OFFICIAL ECONOMIC FORECASTING: THE RELEVANCE OF THE CANADIAN EXPERIENCE FOR TRANSITIONAL ECONOMIES

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INTRODUCTION

Ministries of Economy (MoEs) in the transitional economies of the Former Soviet Union have been given the responsibility for economic forecasting. They have usually been created out of Ministries of Planning (MoPs). The required transformation from planning to forecasting, which requires a fundamental change in mindset and approaches, is discussed in the first part of this paper.

In making this transformation from a MoP to a true MoE, there is much that official forecasters in transition economies can learn about economic forecasting from the experience of industrialized countries such as Canada. A brief overview of official economic forecasting as it is currently practised in Canada is provided in this paper. This includes econometric model-based forecasting at the Department of Finance and the Bank of Canada and the recent prudent approach to fiscal forecasting initiated by the current Finance Minister to reduce the risk of unpleasant deficit surprises and thereby gain more credibility for fiscal policy. The adoption of the prudent approach underlines the perceived weakness of economic forecasting even in advanced industrialized economies. A summary of the advantages of forecasting with macroeconomic models based on the Canadian experience is presented in the paper.

The new Structural Econometric Time Series Approach or SEMTSA, which still has limited applicability to transitional economies, where there is a lack of sufficient consistent time series data, is also discussed in the paper.

Finally some observations on the best type of forecasting model for use in a transitional economy in the Former Soviet Union are provided. In my view, it would be a medium-sized (800 to 1,000 equation) quarterly forecasting model that is Keynesian in approach and would have equations explaining the various standard sectors of aggregate demand (consumption, housing, investment, government, exports and imports). Industrial output by industry if required would be a function of expenditures by category. The model would also have a supply side based on a production function and would capture the relationships between the financial sector and the real sector especially the relationship between money and prices and between interest rates and the exchange rate and aggregate demand.

MINISTRIES OF ECONOMY AS OFFICIAL FORECASTERS

In most of the economies in transition in the Former Soviet Union, ministries of planning (MoPs) have been renamed ministries of economy (MoEs) and given responsibilities for official economic forecasting. To a certain extent, this is a natural evolution as MoPs were responsible for specifying levels of future economic activity. On the other hand, there are significant differences between planning and forecasting that make it difficult for an MoP to smoothly change gears from planning to forecasting. First, planning involved an effort to control the

individual microeconomic units, whereas forecasting seeks only to anticipate economic trends produced by the interaction of a large number of economic units in a multiplicity of markets. Second, planning was carried out at a very detailed level and involved the aggregation of a multitude of individual industrial plans. Third, the orientation of planning was from the bottom up rather than from the top down as economic forecasting. Fourth, planning incorporated interindustrial input and output flows, but tended largely to ignore macroeconomic interdependencies such as those between demand and output and between the financial and the real sector of the economy.

MoEs have to recognize that in market economies goods and services will not be produced if they are not in demand. It is not possible to tell firms what to produce or even to get accurate information in advance from firms on what they are going to produce. It all depends on the demand for their output.

For MoPs to transform themselves into true MoEs carrying out economic forecasting, a radical change in orientation and mindset in required. Given the severity of this problem, it is tempting to ask if it would not make more sense to abolish the MoEs and start from scratch. But since this has been ruled out on practical grounds, it is obvious that it will be necessary to radically transform MoEs. First, MoEs need to rid themselves once and for all of their planning mentality and become forecasters. They have to realize that they do not have to forecast every single aspect of economic activity. They need to ask themselves what is really essential to forecast. They definitely should not mechanically try to continue to forecast everything that they used to plan. MoEs have to develop an appreciation that it is impossible to forecast everything accurately. Even trying to do so compromises their ability to forecast macroeconomic aggregates within a reasonable margin of error. Some of the most important economic relationship such as that between money supply growth and inflation can only be anticipated at the aggregate level. And if there are large errors in forecasting inflation, the detail underlying a dissaggregated industrial forecast is likely to be so far off as to be useless as a guide.

