Journal of Monetary Economics 58 (2011) 616–631

Contents lists available at SciVerse ScienceDirect

Journal of Monetary Economics

journal homepage: www.elsevier.com/locate/jme

Emerging market business cycles: Learning about the trend

Emine Boz [a], Christian Daude [b], C. Bora Durdu [c,*]

[a] Research Department, International Monetary Fund, USA
[b] Organisation for Economic Co-operation and Development, Development Centre, France
[c] International Finance Division, Federal Reserve Board, 20 and C Streets NW, MS 20, Washington, DC 20551, USA

ARTICLE INFO

Article history:
Received 20 May 2010
Received in revised form
27 October 2011
Accepted 1 November 2011
Available online 20 November 2011

ABSTRACT

Emerging market business cycles feature a higher variability of consumption relative to output and a strongly countercyclical trade balance. An equilibrium business cycle model in which agents learn to distinguish between the permanent and transitory components of total factor productivity shocks using the Kalman filter accounts for these features. Calibrated to Mexico, the model accounts for the behavior of consumption and the trade balance for a wide range of variability and persistence of permanent shocks relative to transitory shocks. Estimation for Mexico and Canada suggests more severe informational frictions in emerging markets than in developed economies.

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1. Introduction

Learning about the "nature" of shocks plays an important role in explaining salient features of emerging market economy (EME) business cycles, namely, the higher variability of consumption relative to output and the strong countercyclicality of the trade balance. We establish this result in the context of a small open economy model in which the representative agent observes all the past and current total factor productivity (TFP) shocks and knows the stochastic properties of the distributions of trend growth and transitory components, but does not observe the realizations of the individual components. Using the available information, she forms expectations about trend growth (or permanent) and transitory (or cycle) components of TFP shocks using the Kalman filter.[1]

To reconcile the key differences between emerging and developed economy business cycles, the model features two different signals that reveal information about the permanent and transitory components of TFP. The first signal is total TFP growth and, therefore, in addition to revealing information, it determines the productivity of the economy. The second one is an additional noisy signal that reveals information about the permanent component of TFP, which is modeled as the trend growth shock plus independent and identically distributed (i.i.d.) noise. This trend growth signal allows us to vary the degree of information imperfection while keeping all other structural parameters unchanged including the parameters of the TFP process and the size of permanent and transitory shocks.

The structural estimation suggests that the accuracy of the trend growth signals for Mexico is significantly lower than that for Canada. Starting from a baseline imperfect information model for Mexico and reducing the noisiness (variance) of the trend growth signal, the model moments move closer to those of developed economies regarding variability of consumption and cyclical behavior of the trade balance. This structural analysis shows that the degree of uncertainty that

* Corresponding author. Tel.: +1 202 452 3755.
E-mail addresses: Bora.Durdu@frb.gov, ceyhunbora@gmail.com (C. Bora Durdu).

[1] Apart from the imperfect information and associated learning, our model is a canonical small open economy real business cycle (RBC) model with trend growth shocks featuring production with endogenous capital and labor, with capital adjustment costs.

0304-3932/$ - see front matter Published by Elsevier B.V.
doi:10.1016/j.jmoneco.2011.11.003

agents face while formulating expectations can help explain key differences of EME business cycles compared with developed countries.

Earlier research found that the predominance of trend growth shocks is crucial to explain salient features of emerging market business cycles. In our setup, however, two key mechanisms are sufficient for the model to generate ''permanent-like'' responses even when trend growth shocks are not predominant. First, under perfect information, in response to a positive and persistent trend growth shock, the agent reduces her labor supply due to the wealth effect while increasing her investment. When the persistence of the trend growth shock is higher than a threshold (around 0.2 in our calibration), the decline in labor supply leads to a fall in output even after capital starts to accumulate. This leads the model to generate low correlations of output with consumption and investment. Under imperfect information, when a positive, persistent trend growth shock hits, the agent only gradually realizes that the economy was hit by such a shock. This, in turn, contains the fall in hours worked, preventing a decline in output.

The second key mechanism that helps explain EME regularities is related to the TFP being modeled as *trend plus cycle*. In this case, the beliefs about the contemporaneous trend growth shock relative to the cycle shock can be higher even when the variability of the trend growth shock is lower than that of the cycle shock. Because when the agent observes a high TFP growth today, she assigns some positive probability to a negative cyclical shock that hit in the previous period and was not fully incorporated to the beliefs. A negative cyclical shock leads to a below-trend TFP growth on impact but in order for TFP to revert back to trend, it leads to above-trend TFP growth in the subsequent periods until it dies off. Since the agent takes into account such a possibility, it is optimal for her to revise her beliefs about the previous period's cyclical shock backwards in the opposite direction to the TFP growth observed in the current period.

