A MACRO-ECONOMETRIC MODEL FOR THE REPUBLIC OF MACEDONIA

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Abstract

This paper describes the methodological problems that arise in modelling economies in transition with the particular emphasis given to modelling macroeconomic time series data in Macedonia. The reason for concentrating on macroeconometric time series data is due to the fact that recent theoretical developments in this area, most importantly the concept of co-integration, have increasingly drawn attention to modelling of macroeconometric relationships and their dynamics, although typically focusing on particular aspects of the economy. structural breaks and regime shifts appear in econometric data and thus make applied econometric analysis extremely difficult. When modelling such data the important thing is not to treat these changes as a nuisance, but as valuable information to be incorporated in the model in order to perform better forecasts or policy analyses. However, the nature of the particular changes will influence the choice of the model class to represent the relevant macroeconomic relationships. The purpose of modelling will also help determine an appropriate model choice.

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1. Introduction

The countries of Eastern and Central Europe have recently experienced significant changes in economic structure and in economic policies. The process of political transition was initiated after the demise of socialism, replacing the single-party politics and introducing liberal democracy. Economic transition was launched in parallel to this process. It aimed to establish a functioning market economy instead of a centrally planned one through simultaneous price liberalisation, trade liberalisation, currency convertibility, promotion of private enterprise, privatisation and prudent monetary and fiscal policies (Sachs 1990 see also Blanchard et al., 1991).

The two transitions have been intertwined. As a result, this period was rendered particularly

difficult for quantitative economic analysis. The collapse of existing relationships created uncertainty and made the economic system and its trends virtually unforecastable (Blangiewicz and Charemza, 2001). Whether predictable or not, all these changes in economic policy and in economic structure raise questions both about the appropriate methodology to apply and about the best ways to incorporate them in the econometric model for the analysis of the particular sector of the economy. Importantly, those changes affect to a various degree the whole system. Rather than being a nuisance, such changes present valuable information and should be included into the model in order to provide better forecasts or policy analyses.

This paper aims to point out some methodological problems that arise in modelling economies in transition. The particular emphasis will be given to modelling macroeconomic time series data in Macedonia. The reason for concentrating on macroeconometric time series data is due to the fact that recent theoretical developments in this area, most importantly the concept of co-integration, have increasingly drawn attention to modelling of macroeconometric relationships and their dynamics, although typically focusing on particular aspects of the economy. In Macedonia, like in the other transitional countries, such as Poland and Hungary (Welfe, 2000, Golinelli and Orsi, 1998, Golinelli and Orsi, 2000, Buch, 2001), Slovenia (Ross, 2000) or Serbia and Montenegro (Petrovic and Vujosevic, 2000), this is a new area of scholarly inquiry.

2. Problems in Modelling Economies in Transition

Finding invariant relationships that accurately characterise observed economic activity is a major purpose of econometric analysis. Though it is a relatively easy task in a stationary world, there is a number of problems when modelling economies in transition. On the one hand, there are problems that can be considered econometric, such as a need to derive estimation equations based on specific transition considerations. This is because very often either the entire concept of transition is only vaguely defined for the purposes of an appropriate shock-outcome research or there are predicted and unpredicted events affecting the sector of the economy to be modelled. For example, introducing various policy measures, such as price or trade liberalisation or enterprise privatisation, can significantly influence variables in the model and produce structural changes or significant shifts in the variables. On the other hand, there are problems of a statistical

nature: specific convergence rates of test statistics and parameters of the model, their non-standard or unknown asymptotic distributions, inconsistency and inefficiency of estimators, etc. Short span of data also puts severe limits on the analysis of dynamic structure of the models making asymptotic properties of the parameters rather questionable or problematic. The quarterly data, as commonly used when analysing Western economies, cannot satisfy statistical requirements and needed convergence criteria in the small data samples characteristic of economies in transition. It has become common practise to use higher-frequency data, usually monthly series, which affect the properties of commonly used estimators, particularly the size and the power of unit root tests, co-integration tests and convergence rates to their asymptotic distributions. Some other problems include: non-stationarity (in the form of unit roots and deterministic shifts), seasonal adjustment of data (seasonality becomes more notable in monthly than in quarterly data), measurement problems that consist of non-systematic error (pure measurement error), partially observed variables and most problematically, systematically mis-measured variables, i.e. systematic measurement error.

