In Search of Distress Risk in Emerging Markets

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Current Policy Challenges Facing Emerging Markets
IMF-CBC-IMFER Summer Research Conference

July 24, 2019

Outline

Motivation

- Increased concern about the deteriorating health of non-financial corporations in emerging markets:
  - EM corporate debt: \$4tn in 2004 $\rightarrow$ \$25tn in 2016 (IIF, 2017)
  - Global debt to earnings ratios around 12-year highs (S&P)
  - Share of debt by troubled firms highest in >10 yrs (IMF, 2015)
- Yet there is little systematic research on the determinants of corporate distress specific to emerging markets....
- ...model specifications developed using US data have low predictive power when applied to the emerging market context.

This paper...

- Novel multi-country dataset on corporate defaults to study EM corporate distress factors.
- EM vulnerabilities to global macro shocks, e.g., advanced economy MP, US$ moves, global liquidity & risk aversion.
- Global monetary outlook: Flow reversals can exacerbate corporate distress risk in emerging markets.
- Objective: Develop a distress risk model, quantify impact of global shocks on EM corporate distress.

Fundamental idiosyncrasies $\rightarrow$ modified approach EM corporate distress risk prediction

1. Documented MP spillovers & international investor risk tolerance $\rightarrow$ key role for global financial factors.
2. Determines accounting, market, & macroeconomic variables that maximize predictive power for EMs.
3. Stock return sensitivities to global factors highlights mechanism $\rightarrow$ how distress risk operates through financial markets.
4. Do investors charge a distress risk premium?

Main Findings

1. **Global factors matter.**
   - Changes in the Fed funds rate, 5-Yr Treasury rate & the VIX correlated with distress risk.
2. Global variables & a prior-default dummy yield much higher explanatory power for EM firms...
   ...than models focusing exclusively on accounting & market variables.
3. Leverage & cash have the largest average marginal effects on the probability of default.
4. Changes in the bilateral US$ rate & 5-Yr US Treasury rates have the largest average marginal effects.

Main Findings

5. Default probabilities for firms with the highest "global betas" highly sensitive to the 5-Yr US Treasury rates, VIX, & TED spreads.
6. Global risk-off environment correlated with higher corporate distress in EM, particularly for globally-exposed firms.
7. Find a positive distress risk premium for emerging markets:
   - Future twelve-month stock returns are robustly monotonically increasing in the probability of corporate default.

Literature

- Probability of default models for US firms: Altman (1968); Ohlson (1980); Zmijewski (1984); Shumway (2001); Campbell et al. (2008); Duffie et al. (2009)
- Non-US studies: Altman (2005); Kordlar and Nikbakht (2011); Hernandez-Tinoco and Wilson (2013)
- Distress Risk Premium: Fama and French (1996); Vassalou and Xing (2004); Campbell et al. (2008); Da and Gao (2010)

Outline

Data

- Sample period: 1995 - 2016
- Financial statement items, equity prices, macro variables, and global financial conditions
- Default events: Bankruptcies, missed coupon/principal/loan payments, restructuring
- Sources: RMI at NUS, World Bank, IMF, BIS, Bloomberg
- Countries: Argentina, Brazil, Chile, China, Colombia, Czech Republic, Egypt, Hungary, India, Indonesia, Jordan, Malaysia, Mexico, Morocco, Pakistan, Peru, Philippines, Poland, Russia, South Africa, South Korea, Taiwan, Thailand, Turkey, and Vietnam
- Firms: Non-financial, publicly listed corporations
- 589,224 firm-months; 589 default events

Data Coverage

Model Specification

- The probability of default follows a logistic distribution given by:

$$P_{t-1}(Y_{i,t} = 1) = \frac{1}{1 + exp\{-\alpha - \beta x_{i,t-1}\}}$$

- $Y_{i,t} = 1$ if firm i defaults in month t
- $x_{i,t-1}$: vector of explanatory variables known at $t-1$