MoEs need to gain experience using macroeconomic approaches to forecasting using econometric models. They have to develop an understanding of the strengths and weaknesses of such approaches. At the same time, they need to develop a healthy skepticism about their ability to forecast as have the official forecasters in most of the industrialized countries. The importance of humility has been an important lesson for economic forecasters in industrialized countries. Without it forecasters are likely to mislead economic decisionmakers about their abilities to predict economic conditions and thus contribute to poor macroeconomic management. To retain their credibility, economic forecasters have to be frank and realistic with decisionmakers about the degree of accuracy of their forecasts and the associated ranges of errors.

OFFICIAL ECONOMIC FORECASTING IN CANADA

In Canada, the Department of Finance is responsible for economic forecasting. It has a division called the Economic Analysis and Forecasting Division which is responsible for preparing the forecast and coordinating the inputs required from other branches and divisions in the Department. This division has a staff of approximately 30 economists.

An economic forecast is an integral part of the federal government's annual budget. The fiscal forecast contained in the budget is based on the Department's economic forecast. Similarly, the government sector of the economic forecast is the same as the fiscal forecast. The federal governments economic and fiscal forecast presented in the budget comprise one consistent and integrated forecast.

The economic forecast is currently made using a medium-term econometric forecasting model called CEFM96.[1] It is a standard Keynesian type macro-model estimated using quarterly data, which has about 800 equations. The model has recently been simplified and the number of equations explaining economic variables greatly reduced. The government sector remains large. The demand side of the model is based on the different categories of expenditures in the national accounts: consumer expenditures (only one category); residential construction; investment; inventories; government spending; exports (three categories); and imports. Its supply side makes the distinction between the commercial and non-commercial sector. This distinction is applied to output and employment. Commercial output is derived from a Cobb-Douglas production function with capital and labour inputs. The wage and price sector also plays a key role in the supply side of the model. Wages are determined based on an expectations-augmented Phillips curve relationship that specifies the percentage change in wages to be a function of the unemployment rate and price expectations. The commercial sector price is set in a cost mark-up equation. Other prices run off this key price. The model has a money demand relationship that can be used to determine the short-term interest rate. The exchange rate is also endogenous and responds to capital flows as well as the current account balance.

The Department of Finance usually updates its economic forecast after each release of the quarterly national accounts. Some of these forecasts amount to not much more than tuning the existing forecast to track the new data, whereas others are full-fledged forecasting exercises.

The starting point for the forecast is usually a model run incorporating the new exogenous data and extrapolating it based on the growth rates of the exogenous variables in the old forecast. The constant terms adjustments are also usually modified to make sure that the model tracks the new observations for the endogenous variables. The constant term adjustments are carried forward as appropriate depending on the specification of the equation. For levels equations, they are kept constant based on the most recent or average of the most recent forecasting errors; for growth rate equations, they are zeroed out; and for equations with lagged dependent variables, they are often tapered off. This null model run is distributed to forecast participants to help them to provide their contributions to the new forecasting process.

Before starting a forecasting round, there is usually a meeting of all the participants in the process to agree on the assumptions underlying the forecast and to set the timetable. Special attention is paid to particular issues arising at the time. These could include: oil price shocks; different scenarios for the U.S. or the global economy; and different assumptions for monetary policy and interest rates.

A full-fledged forecast starts with a view of the external situation. A forecast for the most important international economies is made drawing on the economic intelligence gained from participating in the twice-per-year meeting of the Short-Term Forecasting Group at the OECD. The international forecasts of the IMF and World Bank also provide a valuable input. The forecasters from other countries and international organizations are usually much more knowledgeable about economic developments and prospects in other areas of the world than domestic forecasters because they are able to follow the situation much more closely and have access to privileged information that is not publicly available.

Because of the importance of the U.S. economy for Canada, a separate forecast is prepared for the United States using the Department's own U.S. forecasting model. This model, which is called the USFM, has a similar structure to the Department's Canadian forecasting model. The Department's U.S. forecast is a key input into the Canadian forecast given the strong interdependencies between the two economies. However, feedback effects from the Canadian economy to the U.S. economy are ignored given that the Canadian economy is only about one tenth of the size of the U.S.

Canadian economic forecasters also make at least annual trips to New York and Washington to consult with U.S. government and private sector forecasters. This is a valuable source of economic intelligence in preparing the U.S. economic forecast.

Once a preliminary economic forecast is prepared using the model. A fiscal forecast is prepared using a more detailed methodology than the one embodied in the model. This is used to tune the economic forecasting model for subsequent forecasting rounds.

