants of food processing output growth

Variables	Beveridge–Nelson		Blanchard–Quah	
	1	2	3	4
v_t	0.358 (3.08*)	0.207 (2.36**)	0.244 (2.44**)	0.191 (2.22**)
u_t^m	–0.287 (–1.32)	–0.174 (–0.88)	–0.235 (–1.06)	–0.059 (–0.33)
e_{t-1}	–0.274 (–1.29)	–0.057 (–1.27)	–0.274 (–1.34)	–0.213 (–1.05)
$praw_{t-1}$	–0.375 (–2.99*)	–0.396 (–2.85*)	–0.403 (–3.16*)	–0.395 (–3.03*)
harvest1	0.075 (3.04*)	0.074 (2.86*)	0.074 (2.94*)	0.077 (3.04*)
R^2	0.36	0.36	0.34	0.31
DW	2.03	1.98	2.04	2.14
ADF	–7.02*	–6.93*	–7.30*	–7.28*

Source: own calculations

Table 4. Determinants of agricultural output growth

Variables	Beveridge–Nelson		Blanchard–Quah	
	1	2	3	4
v_t	0.203 (3.72*)	0.168 (3.44*)	0.199 (3.59*)	0.174 (3.49*)
u_t^m	–0.285 (–1.94***)	–0.236 (–2.08*)	–0.290 (–1.95***)	–0.228 (–1.97***)
oil_{t-1}	0.067 (2.08**)	0.077 (2.25**)	0.055 (1.72***)	0.058 (1.78***)
g_t	–0.172 (–2.20**)	–0.147 (–1.89***)	–0.149 (–1.92***)	–0.101 (–1.31)
harvest2	–0.119 (–4.87*)	–0.117 (–4.72*)	–0.117 (–4.74*)	–0.113 (–4.53*)
R^2	0.37	0.36	0.37	0.37
DW	2.16	2.19	2.12	2.14
ADF	–8.01*	–8.42*	–8.26*	–8.15*

Source: own calculations

However, the agricultural output growth is not sensitive to changes in the world price of agricultural raw materials. On the other hand, it benefits from higher oil prices, and this link probably reflects higher demand for biofuels produced from vegetable oil. There is a weak evidence of negative impact on agriculture by the government expenditure (the coefficient on g_t is negative and statistically significant at the 10% level in three out of four specifications). It is quite natural that bad harvests of 2003 and 2007 had slowed the agricultural output growth, as it is indicated by the *harvest2* dummy.

CONCLUSIONS

The results show that money generally plays a statistically important role in explaining GDP and sectoral output growth in Ukraine. It is found that anticipated and unanticipated money supply positively affects GDP growth, with the impact of the latter being almost twice as large. However, empirical estimates indicate that there is a different behaviour regarding the effect of monetary shocks on sectoral output growth. Money supply effects for the machine-building industry mirror those ones for the aggregate level, but it is not the case across other sectors. There are no money supply effects for the steel industry. Though the anticipated money supply contributes to growth in food the processing industry and agriculture, the unanticipated money supply is likely to be neutral in the former and restrictionary in the latter. Generally, our results reject the monetary policy ineffectiveness hypothesis of Rational Expectations─Natural Rate models in that only unanticipated money supply can affect real output.

Although our findings indicate that monetary policy, which is usually related to anticipated money supply, does affect output in Ukraine, it leaves unresolved the problem of substantial sectoral differences of money supply effects. Among possible explanations, different price setting mechanisms, exchange rate effects and industry-specific financial constraints are to be mentioned. Also, there is a puzzle of a strong negative monetary surprise in agriculture. Further exploring of these issues, especially the nature of exchange rate expectations, is left for future research.

REFERENCES

Ahmed S. (1993) Does money affect output? Business Review, No. 3, Federal Reserve Bank of Philadelphia, Philadelphia.

Apergis N., Miller S. (1998) Macroeconomic rationality and Lucas's misperceptions model: Further evidence from forty-one countries, Journal of Economics and Business, Vol. 56, Issue 3, pp. 227–241.

Bae S.-K., Ratti R. (2008) Conservative central banks and nominal growth, exchange rate, and inflation targets, Economica, Vol. 75, Issue 299, pp. 549–568.

Barro R. (1976) Rational expectations and the role of monetary policy, Journal of Monetary Economics, Vol. 2, Issue 1, pp. 1–32.

Barro R. (1978) Unanticipated money, output, and the price level in the United States, Journal of Political Economy, Vol. 86, No. 4, pp. 549–580.

Beveridge S., Nelson C.R. (1981) A new approach to the decomposition of economic time series into permanent and transitory components with particular attention to measurement of the business cycle, Journal of Monetary Economics, Vol. 7, Issue 2, pp. 151–174.

