INTER-COUNTRY ECONOMETRIC MODEL OF THE ECONOMIES OF BELARUS, RUSSIA AND UKRAINE

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Abstract

The paper describes the results of joint econometric modelling of the Belarusian, Russian and Ukrainian economies with the use of the ICM LAM model (Inter-Country Model based on the Long-run Adjustment Modelling approach). The foundations of organization and construction of the inter-country model by means of the GIRAF ICM (Guesstimation, Impulse Response Analysis and Forecasting for ICM LAM) software are described. Further on, simulation experiments of possible globalisation shocks on the economies of Belarus, Russia and Ukraine are analysed.

1 Introduction

The Inter-Country quarterly model LAM ICM is constructed by the aggregation of three LAM-3 models developed for economies of Belarus, Russia and Ukraine. The LAM-3 (Long-Run Adjustment) model is the latest version of a series of LAM models developed for modelling and forecasting of East European economies in transition [1]. Early versions of the model (LAM-PL-1 and LAM-CS-1) were built at the Macroeconomic and Financial Data Centre at the Universities of Gdansk (Poland) and Leicester (U.K.) for Czechoslovakia and Poland and used, inter alia, for simulation of privatisation processes. The series of LAM-2 models dates from 1993 and have been used for systematic quarterly forecasting and simulation of the economies of the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania and the Slovak Republic. Results of the analysis have been published systematically in the Bulletins of the Macroeconomic and Financial Data Centre. The LAM-3 models for Belarus, Russia and Ukraine as well as ICM LAM model were constructed with the participation of the researchers from the European University at St. Petersburg, Belarusian State University and Kiev National University. The descriptions of the national LAM-3 models for Belarus, Russia and Ukraine as well as the results of forecasting accuracy evaluation are presented in [2, 3]. The ICM LAM model consists of three, identical in specification

but different in the estimates, blocks of the LAM-3 models for each country, as well as the separate inter-country block linking the country models through the international trade equations. The main objective of the ICM LAM is to conduct simulation experiments, which allow analyzing effects of real and monetary shocks, passing through one economy onto another by the interlinked import, export and exchange rate equations. The results of forecasting of the main macroeconomic variables as well as the results of early simulation experiments with ICM LAM were published in [4]. The aim of this paper is the presented more complex results of simulations intended to evaluate possible effects of globalisation on the economies of Belarus, Russia and Ukraine.

2 General principles of the LAM-3 modelling approach

The LAM-3 models have the following main features.

1. They are relatively small in size (each consisting of 25 equations), based on the bilinear error correction principle. Each model has an identical structure; since they are estimate with the use of country-specific data, the identified structures differ by the parameters' values.

2. The main variables of the models are the principal macroeconomic aggregates such as investment, consumption, consumers' prices, wages, employment in private and state sectors, unemployment rate, money demand, industrial production in private and state sectors, foreign trade (imports and exports), and finally gross domestic product.

3. For the sake of simplicity, ease of manipulation and feasibility of adjustment and updating, the relationships modelled are linearised and simplified. Also, limited data availability results in further compromise on the theoretical requirements of the models.

4. Generally, two types of relationships are developed from a bilinear vector autoregressive model by imposing restrictions: long-run relationships, and short-run relationships, the latter being essentially model deviations from the long-run path. Unlike in the traditional econometric models, cointegration of the the long-run relationships has been assumed rather than tested.

5. The parameters' estimates have been derived through intertemporal stochastic optimization, using a priori knowledge regarding the initial values of parameters. The criterion function aims at minimization of ex-post forecast errors. The method, called Repetitive Stochastic Guesstimation (RSG), is described in detail in [5]. To set the initial values of the parameters the Two-Step Least Square Method might be applied.

3 The principles of the organisation and construction of ICM LAM

The Inter-Country Model for Belarus, Russia and Ukraine (ICM LAM) can be seen as a system of simultaneous equations which includes two kinds of blocks:

- Blocks of equations that correspond to the national LAM models for Belarus, Russia and Ukraine (that is the LAM-3 type individual models),
- Block of additional linking equations which support the connection between the national models through Inter-Country model.

