COUNTRY SPREADS IN EMERGING COUNTRIES: WHO DRIVES WHOM?

Martín Uribe

PRESIDENTE: Buenos días. Les damos la bienvenida en este segundo día de las Jornadas de Economía del Banco Central**,** en donde tenemos el placer de tener con nosotros a Martín Uribe quien nos va a presentar un trabajo sobre *"Country spreads in emerging countries,who drives whom?"*. Martín es un viejo vecino del Río de la Plata que ha tenido una actividad académica extensa. Actualmente tiene una posición de Profesor Titular en la Universidad de Duke. Ha sido *Assistant Professor* en Pensylvania y economista de la Reserva Federal. Ha mantenido posiciones de *Research Visitor* en NES de Estocolmo, de *Faculty Reserve Fellow* en el *Bureau of Economic Research* que actualmente mantiene y ha publicado sobre temas de Finanzas Internacionales en las revistas más destacadas: el *Journal of Political Economy*, *Journal of Economic Theory, Review of Economic Studies* y el *Journal of Monetary Economics* para mencionar algunos. Así que, sin más preámbulos, Martín va a hacer una introducción en español y después va a continuar en inglés.

MARTÍN URIBE: Muchas gracias. Es para mí un verdadero placer estar aquí en estas Jornadas. Cuando venía en el avión me puse a leer el programa de las Jornadas que había bajado de la *web* antes de salir y lo primero que me llamó la atención fueron las "dos X", Vigésimas Jornadas, y me dio a pensar que en nuestra querida y castigada Latinoamérica, donde la realidad parece indicar que la regla es la discontinuidad en los procesos de inversión, especialmente en capital humano y sobre todo en el área de ciencias, estas veinte Jornadas son un real motivo de celebración. Entonces yo humildemente extiendo las felicitaciones al Banco Central del Uruguay en general y al Departamento de Investigaciones del Banco en particular, por mantener vivo y vigente este proyecto que, a juzgar por la concurrencia y por el nivel de las sesiones de ayer, goza de muy buena salud. Así que espero no darle un resfrío con mi presentación.

Voy a cambiar al inglés ahora por razones técnicas. This paper is co-authored with Vivian Yue, who at the time of our collaboration was a student of mine at the University of Pennsylvania. My presentation has to do with this graph which shows output and country interest rates for a bunch of emerging countries.

Figure 1: Country Interest Rates and Output in Seven Emerging Countries

_____ Output   . . . . Country Interest Rate
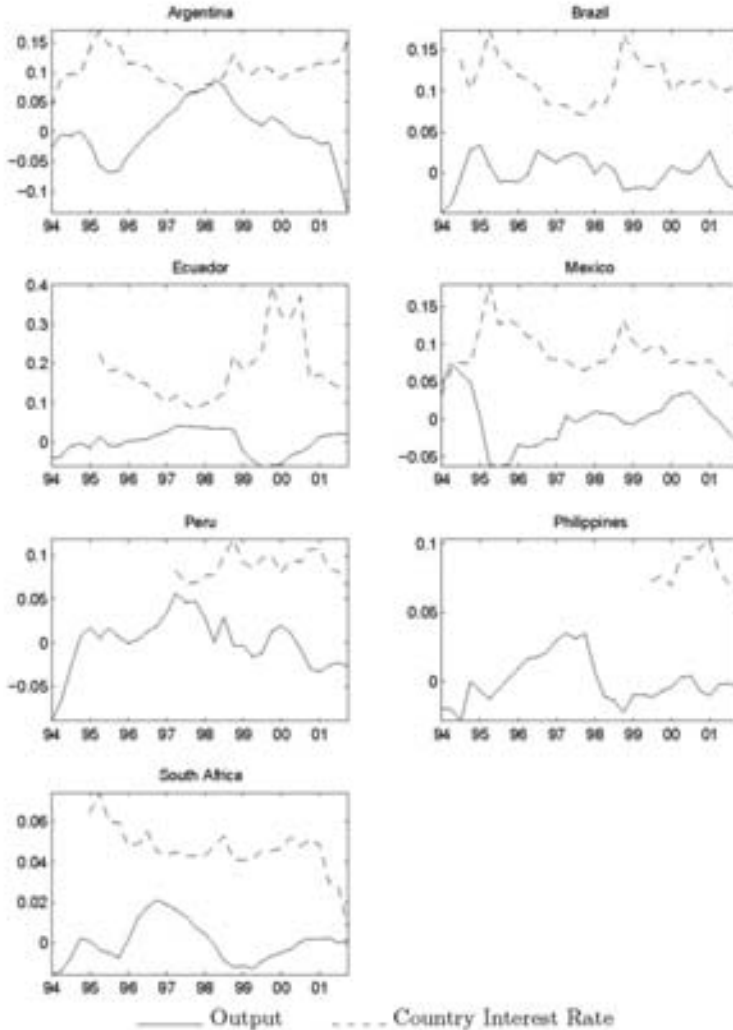
Note: Output is seasonally adjusted and detrended using a log-linear trend. Country interest rates are real yields on dollar-denominated bonds of emerging countries issued in international financial markets. Data source: output, IFS; interest rates, EMBI+.