Choosing Firm-Specific Covariates

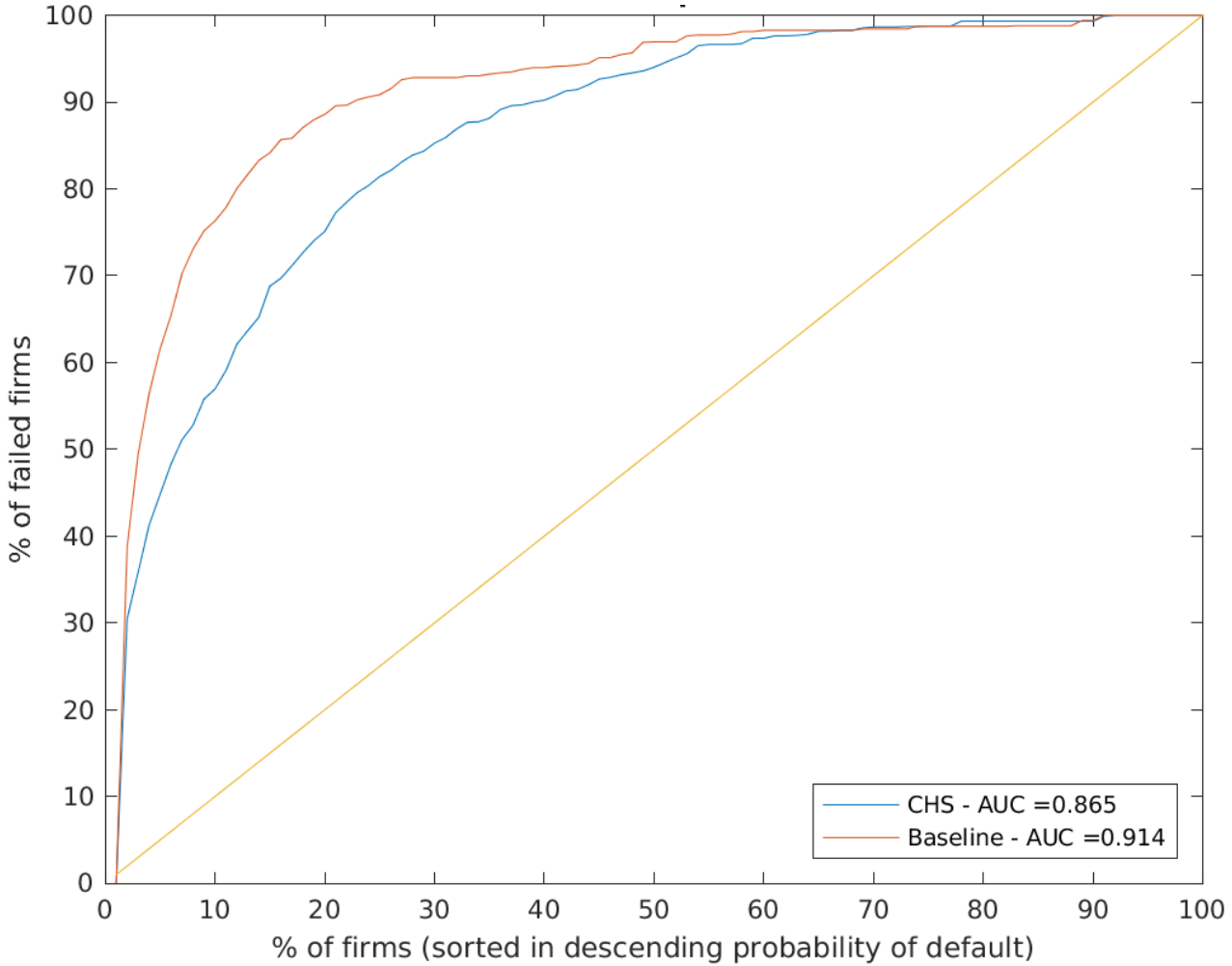
- Campbell, Hilscher, and Szilagyi (2008):
  - Stock returns (-)
  - Stock price (-)
  - Volatility of returns (+)
  - Market capitalization (-)
  - Total liabilities to total assets (+)
  - Net income to total assets (-)
  - Cash holdings (-)
  - Market-to-book ratio (+)
- LASSO variable selection suggests using CHS as EM baseline