The transition process makes a great impact on the functioning of the whole system. As a result, structural breaks and regime shifts usually appear in time series data affecting immensely the analysis and application of econometrics models. The long-run as well as the short-run relationships are subject to change. Consequently, the class of the models applied for such an unstable world must allow for changes in parameters defining the equilibrium. Structural breaks or regime shifts present valuable information that should be taken into account in order to attain better forecasts or achieve better policy analyses. Therefore, standard econometric techniques might need to be modified for the analysis of such transition time series data and specific statistical consideration should be taken into account in order to perform better analysis.

Nowadays many strategies for dealing with non-stationary macroeconomic time series and incorporating changes in economic structure into a model have been proposed. The vector autoregressive model - VAR model (Johansen, 1995) and the vector error correction model - VECM model (Engle and Granger, 1987) have proved to be effective in modelling non-stationary time series. Such models are becoming increasingly used in modelling macroeconomic relationships and their dynamics. Nevertheless, a lot of attention has also been given to analysis of the structural VAR, SVAR models. These models are economically interpretable simplifications of VAR models where, in order to achieve identification, restrictions are used

according to economic theory (see e.g. Canova, 1995 and Pesaran and Smith, 1998). Analyses of cointegration models (Maddala and Kim, 1998) and analyses of the non-linear systems are some of modelling strategies that can be applied in the presence of structural breaks. The analysis of the non-linear systems is usually performed when parameters of the model are non-constant as a result of restricted information set, such as the omission of relevant variables from the model or inclusion of inappropriate lag length (Granger and Terasvirta, 1993). Such models can also be defined as time-varying parameters models or models with parameters treated as random variables (Chow, 1984). Structural time series modelling on the basis of Kalman filter methodology (Harvey, 1993) and the Markov switching model (suitable when there is switching between different regimes) are also strategies in dealing with structural breaks (Krolzig, 1997). In the cases where there is evidence that a segment of the economy being analysed has experienced an important shift the more appropriate strategy will be to model this sector as separate regimes pre- and post-shift (Hall et al., 2000). However, in these models the shift is treated as exogenous event without any explanation of its occurrence, whereas changes in the regime, that are not so fundamental for the particular sector of the economy, can be successfully incorporated into a model using step or impulse dummy variables.

However, a methodological implication of pre- and post-shift modelling is that the econometric analysis is again faced with the limited data sample which casts doubt on standard asymptotic results and inferential procedures. These problems are especially conspicuous when dealing with trending and seasonally adjusting non-stationary time series, which are abundant in transition economies. From the statistical point of view, a transition data generating process is thus analysed by short data span, with a possibility of regime shifts, structural changes and evolving dynamics, violation of ergodicity, multicollinearity, non-identically distributed and correlated disturbances, unknown cointegration properties, specific convergence rates of the test statistics and parameters to their asymptotic distributions, parameter changes and the like.

3. Macedonian Experience

Being a country in transition, Macedonia has moved from a centrally planned towards a free market economy. Therefore, it is facing similar problems as other post-socialist transition countries. The process of transition is a unique social phenomenon bearing important information about social and behavioural attitudes and economic environment. It affects the

public policy and the country's economic dynamics. As a result, the entire economic system in Macedonia has been shaped by transition. During the last decade many events have had an impact on the Macedonian economy and policy. In 1991 Macedonia declared independence from former Yugoslavia. Unlike many transition economies of Eastern and Central Europe that confronted persistent and moderate rates of inflation over their post-stabilisation periods, Macedonia's case was exceptional. Since the implementation of the stabilisation programme the economy has experienced a stable macroeconomic environment while proceeding with privatisation efforts and further structural reforms.

The above-mentioned initiatives in the economic sphere undertaken by the Macedonian government made a significant impact on the Macedonian economy, unlike some other ones whose impact was not palpable. They also strongly affected the econometric methodology that had been used until then raising questions of how best to incorporate such events in the future modelling procedures in order to provide better econometric analysis of the Macedonian economy. Furthermore, until recently more complex macroeconometric studies and time series analyses from transition economies, including the Macedonian ones as well, were made even more difficult by the availability of only short data spans and thus small samples.