As you know, there isn´t such a thing as a single world interest rate all emerging countries borrow at; rather, there is an interest rate that New York charges to Uruguay, an interest rates that New York charges to Argentina, and so on. So there is a country premium for each emerging country. Therefore we can talk about the country interest rate. What one sees in this graph is that for many countries output and the country interest rate are moving in opposite directions: periods of expansion are associated with low interest rates, periods of contraction are associated typically with high interest rates. This is a relationship that has been widely studied. The literature that aims at explaining this comovement between country interest rates and aggregate activity falls broadly into two groups. On the one hand there is a vast empirical literature that has documented the effect of changes in economic fundamentals in emerging countries, like output, the trade balance, etc., on country spreads. Contributors to this line of thought include Sebastian Edwards, Eichengreen and Mody, and Cantor, among others. These authors have pointed out, typically in the context of econometric models, that an increase in aggregate activity in these countries is associated with declines in country spreads. Little is done in these studies to control for the fact that exogenous components in country spreads could indeed affect domestic fundamentals.

In the other extreme of the spectrum there are papers that start with the hypothesis that country spreads and US interest rates are completely exogenous to emerging countries. Neumeyer and Perri, for instance, estimate an autoregressive process for the country spread and the world interest rate and feed the estimated process into a theoretical model. In this way these authors assess the contribution of country spreads to business-cycle fluctuations in emerging countries. They find that country spreads and US interest rates account for a large fraction of aggregate fluctuations in emerging countries. Of course the key hypothesis here is that country spreads follow an autonomous process, independent of the state of the business cycle in emerging markets.

So the question is: Do country spreads and the world interest rate drive business cycles in emerging countries, or business cycles in emerging countries drive country spreads? This is the central topic of my presentation. I will argue that this is not a question that one can answer with an econometric model alone or with a theoretical model alone. It is a question that must be addressed by analysing the data using jointly an econometric model and a spelled out theoretical model.

I will start with the empirical model, which is a VAR system of the form $Ax(t+1)=Bx(t)+e(t+1)$, where $x(t)=[y(t)\ i(t)\ tby(t)\ Rus(t)\ R(t)]$. This system has two blocks: a real block and a financial block. The real block contains variables measuring business cycle conditions in the emerging market. Specifically, this block includes three variables: output, investment, and the trade balance-to-output ratio, denoted $y(t),\ i(t),$ and $tby(t)$, respectively. The financial block is composed of two variables: the US interest rate, denoted $R^{us}(t)$ and the country interest rate, denoted $R(t)$. The vector $e(t)$ contains exogenous innovations. We estimate the *VAR* system using cross-country and time-series panel data. The sample includes seven countries, Argentina, Brazil, Ecuador, Mexico, Peru, the Philippines, and South Africa. The time period is 1994:1 to 2001:4. The frequency of the data is quarterly. The number of countries and the time horizon are both limited by data availability.