Once a complete forecast is available. A meeting is usually held to discuss the forecast and to resolve any outstanding issues. Following the meeting, the forecast is finalized.

Forecasters in the Department of Finance cooperate closely with forecasters in the Bank of Canada. After each forecasting round there is usually a meeting to compare forecasts and to discuss differences. This helps to narrow differences of opinion about the economic situation and outlook when the Minister of Finance and the Governor of the Bank meet to discuss the coordination of monetary and fiscal policy.

An interesting aspect of Canadian economic forecasting with economic models, which is relevant to transition economies, is the tendency to make forecasting models smaller with more

rigorous underlying theoretical structures and with reasonable steady state properties. The old bottom-up approach where the forecasting models of sectoral specialists were put together into an overall model, has been supplanted by a top-down approach which concentrates on macroeconomic interrelationships. This was done to enable the models better to reflect the interdependency of macroeconomic developments and to produce reasonable longer term results for policy analysis. It should not be surprising given the complexity of the real world economy that it has proved more difficult, if not impossible, to capture adequately all of the interdependencies in larger models. The desirable short term forecasting properties of the models have been preserved by attention to lag structures in the models' behavioural relationships.

THE BUDGET FISCAL FORECAST AND THE PRUDENT APPROACH

When the current government took office in September 1993, it was greeted by a deficit of $42 billion or 6 per cent of GDP. This was much higher than had been forecast by the previous government and was the source of much alarm. There was a suspicion on the part of the new government that the previous government had purposely put out an unduly optimistic forecast to make its own record in reducing the deficit look better than it actually was so as to improve its electoral prospects. The newly appointed Finance Minister Paul Martin thus came to his responsibilities with a profound skepticism of economic and fiscal forecasting. In fact, he was so sceptical that he commissioned a review by outside consultants of the Department's forecasting record and methodology (Ernst & Young, 1994). To avoid repeating the errors of his predecessor, he adopted an entirely new approach to preparing the budget fiscal forecast, which he called the "prudent approach." It involves using prudent economic planning assumptions that are somewhat more conservative than the average of private sector forecasters and including a large contingency reserve in government expenditures that gives the government an additional cushion to make sure that the deficit targets are met. The Finance Minister has been successful in pursuing his prudent approach and as a result the government expects that this year (fiscal year 1996-97 which ends on March 31, 1997) the budget deficit will be below the 3-per-cent of GDP target which it set for itself during the last election campaign in 1993.

The new prudent approach has significant implications for the Department of Finances' economic forecasting. First, the government's own economic forecast is no longer published and is only used for internal purposes. Second, the Department has been experiencing difficulties in keeping its economic forecasters motivated when they know that their forecast is not being used for fiscal planning. To a certain extent, the Department is only going through the motions of forecasting now. Third, relying on the private sector consensus has limited the number of economic variables that can be used as independent variables in the fiscal forecasting equations. The only variables used now are real GDP, nominal GDP, the 91-day Treasury Bill Rate, and the 10-year benchmark government bond rate. This greatly simplifies the specifications that can be used in government revenue and expenditure equations, but does not necessarily improve their accuracy. For instance, it means that forecasts of corporate income tax revenues can not take

advantage of information on differential profit trends and tax rates by industry, which can be important factors determining the growth of corporate income tax revenues.

The shift to a prudent approach is yet another swing in the pendulum away from disaggregated macroeconomic forecasting. It shows the increasing skepticism among policy-makers about the ability of macroeconomic forecasters to accurately predict economic developments. It should provide another warning to economic forecasters in transitional economies about the dangers of promising a greater degree of accuracy in forecasting than can be delivered. The greater the detail that forecasters try to forecast the more likely that they will lose the confidence of policy makers.

