International Finance
Lecture V: Interest Rate Shocks
(USG Chapter 6)

Geneva Graduate Institute

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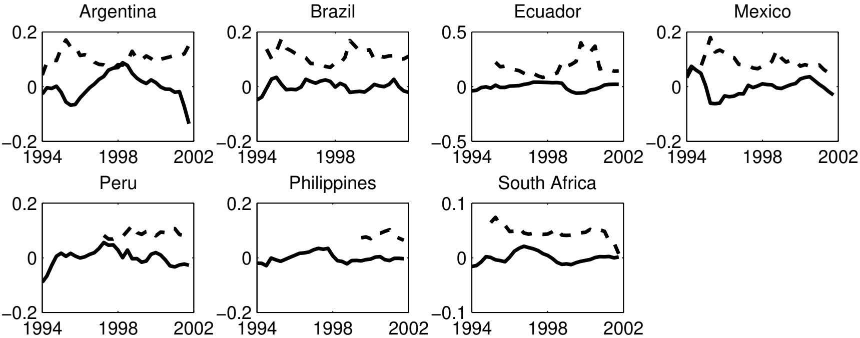
Motivation

- Business cycles in EM are correlated with interest rates faced by these countries in international capital markets
- Interest-rate shocks are generally believed to be a major source of fluctuations for emerging countries.
- The next slide displays country-specific dollar bonds interest rates and output for 7 emerging economies between 1994:Q1 and 2001:Q4.
- Why is there one interest rate per country, as opposed to just one world interest rate?
  - Each country has a different default risk, which is reflected in a country-specific interest-rate premium.
  - A commonly-used measure of country spreads is J.P. Morgan's EMBI+ bond index (Emerging Market Bond Index).
- The figure suggests that output and country interest rates are negatively correlated.
- **Primary References:** Neumeyer and Perri (JME, 2005) and Uribe and Yue (JIE, 2006).

Negative Comovement Between Interest Rates and Output



Solid lines: Output; Dashed lines: Interest rate

Correlations: Argentina -0.67; Brazil -0.51, Ecuador -0.80, Mexico -0.58, Peru -0.37, The Philippines -0.02, South Africa -0.07.

What Drives What?

- The observed negative correlation between output and the interest rate does not necessarily indicate that movements in the interest rate cause movements in output.
- Recessions could reduce ability to pay and lead to higher interest rates
- Addressing this question requires a combination of data and theory which allow identifying the *exogenous* component of country spreads.
- We will study two ways of combining data and theory:
    1. SVAR analysis: here the emphasis is in the **S**. Converting a simple VAR into an SVAR requires the imposition of identifying assumptions, which are necessarily theoretical in nature.
    2. Estimated DSGE model.
- The main difference between these two approaches is how much weight they place on data and theory. We begin with the first approach.
- So far, we abstracted from data on interest rates (all shocks were treated symmetrically as latent variables).
- Now we put interest rates at center stage

SVAR Analysis, Uribe and Yue (2006)

$$AY_t = BY_{t-1} +_t$$

$$A \begin{bmatrix} \hat{y}_t \\ \hat{\imath}_t \\ tby_t \\ \hat{R}^{us}_t \\ \hat{R}_t \end{bmatrix} = B \begin{bmatrix} \hat{y}_{t-1} \\ \hat{\imath}_{t-1} \\ tby_{t-1} \\ \hat{R}^{us}_{t-1} \\ \hat{R}_{t-1} \end{bmatrix} + \begin{bmatrix} \epsilon^y_t \\ \epsilon^i_t \\ \epsilon^{tby}_t \\ \epsilon^{rus}_t \\ \epsilon^r_t \end{bmatrix},$$

- $\hat{y}_t$=log deviation of seasonally adjusted output from a log-linear trend, $\hat{i}_t$=log deviation of investment from a log-linear trend, tby_t=trade-balance-to-GDP ratio, $\hat{R}^{us}_t$= log of U.S. gross real interest rate, and $\hat{R}_t$= log of country gross interest rate ($R_t = R^{us}_t S_t$ or, in logs, $\hat{R}_t = \hat{R}^{us}_t + \hat{S}_t$)
- Note that gross country specific interest rate and spreads are equivalent in this set up (because the model includes $\hat{R}^{us}_t$ and with logs things are additive).

Comments

- Is a linear trend a good assumption?
- Why logged interest rates?
- Why there is no measure of country debt.
  - A number of empirical studies (e.g., Edwards, 1984) pointed out that country indebtedness, as measured, for instance, by the external-debt-to-GDP ratio, plays a significant role in explaining country spreads.
  - U&Y mention that adding the external-debt-to-GDP ratio does not improve the overall fit of the model and that this variable enters insignificantly in the country-spread equation.
  - They find that substituting debt-to-GDP with the trade-balance-to-GDP ratio in the VAR system is better.
  - Intertemporal theories of current account determination predict a tight positive correlation between the trade balance and the level of external debt at least at low frequencies

Identification Assumptions, Estimation, and Sample:

$$AY_t = BY_{t-1} +_t$$

- A is lower triangular ($A(i,j) = 0\ \forall j > i$).
- R_t^{US} follows a univariate process ($A(4,j) = B(4,j) = 0\ \forall j \neq 4$).
- **Countries:** Argentina, Brazil, Ecuador, Mexico, Peru, The Philippines, South Africa.
- **Sample Period:** 1994:Q1 - 2001:Q4.
- **Estimation:** Panel data, equation by equation, using fixed effects and lagged values as instrument (Anderson and Hsiao, 1981, not the now standard GMM of AB or BB/BB).