The main purpose of our study is to identify innovations to the country spread and the world interest rate. Identification is inescapably a theoretical exercise. One cannot identify an econometric model without having a theory in mind. I will provide a formal theoretical model later in my presentation. At this stage, however, I will impose that in my VAR system the matrix A be lower triangular. What does this assumption mean? It means that real variables take one period to adjust to innovations in financial variables, whereas financial variables pick up innovations to real variables contemporaneously. This assumption is motivated by Dornbusch's view that financial variables tend to move much more quickly than real variables. On the other hand, consumption plans, investment plans, employment plans may not be completely reversed in the short run in response to movements in interest rates. But they do adjust afterwards. A second identification assumption we impose is that the US interest rate follows a univariate process. That is, we assume that emerging countries do not affect interest rates in the US.

We can use the estimated VAR system to produce impulse response functions. Consider first an impulse response to a 1% increase in the country spread shock. In response to this shock, output and investment fall significantly. At the same time, the trade balance improves, which implies that domestic absorption is contracting by more than output. These responses make sense. When I say that they make sense I am implicitly using a theoretical model. At this point I am using a model I might have in my head. If you think that this picture makes sense, you are also using a model.

So what I am going to do later is to tell you what model I have in mind. I keep repeating this idea because I think it is important to recognize the role of economic theory in guiding the econometric identification of country-spread and world-interest-rate shocks---or any shock, for that matter.
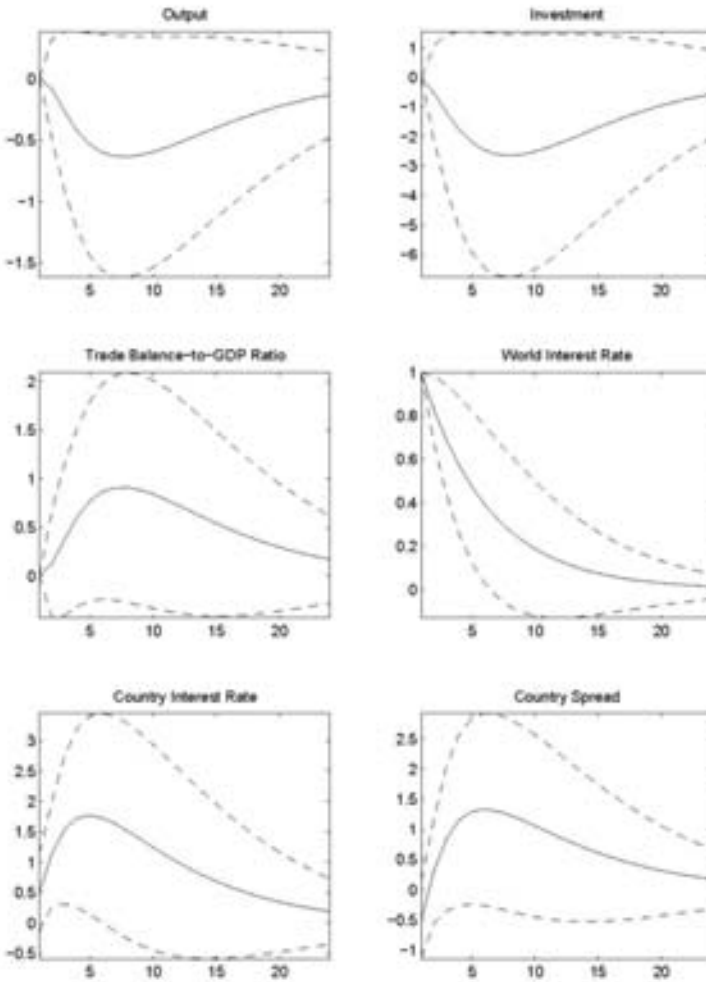
Figure 2: Impulse Response To Country-Spread Shock
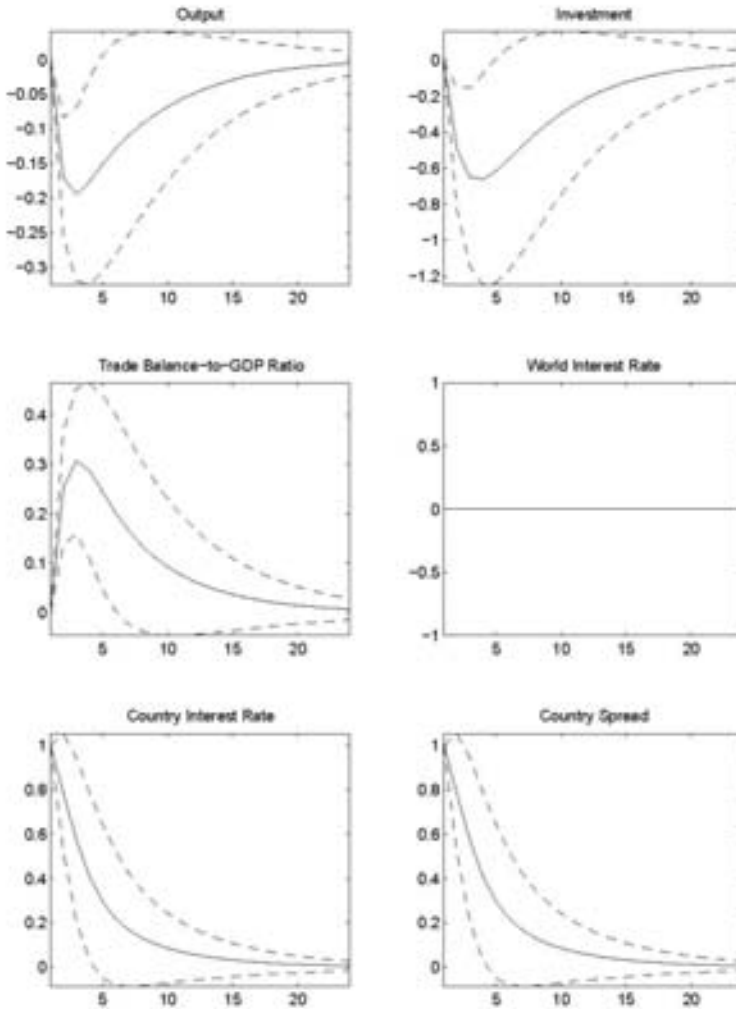
Notes: (1) Solid lines depict point estimates of impulse responses, and broken lines depict two-standard-deviation error bands. (2) The responses of Output and Investment are expressed in percent deviations from their respective log-linear trends. The responses of the Trade Balance-to-GDP ratio, the country interest rate, the US interest rate, and the country spread are expressed in percentage points. The two-standard-error bands are computed using the delta method.