The issue of existence and compatibility of data and small sample properties are the key problems in modelling Macedonian economy. On the one hand, as a result of separation from former Yugoslavia, some data are not available any more. Some have not been collected at regional levels (former republics) but only at the state (Yugoslav) level. As a consequence, such data are inconsistent and incomparable with newly collected data and, thus, by and large, inappropriate for the analysis. In some data series, such as data on export and import prices or import prices of raw materials, there are considerable breaks. Some data do not even exist. For example, the National Bank of Macedonia did not have foreign exchange reserves due to the fact that these reserves were kept in teh National Bank of Yugoslavia. Therefore, these data are not available for the period before 1992. On the other hand, due to the war and the occupation of territories in Macedonia, the number of counties, towns and municipalities has changed over the last decade. Consequently, some of the macroeconomic variables have been only partially observed or data are not comparable because of its dissimilar definition and collection over time.

Having accumulated official data over twelve years until the present moment, the econometric

modelling of some sectors of the Macedonian economy is now feasible.During July 1999 - June 2001 the research teams of the Dutch central bank and the National Bank of the Republic of Macedonia developed the macro-econometric model for the Republic of Macedonia under the name MAKMODEL (Haan, Naumovska and Peeters, 2001). Based on the monthly data collected for the period 1993-1999, its aim is to use it for macro-economic policy analyses at the Macedonian central bank, by means of keeping the statistical basis up to date, elaborating upon the model, and making forecasts and running simulations in the near future.

The model consists of the nine "behavioral" or "estimated" equations in the model. The other 29 equations in the model are technical equations or identities that are not discussed in detail.

From the demand side, actual GDP follows from the ex post income identity:

$Y=CONS+I+G+X-M+MES_y$

The estimated equations for real private consumption reads as:

$$DLOG(CONS) = -0.02^{*}\{LOG(CONS(-1)) - LOG(YDN(-1)/PRS(-1))\}$$

$$+ 0.89^{*} DLOG(CONS(-1))$$
(-) (9.40)

For real investment in fixed assets the following equation was estimated:

DLOG(I)= -0.88*{LOG(I(-1)) - LOG(Y(-1)) + 0.002*INF(-1)}- 0.002*D(IL(-3))
(5.44) (4.07) (3.31)

The equation for the volume of exports reads as

DLOG(X) = -0.20*{LOG(X(-1)) - LOG(YW(-1)) + 0.095*(LOG(PX(-1)/PXW-1))}
(2.73) (2.53)

+ 0.13*DLOG(M(-1))
(1.33)

and for real imports it reads as

DLOG(M) = -0.49*{LOG(M(-1)) - LOG(DD(-1)) + 0.4*(LOG(PM(-1)/PY-1))}

(3.46) (-)

Tlhe labour demand equation reads as

DLOG(LD) = -0.05*{LOG(LD(-1)) - LOG(Y-1)) + LOG(W(-1)/PY(-1))}
(5.85)

+ 0.14*DLOG (LD (-1)) + 0.26*DLOG (LD(-2)) - 0.41*DLOG(LD(-3) + 0.32*DLOG(Y))
(1.00) (3.49) (3.27) (2.71)

The development of the nominal wage bill per worker is captured by the following equation:

DLOG(W) = -0.20*{LOG(W(-1)) - LOG(LP(-1)) + 0.02*U(-1) - LOG(PRS(-1))}
(2.85) (4.08)

+ 0.7*DLOG(LP) - 0.03*D(U)
(-) (3.37)

The consumer price equation is as following:

DLOG(PRS) = - 0.28*{LOG(PRS(-1)/(1+ITAXR(-1))) - 0.82*LOG(ULC(-1)) - 0.18*LOG(PM(-1)))}
(2.63) (11.93) (-)

+ 0.06*DLOG(POILW$(-1)) + 0.03*DUM
(1.32) (2.20)

The equation estimated for real money demand is

DLOG(M2D/PRS) = -0.08*{LOG(M2D(-1)/PRS(-1)) – LOG(Y(-1)) – 0.004*ID(-1) + 0.003 INF(-1)}
(-) (4.12)
(2.46)

+ 0.29*DLOG(M2D(-2)/PRS(-2)) + 0.0002*D(ID(-3)) – 0.12*DUM1 – 0.09*DUM2 – 0.09*DUM3
(4.01) (1.89) (3.57) (6.15) (4.75)

This models should present a basis for obtaining good forecasts and policy analyses. Interactions, causality relationships and influences among variables of interest can only then be studied

properly.