Comments On Identification

- **A** lower triangular implies that shocks to real variables (output, investment, and the trade balance) affect the country interest rate contemporaneously, but shocks to the U.S. interest rate or to the country interest rate affect real variables with a lag.
- This makes sense, because real variables (think about starting investment projects, hiring and firing decisions, etc.) should not respond immediately but financial variables are forward looking.
- Assuming that R_t^{us} is univariate makes sense because individual emerging countries do not affect interest rates in the U.S.
- **Implications of Identifying Restrictions:**
  - ϵ_t^{rus} and ϵ_t^{r} can be interpreted as exogenous U.S.-interest-rate and country-spread shocks, respectively.
  - The identification scheme is vague about the nature of ϵ_t^{y}, ϵ_t^{i}, and ϵ_t^{tby}.
  - This is not a problem, because we try to understand the effects of interest-rate shocks.

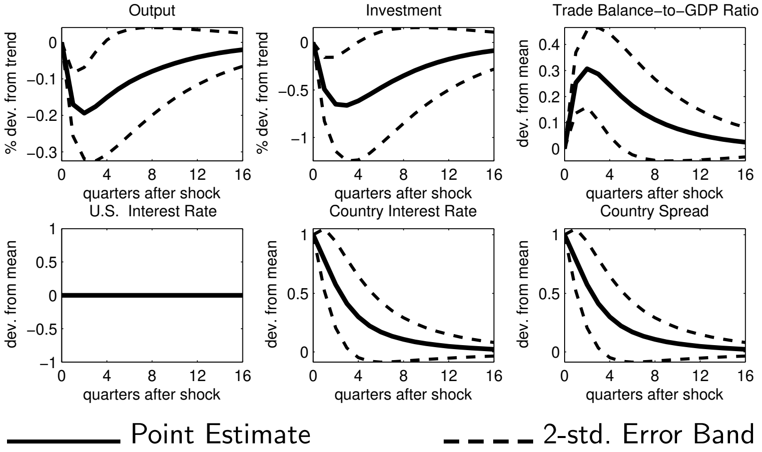
Results

Independent variable	Dependent variable				
	$\hat{y}_t$	$\hat{\imath}_t$	tby_t	$\hat{R}_t^{us}$	$\hat{R}_t$
$\hat{y}_t$	–	2.739 (10.28)	0.295 (2.18)	–	−0.791 (−3.72)
$\hat{y}_{t-1}$	.2820 (2.28)	−1.425 (−4.03)	−0.032 (−0.25)	–	0.617 (2.89)
$\hat{\imath}_t$	–	–	−0.228 (−6.89)	–	0.114 (1.74)
$\hat{\imath}_{t-1}$	0.162 (4.56)	0.537 (3.64)	0.040 (0.77)	–	−0.122 (−1.72)
tby_t	–	–	–	–	0.288 (1.86)
tby_{t-1}	0.267 (4.45)	−0.308 (−1.30)	0.317 (2.46)	–	−0.190 (−1.29)
$\hat{R}_t^{us}$	–	–	–	–	0.501 (1.55)
$\hat{R}_{t-1}^{us}$	0.0002 (0.00)	−0.269 (−0.47)	−0.063 (−0.28)	.830 (10.89)	0.355 (0.73)
$\hat{R}_{t-1}$	−0.170 (−3.93)	−0.026 (−0.21)	0.191 (3.54)	–	0.635 (4.25)
R^2	0.724	0.842	0.765	0.664	0.619
S.E.	0.018	0.043	0.019	0.007	0.031
No. of obs.	165	165	165	62	160

Note: t-statistics are shown in parenthesis. The system was estimated equation by equation. All equations except for the $\hat{R}_t^{us}$ equation were estimated using instrumental variables with panel data from Argentina, Brazil, Ecuador, Mexico, Peru, Philippines, and South Africa, over the period 1994:1 to 2001:4. The $\hat{R}_t^{us}$ equation was estimated by OLS over the period 1987:1–2002:4.

