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Identifying aggregate supply and demand shocks in small open economies: Empirical evidence from African countries

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ABSTRACT

This paper uses a tri-variate structural VAR with a long-run identification scheme, akin to the Blanchard and Quah method, to identify external and domestic supply and demand shocks in 22 African countries between 1980 and 2005. Domestic supply shocks are found to be the most important factor contributing over 70% to output fluctuations in these countries, with external shocks playing a relatively minor role. A partial correlation analysis between the identified shocks and a measure of the fiscal policies of the countries revealed that the fiscal policies pursued by most of the countries during the period are counter-cyclical.

1. Introduction

This paper contributes to the on-going debate over the disappointing economic performance of many African countries over recent decades with respect to economic growth (see, for example, Easterly and Levine, 1997), by focusing on the identification of the sources of the economic shocks faced by these economies between 1980 and 2005, in order to examine the country-specific constraints on economic growth and potential policy options.

Despite the optimism about Africa's economic potential in the 1960s and early 1970s (Enke, 1963; Kamarck, 1976) for most African countries, the 1980s are considered as 'a lost decade' with slow, and even negative, growth commonplace (Fischer, 1991). For example, in 1957 Ghana, then the wealthiest nation in sub-Saharan Africa, had a per capita income almost equal to that of South Korea (US$ 490 against US$ 491 in 1980 dollars), but by the early 1980s, Ghana's annual income per head had fallen by nearly 20 per cent to US$400, while South Korea's per capita GDP was, by then, over US$ 2,000. The UNDP's 1990 Human Development Report suggests that South Korea had an annual purchasing power per head ten times greater than Ghana (US$ 4,832 against US$ 481) based on 1987 statistics (The Economist 23 September, 1989). Furthermore this was not just a country-specific problem, but an African problem. Collier and Gunning (1999), for example, note that African economic performance had been markedly worse than that of other regions, during the 1980s as per capita GDP declined by 1.3% per annum, 5% below the average for all low income developing countries. During 1990–1994 the decline accelerated to 1.8% per annum which, widened up the gap between the average of all low income countries to 6.2%. Since the mid-1990s economic performance in Africa seems to have been improving, with GDP growth in sub-Saharan Africa rising to about 6% per annum, while inflation has been in single digits, a much improved performance perhaps partly attributable to structural adjustment programmes sponsored by the IMF and the World Bank.

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To identify the potential economic shocks faced by the African countries since 1980 we undertake a tri-variate VAR analysis, following Dungey and Pagan (2000). For small open economies, like those in Africa, where external shocks are likely to be at least as important as domestic shocks in influencing the evolution of output growth and inflation, the tri-variate VAR is preferred to Blanchard and Quah's (1989) more usual bi-variate VAR. In this framework in addition to domestic output growth and inflation, world output growth is also included in the model. This variable is assumed to be an important exogenous determinant of individual country exports, and therefore fluctuations in world output growth are likely to have significant effects on domestic output growth and inflation. A second contribution to the existing literature is to identify the contribution of national fiscal policies by a partial correlation analysis between the estimated shocks and a measure of fiscal policies of the countries studied.

The rest of the paper is organised as follows. The next section discusses the identification of aggregate supply and demand shocks within a structural VAR. Section 3 analyses the data from our sample of 22 African countries and the results from the trivariate-VAR analysis. Section 4 concludes.

2. Aggregate supply and demand shocks within an SVAR

The SVAR methodology imposes structural restrictions, based on economic theory (Hoffmaister, Roldos, & Wickham, 1998), on a Vector Autoregressive (VAR) model. In particular, in a bi-variate VAR context, Blanchard and Quah (1989) interpret the permanent shocks as aggregate supply shocks and transitory shocks as aggregate demand shocks. In an open economy context, a third-order VAR is necessary to capture potential shocks from the rest of the world on domestic output growth and inflation (Dungey and Pagan, 2000).

Therefore let y_t^*, y_t, and π_t represent the log of real foreign output, the log of real domestic output and the domestic inflation rate, respectively. Then a tri-variate autoregressive (VAR) model can be set up to represent the small open economies of Africa as follows:

$$\Delta y_t^* = \sum_{j=1}^{k} a_{11j}\Delta y_{t-j}^* + e_{1t} \tag{1}$$

$$\Delta y_t = \sum_{j=0}^{k} a_{21j}\Delta y_{t-j}^* + \sum_{j=1}^{k} a_{22j}\Delta y_{t-j} + \sum_{j=1}^{k} a_{22j}\Delta \pi_{t-1} + e_{2t} \tag{2}$$

$$\Delta \pi_t = \sum_{j=0}^{k} a_{21j}\Delta y_{t-j}^* + \sum_{j=1}^{k} a_{22j}\Delta y_{t-j} + \sum_{j=1}^{k} a_{23j}\Delta \pi_{j-i} + e_{3t} \tag{3}$$

where the constant terms are suppressed for notational convenience and the variables are differenced sufficiently to achieve stationarity. If the domestic economy is assumed to be small, then it is reasonable to assume that this economy has no effect on the world output, and therefore the foreign output equation includes neither current or lagged values of the other variables. The small country assumption also means that domestic output and inflation are allowed to depend on the current and past values of foreign output. The residuals e_{1t}, e_{2t} and e_{3t} are assumed to be related to each other through different types of shocks, which are foreign shocks, v_t, domestic demand shocks, η_t and domestic supply shocks, ε_t. Since these shocks are not observable, they need to be identified from the VAR residuals. Let the relationship between the residuals and the innovations be given by

$$\begin{bmatrix} e_{1t} \\ e_{2t} \\ e_{3t} \end{bmatrix} = \begin{bmatrix} g_{11} & g_{12} & g_{13} \\ g_{21} & g_{22} & g_{23} \\ g_{31} & g_{32} & g_{33} \end{bmatrix} \begin{bmatrix} v_t \\ \varepsilon_t \\ \eta_t \end{bmatrix} \tag{4}$$

In the above system, there are fifteen unknowns to identify. These are nine elements, g_{ij}, of matrix G linking the VAR residuals and the structural innovations, three variances σ^2_v, σ^2_ε, σ^2_η and three covariances $\sigma^2_{v\,\varepsilon}$, $\sigma^2_{\varepsilon\,\eta}$, $\sigma^2_{\eta v}$ in the variance-covariance matrix, $\boldsymbol{\Sigma}$, of the structural innovations. From Eq. (4) the variance-covariance matrix of the VAR residuals $\boldsymbol{\Sigma}_e$ is denoted by

$$\sum\nolimits_e = G\sum\nolimits_s G' \tag{5}$$

The elements of $\boldsymbol{\Sigma}_e$ provide six of the fifteen restrictions required for exact identification of the system. In addition, following the Blanchard–Quah methodology, it is assumed that all variances are unity, i.e. $\sigma^2_v = \sigma^2_\varepsilon = \sigma^2_\eta = 1$ and all co-variances are zero, $\sigma^2_{v\varepsilon} = \sigma^2_{\varepsilon\eta} = \sigma^2_{\eta v} = 0$. The penultimate two restrictions are that the domestic supply shocks ε_t and domestic demand shocks η_t have no impact on the large country, so that both g and g_3 are zero. Finally, domestic demand shocks have no long-run effects on domestic output, so that:

$$g_{23}\left[1 - \sum_{1=1}^{k} a_{33j}\right] + g_{33}\left[1 - \sum_{i=1}^{k} a_{23j}\right] = 0 \tag{6}$$