Exchange Rate Exposure and Firm Dynamics

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Motivation

- Capital inflows associate with increases in foreign currency (FC) borrowing in developing economies.

- This paper argues that FC borrowing arises from a trade-off between exposure to currency risk and firms' growth.

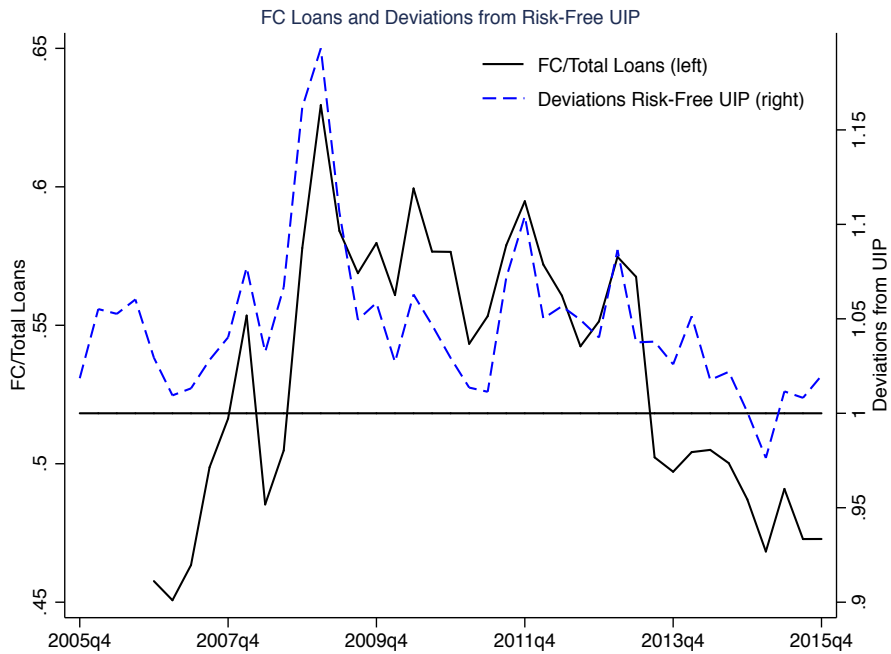
Stylized Facts

→ **Foreign currency (FC) borrowing in developing economies:**

1. Firms hold high shares of foreign currency loans.
2. FC loans associate with deviations from the uncovered interest parity (UIP).
3. Large cross-sectional heterogeneity in the share of FC borrowing across firms.

Stylized Facts in Hungary

1. Share of corporate foreign currency loans: $\approx$ 50% b. 2005-2015.
2. Correlation between UIP deviations and firms' FC loans.
3. Cross-sectional variation in firms' FC borrowing:
   - 33% of firms borrowed in FC.
   - heterogeneity in the share of FC loans (66% of firms nor expo or impo).



$$\frac{E(s_{t+1})}{s_t}(1+r_t^*) \neq (1+r_t) \rightarrow \text{UIP Dev}_t = \frac{s_t}{E(s_{t+1})}\frac{(1+r_t)}{(1+r_t^*)} > \mathbf{1}$$

▸ More

Contribution I

1) Build a firm-dynamics model and propose mechanism leading to FC borrowing:

- *Aggregate* UIP deviations make FC loans attractive, but...

  $\rightarrow$ increase a firm's default risk and *idiosyncratic* cost of funds.

- Two sources of heterogeneity:
  - *Selection*: productivity threshold to borrow in FC.
  - *Heterogeneous* share of FC loans across firms, driven by idiosyncratic risk.

Trade-off between exposure to currency risk and firm's growth.

Contribution II

2) Test this mechanism using firm-level census data on Hungarian firms:

- Why Hungary?
  - High levels of foreign currency borrowing.
  - Firm-level census data on all economic activities over 1996-2010.
- Test model's firm-level implications using simulated and Hungarian data.

Contribution III

3) Conduct counterfactual exercises to:

i) quantify the impact of FC borrowing on the aggregate,

ii) show that allocation across firms is essential to understand its aggregate impact,

iii) assess implications according with countries' characteristics (financial development and exchange rate policy).

Preview of Main Results

→ **Firm-level analysis**

1. Deregulation of FC loans: firms using in FC are more productive and grow faster.
2. UIP deviations:
   - increase FC borrowing and investment.
   - productive firms with low capital borrow more in FC and grow faster.

→ **Aggregate analysis**

1. Economies with FC borrowing see higher capital and sales, but are more volatile.
2. Allocation toward high MPK firms maximize investment and minimize default.
   - Financial development is critical to generate gains from FC loans.
3. Exchange rate policy has large impact on FC loans and can create systemic risk.

Related Literature

- Balance sheet effects and crises: Krugman (1999), Aghion, Banerjee & Bacchetta (2001), Jeanne (2003), Caballero & Krishnamurthy (2003), Schneider & Tornell (2004), Cespedes, Chang & Velazco (2004), Eichengreen & Hausmann (2005), Rappoport (2008), Kalantzis (2015)...