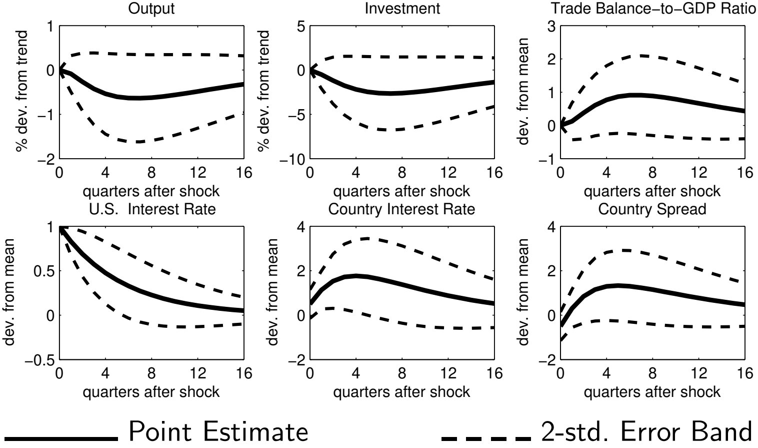
Impulse Response To a Country-Spread Shock, ϵ_t^r

Response to a 1pp increase in the country spread



Impulse Response To an U.S. Interest-Rate Shock, ϵ_t^{rus}

Response to a 1pp increase in the US rate



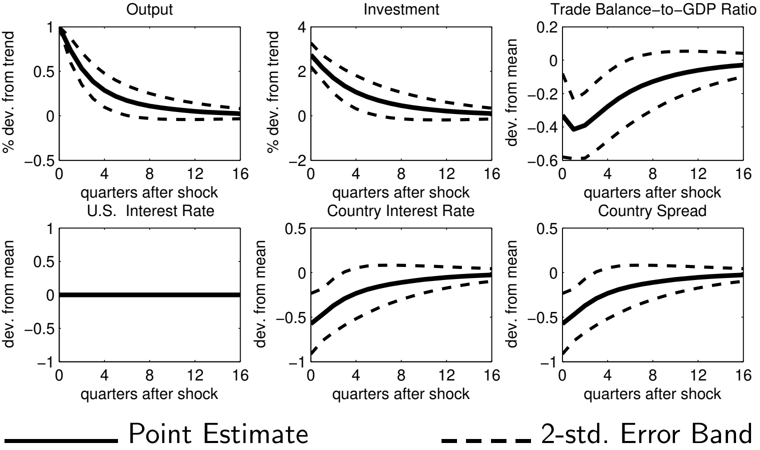
Observations on Responses to ϵ_t^r and ϵ_t^{rus}

- Country-spread and US-interest-rate shocks cause sizable contractions in output and investment and a sizable improvement in the trade-balance-to-GDP ratio
- The latter is because domestic absorption **contracts more** than output.
- Note no response of US rate to country-specific shock. This is by assumption
- The response to US-interest-rate shocks is much larger but estimated with significant uncertainty.
- The through in the output response is is twice as large under a US interest rate shock than under a country-spread shock

Observations on Responses to ϵ_t^r and ϵ_t^{rus}

- The response to US-interest-rate shocks is much larger but estimated with significant uncertainty.
  - One reason is that by design, R_t^{us} does not vary across countries.
  - Also note that σ of the US shock (0.007) is much smaller than that of the country specific shock (0.031)
- US-interest-rate shocks cause a large, **delayed** overshooting of country spreads.
- At first, the spread goes down.
- This is puzzling

Impulse Response To an Output Shock, ϵ_t^y



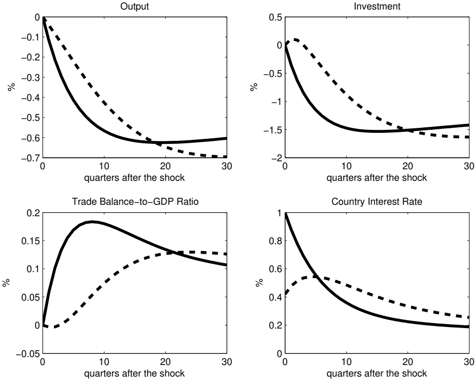
Observations on Response to ϵ_t^y

- An output shock causes expansions in output and investment, and a deterioration of the trade-balance-to-GDP ratio (the response of investment is much larger -three times larger- than that of output)
- This is like we got for a technology shock or a terms-of-trade shock in the SOE-RBC model.
- More importantly for the purpose of the present analysis, the output shock drives down the country spread, thus lowering the country's cost of borrowing. Half life of the country spread is about 5 quarters
- So, country risk is endogenous as discussed at the beginning
- Recall that the present identification scheme is vague with respect to the precise nature of ϵ_t^y.
- It could represent a mix of shocks of diverse natures, such as technology shocks, terms-of-trade shocks, etc.