LASSO

Regression Results

	(1)	(2)	(3)	(4)	(5)	(6)
Constant	-7.470***	-8.108***	-8.297***	-9.360***	-9.478***	-9.973***
Excess returns	-1.354***	-1.493***	-1.309***	-1.195***	-1.222***	-1.344***
Stock price	-0.224***	-0.168***	-0.079***	-0.080***	-0.054**	-0.193***
Volatility of returns	-0.074**	-0.071**	-0.058*	-0.077**	-0.065*	-0.022
Market capitalization	0.027	-0.002	-0.045*	-0.063***	-0.082***	0.164***
Profitability	-6.543***	-5.997***	-6.416***	-6.330***	-6.570***	-7.141***
Leverage	2.583***	2.102***	2.197***	1.904***	2.041***	3.136***
Cash	-4.837***	-3.235***	-4.195***	-3.451***	-3.717***	-5.993***
Market-to-book ratio	0.206***	0.119***	0.089***	0.082***	0.087***	0.051***
Prior default		2.502***	2.491***	2.560***	2.515***	2.234**
Unemployment rate			0.054**		0.032	
Inflation			-3.488		-2.587	
Real interest rate			-0.048***		-0.038***	
Sovereign spread			-0.037**		-0.018	
ΔSovereign spread				0.193	0.093	0.127
ΔFX				1.194	-1.129	0.878
5-year Treasury				0.351***	0.320***	0.349***
VIX				0.007	0.009*	0.015***
Fed funds rate				-0.119**	-0.110*	-0.109*
TED spread				0.270**	0.218*	0.088
Pseudo-R^2	0.124	0.200	0.235	0.232	0.241	0.221
AUC	0.865	0.907	0.888	0.899	0.893	0.914
Observations	589,224	589,224	372,673	402,253	372,158	402,253
Defaults	589	589	524	544	522	544
Country FE						✓

Area Under the ROC Curve



Average Marginal Effects

- We explore the economic significance of our coefficients by computing average marginal effects.
- A one-standard-deviation increase in the predictor is associated with:
  - Leverage: 0.45 pct point increase in P(Default)
  - Cash: 0.4 pct point decrease in P(Default)
  - Prior Default: 0.30 pct point decrease in P(Default)
- ΔFX and 5-year Treasury Rate are global variables with largest marginal effects.

Global Betas - Top Tercile Dummy

- Sensitivity of stock returns to global variables predicts default risk.
- For each firm i and global variable j: $R_{i,t} = \alpha_{i,j} + \beta_{i,j} F_{j,t} + \gamma_{i,j} CR_t$
- For each global variable, dummy indicates top tercile of firms with most negative $\beta_{i,j}$

	ΔSov. spread	ΔFX	5-year Treasury	VIX	Fed funds	TED spread
Constant	-7.417***	-7.447***	-8.363***	-7.529***	-7.824***	-7.503***
Excess returns	-1.094***	-1.317***	-1.295***	-1.334***	-1.304***	-1.264***
Stock price	-0.160***	-0.224***	-0.198***	-0.222***	-0.207***	-0.219***
Volatility of returns	-0.100***	-0.083**	-0.088***	-0.078**	-0.088**	-0.084**
Market capitalization	0.009	0.027	-0.016	0.024	0.003	0.021
Profitability	-7.019***	-6.539***	-6.631***	-6.489***	-6.661***	-6.660***
Leverage	2.416***	2.559***	2.473***	2.651***	2.501***	2.560***
Cash	-5.725***	-4.966***	-4.751***	-5.191***	-4.796***	-4.941***
Market-to-book ratio	0.184***	0.204***	0.204***	0.200***	0.205***	0.205***
Global variable	0.612*	1.434	0.182***	-0.009*	0.092***	0.381***
Global variable * Top-tercile	-0.201	0.890	**0.075*** **	**0.026*** **	**0.059***	-0.013
Pseudo-R^2	0.102	0.123	0.129	0.128	0.126	0.125
Observations	398,601	586,985	586,985	586,985	586,985	586,985
Defaults	536	586	586	586	586	586

Global Beta Z-Score

- Composite measure of exposure to global financial conditions
- Global Beta $Z_i = \sum_j \frac{\beta_{i,j} - \mu_j}{\sigma_j}$, $\forall\ j \in \{\Delta$Sovereign spread, ΔFX, 5-year US Treasury, Fed funds, VIX, TED spread$\}$, $\forall$ firm i
  - Most negative $Z_i \rightarrow$ returns fall most in response to rising US dollar, sovereign spread; higher US rates, VIX, TED spread.
  - Proxy for sensitivity to "risk-off" environment, i.e. difficult conditions for EM firms to secure financing.