The entire ICM LAM model consists of 90 equations including three blocs of 25 equations in each national LAM model and 15 linking equations in the IC model. Overall the number of parameters equals to 336. Estimation of the national models is realised separately for each models before the aggregation in ICM LAM. The interaction between the national economies in LAM ICM model is carried out through the equations describing the trade turnover between Belarus, Russia and Ukraine. With this in mind, in each LAM model the total export have been disaggregated into the export from two remaining countries of the model and export from all other countries. For each country, export form rest of the world is modelled stochastically, while for all three countries included in the model, export country i from j is equal to recomputed, though the exchange rate, import of j from i.

Let us illustrate this approach on the example of the Belarus part of the IC model. Symbols B, R, U will be used for notation of the variables from models for Belarus, Russia and Ukraine respectively. Export aggregate equation for Belarus is given by:

$$Expr_t^B = Expr_t^{B0} + (Expr_t^{BR} + Expr_t^{BU})ExRat_t^B/ConPi_t^B,$$

where $Expr^{B0}$ denotes export (in constant prices) from Belarus to all countries except Russia and Ukraine, $Expr^B$ export from Belarus to all countries, $Expr^{BR}$ export from Belarus to Russia (in US dollars), $Expr^{BU}$ export from Belarus to Ukraine (in US dollars) and $ExRat^B$ is exchange rate in Belarus (domestic currency to USD).

The equation for $Expr^{B0}$ is stochastic, as in LAM 3. Exports and imports to other countries are described by the linking equations listed below.

Linking equation "Export from Belarus to Russia":

$$Expr_t^{BR} = Imp_t^{RB},$$

where $Expr^{BR}$ is export from Belarus to Russia (in US dollars), Imp^{RB} is import to Russia from Bel-arus (in US dollars).

Linking equation "Export from Belarus to Ukraine":

$$Expr_t^{BU} = Imp_t^{UB},$$

where $Expr^{BU}$ is export from Belarus to Ukraine (in US dollars), Imp^{UB} is import to Ukraine from Belarus (in US dollars).

Linking equation "Import to Belarus from Russia":

$$Imp_t^{BR} = K_t^{BR} Imp_t^B / ExRat_t^B,$$

where $ExRat^B$ is the exchange rate in Belarus (domestic currency to USD), Imp^B is import of goods and services to Belarus from all countries, Imp^{BR} is import to Belarus from Russia (in US dollars), K^{BR} is the exogenous proportion of Belarus import from Russia to total import of Belarus.

Linking equation "Import to Belarus from Ukraine":

$$Imp_t^{BU} = K_t^{BU} Imp_t^B / ExRat_t^B,$$

where $ExRat^B$ is the exchange rate in Belarus (domestic currency to USD), Imp^B is import of goods and services to Belarus from all countries, constant prices, Imp^{BU} is import to Belarus from Ukraine (in US dollars), K^{BU} is exogenous proportion of Belarus import from Ukraine to total import of Belarus.

For construction and application of the national LAM models and the IC model the special software GIRAF ICM (Guesstimation, Impulse Response Analysis, Forecasting and Inter-Country Modelling) has been developed at the Belarusian State University.

The GIRAF ICM Software allows solving the following problems:

- Estimation of parameters of the models with the RSG procedure of stochastic optimization;
- Testing stability of the models through impulse response analysis;
- Forecasting of endogenous variables within the LAM-3 models and the IC model;
- Simulations on the IC model;
- Extended graphic analysis of guesstimation, impulse response analysis and forecasting results for LAM-3 model and simulation and forecasting results for ICM LAM model;
- Estimation of the models by the Two-Step Least Squares method with the relevant significance tests for the model parameters and model adequacy;
- Setting of the values of exogenous variables using smoothing and extrapolation procedures.

4 Cross-spillovers and pass-trough effects in a simple globalisation experiment

Unlike the common myths that the effects of globalisation are universally positive, the empirical evidence seems to be rather ambivalent. Leaving apart the sole definition of globalisation, the controversy started with its measurement, and hence with the evaluation of its positive and negative aspects. According to the EU Economic Policy

Committee [8], globalisation should bring such benefits like lower inflation, increase in production efficiency, costs reduction, increased foreign direct investments, integration of financial markets and increased exports. However, even assessing which countries, and to what extent, benefit from globalisation, is controversial. In particular, the commonly used Kearney index of globalisation, in its latest, fifth edition, ranked Russia at the 52nd place in the list of countries benefiting from globalisation, out of 62, with Ukraine at the 39th place (Belarus was not listed, see Kearney, [6]). However, the modified index, using the same data [7], ranked Russia at the 30th place and Ukraine at the 60th. This illustrates the controversies and uncertainties in assessing the outcomes of globalisation. In fact, even the relations between growth and globalisation are not certain. Data from [7] suggest that there might be a slight negative correlation between the economic growth and the globalisation index. Some theoretical models which support positive relation between growth and globalisation are based on rather strong assumptions and hence are not very convincing (see e.g. Steger and Bretschger, [9]).