Robustness To Expanding The Temporal And Country Coverage of the Data

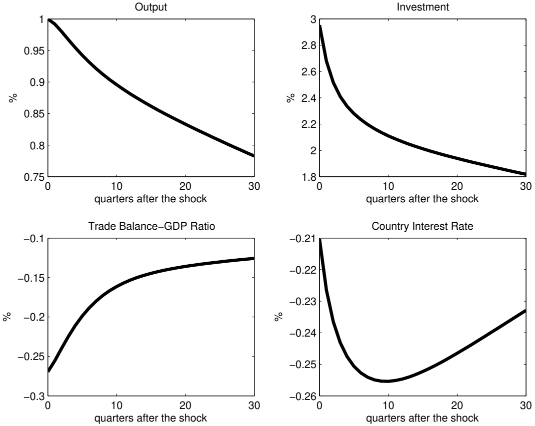
Expanded Time Span: 1994:Q1 to 2012:Q4.
Expanded Country Set: Argentina, Brazil, Bulgaria, Chile, Colombia, Ecuador, Hungary, South Korea, Malaysia, Mexico, Peru, South Africa, Thailand, Turkey, and Uruguay.

Responses to Country-Spread and U.S.-Interest-Rate Shocks: Expanded Data



1% increase in country-spread (solid) and US-int.-rate (broken). Output and investment in % dev. from trend; TB/GDP and country int. rate in percentage point dev. from mean.

Responses to an Output Shock: Expanded Data



1% output shock. Output and investment in % dev. from trend; TB/GDP and country int. rate in percentage point dev. from mean.

Observations on Robustness Analysis

- The baseline empirical results are somewhat robust to extending the temporal and cross-sectional dimensions of the panel
  - We still get that an increases in the U.S.-interest-rate and country-spread cause contractions in output and investment.
  - However, magnitude is reversed
  - We still get that an increases in the U.S.-interest-rate and country-spread cause an improvement in the trade-balance-to-GDP ratio (or, equivalently, a proportionally larger contraction in domestic absorption than in output).
  - U.S.-interest-rate shocks cause a delayed increase in country spreads.
  - Output shocks cause an expansion in investment, a deterioration of the trade-balance-to-GDP ratio, and, more importantly, a fall in country spreads.

Decomposition of Forecast-Error Variances

An alternative way to assess the relative importance of alternative shocks is to decompose the variance of the forecast error. Recall that the SVAR can be written as

$$Ax_{t+h} = Bx_{t+h-1} + \epsilon_{t+h}$$

And its MA(∞) representation is given by

$$x_{t+h} = \sum_{j=0}^{\infty} C_j \epsilon_{t+h-j}, \text{ with } C_j \equiv \left(A^{-1}B\right)^j A^{-1}$$

The forecast of x_{t+h} in t is

$$E_t x_{t+h} = \sum_{j=h}^{\infty} C_j \epsilon_{t+h-j}$$

And the associated forecast error, denoted $FE_t^h \equiv x_{t+h} - E_t x_{t+h}$, is

$$FE_t^h = \sum_{j=0}^{\infty} C_j \epsilon_{t+h-j} - \sum_{j=h}^{\infty} C_j \epsilon_{t+h-j} = \sum_{j=0}^{h-1} C_j \epsilon_{t+h-j}$$

With $x_t \equiv [\widehat{y}_t\ \widehat{i}_t\ tby_t\ \widehat{R}_t^{us}\ \widehat{R}_t]'$.

Decomposition of Forecast-Error Variances

Then, the forecast-error variance at horizon h, denoted FEV^h, is

$$FEV^h = \sum_{j=0}^{h-1} C_j \Sigma_\epsilon C_j', \text{ where } \Sigma_\epsilon \equiv E[\epsilon_t \epsilon_t']$$

The forecast-error variance attributable to shock i (the i-th element of ϵ_t), denoted $FEV^{h,i}$, is

$$FEV^{h,i} = \sum_{j=0}^{h-1} (C_j \Lambda_i) \Sigma_\epsilon (C_j \Lambda_i)',$$

where Λ_i is a square conformable matrix with all zeros except for diagonal element (i, i) which equals unity.

Decomposition of Forecast-Error Variances

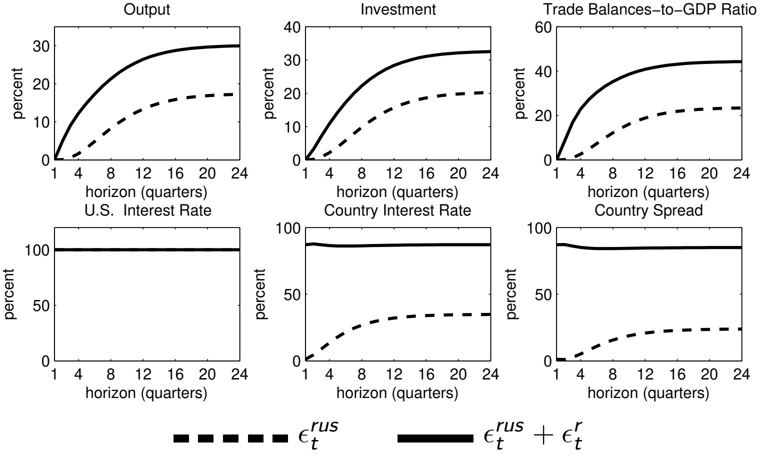
The share of forecast-error variance of variable k (i.e. k-th element of x_t) at horizon h attributable to shock i, denoted $SFEV_k^{h,i}$, is given by

$$SFEV_k^{h,i} = \frac{FEV_{kk}^{h,i}}{FEV_{kk}^{h}},$$

Where kk denotes the k-th diagonal element. This is called a forecast-error variance decomposition (FEVD).