Global Beta Z-Score

	(1)
Constant	-8.386***
Excess returns	-1.187***
Stock price	-0.063**
Volatility of returns	-0.066*
Market capitalization	-0.068***
Profitability	-6.515***
Leverage	2.113***
Cash	-3.947***
Market-to-book ratio	0.082***
Prior default	2.567***
Unemployment rate	0.034
Inflation	-4.259*
Real interest rate	-0.041***
Sovereign spread	-0.027
Beta Z	-0.013
Variable Z	0.073***
Beta Z * Variable Z	-0.011†
Pseudo-R^2	0.202
AUC	0.893
Observations	386,884
Defaults	515

- Exposure to global financial conditions not a predictor of default...
- ...but risk-off environment increases corporate default risk in EM...
- ...and the impact is greater for firms most exposed to such global conditions.

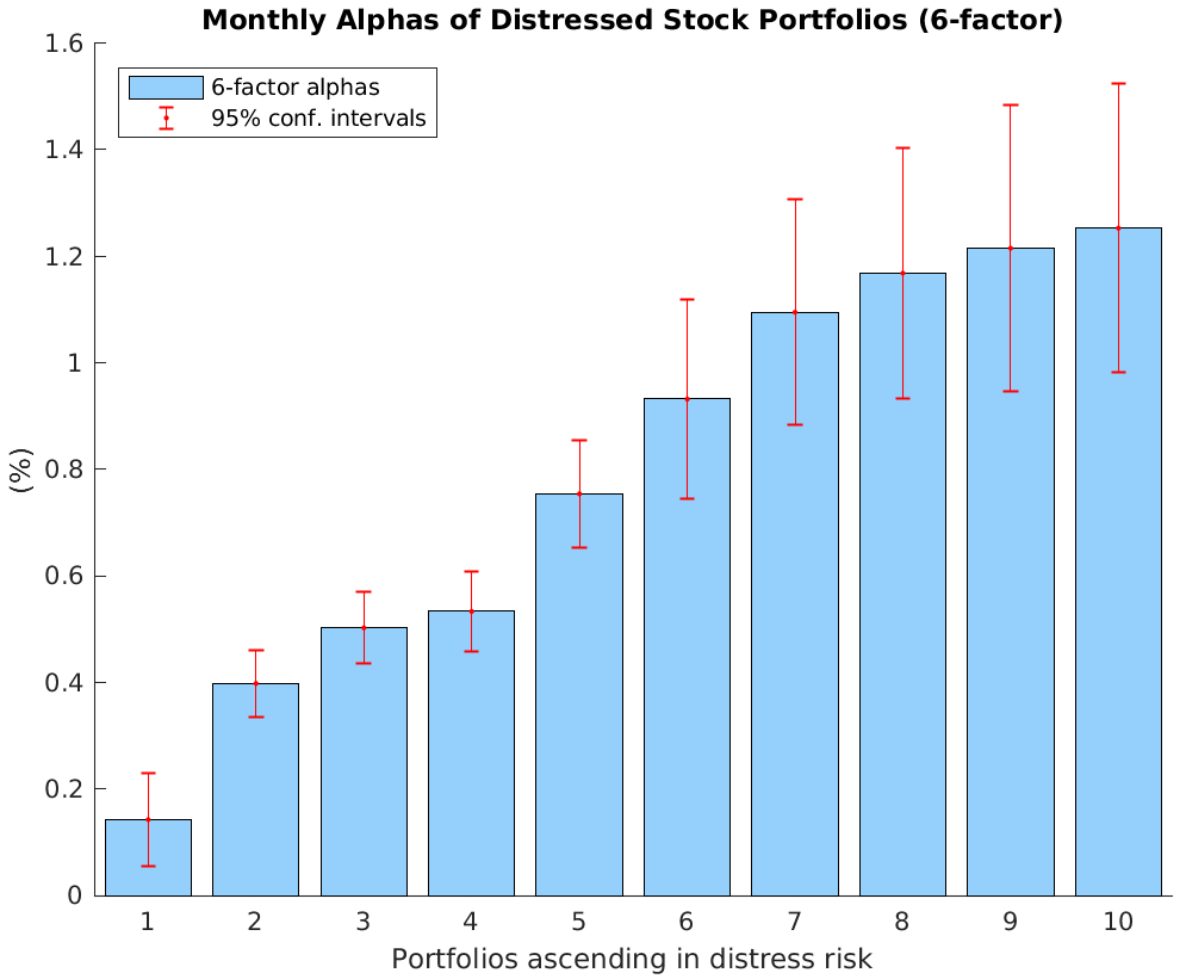
Outline

Asset Pricing Implications

- Investors should demand a premium for holding stocks at risk of default.
- Jan 2002 - Dec 2015: Sort firms monthly by estimated probability of default and divide into 10 portfolios.
- Regress 12-month future returns on Fama French 3 factors, Momentum, Short-term Reversal, and Long-term Reversal.