THE COMPARATIVE MODELS EXERCISES

An distinctive feature of Canadian macroeconomic modelling and forecasting has been the important role played by comparative models exercises. These are gatherings where modelling groups get together to compare the structure and simulation properties of their models by subjecting them to standard sets of shocks. The results of the first such exercise were published in the May 1979 issue of the *Canadian Journal of Economics* (Helliwell *et. al, 1979*). It identified large differences in fiscal policy multipliers among the models and even found explosive reactions in some of the models. A positive outcome of this discovery was that those model builders, who found their models among the outliers felt, compelled to introduce modifications to the structure of the models to produce the upside down "U" patterns for their multipliers that were exhibited by the models deemed to have the most reasonable response properties. There were two subsequent exercises that helped to develop a smaller range of estimates for multipliers with respect to such financial variables as money supply, interest rates and the exchange rate, but it was more difficult to develop a consensus on the response to these shocks. The results of the third exercise were published by the Bank of Canada in 1983 (O'Reilly). Another different sort of comparative exercise was carried out in 1985. It involved the preparation of a detailed sector by sector comparison of the structure of the 11 main Canadian models. The models reviewed included: two large input-output models with several thousand equations (CANDIDE 2.0 and TIM); seven medium-sized quarterly forecasting models with 500 to 1,000 equations (RDX2, CHASE, DRI, FOCUS, MTFM, QFS, and RDXF), and two small annual models of 100 to 200 equations (MACE and SAM). This exercise resulted in greater emphasis on the supply side of macromodels and some further convergence of structure.

MODEL BUILDING AND FORECASTING AT THE BANK OF CANADA

The Bank of Canada, which prepares its own forecast independently of the Department of Finance, has long been at the forefront of macroeconomic model building in Canada and even the world.[2] The Bank's first model was RDX1, an experimental quarterly model developed in the mid 1960s (Helliwell *et al*, 1969a&b). This was followed by RDX2, an experimental

quarterly policy analysis model (Helliwell *et al*, 1971). RDX2 was never used for forecasting because of the difficulty of updating its database due to the number of series it used that were not produced by the statistics agency and had to be calculated. Both RDX1 and RDX2 were constructed as research and learning tools by the Bank rather than for forecasting. Of all the Canadian models, RDX2 has the distinction of being the one that has had the greatest influence on the subsequent development of Canadian macro-models.

Building on the experience gained from RDX2, a quarterly forecasting model, RDXF , was developed (Robertson and McDougall, 1982a&b). Much more emphasis was put on tracking the historical data and less emphasis on theoretical rigour. RDXF, which was more practical and simpler to maintain, was used by the Research Department of the Bank for forecasting through much of the 1980s.

Dissatisfaction with the lack of theoretical rigour of RDXF and other models led to the development of a small annual simulation model, SAM (Rose and Selody, 1985). The SAM model was the first model designed specifically to produce desired steady state results based on economic theory. It also used complex, systems econometrics, including very large full information maximum-likelihood estimators. This was made possible by its small size. Previous Bank models had relied almost entirely on ordinary least squares or at most on instrumental variables techniques. The Bank eventually decided that it could not support two such different models as RDXF and SAM and that it did not make sense to use SAM to analyse shocks around an RDXF-produced baseline given the radically different structures of the two models.

Most recently, Bank of Canada has developed a new Quarterly Projection Model, QPM (Coletti *et al*, 1996), which combines the short term dynamic properties necessary for projections with the consistent behavioural assumptions necessary for policy analysis.[3] The core theoretical structure of the model is the Simple, Overlapping Generations Model (SOLGM) model of Blanchard and Weil. It has four assets - capital, government debt, and net foreign assets. Interest rates depend on foreign interest rates and a risk premium based on the amount of borrowing. Two important features of this model are its forward-looking expectations and endogenous policy rules or reaction functions. Another interesting feature of this model is that it had to be calibrated rather than estimated econometrically because of the complexity of its theoretical structure.

In my view, the QPM is not directly applicable as a prototype for forecasters in transition economies. First, it embodies a level of skill and experience in model building that can only be acquired from a long history of model development and is probably beyond their present capabilities. Second, the QPM is still more experimental than practical. The model builders acknowledge that: for pure policy purposes, QPM might be too complicated and take too long to solve even with the latest in computer hardware; and for forecasting, it might be possible to do better by devoting more resources to model maintenance and estimation of more complex systems (Coletti *et al*, 1996:pp5). Nevertheless, the QPM does provides some interesting and

valuable theoretical and methodological lessons for model builders around the world, including those in transition economies. The experience with the calibration of the QPM is particularly relevant to model builders in transition economies where lengthy time series economic data are not available and where calibration is the only alternative for many structural relations.

