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Do Dollar-Denominated Emerging Market Corporate Bonds Insure Foreign Exchange Risk?

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Dollar Denominated Debt

- 85% of emerging market debt as of December, 2010 denominated in developed market currencies (BIS)
- Why do investors buy dollar-denominated emerging market debt?

EMD is broadly divided in two categories:

- *External or "hard currency" debt denominated primarily in U.S. dollars and Euros*
- *Local or "soft currency" debt denominated in the local currency of the issuer ...*

For U.S. based investors, the key difference is foreign currency risk where local currency debt (if unhedged) exposes investors to currency fluctuations.[1]

[1] From "Emerging Markets Debt: An Evolving Opportunity Set", by Steve Lee, Morgan Stanley Consulting Group Research Paper, June 13, 2011 14 (7).

- The corporate finance literature has long noted that issuing in foreign currency affects default risk
- Krugman (1999) discusses this point
  - Local currency depreciates relative to major currency $\Rightarrow$
  - Domestic currency value of major currency liabilities increase $\Rightarrow$
  - Default boundary in the sense of Merton (1973) moves rightward $\Rightarrow$
  - Increased probability of default

  meanwhile ...
  - Local currency revenues fall $\Rightarrow$
  - Ability to convert revenues into appreciated dollars falls and
  - Value of assets falls $\Rightarrow$
  - Feedback effect into increased probability of default
- Focus of corporate finance literature is on why firms issue (too much) dollar debt in the first place
  - Caballero and Krishnamurthy (2003)
  - Korinek (2011)

- The literature has largely ignored *investors*' motives for purchasing this debt
  - Calvo and Guidotti (1990): Governments have incentive to devalue currency to reduce real value of debt
  - Caballero and Krishnamurthy (2003): Hard to extend this argument to corporations and low inflation countries
- We cannot find explanations beyond currency risk hedging, but
- Given balance sheet risk this suggests investors are trading currency risk for default risk
- Questions to be addressed
  - Does currency risk affect default risk?
  - What is the magnitude of this effect?
  - Is this risk priced in bonds?

- Reduced-form credit risk model [Duffee and Singleton (1999)]:

$$P(t,T) = E_t^Q\left[e^{-\int_t^T R_s ds}\right]$$
$$R_t = r_t + (1-\delta)\,\lambda_{d,t}$$

- For parsimony, assume a two-factor risk-free term structure,

$$r_t = a_f + s_{1,t} + s_{2,t},$$
$$d\mathbf{s}_t = \mathbf{K}\left(\mathbf{\Theta} - \mathbf{s}_t\right)dt + \mathbf{\Sigma}\sqrt{\mathbf{S}_t}\,d\mathbf{W}_t^P$$

- We know from Duffie and Kan (1999) that yields are exponentially affine,

$$\ln Y(s_t, t, T) = a_f + \frac{1}{T-t}\left(A(t,T) + \mathbf{B}'(t,T)\,\mathbf{s}_t\right)$$

and from Cox, Ingersoll, and Ross (1985) we know the solution for $A(\cdot)$ and $B(\cdot)$

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- The instantaneous yield spread is given by

$$\begin{aligned} R_t - r_t &= (1-\delta)\,\lambda_{d,t} \\ &= a_d + h_{d,t} + \beta'(\mathbf{s} - \bar{\mathbf{s}}) \end{aligned}$$

where the dynamics of the hazard rate are square root,

$$dh_{d,t} = \kappa_d\left(\theta_d - h_{d,t}\right)dt + \sigma_d\sqrt{h_{d,t}}\,dW_{d,t}^{P}$$

- The bond yield spread will also be exponentially affine,

$$\ln Y_d\left(s_t, h_t, t, T\right) - \ln Y\left(s_t, t, T\right) = A_d\left(t, T\right) + B_d\left(t, T\right)h_{d,t}$$

where the solutions for $A(\cdot)$ and $B(\cdot)$ will again be of the CIR form

Estimation

- We estimate the model using the extended Kalman filter
  - Risk free term structure parameters are estimated, then
  - Risky term structure parameters
    - Difficult to jointly estimate risk-free and risky for all bonds in our sample
    - Same procedure as Duffee (1999)
  - Coupon bond prices are sum of prices of coupon plus principal "STRIPS"
- Data
  - Risk free rates
    - Daily data on 3-month, 6-month, 1-year, 2-year, 5-year, 7-year, and 20-year maturities from Federal Reserve H.15
    - Sampled over January 3, 1994 through September 28, 2010 (4,190 observations)
  - Risky bonds
    - Prices from Datastream
    - Non-callable fixed-coupon debentures
    - 75% of price changes non-zero and 250+ trading days
    - 86 bonds in Brazil, Chile, Mexico, Russia, Singapore, and South Korea

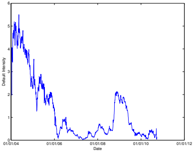
Summary Statistics (Table 2)

Country	BR	CL	MX	RS	SG	SK
Bonds	12	14	11	17	13	19
Companies	7	8	3	8	5	8
Avg. Coupon	8.28	7.00	5.68	8.28	6.09	5.84
Min. Coupon	6.25	5.13	4.75	5.67	5.00	4.25
Max. Coupon	10.50	8.63	6.63	10.00	7.38	8.75
Avg. Maturity	12.96	15.64	13.47	7.00	11.70	8.47
Min. Maturity	5.00	9.50	5.00	5.00	5.00	5.00
Max. Maturity	30.00	30.00	30.00	10.00	30.00	20.00
Mean Average Yield	8.16	6.26	5.64	8.86	5.53	5.71
Std. Average Yield	1.73	0.73	0.71	3.69	1.06	1.26
Min. Average Yield	5.55	4.95	3.67	4.93	2.59	3.03
Max. Average Yield	15.32	8.68	8.30	28.00	9.78	10.61
First Observation	1/14/04	12/28/00	1/7/05	4/16/04	11/19/01	7/24/01