Let me now show you impulse responses to US interest rate shock. The first thing that comes to your attention is that US interest rate shocks are measured with a lot of uncertainty. But if one looks at the point estimate, they look like as we would expect them to look. In response to an increase in the US interest rate, output collapses, investment falls, the trade balance improves.

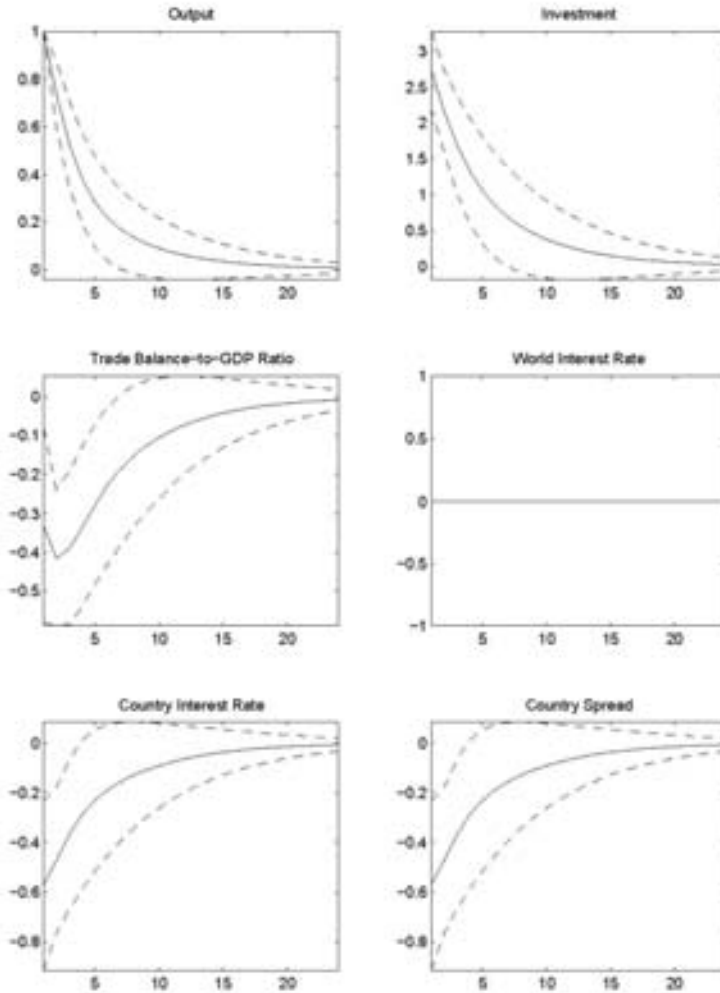Figure 3: Impulse Response To A US-Interest-Rate Shock

