On the Modelling Strategies in Macro-econometric Analysis

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* Since this is a preliminary position note, I have not made any `reference to the existing literature.

1. Scope and Issue

Macro-econometric analysis of economies undergoing drastic structural changes is an underdeveloped and extremely challenging field of research. Here, my views and observations are mainly drawn from attempts to model empirically economies in transition from formerly centrally-planned economies (CPEs). However, I believe that most of them are relevant to modelling other economies experiencing rapid changes. The basic criterion upon which I have formed my opinions is that the merits of modelling strategies should be judged by the degrees of benefit that they can produce to the understanding of the economies and the improvement of the policy-making process.

To evaluate the appropriate modelling strategies implies the presumption that macro-econometric analysis of such economies is possible. One minimum requirement of this is the availability of time-series data with a sufficient number of observations, say a sample size of 40 (e.g. 10 years of quarterly data). Given the sample, we also have to assume that there is no change in the measurement definitions of any variables concerned, i.e. there is no measurement inconsistency within any single time series. These preconditions may be viewed as the insurmountable limitations of macro-econometric analysis.

At the first sight, one often describes the fundamental difficulty in modelling such economies as one of how to describe those unexpected fluctuations shown from the data1. However, I shall argue that this is a very vague description which might nurture unproductive modelling strategies. My essential point is that the "unexpectedness" should be made conditional upon given stereotyped economic theories so that we could identify the unexplained fluctuations with missing important explanatory variables of the particular economic system under study via the equilibrium-correction modelling (ECM) approach.

2. Previous Empirical Studies

The phenomenon of the unexpected fluctuations is frequently referred to as "structural breaks (or regime shifts)" in econometrics. Scanning through the existing literature of the relevant empirical studies, these breaks have been dealt with mostly in one of the two ways: the use of dummy variables and the use of time-varying parameters. The latter appears to be more suitable when structural breaks occurs more frequently than a few step or impulse dummies could cope, and is therefore more appealing to modellers of the economies in transition. The econometric models used in either case can be the traditional simple structural model, a VAR model, an ARMA model, or even an ECM model. But whatever the model type, the underlying economic theory tends to be a very simple market equilibrium (steady-state) story.

One serious drawback common to both ways is the little help which such models could offer for the purpose of policy analysis or forecast. However, there is a sharp conceptual difference between representing the breaks by dummies and representing them by time-varying parameters. The dummyvariable approach explains the breaks as caused by separate factors extraneous to the standard structural models, whereas the time-varying parameter approach ascribes them to continued behavioural changes, which in fact can be viewed as revealing continued theoretical breaks.

3. Understanding "Structural Breaks"

Several points can thus be drawn from the previous empirical studies:

Structural breaks, the key feature in modelling structural changes, have to be clearly defined conditional upon given structural models.

The implicit definition through time-varying structural parameters actually invalidates the given models, i.e. they fail to explain the structural changes.

The explicit definition by dummies lacks reference to economically meaningful variables which take values intermittently like dummies.

The first point implies that what is interesting to modellers as evidence of the structural changes is only a derived phenomenon from multivariate modelling analyses. Singularly erratic series may not produce structural breaks when combined together. This suggests that it might well be a fruitless route to study structural breaks on a univariate basis.

The latter two points narrow the problem down to the inadequately postulated conditioning variables in the standard theory underlying the standard structural models. Think of an economy in transition in particular. We can roughly describe its macroe conomy as a mixture of a declining planned sector and a rising free market sector. With respect to the purely market general equilibrium setting, two important facets are disregarded by textbook macro theory: the distinct behavioural characteristics of agents working in the planned sector, and the interaction between the two sectors when the relation between them is significantly out of the steady-state position. The latter facet applies also to other types of economies undergoing rapid structural changes. Below, I refer to the variables representing these two facets as "institutional" variables, and regard the key to modelling structural changes as to discovering data-permissible institutional variables which could restore meaningfully the "breaks" shown from estimated structural models without these variables.

4. The ECM Approach

An ECM model is actually a reparameterised version of a conditional, dynamic model:

[1] $B(L)y_t = C(L)z_t + \varepsilon_\tau$ where ε_τ is assumed to be white noise

Its conditional part $E(y_t \mid z_t\ ; \beta)$ stems from a priori postulated theory, and its namic part (the minimum order of the polynomial matrices B(L) and C(L) in the lag operator L) is specified a posteriori to ensure the model's stability. Reparameterization of [1] into an ECM is done through linear transformation:

[2] $B^{*}(L)\Delta y_t = C^{*}(L)\,\Delta z_t + \alpha\,L(y_t - \beta z_t) + \varepsilon_\tau$

such that the model remains invariant. The main advantages of this approach are that [1] augments the theory to suit a dynamic context and that [2] then makes the augmented dynamic model economically interpretable, especially to obtain the corresponding . These imply that we could utilise [1] or [2] as detectors for the possible missing institutional-variable problem, since the approach has filtered out the dynamic problem.Let us denote the institutional variables relevant to by . We should, from the above discussions, expect that could embody government policy instruments, or ratios of certain variables between the rapidly changing sectors, and that they should have the data features of intermittent impulses or jagged steps during periods of rapid structural changes and appear flat otherwise. Corresponding to [1], we have then:

[3] $B(L)y_t = C(L) z_t + D(L)q_t + \varepsilon_\tau^*$ where ε_τ^* is white noise

We can think of three cases: (a) q_t and z_t are uncorrelated; (b) q_t and z_t are imperfectly correlated; and (c) z_t is a function of q_t. It is discernible that case (b), and (c) if does not possess the super exogeneity property, may result in nonconstant coefficient estimates in [1] or [2], whereas case (a) may not, although all should cause lose the white-noise assumption in terms of its higher moments such as heteroskedasticity, or significant third/forth moments. Since [3] extends the conditional part of [1], the economic validity of the extension is better demonstrated through reparameterizing [3] into an ECM form like [2]. The extended ECM presents, all in separate parametric forms, the long-run and short-run effects of the purely theoretical variables and the institutional variables.

In a nutshell, the significance of this approach lies in the simple logic of treating structural changes in a structural way. The advantages of the resulting models are obvious:

These ECM models can be used easily for policy analysis and conditional forecasting, and even as a way to measure the degree that the relevant economy diverges from the ideal market equilibrium;
These models provide a much more realistic setting for the verification of the pure theory when the ceteris paribus condition obviously fails to hold;

More importantly, it shows a clear link between data and theory which may facilitate postulation of better theories.

Finally, this modelling approach can be complementary to other approaches used for the analysis of different features of transition economies.

1 There is another type of structural changes, that is long-term, gradual behavioural changes, such as a gradual shift in the saving rate. This is normally described by a priori postulated time-varying structural parameters, I rule out this case here since this does not seem to be the focus of the workshop, and since this mainly entails estimation problems rather than modelling problems.