As the horizon become large, $h \to \infty$, the forecast-error variance of variable k due to shock i converges to the unconditional variance of k due to i.

Estimated Forecast-Error Variance Decomposition



Observations on the Forecast-Error Variance Decompositions

- Associate business cycle fluctuations with the variance of the of the forecast error at at a horizon of about 20 quarters (or 5 years)
  - This is an intermediate choice as business cycle is normally defined as movements in time series at frequencies ranging between 6 and 32 quarters
- At $h = 20$ country-spread and US-interest-rate shocks (ϵ_t^r and ϵ_t^{rus}) explain:
  - 30% of movements in output (17% US rate 13% domestic rate).
  - 32% of movements in investment (20% US rate 12% domestic rate)..
  - 44% of movements in the trade-balance-to-GDP ratio (23% US rate 21% domestic rate)..
  - 85% of movements in country-spreads (24% US rate 61% domestic rate).

Alternative Identification Scheme:

- Remember that FEVD requires an identification scheme (like IRFs)
- Why Not Place the Country Spread First in the SVAR System?
- **SVAR Prediction Under This Specification:**
  - Output and investment expand in response to an increase in the U.S. interest rate.
- **Problematic:**
  It's difficult to rationalize this implication on theoretical grounds.

DSGE Analysis: Motivation

- In order to identify the SVAR we imposed some lose restrictions on the matrix **A**
- Are these restrictions **plausible**?
- Does the propagation mechanism of interest rate shocks (ϵ_t^{rus} and ϵ_t^{r}) implied by the estimated SVAR model concur with the one implied by an optimizing DSGE open economy model?
- If so, the identified interest-rate shocks would be more compelling since the effects they generate would be consistent with the optimizing behavior of households and firms.
- **Strategy:**
    1. Build a DSGE model of the open economy.
    2. Estimate the deep structural parameters of the model
    3. Feed the model with the estimated processes for R_t^{us} and R_t (the last 2 equations of the SVAR).
    4. Compare the impulse responses predicted by the SVAR and DSGE models.

The Theoretical Model (Uribe and Yue, 2006)

Open economy model with frictions:

- Departures WRT canonical SOE-RBC
  1. HHs make consumption and labor supply decisions before observing the interest rate shocks. Thus these shocks have allocative effects with one period lag. This assumption is consistent with the hypothesis that it takes one period for financial shocks to affet real variables
  2. External habit formation (keeping up with the Joneses). This assumptions allows to limit consumption contractions in response to external financial shocks.
  3. Gestation lags in addition to adjustment costs in investment. This prevents excessive investment volatility
  4. Working-capital constraint on firms (as in the last model we saw). This constraint introduces a direct supply side effect of changes in the cost of borrowing

Firms and Working Capital Constraints

$$\max F(k_t, h_t) - u_t k_t - w_t h_t \left[1 + \frac{\eta(R_t^d - 1)}{R_t^d}\right]$$

where $F(\cdot, \cdot)$ is a production function, $h_t =$labor, $k_t =$capital, $w_t =$wage rate, $u_t =$ rental cost of capital, and $R_t^d =$gross interest rate.

The parameter η governs the strength of the working-capital constraint.

The implied demand for labor is

$$F_h(k_t, h_t) = w_t \left[1 + \eta \left(\frac{R_t^d - 1}{R_t^d}\right)\right]$$

The working-capital constraint is a financial friction that allows for a supply-side effect of interest rate shocks.

If $\eta > 0$, an increase in the interest rate increases the (financial) cost of labor, inducing a contraction in labor demand.

Capital Accumulation: Gestation Lags and Convex Adjustment Costs

$$i_t = \frac{1}{4}\sum_{i=0}^{3} s_{it}.$$

$$s_{i+1t+1} = s_{it}, \quad i = 0, 1, 2$$

So, $s_{2t+1} = s_{1t}$ (this is the gestation lag)

$$k_{t+1} = (1-\delta)k_t + k_t\Phi\left(\frac{s_{3t}}{k_t}\right)$$

where i_t=investment, s_{it}=number of investment projects started in period $t-i$, for $i = 0, 1, 2, 3$ (4-period gestation lag); k_t=capital stock. Function $\Phi(\cdot)$ captures convex adjustment costs (note that $\Phi(\cdot)$ must be concave). UY also assume that $\Phi(\delta) = \delta$ and $\Phi'(\delta) = 1$. These last two assumptions assure that there are no adjustment costs in steady state