These uncertainties suggest that the effects of globalisation have to be analyzed dynamically, since they might be different in its particular phases. Samuelson [11] identifies three phases of globalisation. The first phase is characterized by the opening of the economy, with all its uncertainties and informational inefficiencies, the second by productivity growth in export sector and the thirds by import growth. For the countries entering the first stage relatively late, when other countries have already moved to the second stage, it is likely that between the first and second stage is an intermediate period of import growth which, if import growth is mainly of the investment rather than consumption goods, would stimulate export growth in the second phase (for some theoretical and empirical evidence see Lawrence and Weinstein, [10]).

In this work we intend to evaluate possible effects of globalisation on the economies of Belarus, Russia and Ukraine. We have conducted here a very simple experiment, where, the inter-country model has been used for simulation of possible effects of a decline in world prices, due to globalisation. Clearly, in relation to each country separately, expected effects for non-oil exporting countries, Belarus and Ukraine, could be, ceteris paribus, an initial decline in output, due to a short-term stock induced crowding-out effect of export by some more competitive countries, followed by an increase in output, export and import. Hence, the overall effect or world price changes on the current account, and hence on GDP is unclear, since it depends on import and export elasticities, capacity utilization at the moment of shock and price and wage rigidities, which affects labour costs, especially in the export-oriented industries. For Russia, the time path of the simulated globalisation effect would depend on the relation of the dynamics of the commodity and oil prices. Unfortunately, in the LAM models it is not possible to include the relation of the commodity to oil prices directly. After some experimenting, it has been decided that globalisation affects the commodity and raw material prices are identical.

While analyzing the entire inter-country model, expected outcomes of simulation might become more tangled. This is due to possible cross-country spillovers (quantity constraints) and pass-trough price effects. For Russia, if it is to maintain the dirty float

exchange rate policy, initial inflation, caused by the near-capacity increase in demand, might lead initially to intervention on a foreign exchange market and, eventually, when such prolonged intervention is deemed unsustainable, to an inflationary spiral and a pressure towards a negative current account. For Belarus, much depend on a possible pass-through price effect of oil import prices from Russia and commodity prices from Ukraine. With a relatively high price elasticity of the Belarusian economy for raw materials, the overall inflationary and real effect will result from export elasticity for the Belarusian manufacturing goods. For Ukraine, the situation should become less dependent on their neighbours' behaviour, due its relative balance between trading in row materials and manufacturing goods, and significant foreign trade price elasticities.

Figure 1 shows the dynamic development of the effects of globalisation shocks on GDP in Belarus, Russia and Ukraine. It indicates that the first negative (informational) effect of the world price reduction on the domestic product would be for Belarus. For two other countries such effect could be much smaller. After two quarters (for Belarus and Ukraine) and three (for Russia), there would be a substantial recovery, followed, for each country, by a prolonged period recess.

Figures 2 and 3, where the simulated time paths of export and import changes are depicted, provide some further explanation of this phenomenon. It is shown that the first negative effect on Belarusian GDP would be caused by a larger extent by a drastic drop in export rather than an increase in import.

The symptoms of the second phase, the recovery, are the increases in both export and import, with the overall positive effects on the current account. The smallest recovery has been noticed for Ukraine. For Belarus and Russia the direction and magnitude of the GDP shock has been similar, although in Russia it would happen with a one-quarter delay. In the third phase, the slowdown would be the strongest in Russia, mainly due to a prolonged period of crowding out domestic output by cheap import, as a direct effect of the 'dirty float' foreign exchange policy. For all countries, gradual conversion towards the long-run path is visible. Although the real effects of globalisation for all countries have been similar and, to some extent, expected, its monetary effects have been mixed.

Figure 4 shows simulated time paths of changes in domestic inflation. For Belarus and Ukraine two phases of the dynamics of these paths are visible: first is characterised by a decline in inflation, due to cheap import prices, followed by its increase, along the lines of export increases. For Russia, the first two phases are similar to that of Belarus and Ukraine, albeit more volatile. However, for Russia there is also a third phase. From the 11th quarter after the initiation of the shock, domestic prices in Russia would start to rise again. A possible explanation of this is that the monetary policy of keeping the rouble exchange rate against the main currencies unchanged is likely not to be unlimited. According to historical data, it may last, without a major revision, for about 3 years. After that, an import-dependent economy might likely experience nominal and real depreciation and a substantial raise in import prices.