ADVANTAGES OF FORECASTING WITH MACROECONOMIC MODELS

In spite of the recent shift away from model-based forecasting in Canada, there are many well-known advantages of forecasting with a model that make them the best forecasting tools for government. A model:

- is the most systematic way to use past economic data to project the future;
- provides a comprehensive accounting and behavioural framework to ensure the consistency of the forecast;
- formalizes the key relationships underlying the forecast and focuses discussion of differences of opinion on specific model parameters that can be varied based on empirical analysis and judgment;
- forces forecasters to be clear about the assumptions underlying their forecast (exogenous variables) and their views about the structural relationships in the economy that determine the key economic indicators (endogenous variables);
- can be used to determine the source of forecast error;
- is the only systematic way to take into account the many complex interrelationships and interdependencies that exist in the economy;
- enables forecasters to quickly and systematically modify the forecast in response to external developments and changes in policy;
- can provide policy makers with useful analysis on the effects of proposed policy measures that can help them to decide the best course of action;
- provides a vehicle to use statistical estimation procedures to obtain the best estimates of the key structural relationships in the economy.

Macroeconomic modeling is a tool for forecasting. It is a continuing process rather than something that is done once and completed. A macroeconomic model must be continuously

updated, tested and validated as part of the forecasting process if it is to continue to be a useful tool.

It is especially important to regularly re-estimate a model and to compare the predicted values it produces both inside and outside of its estimation sample range. It is also important to subject the model to a large number of simple shocks (i.e. increases in government spending, cuts in taxes, and increases in the money supply) to make sure that its dynamic response properties are reasonable. It is often impossible to predict in advance the results of simulations of complex systems of equations. It is necessary to make sure that the model responds reasonably to simple stylized shocks before subjecting it to more complicated real world shocks.

TIME SERIES FORECASTING

Time series analysis burst into the forecasting world in the 1970s. At first, economic forecasters tried to ignore time series approaches to forecasting. But with the introduction of multi-variate Box-Jenkins models, time series methodologies began to rival or even outperform structural econometric models in short-term forecasting accuracy. The economic forecasters responded to the time series challenge to their erstwhile supremacy by developing a synthesis of structural modelling and Box-Jenkins /time series methodologies, called Structural Econometric Time Series Approach, or SEMTSA.[4] According to this approach, a structural model based on economic theory is developed, the implied properties of the corresponding ARIMA (Autoregressive Integrated Moving Average) equations are derived; and time series methods are used to estimate the ARIMA equations and to test the consistency of the restrictions from economic theory. This enables the forecasters to explain and understand how the economy functions while still capitalizing on the forecasting strengths of time series models. It is an approach that is gaining in popularity among forecasters in industrialized countries.

In the future, SEMSTA also has promise for forecasting in transitional economies. For the present, however, the short consistent time series available for most economic variables in transition economics make time series methods not very useful.

BEST TYPE OF FORECASTING MODEL FOR A TRANSITIONAL ECONOMY

In my view, the best type of forecasting model for a transitional economy would be a medium-sized (500 to 1,000) equation structural model. The model should be based on quarterly data if such data is available. Quarterly data allows forecasters to take into account partial information for the current year. This more reliable starting point for the forecast is a real advantage in making short-term forecasts.

Because of the lack of long consistent time series data for many economic variables, it will be necessary to calibrate the model using the most recent data and external information (or guesses) for the model's parameters. But it will be important to continuously experiment with

estimating the model's structural relationships econometrically so that as statistically significant estimation results that are consistent with theory are obtained, they can be quickly incorporated in the model.

The forecasting model should follow the approach utilized in most industrialized market economies, but be suitably modified to take into account any unique institutional features of the economy or residual non-market elements. This means that the model should be Keynesian in approach with equations explaining the various sectors of aggregate demand (consumption, housing, investment, government, exports and imports). Output should be determined by demand and not vice versa. This is a fundamental difference between market and command economies. Industrial output by industry, if required, would be a function of expenditures by category. These relationships would be based on an input-output model.[5]

An important interdependency in the model would be the relationship between output and income based on the consumption function. This is the relationship that is probably the most developed and reliable in macroeconomic models. The most important category of income is usually labor income which is a function of wages and employment both determined endogenously. Investment is also usually dependent on output through a flexible accelerator incorporating the user cost of capital (Jorgenson model). Investment relationships pose estimation problems and it can be difficult to capture appropriately signed cost of capital effects through empirical estimation. Housing is usually modeled allowing for the influence of income and interest or supply of funds variables. Imports are dependent on the various other categories of aggregate demand and relative prices. Exports are dependent on demand variables in trading partners and relative prices.