Households and Habit Formation

$$\max E_0 \sum_{t=0}^{\infty} \beta^t\, U(c_t - \mu \tilde{c}_{t-1}, h_t),$$

($\tilde{c}_{t-1}$ is the cross-sectional average level of consumption in period $t-1$ this is the KUWTJ effect) subject to

$$d_t = R_{t-1} d_{t-1} - w_t h_t - u_t k_t + c_t + i_t + \Psi(d_t)$$

$$\lim_{j \to \infty} E_t \frac{d_{t+j+1}}{\prod_{s=0}^{j} R_{t+s}} \leq 0$$

* HHs choose consumption, investment and labor supply one period in advance. They take profit as given and have access to 2 types of assets: Physical capital and one-period bonds. All physical capital is domestically held
* The function $\Psi(d_t)$ is convex; it introduces portfolio adjustment costs and gives rise to an effective interest rate, R_t^d, satisfying

$$R_t^d = \frac{R_t}{1 - \Psi'(d_t)}.$$

Maximization problem and FOC

- This is standard but kind of messy (you can find everything in on page 203 of the textbook)
- One important thing is that given our assumption on the timing, the values of c_{t+1}, h_{t+1}, and s_{0t+1} are all driven by the information set of period t
- Given that consumption cannot react to unanticipated changes in wealth, the marginal utility of wealth will generally be different from the marginal utility of consumption.
- Moreover, when people wake up and see that their neighbors are richer, they want to consume more to catch up with them (and this increases the marginal utility of consumption)

Driving Forces

- Uribe and Yue (2006) assess the plausibility of the identified US interest rate shock and country spread shock by feeding in the model the estimated law of motion of these interst rates. They do this using the estimates of their VAR for $\hat{R}$ and $\hat{R}^{US}$
- One cool thing of their limited information method is that they only need to feed the model with the shocks that they are interested in.

$$\begin{aligned}
\hat{R}_t &= 0.63\hat{R}_{t-1} + 0.50\hat{R}^{us}_t + 0.35\hat{R}^{us}_{t-1} - 0.79\hat{y}_t \\
&+ 0.61\hat{y}_{t-1} + 0.11\hat{\imath}_t - 0.12\hat{\imath}_{t-1} + 0.29tby_t \\
&- 0.19tby_{t-1} + \epsilon^r_t,
\end{aligned}$$

$$\hat{R}^{us}_t = 0.83\hat{R}^{us}_{t-1} + \epsilon^{rus}_t,$$

where ϵ^r_t and ϵ^{rus}_t are mean-zero, iid, innovations with standard deviations equal to 0.031 and 0.007, respectively.

Evaluating the model

- To evaluate the model, we need
  - Functional forms
  - Parametrize the model
  - Uribe and Yue use a paramerization that combines calibration and econometric estimation
  - The model has 10 parametres.
  - 6 are calibrated with knowledge external to the model
  - 4 are estimated by minimizing the distance between the model's IRFs and the estimated IRFs

Functional Forms

$$U(c - \mu\tilde{c}, h) = \frac{\left[c - \mu\tilde{c}_{t-1} - \omega^{-1}h^{\omega}\right]^{1-\gamma} - 1}{1-\gamma}$$

note the habit formation & KUWTJ effect (also note that in equilibrium $c_t = \tilde{c}_t$)

$$F(k, h) = k^{\alpha}h^{1-\alpha}$$

$$\Phi(x) = \frac{s_{3t}}{k_t} - \frac{\phi}{2}(\frac{s_{3t}}{k_t} - \delta)^2; \quad \phi > 0$$

$$\Psi(d) = \frac{\psi}{2}(d - \bar{d})^2$$

Calibrated Parameters (Quarterly)

$$\omega = 1.45$$

$$\gamma = 2$$

$$\alpha = 0.32$$

$$R = \beta^{-1} = 1.0277$$

$$\delta = 0.025$$

$$\frac{tb}{y} = 0.02$$

Note that these parameters imply a value of $\bar{d}$ of 19%
Note that the steady state interest rate faced by the country is set at 11% per year (2.77% per quarter). This is given by 4% US rate and 7% spread

Estimating ϕ, ψ, η, and μ

- **Criterion:** Minimize the distance between empirical and theoretical impulse response functions.
- Match the the first 24 quarters of the IRF of 4 vars (output, investment, trade balance, and country interest rate) to two shocks (US rate and country-spread)
- Hence 4 paramaters are picked to match 185 points (4*2*24-7)
- 7 observation are lost because the impact the impact effect of the US rate and the country spread on output, investment, and trade balance are zero by construction and the impact of the country spread on itself is unity.