Portfolios	1	2	3	4	5	6	7	8	9	10
Mean P(default) (%)	0.005	0.010	0.016	0.025	0.038	0.058	0.079	0.110	0.171	1.169
Mean 12-month returns	0.005	0.007	0.008	0.008	0.010	0.012	0.013	0.014	0.014	0.014
6-factor alpha	0.0014	0.0040	0.0050	0.0053	0.0075	0.0093	0.0109	0.0117	0.0121	0.0125
RM	0.0045	0.0137	0.0210	0.0317	0.0141	0.0381	0.0491	0.0490	0.0401	0.0546
SMB	0.1166	0.1147	0.1271	0.174	0.1677	0.2458	0.2564	0.3188	0.3092	0.3930
HML	0.1885	0.1997	0.2206	0.2382	0.231	0.281	0.2723	0.3134	0.2902	0.3415

Alphas and Confidence Intervals



Long-Short Portfolios

- Construct portfolios long the 10% (20%) of stocks with highest probability of default, short 10% (20%) with lowest probability of default.
- Regress 12-month future returns on Fama French 3 factors, Momentum, Short-term Reversal, and Long-term Reversal.

	LS90-10	**LS80-20**
Mean 12-month returns	0.013‡	0.011‡
6-factor alpha	0.011***	0.010***
RM	0.050	0.038
SMB	0.276***	0.235***
HML	0.153**	0.122*

Outline

Conclusion

- Emerging market corporate debt vulnerabilities heightened.
- A prior default dummy and global financial variables improve US-based default risk models in emerging-market context.
- Global variables better predictors than domestic macro environment.
- The 5-year US Treasury rate, Fed funds rate, and VIX are correlated with distress risk.
- A global risk-off environment is associated with higher corporate distress in EM, particularly for globally-exposed firms.
- A range of asset pricing exercises indicate the existence of a positive distress risk premium in emerging market equities.

