

Structural macro econometric model of Turkey; impact of structural characteristics on macroeconomic indicators

By

Durmuş Özdemir^ψ and Mustafa Kemal Gündoğdu^θ

Abstract

In this paper, we develop a structural macro econometric model for Turkey, to assess the role of structural characteristics of an emerging economy on macroeconomic indicators. In this model, standard macroeconomic policy results are observed as the target levels and actual levels. Technically, we shall simulate our model over a rather long future period, and address in turn: i) The structural differences in Import dependence of Export, Factor productivity, Inflation & Growth, Exchange rate vs. Growth, Unemployment, CA, and consumption impact on actual and target levels. ii) The expected changes in structural elements: increase in factor productivity, faster depreciation of capital etc. iii) The policies the government could enact to soften or to profit from these changes.

On the whole, we shall evidence a strong impact of structural characteristics in the process. Its role will generally prove a serious impediment to the standard macroeconomic policy results.

Keywords: Structural Modeling; Turkey; Macroeconometric Modeling, Stochastic Simulation

JEL classification: C 54; C 30; E 17

^ψ Corresponding author: Istanbul Bilgi University, Department of Economics, Santral Campus, Eski Silahtarağa Elektrik Santrali, Kazım Karabekir Cad.No: 2/13, 34060 Eyup, Istanbul, Turkey, Tel.+902123115326, Fax+902122970134, E-mail: dozdemir@bilgi.edu.tr

^θ Istanbul Bilgi University, Department of Economics, Dolapdere Campus, Kurtuluş Deresi Cad., Yahya Köprüsü Sok.No: 1, 34440 Beyoğlu, Istanbul, Turkey, E-mail: Kemal.Gundogdu@isbank.com.tr

1. Introduction

Macroeconometric models have been used as important tools of analysis for macroeconomic forecasting and policy assessment over the past three decades, [Herve, et al. (2010)]. Macroeconometric models provide with a useful insights of structural relationship among different key macroeconomic variables. It also helps to policymakers to identify cause and effect relationship between policy and target variables and helps in makings forecasts for the variables. Among the different type of models macroeconometric models are useful because they illustrate the whole structure of the economy, as well as temporal behaviour of the macro economy. Macroeconometric models also provide with an opportunity of tracking the implications of a variety of shocks, (both exogenous and endogenous) and effects of economic policies driven within and between economies and regions (Herve, et al. 2010).

The concept of macroeconometric modelling was born with the work of Jan Tinbergen in the 1930s. After that many economic institutions and academic researchers have constructed macroeconometric models to illuminate the pattern of domestic output growth and inflation trends, reaction of monetary and fiscal policies in the face of unexpected shocks and the prospects of macroeconomic stability. These models provide frameworks to analyze and observe many aspects of macroeconomic behaviour simultaneously and allowing the model builders to study the implications of the economic theories. Attempts to construct macroeconometric model of Turkish economy have been limited and policy evaluation with the help of macroeconometric models are rarely undertaken. Although one can find small-scale partial econometric models or CGE models in sectoral basis for Turkish economy, there are limited numbers works about general structural macroeconometric models that covers main economics blocks such as consumption, money market, labor market, trade market etc.

2. Structural Characteristics of Turkish Economy; A review of Structural Turkish models.

The first macro econometric model for the Turkish economy was designed in 1962 by von Hohenbalken-Tintner. And with losing popularity of economic modelling after 2000's, there are not enough number of structural macroeconometric models which reveals changes in Turkish economy after the financial crisis in 2001. Other models for the Turkish economy were by Uygur (1967), Korum (1969), Blitzer (1970), Uğurel (1971) Celasun (1972), Patel (1973), World Bank (1974), IMF (1976), Özmucur (1980) and (1984), Yörükoğlu (1980), Yağcı (1983), Conway (1984), Fair (1984), Celasun (1986), Gupta-Togan (1984), Uygur (1987), Yeldan (1989), Karbuz (1993), Özmucur (1993), Özatay (2000), Kıpıcı (2005), Coşkun (2007) and Özatay (2007).

In the book of Uygur in 1967, appropriate equations on consumption, investment, production (econometric equations on national income, agricultural and industrial production), foreign trade and taxes are used. Uygur used taxes into two categories; direct

and indirect taxes. The results obtained from investment block show that the previous year's capital stock has a positive effect on current investment. The second result is on the effectiveness of prices in foreign trade. The results of foreign trade block has shown that prices have no significant effects on the import and export of Turkey. In a recent study (Uygur, 1986 pp. 96, 97) the same result is also obtained.

Kıpıcı (2004) constructed a small-scale quarterly model for the Turkish economy in which the explicit treatment of the expectations in the inflationary process and the effect of public borrowing on inflation via interest rates are used in the model. Kıpıcı found that expectations have the greatest importance in the determination of inflation along with the exchange rate in Turkey. In addition, to use the overnight interest rate as an effective policy tool, it seems to be essential to accomplish the structural reforms so as to eliminate risk premium due to the concerns about the debt sustainability.