To some extent, a limited number of studies conducted so far are due to still relative instability of many sectors of the Macedonian economy and data spans, which are still moderate. Although there may not yet be enough observations on some macroeconomic variables, for instance, on the current floating exchange rate, there are many variables about which sufficient data are already available. Accordingly, there are many sectors of the Macedonian economy that can be properly analysed using advanced econometric techniques, such as the analysis of Macedonian economic growth, consumption, unemployment, investment, budget deficit and fiscal policy or business cycle analysis. Applying, for example, a co-integration technique in such analyses is becoming plausible. However, it should be taken into account that co-integration is a long-run property of variables and needs long spans of data. At the same time, the long-run may be a matter of decades for some issues while for others it may be a matter of years or even months. Furthermore, in their study using Monte Carlo simulations, Hakkio and Rush found strong evidence that in co-integration tests detection of co-integration depends more on the relationship between total sample length and the length of the long-run than on the mere number of observations (Hakkio and M. Rush, 1991).

In addition, the attitude towards quantitative economic is changing nowadays in Macedonia. The professionals engaged in economics, either on academic, business or policy-making level are trying to work together.Being more or less successful, all such efforts of collaborative work and new trends in applied econometric should be welcomed. A new generation of econometricians, their awareness of importance of quantitative methods in modelling Macedonian economy and availability of longer data samples suggest that there is no more need to sit and wait.

4. Conclusion

The transition process has strongly influenced economic policy and economic structure of Central and Eastern European countries, including Macedonia. The most profound change has been a shift from the centrally planned to the market economy. As a result, structural breaks and regime shifts appear in econometric data and thus make applied econometric analysis extremely difficult. When modelling such data the important thing is not to treat these changes as a nuisance, but as valuable information to be incorporated in the model in order to perform better forecasts or policy analyses. However, the nature of the particular changes will influence the

choice of the model class to represent the relevant macroeconomic relationships. The purpose of modelling will also help determine an appropriate model choice.

Nowadays many strategies of how to deal with such problems in a suitable manner have been proposed. The one that is starting to be increasingly used in modelling economic relationships and their dynamics is vector autoregressive (VAR) methodology. This paper outlined some methodological problems that arise in modelling economies in transition with a special emphasis on Macedonia. The reason for concentrating on applied econometrics in macroeconomics is due to the fact that the concept of cointegration and VAR modelling have been attracting attention in Western economies, especially in the area of the analysis of macroeconometric relationships and their dynamics, although typically focusing on the particular aspects of the economy.

One of the major problems in modelling transition economies, including the Macedonian as well, concerns data. Short data spans and thus small data samples are characteristic of almost every sector of Macedonian economy. In addition, the problem of accessibility of some data still remains because data on some variables do not exist for long enough time period or are incompatible with the previous data and of no use for further analysis. The employment of monthly higher frequency data and seasonal adjustment are also restricting dynamic structure of estimated models.

Facing all this, there are only one study of macroeconometric models in Macedonia. At the moment, greater availability of data, which is crucial for any proper statistical analysis, enables the analysis of Macedonian economic growth, consumption, unemployment, investment, budget deficit and fiscal policy or business cycle. Defining adequate macroeconometric models, that will incorporate all events that significantly influenced Macedonian economy in the past decade, are now feasible for many sectors of Macedonian economy. Only on the basis of such models the proper analysis of transition mechanism, concerning specifics of Macedonia, can be studied. The impact of transition changes on macroeconomic variables, responses of the variables to the changes, discrimination among alternative models that will adequately characterise observed economic activity, the analysis of relationships between macroeconomic variables and some among them.

Finally, it is worth mentioning that the attitude towards the quantitative economic is currently

undergoing a change in Macedonia. A new generation of econometricians are eager to work in groups and to apply advanced econometric techniques in order to perform comprehensive analyses of various sectors of the Macedonian economy.

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