Notes: (1) Solid lines depict point estimates of impulse responses, and broken lines depict two-standard-deviation error bands. (2) The responses of Output and Investment are expressed in percent deviations from their respective log-linear trends. The responses of the Trade Balance-to-GDP ratio, the country interest rate, and the US interest rate are expressed in percentage points.

In response to an increase in the US interest rate, the country spread falls on impact. The existing literature has been puzzled by this effect, because one would expect country spreads to increase in response to increases in the world interest rate. The existing literature focuses on static econometric models. Our VAR analysis suggests, however, that if one looks at the dynamic effect of US interest rates on spreads, one obtains a very different picture. In effect, after the initial decline, country spreads come up with a vengeance. Five quarters after the US-interest-rate shock, the country spread is about 1% above average. That is, if the US interest rate increases by 1 percent, emerging countries face an increase in interest rates of about 2 percent after five quarters. Thus, country spreads are an important source of amplification of US interest rate shocks. We refer to the identified response of country spreads to US interest rate shocks as displaying a "delayed overshooting." This overshooting effect will play a crucial role in our story. I will argue later on that most of the effects of US interest rate shocks in emerging countries are not direct effects, but are mediated by country spreads.

Consider now the system's response to a positive output shock in the emerging country. We observe that output and investment go up, while the trade balance deteriorates. These responses look similar to those triggered by a productivity shock. More interestingly, interest rates and country spread fall significantly in response to a positive output shock in the emerging economy. Therefore, the feedback from the domestic economy into spread is sizable and significant.

Figure 4: Impulse Response To An Output Shock

Notes: (1) Solid lines depict point estimates of impulse response functions, and broken lines depict two-standard-deviation error bands. (2) The responses of Output and Investment are expressed in percent deviations from their respective log-linear trends. The responses of the Trade Balance-to-GDP ratio, the country interest rate, and the US interest rate are expressed in percentage points.

We now use the estimated VAR system to compute a variance de-composition to determine what fraction of output in emerging countries is explained by each of the two shocks that we are interested in: US interest rate shock and country-spread shocks. We find that 20% of movements in aggregate activity in emerging countries is explained by US interest rate

shocks. About 13% of movements in aggregate activity is explained by country spread shocks. So jointly US interest-rate shocks and country-spread shocks explain about a third of observed output fluctuations in emerging countries. It is a large fraction. I will argue later that of the 20% of movements in output explained by US interest-rate shocks, about 12 percentage points are mediated by the country spread. Domestic real variables, such as output, explain about 12 to 15% of movements in country spread.

Until this point, I have used intuitive arguments to claim that the impulse response functions implied by the estimated VAR system make sense. I now would like to show that those impulse response functions are sensible in terms of a fully fledged dynamic general equilibrium model of an emerging country.