The studies by Korum (1969), Uğurel (1971) and Özmucur (1980) are defined as first generation models by Uygur (2004). The studies by Korum (1969) and Uğurel (1971) emphasize the role of econometric models in the process of economic planning which started in 1961 in Turkey. In line with this emphasis, they are primarily concerned with the structural analysis of the economy even though they contain one period ahead forecasts and Özmucur (1980) contains policy simulations (multiplier analysis) as well. The behavioural equations are all linear in variables and parameters and are estimated by annual data. They are solved to obtain the estimates of reduced form parameters from structural parameter estimates and the solution values. (Uygur, 2004)

The studies by Yörükoğlu, Yağcı, Özmucur (1984), Uygur and Şenesen, on the other hand, can be labelled as second generation models by Uygur (2004). These models concerned with forecasting the immediate future and, except the last one, they also contain policy simulations (Uygur, 2004). In all models the behavioural equations includes non-linearities in variables, that are estimated by annual data like their predecessors. Iterative dynamic solution methods are used to solve the equations. Korum's model has two versions. In the first version Korum use current prices to determine variables, while in the second version real prices are used. The method of estimation is Ordinary Least Squares (OLS). Problems in estimation, including simultaneity, are mentioned but no measures are taken. Korum also admits that the import equations are not successful and this is partly attributed to import controls which could not be taken into account. Specification and estimation problems also exist in domestic demand equations, especially in those that explain agricultural and non-agricultural stock changes. An interesting feature of Korum's model is that non-agricultural wage and profit (non-agricultural non-wage) incomes are explained which can be used to analyse the functional distribution of income (Uygur, 2004).

Uğurel's model (1971) is the smaller than the Korum's one. Most of the behavioural equations are constructed to explain import and domestic demand variables. Although investment expenditure is used as an explanatory variable in the equation for imports of investment goods, the parameter of the variable is found to be insignificant. What is more, this result is taken to indicate a characteristic of the Turkish economy. Uğurel takes

simultaneity into account in estimation and applies Two Stage Least Squares (2SLS) to a data set of the period 1949-1967. On the other hand, half of Uğurel's estimated equations suffer from severe negative autocorrelation, a problem which is not treated nor even considered (Uygur 2004).

Özmucur (1980) developed an extensive version of Korum's model in terms of specification, estimation and other procedures employed. In addition not only wage and profit incomes, but also employment and unemployment are also determined in this model. In this study, all of the sectoral exports, i.e. agricultural, mining and industrial exports, are deflated by the same deflator which could of course lead to systematic and sizeable measurement errors. Measurement errors of this nature are also likely to be present in the real values of import variables (Uygur, 2004). Özmucur also use OLS method to estimate the behavioural equations. His data set that covers either 1950-74 or 1962-74 periods. One can noticed that positive autocorrelation exists in his data set, however the problem is not considered in the model. On the other hand 2SLS estimation method is used to eliminate simultaneity problem in estimation.

Uygur constructed another econometric model for Turkey in 1986 by using single equation method with OLS and GLS. The model has output, price, foreign trade, domestic demand, monetary and fiscal variables. The model has some policy simulations to investigate the effects of assumed alternative government policies on the endogenous variables. The simultaneous blocks in the model are estimated by Non-Linear Three Stage Least Squares (NL3SLS) and the recursive blocks by Seemingly Unrelated Regression (SUR) methods. The OLS and GLS estimates are compared with the estimates obtained from NL3SLS and SUR. The data used in estimations relate to the 1961-84 period (Uygur 2004).

Özatay (1999) developed, estimated and simulated a quarterly macroeconomic model for Turkey. The model analyzes the substantial inertia in the inflation rate and the high public sector borrowing requirement. Özdemir and Turner (2005) construct a monetary disequilibrium model for the Turkish economy and run several simulation experiments through their model. The aim of the simulations was the revealing relation between fiscal policy and money supply. The simulation results show that fiscal discipline is very important in achieving objectives such as sustaining the disinflation process and reducing the high budget deficit in Turkey.

Coşkun (2006) develop the Model TURKPOL (Turkish Economic Policy Model) which consists of 13 behavioral equations. The model TURKPOL combines Keynesian and neoclassical elements. The aim of the work is to analyze the optimal monetary and fiscal policy mix for Turkish economy. Optimal monetary and fiscal policy designs will be presented for Turkish economy over the period 2007-2013. Optimization experiment will be conducted under the fixed exchange rate regime and the flexible exchange rate regime. The optimization experiment is carried out using the optimum control algorithm OPTCON and a macroeconomic model of the Turkish economy. In both exchange rate regimes, very similar results are obtained for the growth rate of the GDP, the inflation rate and the unemployment rate. These results can be interpreted to mean that the exchange rate is

ineffective in the iteration process of our functional form or the exchange rate regime has very little effect on the saddle path of those variables. (Coşkun 2006)

Although there are limited number of studies about structural macroeconomic model for Turkey, one can find many well-organized partial economic models which should be taken into account while constructing comprehensive country models. For instance, Ögünç and Ece (2004) try to estimate potential output of Turkish economy by using basic univariate and bivariate unobserved components models from 1987:q1 to 2002:q4. They also constructed confidence bands for potential output and output gap. These bands show that 1993 and 1997-1998 are the expansion periods but 1989, 1994 and 2001-2002 are the recession periods of the economy. Moreover, they claimed that the relationship between inflation and output gap is limited since inflation is closely tied to exchange rate and past inflation at the period of study (Özatay, 2007).