Even though there is not much past experience with the response of economic agents to changes in relative prices including interest rates, it will be important to try to build these effects into the forecasting model. Although there is no way of knowing exactly how strong they are, it is certain from economic theory that they will exist in a market economy. Indeed as the economy becomes more market oriented, it is quite likely that official forecasters will be surprised by the strength of the responses of economic agents to economic incentives. These responses will probably strengthen as economic agents become more used to the functioning of markets and the opportunities that they present.

An important interdependency that must be captured by forecasters is the link between the money supply and interest rates and the exchange rate, and the impact of these key financial variables on real variables such as aggregate demand, and wages and prices. Ideally, the model should have a relatively complete financial sector including the most important assets and liabilities of financial institutions. Asset demand can be modelled using the Tobin portfolio allocation approach.

The model should also incorporate a formal supply side of the model where output by sector is determined by capital, labor, and other inputs such as energy and materials. The

production function can be used to derive capacity output. The relationship between this output concept and actual output is important in determining the extent to which any change in aggregate demand gets translated into price increases rather than output increases. Key supply-side relationships are production functions, and wage and price equations.

Other key issues that will have to be addressed in building a forecasting model include the formation of expectations, the government budget constraint and the accumulation of domestic and foreign debt stocks. The supply of stocks of financial assets and liabilities and related demand equations are necessary to ensure that there is an equilibrium between the supply and demand for stocks.

Issues unique to transitional economies relate to the responses of economic agents to disequilibrium in product and factor markets. For example, residual controls can lead to queuing for scarce goods. Subsidies and the continued predominance of state enterprises can lead to non-market oriented responses by firms. More specifically, firms may continue to invest if provided credit and subsidies even if the rate of return on the investment is low or negative and firms may retain labour even if the labour is being productively employed.

Because of the importance of the policy issue of the relationship between money supply growth on the one hand and real output growth and inflation on the other, it is important to experiment with some simple relationships relating nominal GDP growth to current and past money supply growth, and changes in the government deficit as a percentage of GDP.[6] This will provide some idea of the impact of money supply growth on inflation that could be useful in helping to gauge what the impact of money supply growth should be in the larger forecasting model.

In incorporating the suggested relationships based on economic theory in their model, modelers will have to be careful to take into consideration institutional constraints like controls on wages, prices, quantities produced or consumed, interest rates and exchange rates that may cause the economy to deviate from the equilibrium suggested by market-oriented macroeconomic models.

FOOTNOTES

1. A brief history of macroeconomic forecasting in the Government of Canada is provided in Grady (1992). No published documentation yet exists for CEFM96, but the Department of Finance is expected to release a working paper by late December or early January. In the abscence of documentation, this section of the paper is based on a discussion with Cliff Halliwell, the Director of the Economic Analysis and Forecasting Division.

2. The evolution of the Bank of Canada models is described in Bodkin *et al* (1991: pp.279-283) and Coletti *et al* (1996:pp.8-13).

3. The structure and properties of the QPM are set out in Bank of Canada Technical Reports 72, 73 and 75.

4. A good overview of time series methods and SEMTSA is contained in Kennedy (1994).

5. It would be useful to develop rectangular input-output tables such as are in use in Canada (see Statistics Canada, 1986). These tables have make and use matrices which give commodities produced by industries and commodities purchased by industries. This allows an industry to produce a whole range of commodities and is more likely to reflect actual production than the fiction that there is a one-to-one correspondence between an industry and a commodity. Even if such a correspondence existed in the past which is unlikely, it will likely not exist in the future as the structure of industry in the transition economies comes closer to that in the western industrialized economies.

6. This is the approach originally pursued by Andersen and Jordon (1968) at the Federal Reserve Bank of St. Louis. Pierre Duguay (1979) of the Bank of Canada estimated similar equations for Canada.

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