Blanchard O., Quah D. (1989) The dynamic effects of aggregate demand and supply disturbances, American Economic Review, Vol. 79, No. 4, pp. 655–673.

Bilquees F., Mukhtar T., Sohail S. (2012) Dynamic causal interactions of money, prices, interest rate and output in Pakistan, Journal of Economic Cooperation and Development, Vol. 33, No. 3, pp. 37–64.

Burstein A. (2006) Inflation and output dynamics with state-dependent pricing decisions, Journal of Monetary Economics, Vol. 53, Issue 7, pp. 1236–1257.

Caplin A., Spulber D. (1987) Menu costs and the nnutrality of money, The Quarterly Journal of Economics, Vol. 102, No. 4, pp. 703–726.

Chatterjee S. (1999) Real business cycles: a legacy of countercyclical policies? Business Review, Issue 1, Federal Reserve Bank of Philadelphia, Philadelphia, pp. 17–27.

Darby M. (1980) Unanticipated or actual changes in aggregate demand variables: A cross-country analysis, Proceedings, Federal Reserve Bank of San Francisco, San Francisco, pp. 160–198.

Devadoss S. (1991) Tests of monetary neutrality on farm output**,** Western Journal of Agricultural Economics, Vol. 16, No. 1, pp. 163–173.

Dunn S. (2002) A Post Keynesian approach to the theory of the firm, Post Keynesian Econometrics, Microeconomics and the Theory of the Firm, S. Dow, J. Hillard (eds.), Edwin Elgar, Cheltenham, UK, Northampton, USA, pp. 60–80.

Farahani M., M. Abadi (2012) Influence of rise in volume of money on economic growth in Iran during 1367-1387 (1988-2009), Journal of Basic and Applied Scientific Research, Vol. 2, No. 12, pp. 12192–12206.

Fischer S. (1977) Long-term contracts, rational expectations, and the optimal money supply rule, Journal of Political Economy, Vol. 85, No. 1, pp. 191–205.

Fischer S. (1979) Anticipations and the non-neutrality of money, Journal of Political Economy, Vol. 87, No. 2, pp. 211–247.

Giraud G., Tsomocos D. (2004) Global uniqueness and money non-neutrality in a Walrasian dynamics without rational expectations, Economics Series Working Papers No. 2004-FE-15, University of Oxford, Oxford.

Jha R., Donde K. (2001/02) The real effects of anticipated and unanticipated money: A test of the Barro Proposition in the Indian context, The Indian Economic Journal, Vol. 49, No. 1, pp. 21–30.

Lucas R. (1972) Expectations and the neutraliy of money, Journal of Economic Theory, Vol. 4, pp. 103–124.

Marston R. (1985) Stabilization policies in open economies, in: Handbook of International Economics, R. Jones and P. Kenen (eds.), Vol. I, Book 3, North-Holland, Amsterdam; N.Y.; Oxford, pp. 859–915.

Maitra B. (2011) Anticipated money, unanticipated money and output variations in Singapore, Journal of Quantitative Economics, Vol. 9, No. 1, pp. 118–133.

Pragidis I., Gogas P., Tabak B. (2013) Asymmetric effects of monetary policy in the U.S. and Brazil, BCB Working Papers No. 340, Banco Central do Brazil, Brasilia.

Ravn M., Sola M. (2004) Asymmetric effects of monetary policy in the US, Federal Reserve Bank of St. Louis Review, Vol. 86, No. 5, pp. 41–60.

Rojas-Suarez L. (1992) Limited capital markets and the real effects of monetary stabilization policies under alternative exchange rate regimes, Journal of International Money and Finance, Vol. 11, No. 6, pp. 594–613.

Sounders P., Bailey D. (1986) Effects of monetary changes on the price level and output in the U.S. agricultural sector, Agricultural Finance Review, Vol. 46, No. 1, pp. 58–68.

Wallace F., Shelley G. (2007) Long run neutrality of money in Mexico, Economia Mexicana Nueva Época, Vol. XVI, No. 2, pp. 219–236.

Williamson S. (2005) Search, limited participation, and monetary policy, International Economic Review, Vol. 47, No. 1, pp. 107–128.

Uhlig H. (2005) What are the effects of monetary policy on output? Results from an agnostic identification procedure, Journal of Monetary Economics, Vol. 52, No. 2, pp. 381–419.

Yamak R., Küçükkale Y. (1998) Anticipated versus unanticipated money in Turkey, Yapi Kredi Economic Review, Vol. 9, No. 1, pp. 15–25.