Another work on estimating potential output of Turkey is done by Özatay (2007). In the paper Vector Error Correction Model and univariate Kalman Filter techniques are used. The estimation findings are similar with the existing literature. In addition it is verified that Turkish economy has entered a new era of economic stability after many years of fluctuating output (Özatay, 2007).

Sarikaya et al. (2005) employed the extended Kalman Filter in a multivariate framework and output gap is defined as a function of real interest rate, real effective exchange rate, demand index and it's own past. All parameters in this work are time-varying and timeseries specification of each is assumed for estimation. Kaya & Yavan (2007) also use statistical and economical approaches to measure the gap for Turkish economy and compared all the results. They analyze the correlation between capacity utilization, which is representing the cyclical movements of the economy (Özatay, 2007).

As the literature review shows, there are many well-organized partial economic models but constructing comprehensive country models are very limited.

3. The structure of the Model

Our preliminary model is small, compact, and highly aggregate macro model and we are currently working on a more detailed version. The simple version of the model structure can be divided into five blocks: monetary, government, production, trade and national income. Current structural characteristics can be summarized as follows; Investment depends on Import; Due to import machinery, petrol, high technology inputs, raw material etc. FDI impact is significant. For aggregate supply side: Prices and wages are fairly flexible: Prices adjust after second quarter (Yazgan and Yılmazkuday, 2005). Export depends on Import. Due to the financial flow large consumer credit availabilities affect household consumption and investment. Government expenditure on consumption is significant. Exchange rate impact on consumption (Due to imported consumption goods) is obvious.

Monetary Block

- Price Level
- Real Interest Rate
- Monetary Policy
- Total Credits

Government Block

- Government Expenditures
- Taxes
- Budget Deficit

Production Block

- Technology
- Employment
- Capital
- Wage
- Output Gap

Trade Block

- Exports
- Imports
- Exchange Rate
- World Price Level

National Income Block

- Nominal Income
- Investment
- Total Demand
- Household Spending

Import of consumption goods is one of the major items in subgroup of import in Turkey. That's why Foreign trade deficit is the main determinants of consumption in the regression result. Growth in wages and growth in banking credit have also positive effect on growth in consumption.

Investment equation shows that change in investment is negatively correlated with unemployment level. Growth in banking credit is the main funding resource of investment similar to the other emerging countries. So coefficient of growth in banking credit is positive and significant for %5 level. Due to structural characteristics of Turkish economy, imports and exports, which may be represented as foreign trade deficit, has the one of the main determinants of growth in investment.

According to regression results it can be seen that real return on demand deposit has effect people's consumption decision. Any increase real return on demand deposit causes a decrease in imports in Turkey. Although, government expenditure has major effect on imports, the coefficient of government expenditure is significant only for %10 significance level. However due to structural-dependency of export and import in Turkey

and , investment, which level is also an important determinants of the import. For instance, share of intermediate goods in total imports is close to 30% in 2011.

According to regression result of the Export, percentage growth of G20-Countries's GDP has effect on percentage growth in Turkish Export positively. On the other effect of percentage change in foreign investment on exports is not significant for %5 level of significance. Since, the export volume to the G-20 countries is limited when we compare it with the GDP level of these countries.

Growth in capital stock, government expenditure and import have significant effect on growth of export in Turkey. Turkish industrial and manufacturing sectors which are the major chapters in exports, are dependent to imported intermediate goods, growth in imports the main determinants of growth in exports. On the other hand, effect of government expenditure on export is statistically negative due to any increase in government expenditure causes rise in domestic demand which reduce volume of foreign trade. The other variable which positively affect exports is change in capital stock. After the liberalization of the Turkish economy, investments in Turkey have concentrated on export oriented sectors. That's why the effect of growth in capital stock has statistically positive effect on growth in exports.

The data used in the model for the block variables with its details are provided on the table below;

Block	Data	Source	Period	Frequency
Monetary Block				
	Money Supply	CBRT	2005-	Monthly
	Volume of Foreign Exchange Transactions of Banks Against Turkish Lira	CBRT	2002-	Monthly
	Weighted Average Interest Rates For Turkish Lira Banks' Loans	CBRT	2002-	Monthly
	Monetary Sector Analytical Balance Sheet	CBRT	1986-	Monthly
	Interest Rate on Deposits	CBRT	1984-	Monthly
	Interest Rate on FX Deposits	CBRT	1990-	Monthly
	Total Loans (Banking Sector)	BRSA	2002-	Monthly
	Total Deposit (Banking Sector)	BRSA	2002-	Monthly
	Total Assets (Banking Sector)	BRSA	2002-	Monthly
	Sectoral Loan Distribution	BRSA	2002-	Monthly
	Consumer & SME Loans	BRSA	2002-	Monthly
	Interest Rate	MOD	1950-2010	Yearly
	CPI and PPI	Turkstat	1994-	Monthly
	ISE Index	ISE	1986-	Daily
	Open Market Repo and Reverse Repo Transactions	CBRT	1987	Monthly