The theoretical model is a familiar small open economy neoclassical model with a few modifications. One modification is the assumption that consumption decisions, investment decisions and employment decisions do not adjust contemporaneously to innovations in financial variables. In addition, we incorporate two real frictions: habit formation and capital adjustment costs. The motivation for these features is the well-known fact that in frictionless environments variables such as investment and consumption move way too much in response to shocks in the interest rate. So if one doesn't put some sand in the wheels of this model these variables go haywire. A third modification to the basic small open economy model is the assumption of a working capital constraint on factor payments. Specifically, firms must hold noninterest bearing assets to pay real wages. Under this constraint, increases in the country interest rate are equivalent to increases in wages from the firm's perspective. We impose this assumption because we want the interest rate shock to have a direct effect on output. In the absence of a working-capital constraint what happens is that in response to an increase in the world interest rate, if the country is indebted to the rest of the world, everybody feels poorer. Because they are poorer, people work harder, and thus output goes up. This would be a wrong type of implication, because in response to increases in country interest rates or the US interest rate, we observe output to fall in emerging countries. To avoid this problem we assume realistically, although a little bit ad hoc, that firms do need working capital to finance their wage payments, generally they need working capital to finance sales, exports, imports, and so on, so the

link between interest rates and the supply side of the economy is a direct one in this model.

What are going to be the driving forces in this model? We are going to go to the VAR system that I estimated at the beginning of my talk and pull from that VAR the last two equations (the financial block) and plug them into the theoretical model. Then we are going to see whether the theoretical model mimics the first block (the real block) of the VAR system.

There are four parameters that we know nothing about for these emerging countries: one is the degree of habit formation; another is the parameter determining the adjustment cost of investment; and the parameters of the working capital constraints. We estimate these parameters to give the model the best chance to fit the data.

What I would like to do now is to put the estimated impulse responses I showed at the beginning of my talk together with the impulse responses of the theoretical model. I do so in figure 5. When I first conducted this exercise, I thought the empirical and theoretical impulse response functions would be worlds apart but they turned out to fit in one page. So that gave me a lot of happiness. But then I started looking at the empirical impulse responses and of course noticed that even though it's true that the theoretical impulse responses fall most of the time within the two-standard-deviation error bands, the problem is that the error bands of the empirical impulse responses are pretty wide---particularly for US interest-rate shocks. So in some senses it is not difficult to come up with stories (models) that produce impulse responses that fall within very wide error bands. What can one do about that? The answer is: nothing. Because you have to live with the data you have. If the data you have tells you that you are measuring US interest rate shocks with a lot of uncertainties, you have to say "Too bad." So we have to wait for more data for more years and so on. With the data available, our theoretical model does pretty well, at least as measured by figure 5.

Figure 5: Theoretical and Estimated Impulse Response Functions
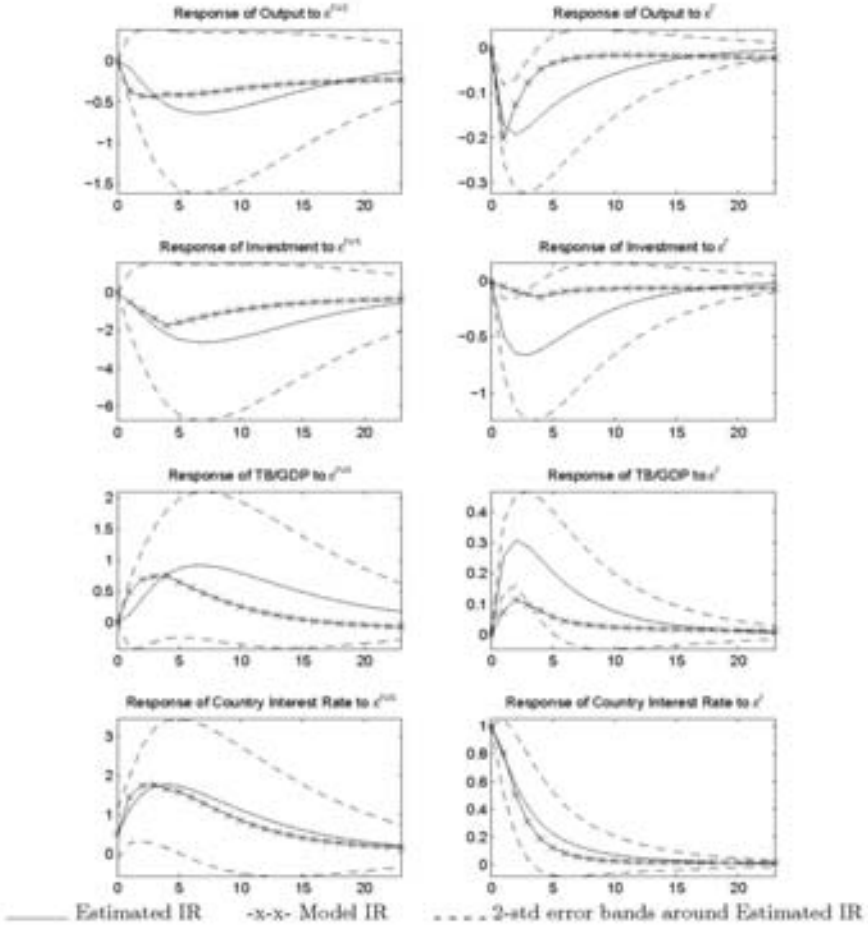
Note: The first column displays impulse responses to a US interest rate shock (ϵ^{rus}), and the second column displays impulse responses to a country-spread shock (ϵ^r).

