

SOME POLICY EXPERIMENTS USING A MARSHALLIAN MACROECONOMETRIC MODEL: Case of South Africa

Jacques Kibambe Ngoie
and
*Arnold Zellner**

Abstract

The present paper investigates the use of a disaggregated Marshallian Macro econometric Model (MMM) of the South African economy to analyze the effects of certain policy changes. Referring to the underlying theory of demand and supply linked throughout by an entry/exit equation, this paper discusses several extensions to the MMM providing higher adaptability to the model. The macroeconomic impact of 'human capital', as it is introduced in the model, provides a better understanding of any government action meant to raise public investment in education or health. The impact is captured through labour productivity.

Thatcher's like reforms, as implemented on the British economy during Mrs Margaret Thatcher's tenure as Prime Minister, have been applied to the South African economy and this study's findings support the idea that, when carefully implemented, these reforms may induce significant growth (as high as 8.1 percent) to individual industrial sectors as well as the overall South African economy. In order to highlight the use of a MMM as efficient tool of policy analysis, this study makes use of the model to predict the effects that Thatcher's like reforms will have on the South African economy, if ever implemented.

This model is based on a sectoral disaggregating including demand, supply and entry/exit relations with sound consideration of labour productivity as affected by social ingredients such as health and education.

* Jacques Kibambe Ngoie: Department of Economics, University of Pretoria, Pretoria, South Africa (e-mail: Jacques.kibambe@up.ac.za); Arnold Zellner: HGB Alexander Distinguished Service Professor Emeritus of Economics and Statistics, Graduate School of Business, University of Chicago, Chicago, Illinois (e-mail: [fazellne@chicagogsb.edu](mailto:fzellne@chicagogsb.edu)).

The MMM belongs to the group of chaotic models that generate 'booms and bubs' as compared to the sin-waves generated by traditional linear models. It generates non-linear differential equation systems. Using Newton's theory of motion, scientists have since elaborated extensions to the theory and later on (1975) they became aware of another kind (the third) of motion that they called 'chaos'. 'Chaotic' being the description for erratic and quasi periodic models that are found in several systems.

The use of disaggregating process in the MMM is sustained by sector differentials that prevail in the South African economy. The output growth per sector presents disparate behaviour to such extent that using aggregate data entails loss of useful information. Moreover, aggregate models are unable to analyze detailed policy shocks. Improvement effects of disaggregation have been captured in previous studies as measured by reduced 'Mean Absolute Errors' (MAEs) and 'Root Mean Squared Errors' (RMSEs). While using disaggregated frameworks, MAEs and RMSEs displayed smaller error figures as compared to aggregate models. That is noticeable as improvement in forecasting performance. We decided to disaggregate by sector of production (industries) as each sector portrays specific characteristics.

In order to estimate the MMM-DA model, the iterative SUR (Seemingly Unrelated Regressions) have been utilized in this research. Among several other advantages, the use of iterative SUR allows for correction of contemporaneous correlation and heteroskedasticity biases related to the different cross-sections. This technique permits to estimate transfer equations with a different coefficient vectors. The correlation of cross sections disturbances increases efficiency.

Moreover, the present research investigates the improvement of forecasting process through the use of shrinkage estimations (*à la* Stein).

The main results to be drawn from this exercise suggest that such reforms are most likely to produce remarkable improvement on the country's growth pattern. While carefully implemented, reforms on the impact that unions have on the economy coupled with freer sectors' production activities (less entry requirements) and higher labour productivity are expected to raise the South African growth rate as high as 8.1 percent within a reasonable confidence interval. This research provides clearer

evidence that a Marshallian Model constitutes a useful tool to understand and predict a country's growth throughout sectoral production activities.

In some cases, as this research suggests, the use of shrinkage estimations does not always produce improvement in the model's prediction ability considering that sectors often have disparate dynamics. However, the MMA-DA when carefully used can be valuably introduced to guide output growth forecasting in multiple output sectoral units, as long as the data used in the analysis and the vector means is representative of the production process and can be compared to appropriate peer production units.

In reaction to some valuable suggestions made during the presentation of this model at the University of Chicago, we carefully consider expanding the exercise much further by including more features to the research. In fact, additions such as: (1) the dynamic of inventories; (2) the capital market; (3) the entry of new sectors (Schumpeterian innovations); (4) the distinction between skilled and unskilled labour force; (5) the use of a generalised production function instead of restricting the process to the use of a Cobb-Douglas production function; etc; might increase the prediction ability of the model. In connection with what we discussed earlier regarding the optimality of a maximum likelihood estimator iterated while using SUR, when the loss function is defined as a zero-one loss function, the modal value obtained using SUR is optimal. It appeals to us that a zero-one loss function seems very appropriate in policy making process since policymakers act according to specific targets. When the target is missed, there is a big loss, and vice versa. However, in some further studies this issue will be discussed more thoroughly.