	Istanbul Gold Exchange	CBRT	1995	Yearly
	Purchasing Power Parity	Turkstat	2005	Yearly
	The Rates of Profits Created by Means of Financial Investment	Turkstat	1997-	Monthly
Government Block				
	Treasury Auctions	CBRT	1984-	Not Regular
	Central Government Budget Expenses	MOF	1994-	Monthly
	Central Government Budget Revenues	MOF	1994-	Monthly
	Government Final Consumption Expenditure	Turkstat	1998-	Quarterly
	Tax Revenues	MOF	2005-	Monthly
	VAT on Imports	MOF	2005-	Monthly
	Corporation Tax Revenues	MOF	2005-	Monthly
	Privatization Implementations	CBRT	1986-	Yearly
	Domestic Debt Stock	Treasury		
	General Budget Balance and Financing	Treasury	2006-	Monthly
	General Budget Balance and Financing	Treasury	1994-2006	Yearly
Production Block				
	Innovative enterprises in industry	Turkstat	1998-	Not Regular
	Gross Domestic Expenditure on R&D	Turkstat	1990-	Yearly
	Science & Technology Indicators	MOD	1990-	Yearly
	Index of Production per Hour Worked	CBRT	2005-	Quarterly
	Index of Production per Person Employed	CBRT	2005-	Quarterly
	Employment	Turkstat	1988-	Not Regular
	Unemployment	Turkstat	1988-	Not Regular
	Labor Force	Turkstat	1988-	Not Regular
	Labor Force Participation Rate	Turkstat	1988-	Not Regular

Cont. Production Block	Data	Source	Period	Frequency
	Women Participation Rate	Turkstat	1988-	Not Regular
	Gross Fixed Capital Formation	Turkstat	1970-	Quarterly
	Capital Goods Net Exports	CBRT	1989-	Monthly
	Hourly labour cost index	Turkstat	2007-	Quarterly
	Industrial Production Index	CBRT	1998-	Monthly
Trade Block				
	Exchange Rates	CBRT	1990-	Monthly
	CPI Based Reel Effective Exchange Rate	CBRT	2003-	Monthly
	CRB Commodity Index	Reuters	1985-	Daily
	Brent Type Oil Price	Reuters	1991-	Daily
	Gold Price	Reuters	1985-	Daily
	VIX	CBOE	1990-	Daily
	Msci World Daily Price Return In Local Currency Index	Reuters	1998-	Daily
	Imports	CBRT	1989-	Monthly
	Exports	CBRT	1989-	Monthly
	Net Exports	Turkstats	1998-	Quarterly
	Imports & Exports by Broad Economic Categorization	CBRT	1998-	Monthly
	€, ¥, \$ Cross Parities	Reuters	1990-	Daily
	World Trade Volume	OECD,IMF	1980-	Not Regular
	World Output	OECD,IMF	1980-	Not Regular
	World Trade Indices, by regions	Reuters	2000-	Daily
National Income Block				
	Final Consumption Expenditure of Resident Households	Turkstat	1998-	Quarterly
	Investment	Turkstat	1998-	Quarterly
	Public Sector Investment	Turkstat	1998-	Quarterly
	Private Sector Investment	Turkstat	1998-	Quarterly
	Stock Changes	Turkstat	1998-	Quarterly
	Compensation of Employees	Turkstat	1998-	Quarterly

4. The structural change in the main macro data.

There are some pros and cons of the Turkish economic developments after last 12 years. The data reveal that the take of year of the Turkish economy observed in 2005 which is the year Turkey receive candidacy status from EU. The main pros are the high FDI inflow, high economic growth and the trade diversification. However there are still a number of cons in this development. These are; i) Large Current account deficit (ratio of exports to imports 60-66% (Debt fuelling consumption towards export), ii) Vulnerable to further global financial shocks- (under possible capital flow reversals), iii) Slow institutional reforms and problems on accountability, efficiency and transparency, iv) Competition policy problems: Limited progress in the area of anti-trust and mergers. There are not much the regulation vs Liberalization argument but there are more liberalization, v) Human capital problems: Education , Official un employment still more than 11%: labour participation rate: Women: 30%, men 71,4%.

The figures 1-10 show the trend of main macro indicators between 1997 and 2011.