Estimating ϕ, ψ, η, and μ

Criterion: Minimize the distance between empirical and theoretical impulse response functions. Formally, ϕ, ψ, η, and μ are set so as to minimize

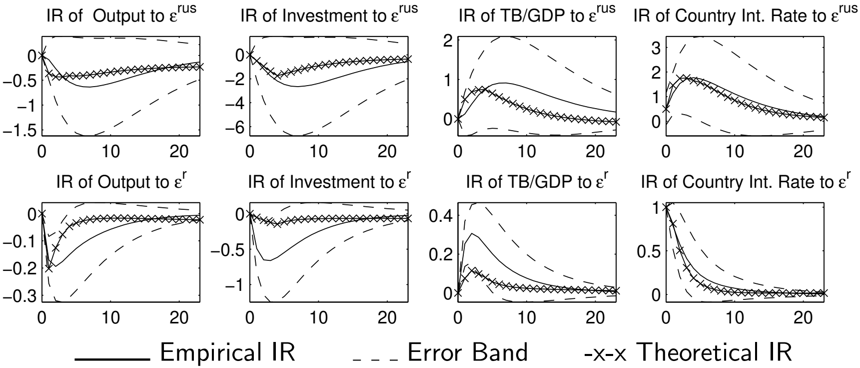
$$[IR^e - IR^m(\psi, \phi, \eta, \mu)]' \Sigma_{IR^e}^{-1} [IR^e - IR^m(\psi, \phi, \eta, \mu)],$$

- $\Sigma_{IR^e}^{-1}$ is a diagonal matrix containing the variance of the empirical IRFs alongside its diagonal.
- This matrix penalizes the associated IRFs with a large confidence interval.

Result of estimation:

* Portfolio adjustment costs are small $\psi = 0.00042$
* Capital adjustment costs are significant $\phi = 72.8$
* Working capital is abour 3.6 months of wage payments $\eta = 1.20$
* Habit formation is lower than what used in closed economies models $\mu = 0.20$

Theoretical and Estimated Impulse Response Functions



Observations on the Theoretical Impulse Responses

- The theoretical model replicates well a number of key features of the estimated IRFs:
  - Output and investment contract in response to an increase in ϵ_t^{rus} or ϵ_t^{r}.
  - The trade balance improves in response to an increase in ϵ_t^{rus} or ϵ_t^{r}.
  - The country interest rate, R_t, displays a hump-shaped response to an increase in ϵ_t^{rus}.
- These findings suggest that the identification assumptions imposed in the SVAR analysis are successful (**plausible**) in isolating U.S.-interest-rate and country-spread shocks.

Conditional Standard Deviations Implied by the SVAR and Theoretical Models

- Another way to assess the plausibility of the SVAR restrictions is to see if the tehoretical model can match the conditional standard deviation of the endogenous variables due to shocks to the two interest rates
- This is related to the IRF because the conditional variance of any variable is given by the sum of its squared impulse response to the shock scaled by the variance of the shock
- The table shows the SD conditional on US rate and country sperad shocks implied by the SVAR and theoretical model
- The last column shows the unconditional volatilities implied by the SVAR. SOE model implies that ϵ_t^{rus} and ϵ_t^{r} jointly explain 32 percent of fluctuations in output $((1.6^2 + 1.3^2)/3.7^2 = 0.32)$, almost same as SVAR $((1.5^2 + 1.3^2)/3.7^2 = 0.30)$.

	ϵ_t^{rus}		ϵ_t^{r}		Unconditional
Variable	SVAR	Theory	SVAR	Theory	SVAR
$\widehat{y}$	1.5	1.6	1.3	1.3	3.7
$\widehat{\imath}$	6.4	3.6	5.0	2.0	14.2
tby	2.1	1.6	2.0	0.9	4.4
$\widehat{R}^{us}$	1.3	1.3	0	0	1.3
$\widehat{R}$	3.8	3.5	4.7	4.4	6.5

Observations on Conditional Volatilities

- SOE model does well at capturing the importance of US-interest-rate and country-spread shocks in explaining movements in output and country interest rates.
- The SOE model does a good job at accounting for variations in the trade balance due to US-interest-rate shocks.
- But the SOE model underpredicts the volatilities of investment and the trade balance caused by country-spread shocks.
    - But SOE model assigns less importance to ϵ_t^{rus} and ϵ_t^{r} in accounting for variations in i_t and tby_t than does the SVAR
    - i_t Model $(3.6^2 + 2^2)/14.2^2 = 0.08$, SVAR $(6.4^2 + 5^2)/14.2^2 = 0.33$
    - tby_t Model $(1.6^2 + 0.9^2)/4.4^2 = 0.17$, SVAR $(2.1^2 + 2^2)/4.4^2 = 0.43$
- Overall, identified ϵ_t^{rus} and ϵ_t^{r} shocks are sensible and economically important.

Shocks to Global Risk Premia

- Global risk premia move more than the US rate.
- What is the effect of movements in global risk premia on real and financial variables in emerging economies?
- Akinci (2013) expands the SVAR studied above to include the spread between the U.S. Baa corporate bond rate and the 20-year U.S. Treasury bond yield.
- Baa corporate bonds carry a medium degree of default risk: 13% cumulative default risk over 20 years, compared with less than 1% for Aaa rated bonds (highest rating by Moody's) and more than 70% for C rated bonds (lowest rating).