To further elaborate the second key mechanism, let's define total TFP as $A_t \equiv e^{z_t}\Gamma_t^{\alpha}$.[2] Γ_t represents the cumulative product of growth shocks defined by $\Gamma_t = e^{g_t}\Gamma_{t-1} = \prod_{s=0}^{t} e^{g_s}$. z and g are Normal AR(1) processes. The growth rate of A can be written as $\ln(g_t^A) \equiv \ln(A_t/A_{t-1}) = \alpha g_t + z_t - z_{t-1}$. Under the imperfect information assumption, the agent optimally decomposes the signal, $\ln(g_t^A)$, into *trend growth*, g_t, and *change in the cycle*, $z_t - z_{t-1}$.[3] When updating the beliefs about the changes in the cycle,the agent finds it optimal to update her beliefs not only about the contemporaneous cycle shock but also its first lag. This backward revision has no implications for the already executed decisions in the previous period. However,it implies,for example,that in response to a positive signal,the agent may improve her beliefs about the change in cycle (that is, $z_t - z_{t-1}$) by not only improving her beliefs about the contemporaneous cycle shock (z_t) but also lowering her beliefs for its first lag (z_{t-1}). Therefore,a given upward updating of $z_t - z_{t-1}$ can be attained by improving the beliefs about contemporaneous cycle shock, z_t, by less than she would in a setting without the backward revision of z_{t-1}.[4]

The permanent component of TFP shocks captures major structural changes in the economy driven by policy regime switches such as trade or financial reforms (as in Aguiar and Gopinath, 2007). These changes are likely to have permanent effects on TFP, as opposed to business cycles that do not alter trend growth but simply are mean reverting fluctuations around a stable trend. Capturing these policy regime switches adequately requires an explicit modeling of these two components separately. In addition, Baxter and Crucini (1995) find that, in an incomplete markets environment, the effects of an international business cycle shock vary greatly depending on whether shocks are permanent or transitory. Their findings provide an additional rationale for the explicit modeling of trend-cycle decomposition as well as a reason for why the agents would want to know about this decomposition for both their economy and for foreign economies that they have financial linkages with.

The motivation for introducing a learning problem to decompose total TFP into trend and cycle relies on the uncertainty surrounding the duration of structural changes in EMEs. Once a reform takes place in an EME, agents face a high degree of uncertainty as to when and if the next government will undo the reform.[5] This view is also supported by the earlier literature on emerging market business cycles that hinged on uncertain duration of reforms, particularly in the context of exchange-rate-based stabilization programs (see, for instance, Calvo and Drazen, 1998; Mendoza and Uribe, 2000, among others). In this context, this paper underscores that the *uncertainty* regarding the duration of these structural breaks contributes significantly to the salient differences between emerging and developed economy business cycles.

Most time series data (particularly at high frequency) in EMEs are shorter than in developed economies making the informational frictions more acute. For example, the median length of quarterly gross domestic product (GDP) series available for EMEs is 96 while that in developed economies is 164 quarters (see International Financial Statistics of the International Monetary Fund (IMF)). Looking at employment, the median length for EMEs is about half of that for developed economies (44 vs 80 quarters).[6] For EMEs, series such as Emerging Markets Bond Index (EMBI) spreads start as

[2] α is labor share of output and appears in the definition of total TFP because of the labor augmenting trend shock assumption. See Section 2 for a more detailed description.

[3] Our baseline model incorporates two signals. The second signal does not play a key role in the mechanism elaborated in this paragraph.

[4] Under learning with trend plus pure noise, for example, such a backward revision does not happen.

[5] EMEs are surrounded by greater uncertainty in general and not only with regards to duration of reforms. This greater uncertainty can be due to several intertwined characteristics of these economies such as a lack of transparency, lower institutional quality, and greater political uncertainty. Acemoglu et al. (2003) and references therein document that EMEs are characterized by poorer institutional quality and greater political uncertainty compared with developed countries.

[6] In these calculations, the set of EMEs and advanced economies follow the sample choice of Aguiar and Gopinath (2007).