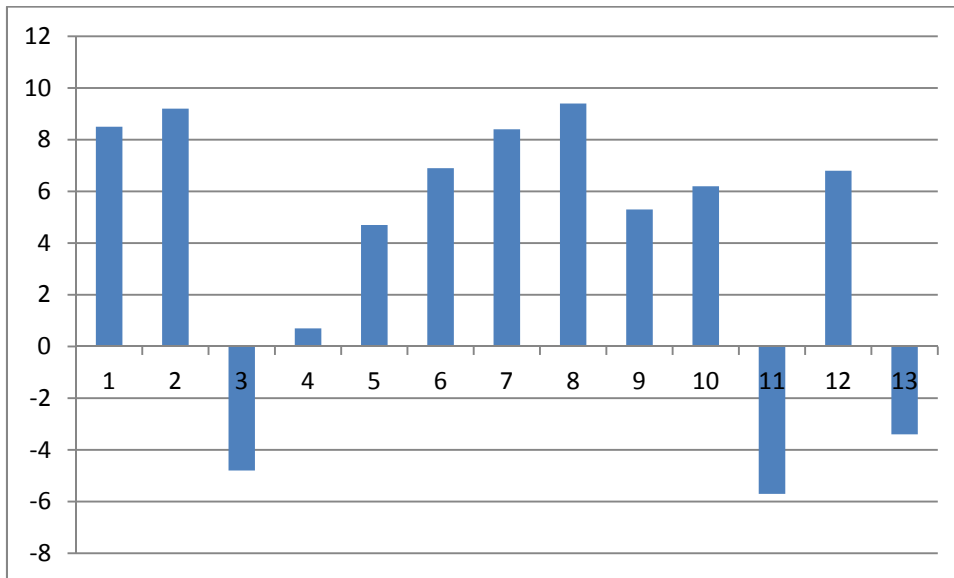


Figure 1: Turkish economic growth for last decade, 1=2011, 13= 1999

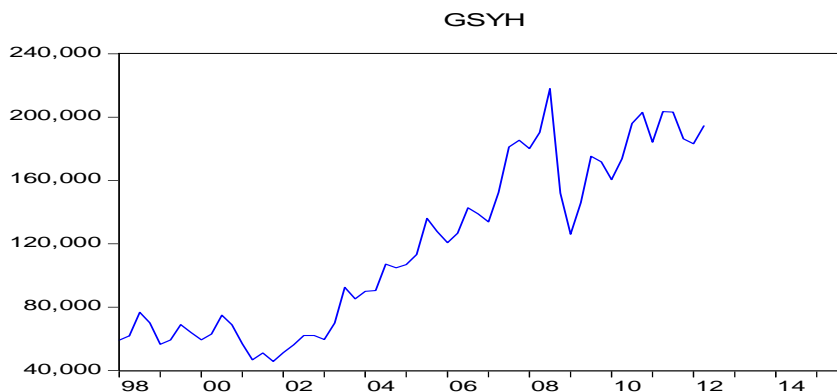


Figure 2: GDP between 1998-2011

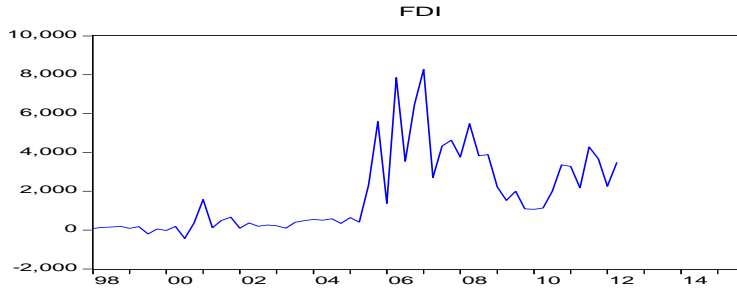


Figure 3: FDI inflow

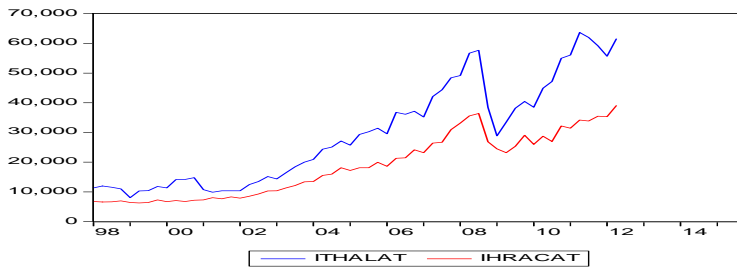


Figure 4: Export and import (A large CA deficit)