The Augmented SVAR

$$A \begin{bmatrix} \widehat{y}_t \\ \widehat{\imath}_t \\ tby_t \\ \widehat{R}^{us}_t \\ \widehat{S}^{us}_t \\ \widehat{R}_t \end{bmatrix} = B(L) \begin{bmatrix} \widehat{y}_{t-1} \\ \widehat{\imath}_{t-1} \\ tby_{t-1} \\ \widehat{R}^{us}_{t-1} \\ \widehat{S}^{us}_{t-1} \\ \widehat{R}_{t-1} \end{bmatrix} + \begin{bmatrix} \epsilon^y_t \\ \epsilon^i_t \\ \epsilon^{tby}_t \\ \epsilon^{rus}_t \\ \epsilon^{sus}_t \\ \epsilon^r_t \end{bmatrix},$$

S^{us}_t = U.S. corporate bond spread.
Identification: same as Uribe and Yue (2006). Pair $[R^{us}_t \; S^{us}_t]'$ follows bivariate process.
$\Rightarrow \epsilon^{sus}_t$ can be interpreted as an innovation to the U.S. risk premium.
Same interpretation as before for other innovations.
Countries: Argentina, Brazil, Mexico, Peru, South Africa, Turkey.
Sample: 1994:Q1 to 2011:Q3.

Responses to US risk premium (look at country spread)

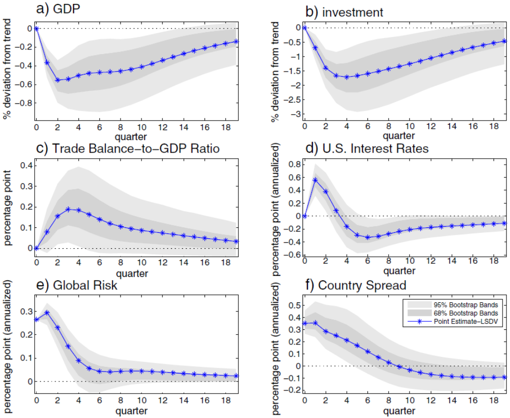
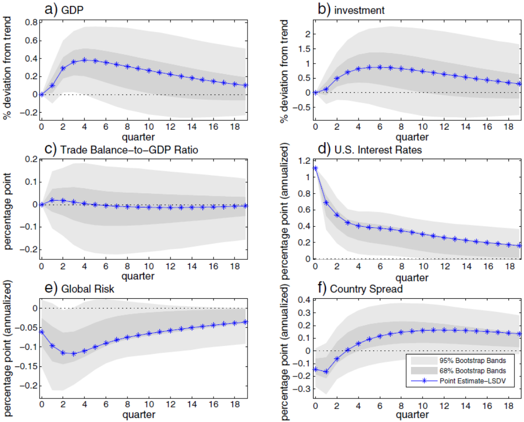


Fig. 3. Impulse response to a one standard deviation shock to the global financial risk. Notes: solid lines with stars show point estimates of impulse responses; and 68% and 95% confidence bands are depicted with dark-gray and light-gray shaded areas, respectively. The responses of output and investment are expressed in percent deviation from their respective log-linear trends. The response of the trade balance-to-output ratio, the country spread, the U.S. interest rate and the global financial risk are expressed in (annualized) percentage points. Bootstrap confidence bands are based on 10,000 repetitions. The U.S. BAA corporate spread is used as a proxy for the global financial risk.

Responses to US rate (look at country spread)



l. Impulse response to a one standard deviation shock to the U.S. real interest rate. Notes: solid lines with stars show point estimates of impulse responses; and 68% and 95% confidence
s are depicted with dark-gray and light-gray shaded areas, respectively. The responses of output and investment are expressed in percent deviation from their respective log-linear
ls. The response of the trade balance-to-output ratio, the country spread, the U.S. interest rate and the global financial risk are expressed in (annualized) percentage points. Bootstrap

Predictions of SVAR with Global Risk Premium Shocks

- Interest rate shocks, i.e., $[\epsilon_t^{rus}\ \epsilon_t^{sus}\ \epsilon_t^{r}]$, jointly explain 42% of the variance of output $\Rightarrow$ reinforces the result obtained by Uribe and Yue (2006).
- The global risk-premium shock takes over the role previously played by the U.S. interest rate: ϵ_t^{sus} explains 18% of the variance of output whereas ϵ_t^{rus} explains only 6%.
- The country spread shock, ϵ_t^{r}, continues to be an important driver of aggregate fluctuations in emerging countries, accounting for 18% of the observed variance of output.
- Effects of global risk-premium shocks is mediated by the country premium: a 1 percentage point increase in ϵ_t^{sus} raises the country premium by 1.3 percentage points.

Chapter Summary

- Interest-rate shocks represent an important driver of business cycles in emerging countries, accounting for 30 to 42 percent of the variance of output.
- Of the 30 to 42 percent of output variance explained by interest rate shocks, half is due to a global component (U.S.-interest-rate shocks and U.S.-risk-premium shocks) and the other half is due to country-specific spread shocks.
- In response to an increase in the interest rate, output and investment contract and the trade balance improves.
- An increase in the U.S. interest rate or in the U.S. risk premium produces an overshooting in country spreads, that is, the country spread increases by more than one for one.
- The majority of movements in country spreads (more than 60 percent) is explained by country spread shocks.