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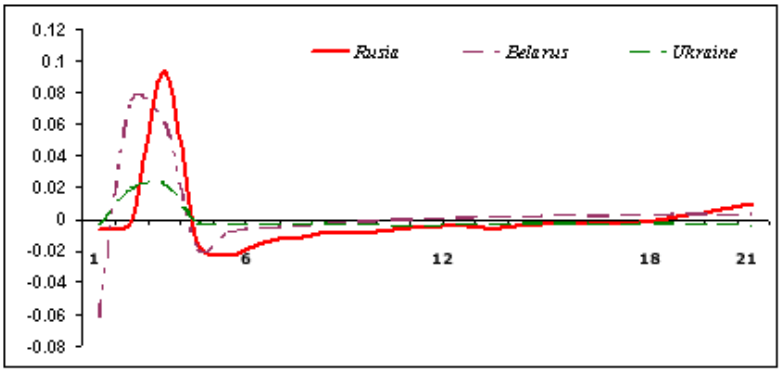

Fig.1. Simulated effects of globalisation on GDP

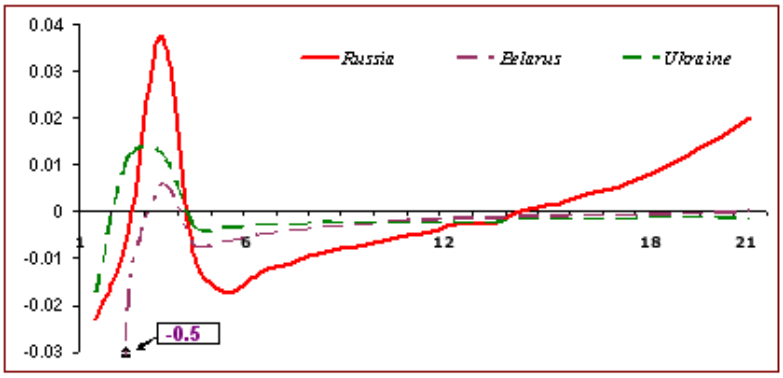

Fig. 2. Simulated effects of globalisation on export

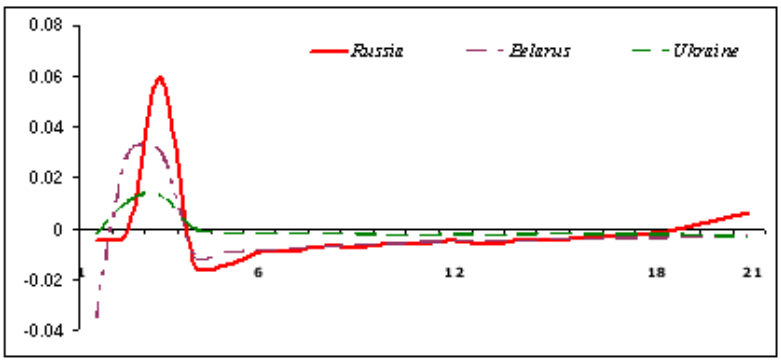

Fig. 3. Simulated effects of globalisation on

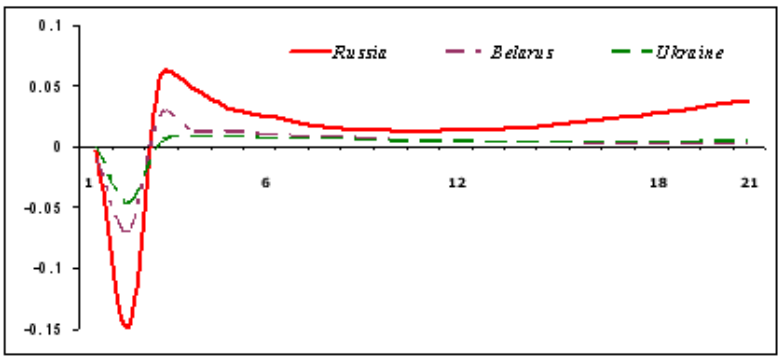

Fig 4. Simulated effects of globalisation on domestic inflation

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