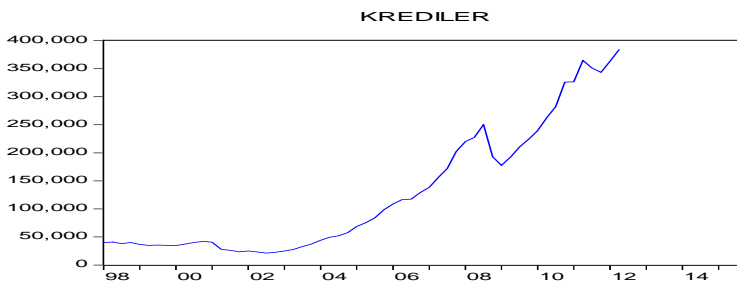


Figure 5: Domestic borrowing

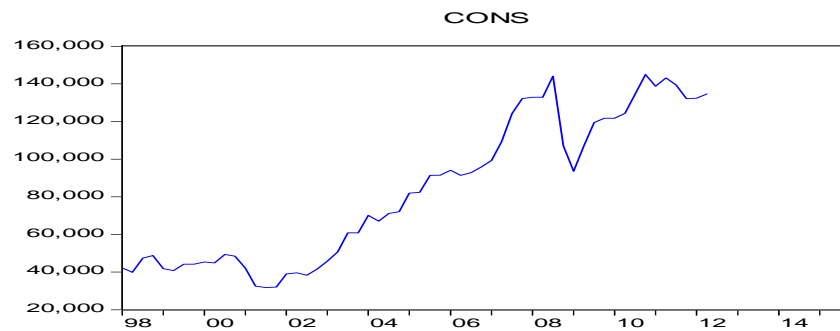


Figure 6: Consumption

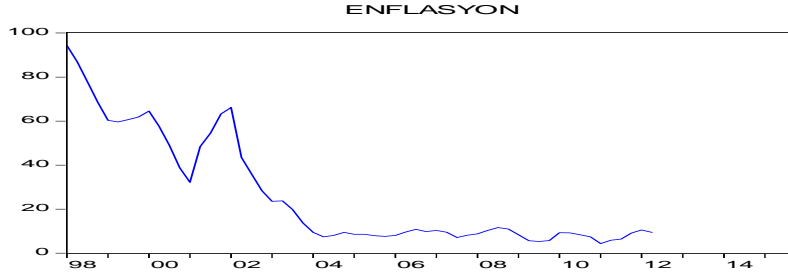


Figure 7: Inflation

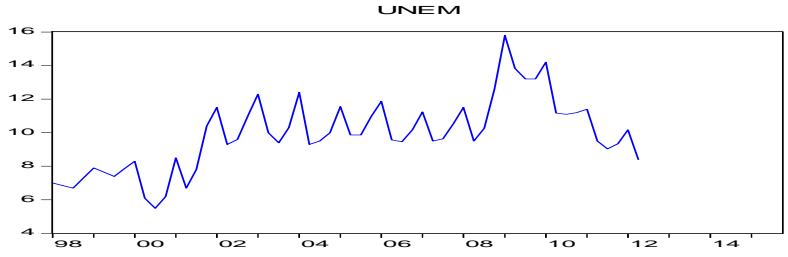


Figure 8: Unemployment

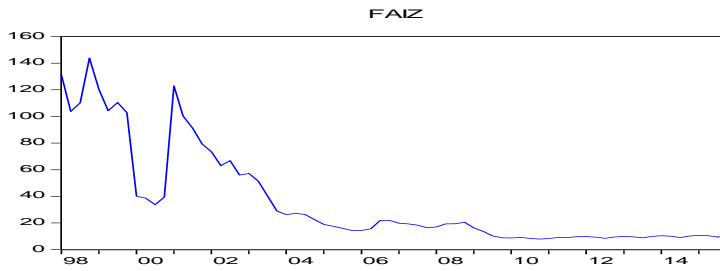


Figure 9: Interest rates



Figure 10: Euro - Turkish lira exchange rate

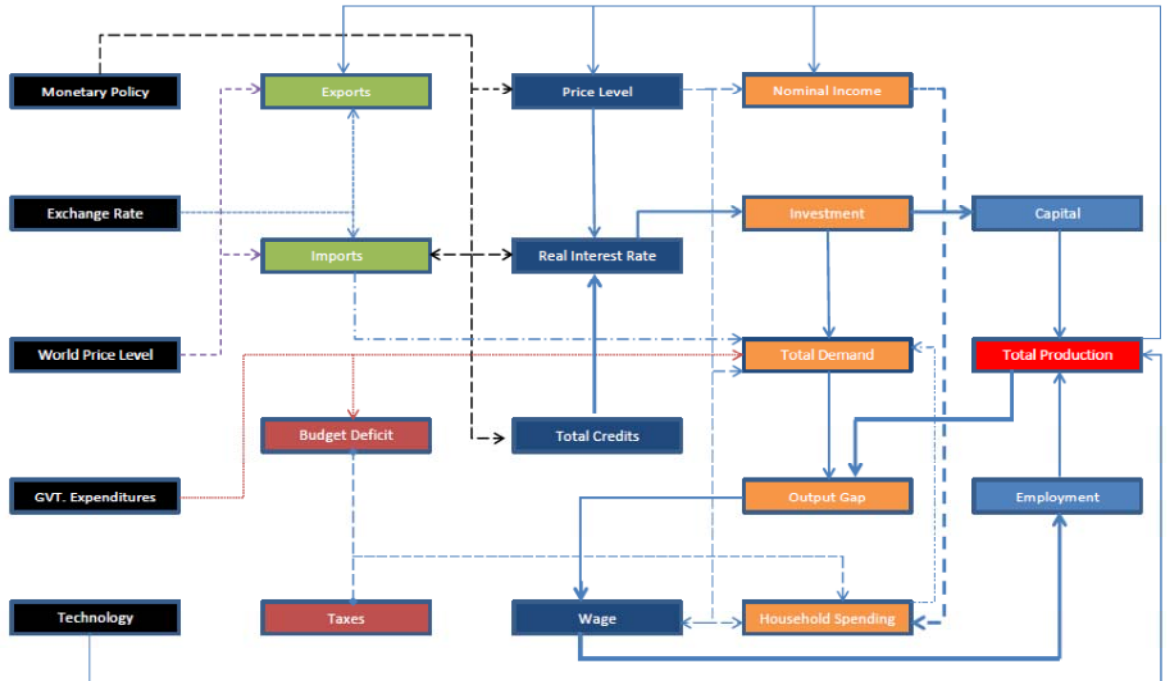


Figure 11: Flow chart of the preliminary model

We started to build our model with 11 simultaneous equations with dependent, independent and recursive blocks. The intended operational final version of this model will be much larger. The current version of the model passed the stability tests.

We have checked for the consistency the set of equations, data and parameters. Firstly, the model is solved and simulated for the same period than the model solution and simulation is carried out for future periods.

5. Simulation.

Current model is much aggregated and the details are missing, therefore it is not relevant and suitable for the realistic impact and scenario analyses. An examination of the long run properties of the full model by running a stochastic simulation from 2012Q1 to 2100Q1 is carried out. Growth rates of National Accounts Variables clearly show that the all of the variables reach their steady state growth path between 2030 and 2040.