Now that we have at hand a model that predicts well the effects of US interest-rate shocks and country-spread shocks, we can use it to run contra-factual experiments. An experiment that I find of central interest is the following: we estimated that 20% of business cycles in emerging countries are driven by US interest rate shocks. The question is, how much of that 20% variation in output due to US interest rate shock is mediated by country spread? That is to say: if country spread didn't respond directly to US interest rate, would US interest rate still be so important in driving business cycles in emerging countries? The way I am

going to address this question is as follows. I will replace the driving force of the model by one that is identical in all respects except in that the country spread will not depend directly on the US interest rate. Of course US interest rates could have an indirect effect on country spreads by affecting output, investment, and the trade balance in the emerging country. So now, if US interest rates shocks are going to have any effect on this country, this is going to be an effect that goes directly from the US interest rate, through output, investment and so on. I find that when I plug this modified driving force into the theoretical model the fraction of the variance of output in the emerging country that is explained by US interest rate falls from 20% to only 8%. Therefore, 2/3 of the variation in output due to US interest rate is mediated by the country spreads. Pushing the envelope a little bit, one is tempted to conclude that if there were something that our countries (emerging countries) could do, something related to banks supervision or financial architecture, something that would ameliorate the effect of US interest rate onto the spread that these countries are facing in financial markets, it would go a long way in reducing aggregate volatility.

I will close with an exercise that asks the following question: What if country spread did not feed from domestic variables? That is, what if output, investment and the trade balance did not have an effect on country spread. What would business cycles look in emerging countries in this case? Would these countries be more volatile or less volatile? One can answer this question by modifying the driving force of the theoretical model by setting all coefficients on domestic variables equal to zero. In this way, the country interest rate depends on its own lagged values and on current and lagged values of the US interest rate, but not on domestic variables, such as output, investment, or the trade balance. By using this modified driving process, we are wiping out any feedback from the domestic economy to country spreads. I find that feeding the theoretical model with this new driving force brings down the variance of output explained jointly by US interest rate and country spread shocks by one third. This is a big number, if one recalls that the variance of output explained jointly by country-spread and US interest-rate shocks is about 30 percent. Again, stretching the model's implications a bit, one could conclude by saying that if there was something emerging countries could do so that a recession wouldn't be reflected right away in high spreads, that would go a long way in avoiding that every recession in Latin America is a crisis.

In which direction is this work being extended? We are taking the driving process for the country spread right out of our VAR. This is ad-hoc. One would like to endogenize the determination of country spreads. There is a lot of work being done right now, as we speak, in trying to come up with models for how the country spread is formed endogenously within a theoretical framework. This line of research is extending the pioneering work of Eaton and Gersovitz. I think there is very promising work being done in this area and I am confident that in a few years we are going to learn much more about how these country spreads are formed, and that's going to give us guidance as to what kind of policies are conducive to ameliorating these exacerbation effects that my paper is identifying.