Thank you

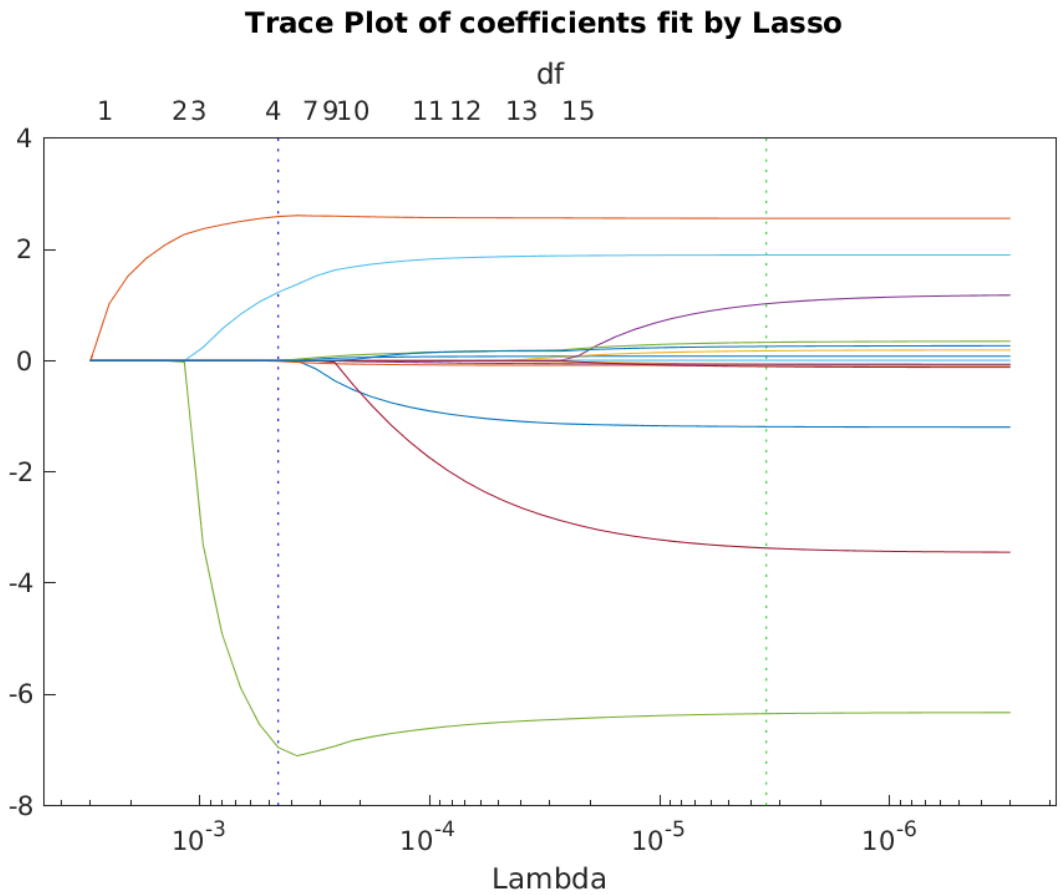
LASSO Variable selection

- Minimize negative log-likelihood function subject to an "l_1 constraint":

$$\sum_{i=1}^{n}(-Y_{i,t+1}(\alpha+\beta x_{i,t})+log(1+exp\{-\alpha-\beta x_{i,t-1}\}))+\lambda(\sum_{k=1}^{p}|\beta_k|)$$

- λ controls the shrinkage applied to the estimates
- Selects subset of relevant predictors for model fit
- Simplification of models $\rightarrow$ ease of interpretation
- Eliminates the curse of dimensionality
- Enhanced generalization $\rightarrow$ reduces overfitting

LASSO Variable Selection



Default Events

PANEL A

Action Type	Subcategory
Bankruptcy Filing	Administration, Arrangement, Canadian CCAA, Chapter 7, Chapter 11, Chapter 15, Conservatorship, Insolvency, Japanese CRL, Judicial Management, Liquidation, Pre-Negotation Chapter 11, Protection, Receivership, Rehabilitation, Rehabilitation (Thailand 1997), Reorganization, Restructuring, Section 304, Supreme court declaration, Winding up, Work out, Sued by creditor, Petition Withdrawn, Other
Delisting	Bankruptcy
Default Corporate Action	Bankruptcy, Coupon & Principal Payment, Coupon Payment Only, Debt Restructuring, Interest Payment, Loan Payment, Principal Payment, ADR (Japan only), Declared Sick (India only), Regulatory Action (Taiwan only), Financial Difficulty and Shutdown (Taiwan only), Buyback option, Other

PANEL B

Action Type	Count
Bankruptcy	74
Delisting	3
Default Corporate Action	509
Bankruptcy Corporate Action	11
Coupon & Principal Payment	19
Coupon Payment	19
Restructuring	133
Interest Payment	10
Loan Payment	320
Principal Payment	10
Other	2
Unknown	12

Distribution of Firm-Months and Defaults by Year

Year	Firm-Months	Defaults	%
1995	16	0	0
1996	370	0	0
1997	692	0	0
1998	1,725	5	0.29
1999	2,561	8	0.31
2000	5,808	6	0.10
2001	7,688	5	0.07
2002	15,406	15	0.10
2003	23,829	19	0.08
2004	30,882	67	0.22
2005	33,640	55	0.16
2006	35,724	46	0.13
2007	40,844	42	0.10
2008	43,601	47	0.11
2009	45,812	54	0.12
2010	50,627	52	0.10
2011	60,405	18	0.03
2012	58,599	47	0.08
2013	72,280	58	0.08
2014	72,730	25	0.03
2015	68,523	21	0.03
Total	671,762	590	0.09