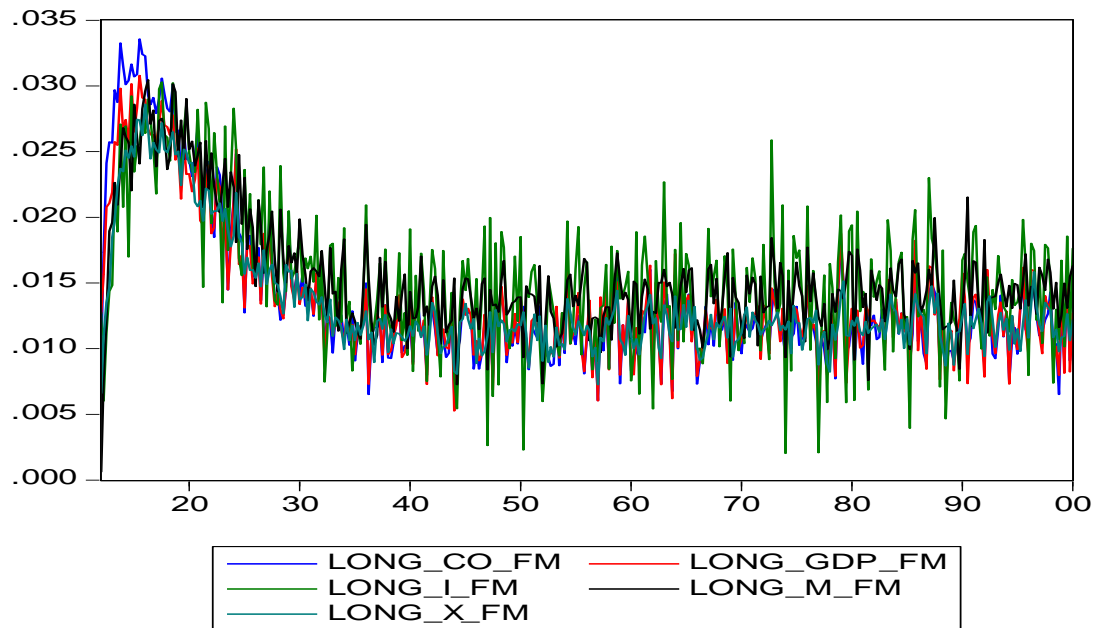


Figure 12: The long run properties of the full model by running a stochastic simulation from 2012Q1 to 2100Q1; Growth rates of National Accounts Variables

6. Discussion.

This paper introduces a preliminary study of structural quarterly macro econometric model of the Turkish economy.

Although there are many well-organized partial economic models, constructing comprehensive country models are very limited in Turkey. Our model is a first attempt to construct a comprehensive structural country model. Turkish economy is in the process of a serious structural change for the last decade. Any model does not consider this issue will be misleading. We are currently working on a more comprehensive version of our present model and we will be able to provide more detailed simulation study with the impact and scenario analysis. The resulting model will demonstrate good forecasting capacity and versatile potential for policy simulations. The policy simulation potential of the model will then be examined with different types of simulations for possible problems of the Turkish economy.