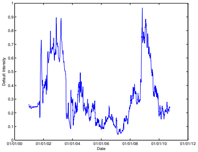
Risky Bond Pricing (Table 4)

Country	Risk Price Pct. 25	Risk Price Pct. 50	Risk Price Pct. 75	Pricing Err. Pct. 25	Pricing Err. Pct. 50	Pricing Err. Pct. 75
Brazil	-2.477	-1.645	-1.282	15.710	32.415	38.945
Chile	-1.924	-1.307	-0.504	11.070	14.110	22.510
Mexico	-1.890	-1.270	-0.284	8.510	11.600	15.140
Russia	-2.671	-1.879	-1.250	37.740	50.920	66.530
Singapore	-2.443	-1.241	-0.955	9.780	11.120	19.440
S. Korea	-1.618	-1.147	-0.494	13.390	17.760	24.710

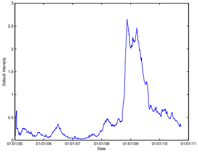
Duffee (1999): Median price of risk and RMSE for Baa bonds: -0.307 and 9.76



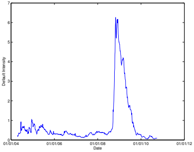
(a) Brazil



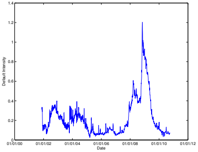
(b) Chile



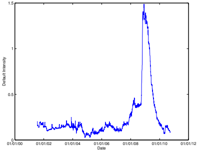
(c) Mexico



(d) Russia

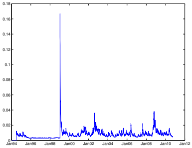


(e) Singapore

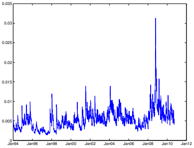


(f) S. Korea

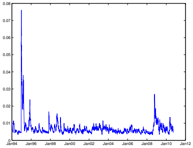
MA(1)/EGARCH(1,1)



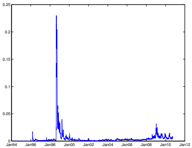
(a) Brazil



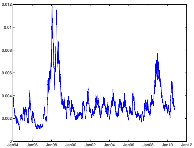
(b) Chile



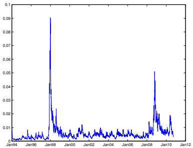
(c) Mexico



(d) Russia



(e) Singapore



(f) S. Korea

Default Intensity and Volatility (Table 5)

Country	Stat.	Level	Vol.	R^2
All Countries	Coeff.	-0.013	6.591	0.351
	% 5% Sig.	15.9	95.5	
Brazil	Coeff.	0.032	4.862	0.367
	% 5% Sig.	7.7	92.3	
Chile	Coeff.	-0.084	2.145	0.216
	% 5% Sig.	57.1	92.9	
Mexico	Coeff.	-0.011	4.001	0.208
	% 5% Sig.	0.0	91.7	
Russia	Coeff.	0.264	5.644	0.303
	% 5% Sig.	0.0	94.1	
Singapore	Coeff.	15.012	0.567	0.567
	% 5% Sig.	0.0	100.0	
S. Korea	Coeff.	-0.238	7.661	0.427
	% 5% Sig.	26.3	100.0	

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- We augment the original instantaneous spread by an exchange rate volatility component,

$$R_t - r_t = a_d + h_{d,t} + \beta_3 \sigma_{fx,t}$$

where

$$d\sigma^2_{fx,t} = \kappa_3 \left(\theta_\sigma - \sigma^2_{fx,t}\right) dt + \sigma_\sigma \sqrt{\sigma^2_{fx,t}} dW^P_{\sigma,t}$$

and adds an additional affine term into the yield specification,

$$Y\left(\mathbf{s}_t, h_{d,t}, \sigma_{fx,t}, t, T\right) - Y\left(\mathbf{s}_t, h_{d,t}, t, T\right) = A_\sigma\left(t, T\right) + B_\sigma\left(t, T\right)\sigma^2_{fx,t}$$

The coefficients again follow Cox, Ingersoll, Ross (1985)

- We re-estimate the model via extended Kalman filter

Incorporating Exchange Rate Risk (Table 6)

	Risk Price Pct.			β_3 Pct.			Pricing Err. Pct.		
Country	25	50	75	25	50	75	25	50	75
Brazil	-2.92	-2.34	-1.58	0.38	0.75	1.48	14.84	19.30	40.40
Chile	-1.97	-1.32	-0.57	-0.06	-0.02	0.01	9.35	10.80	15.98
Mexico	-2.28	-1.53	-0.43	-0.03	0.19	0.44	8.35	10.57	12.50
Russia	-3.14	-2.47	-1.41	0.12	0.29	1.11	31.78	47.29	65.44
Singapore	-2.20	-1.29	-0.84	0.09	0.55	1.82	9.16	11.57	16.73
S. Korea	-2.05	-1.28	1.21	-0.09	0.00	0.35	12.31	16.47	23.24

Conclusions and Future Directions

- Foreign exchange risk has a large and significant effect on default risk
  - Explains an average of 35% and up to 57% of hazard rate variation
  - Incorporating sensitivity into model helps fit
- A more formal model with a price of exchange rate risk would probably help further
  - Theoretically appealing
  - Empirically challenging
- Refine estimation through incorporation of firm-specific attributes