Firm-Months by Country and Year

	Argentina	Brazil	Chile	China	Colombia	Czech Republic	Hungary	India	Indonesia	Malaysia	Mexico	Pakistan	Peru	Philippines	Poland	South Africa	South Korea	Thailand	Turkey	Vietnam	Total
1995	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	16	.	.	16
1996	.	.	.	.	.	.	.	.	.	.	123	.	.	.	.	.	.	247	.	.	370
1997	27	.	8	.	.	.	.	.	.	.	225	.	.	.	.	.	.	417	15	.	692
1998	42	.	324	.	.	.	.	.	.	.	255	.	.	.	.	.	.	1072	32	.	1725
1999	61	.	459	.	.	.	.	.	.	173	265	.	.	129	.	12	.	1384	78	.	2561
2000	165	373	492	.	.	.	.	.	33	1817	431	.	.	225	57	36	6	1363	810	.	5808
2001	182	457	472	.	.	.	.	.	308	2270	468	.	.	218	301	45	23	1642	1302	.	7688
2002	124	493	442	.	.	15	15	.	454	2469	448	.	7	223	402	57	7077	1806	1374	.	15406
2003	97	553	441	4933	.	43	30	27	513	2447	455	.	8	235	438	74	10204	2001	1330	.	23829
2004	166	609	448	7720	.	94	94	12	732	4761	507	.	21	217	913	67	11057	2122	1342	.	30882
2005	304	709	621	7846	104	130	136	15	869	5556	483	12	159	244	1316	57	11273	2130	1676	.	33640
2006	359	803	921	7539	119	109	131	18	948	6099	525	195	217	265	1469	54	11620	2296	2037	.	35724
2007	422	1188	992	9682	115	76	116	42	1206	6492	559	675	307	320	1732	58	12341	2470	2051	.	40844
2008	401	1350	1084	10647	131	76	129	78	1285	5096	521	478	270	690	2194	71	12956	2474	2048	1622	43601
2009	380	1361	1117	11484	120	.	168	105	1329	4872	577	1152	240	835	2386	63	13147	2464	2026	1986	45812
2010	376	1444	1065	12991	170	.	175	455	1602	5717	590	1563	270	912	2571	93	12892	2785	2071	2885	50627
2011	396	1520	1187	16071	176	.	130	4305	1919	5633	567	1316	287	1004	2787	93	13863	2786	2176	4189	60405
2012	311	1441	1200	17919	159	.	136	9626	2079	5536	595	.	245	1164	2788	87	10013	2957	2343	.	58599
2013	320	1600	1227	18298	127	.	162	12246	2256	5508	610	.	197	1124	2814	78	15942	3162	2418	4191	72280
2014	357	1656	1158	17449	164	.	169	11647	2315	5706	575	.	181	1265	2807	106	16418	3366	2400	4991	72730
2015	371	1545	1108	16958	159	.	181	6791	2341	5472	584	.	188	1364	2854	71	17607	3519	2432	4978	68523
Total	4861	17102	14766	159537	1544	543	1772	45367	20189	75624	9363	5391	2597	10434	27829	1122	176439	42479	29961	24842	671762

Back to Data

Defaults by Country and Year

	Argentina	Brazil	Chile	China	Colombia	Czech Republic	Hungary	India	Indonesia	Malaysia	Mexico	Pakistan	Peru	Philippines	Poland	South Africa	South Korea	Thailand	Turkey	Vietnam	Total
1995																		0			0
1996											0							0			0
1997	0		0								0							0	0		0
1998	2		0								0							3	0		5
1999	1		0							0	0			3		0		4	0		8
2000	1	0	0						0	1	0			1	0	0	0	3	0		6
2001	0	0	0						1	3	0			0	0	0	0	1	0		5
2002	2	1	1			0	0		1	2	0		0	4	1	0	2	1	0		15
2003	0	1	0	11		0	0	0	1	0	2		0	2	0	0	1	1	0		19
2004	0	0	0	63		0	0	0	0	1	0		0	2	0	0	0	1	0		67
2005	0	1	0	51	0	0	0	0	0	2	0	0	0	0	0	0	1	0	0		55
2006	0	0	0	40	0	0	0	0	0	5	0	0	0	0	0	0	1	0	0		46
2007	0	0	0	35	0	0	0	0	0	6	0	0	0	0	0	0	0	1	0		42
2008	0	0	0	29	0	0	0	0	0	10	1	0	0	1	0	0	5	1	0	0	47
2009	0	0	0	36	0		0	0	2	3	3	0	0	2	1	0	2	5	0	0	54
2010	0	0	0	26	0		0	1	1	18	1	0	0	0	0	0	4	1	0	0	52
2011	0	0	0	4	0		0	2	1	8	0	0	0	0	0	0	3	0	0	0	18
2012	0	3	0	12	0		0	24	0	2	1		0	0	5	0	0	0	0		47
2013	0	7	0	9	0		0	29	0	3	2		0	0	1	0	7	0	0	0	58
2014	0	4	0	1	0		0	13	1	1	0		0	0	0	0	5	0	0	0	25
2015	0	0	0	2	0		0	12	0	0	2		0	0	3	0	1	1	0	0	21
Total	6	17	1	319	0	0	0	81	8	65	12	0	0	15	11	0	32	23	0	0	590

Back to Data