References

- Bagnai, A. and Ospina, C. (2007). Structural changes and the transition process: a macroeconometric model of China. Luiss Lab of European Economics LLEE Working Document no:47
- Bardsen, G. et. al (2004). The Econometrics of Macroeconomic Modelling. Oxford University Press.
- Bautista, C. et. al. (2004). The Neda quarterly macroeconomic model: theoretical structure and some empirical results. 9th National Convention on Statistics(NCS)
- Brillet, J. (n.d) Structural econometric modelling methodology and tool with applications under E-Views. <http://www.scribd.com/doc/89229429/Structural-Modelling-Bkm#download>
- Chen, P., Schneider, E., Frohn, J. (2007). A Long-run structural macroeconometric model for Germany. Economics Discussion Papers / Institut für Weltwirtschaft, No. 2007-47, <http://hdl.handle.net/10419/17970>
- Enders, W. (2004). Applied econometric time-series, 2nd edition. New York: John Wiley and Sons.
- Engle, R.F. and C.W.J. Granger (1987). Cointegration and error correction: representation, estimation and testing. *Econometrica*.
- Felix, R. (2005). A Macroeconomic structural model for the Portuguese economy. Banco de Portugal.
- Fukac, M. & Pagan A. (2009). Structural macroeconometric modelling in a policy environment, RBNZ DP2009/16. available from <http://www.rbnz.govt.nz>.
- Garratt, A., K. Lee, M.H. Pesaran & Y. Shin (2004). Forecast uncertainties in macroeconomics modelling: an application to the UK economy. ESE Discussion Papers 64, Edinburgh School of Economics, University of Edinburgh.
- Gregory, A.W. and B.E. Hansen (1996). Residual-based tests for cointegration in models with regime shifts. *Journal of Econometrics*.
- Hanclova, Jana. (2011). A prediction of long-run macroeconomic relations and investigation of domestic shock effects in the Czech economy. *Mathematical Models and Method in Modern Science*, ISBN: 978-1-61804-055-8
- Hervé, K. et al. (2010). The OECD's new global model. OECD Economics Department Working Papers, No. 768, OECD Publishing.
- Hossain, I. (2003). Micro Impacts of Macroeconomic and Adjustment Policies in Bangladesh. Bangladesh Institute of Development Studies.

- Khan, M. and Din, M. (2011). A Dynamic macroeconometric model of Pakistan's economy. Pakistan Institute of Development Economics Working Papers 2011:69
- Koopmans, T.J.(1950) Statistical Inference in Dynamic Economic Models. Cowles Commission for Research in Economics. New York: John Wiley and Sons.
- Köksal, B., An Econometric Model for Turkey, Unpublished Ph.D. Thesis, New York University, 1970.
- Lewis, J.D. and Urata, S. (1983) "Turkey: Recent Economic Performance and Medium-Term Prospects, 1978-1990", World Bank Staff Working Paper No.602, Washington D.C.: World Bank.
- McHugh, Z. (2004). A small, macroeconometric model of Australian economy: with an emphasis on modelling wages and prices.
- Öğünç, F., and D. Ece, 2004, "Estimating the output gap for Turkey: an unobserved components approach," Applied Economic Letters, Vol. 11, pp.177-182.
- Özatay, F., 2000 "A Quarterly Macroeconometric Model for a Highly Inflationary and Indebted Country: Turkey", Economic Modelling, 17, 1-11.
- Özdemir, K.A. and Turner, P., 2005 "A Monetary Disequilibrium Model for Turkey: Investigation of a Disinflationary Fiscal Rule and its Implications on Monetary Policy", CBRT Working Papers, No: 05/07.
- Özmucur, S., Türkiyenin Ekonometrik Modeli:1950-1974, Boğaziçi Üniversitesi, İstanbul, 1980.
- Özmucur, S. (1986) An Econometric Model For Turkey: 1965-1984. Istanbul: Turkish Industrialists and Businessmen's Association.
- Pesaran M. H. & Shin Y.(2002). Long-run structural modelling. Econometric Reviews, Vol.21,
- Sarıkaya, Ç., F. Öğünç, D. Ece, H. Kara and Ü. Özlale, 2005, "Estimating Output Gap for the Turkish Economy," Central Bank of the Republic of Turkey.
- Togan, S. (1983) "A Macroeconometric Model of The Turkish Economy-A Comment", METU Studies in Development, 10(3), 323-8.
- Uğurel, İ. (1971) "A Macroeconomic Model For Turkey: 1949-1967", Paper Presented at the European Meeting of the Econometric Society, Barcelona, Semptember.
- Uğurel, I., 1971 "A macroeconomic Model for Turkey: 1949-1967", paper presented at the European Meeting of the Econometric Society, Spain.

Uygur, E., SESRTCIC Econometric Model of the Turkish Economy, Statistical, Economic and Social Research and Training Centre for Islamic Countries, Ankara, 1987.

Uygur, E. (1986) SESRTCIC Econometric Model of the Turkish Economy. Ankara: SESRTCIC.

Uygur, E. (1986) SESTRCIC Econometric Model of The Turkish Economy. Ankara: SESRTCIC.

Uygur, E., Bulutay, T. (2004) THE EXPERIENCE OF ECONOMETRIC MODEL BUILDING FOR THE TURKISH ECONOMY: 1960-1986. TURKISH ECONOMIC ASSOCIATION DISCUSSION PAPER 2004/12 <http://www.tek.org.tr>

Wallis, K. (2000). Macroeconometric Modelling. Reykjavik: University of Iceland Press.

Yağcı, F. Türk Ekonomisi için Ekonometrik Bir Model Çalışması: TEM 1, Türkiye Sınai Kalkınma Bankası, İstanbul, 1982.