- Country studies: Pratap & Urrutia (2004), Aguiar (2005), Beakley & Cowan (2008), Ranciere, Tornell & Vamvakidis (2010), Kalemli-Ozcan, Kamil & Villegas-Sanchez (2013), Kim, Tesar & Zhang (2015), Kalemli-Ozcan (2015), Alfaro, Asis, Chari & Panizza (2017)...

- Capital inflows : Arellano, Bai & Zhang (2012), Heathcote & Perri (2016), Bianchi (2011), Bianchi, Hatchondo & Martinez (2018), Baskaya, Di Giovanni, Kalemli-Ozcan & Ulu (2017), Maggiori, Neiman & Schreger (2017), Gopinath, Kalemli-Ozcan, Karabarbounis & Villegas-Sanchez (2017)....

- UIP deviations: Lustig and Verdelhan (2006, 2007 & 2011), Hassan (2013), Maggiori (2017), Bocola & Lorenzoni (2017), Sarno, Schneider & Warner (2012), Sarno & Schmeling (2013), Chinn (2014), Chinn & Quayyum (2012)...

Outline

1. Data
2. Model
3. Firm-Level Analysis: Model vs Data
4. Aggregate Implications: Numerical Exercises
5. Policy Experiments
6. Sensitivity Analysis

Data

We use two datasets:

1. APEH: census data on all firms in the economy (1996-2010).
2. Credit Register: census data on loans by currency denomination (2005-2010).

   → Panel on all economic activities (agriculture, manufacturing and services).

FC borrowing was deregulated in 2001:

- By 2005, 33% of firms had FC loans, accounted for 40% VA & 34% of empl.
- SME accounted for 63% of FC loans, 14% of VA & 18% employment.
- Firms had a large currency exposure:
  - 66% firms didn't export or import, and had 64% of FC share.
  - Only 4% of firms use financial hedges (NBH 2006).

▸ More

Firm Optimization Model

- DRTS, idiosyncratic productivity and exchange rate shocks.
- Capital adjustment costs, fixed cost of operation.
- External financing with debt:
  - Local and foreign currency debt.
  - Debt is non-enforceable, firms can default.
  - Deviations from the UIP.
- Endogenous firm entry and exit.
- Partial equilibrium analysis.

Technology and Shocks

- Production:
  - Firms produce with $F(z,k) = zk^{\alpha}$, $\alpha \in (0,1)$

$$\log z' = \rho_z \log z + \sigma_z \epsilon_z'; \quad \epsilon_z \sim N(0,1)$$

- Exchange Rate:

$$\log s' = \rho_s \log s + \sigma_s \epsilon_s'; \quad \epsilon_s \sim N(0,1); \quad s(\text{LC/ FC})$$

Firms' Problem

→ **Incumbent Firms:**

$$V = max\left\{V^R, V^D = 0\right\}$$

$$V^R(\underbrace{s, z,}_{\text{Ex.}} \underbrace{k, b, b^*}_{\text{End.}}) = \max_{k', b', b'^*} \left[e + \beta\, E_{z', s'} V\left(s', z', k', b', b'^*\right)\right]$$

$$e = \underbrace{p[zk^{\alpha} - i(k, k') - \psi(k, k') - c_f]}_{\text{Net sales}} - \underbrace{[b + sb^*]}_{\text{Debt Repayment}} + \underbrace{[qb' + q^* sb'^* - pc_{I_{(b'+b'^*>0)}} - pc^*_{I_{(b'^*>0)}}]}_{\text{Debt Issuance}}$$

$$\text{where} \quad p = p^* s^{\eta} \qquad (p^* = 1) \qquad \text{and} \qquad \psi(k, k') = c_0 \left(\frac{k' - (1-\delta)k}{k}\right)^2 k$$

→ **Entrant Firms:**

$$V_e(s, \chi) = \max_{k'}[-pk' + \beta E_{z', s'} V(s', z', k', b', b'^*)]$$

$$\text{if } V_e(s, \chi) \geq pc_e.$$

Financing and Mechanism

→ **UIP:**

$$\underbrace{\theta}_{\text{UIP Dev.}} \; E(s'|s)\,(1+r^*) = s\,(1+r) \tag{1}$$

→ **Firms' bond prices:**

$$q = \frac{1 - P_{z,s}\left(\Delta(k,b,b^*)\right)}{1+r} \quad \text{and} \quad q^* = \frac{1 - P_{z,s}\left(\Delta(k,b,b^*)\right)}{1+r^*} \tag{2}$$

Default Prob.: $P_{z,s}\left(\Delta(k,b,b^*)\right)$. Default set: $\Delta_{k,b,b^*} = \left\{ (s,z) \text{ s.t. } V^R(s,z,k,b,b^*) \leq 0 \right\}$.

→ **Mechanism: 2 forces driving currency debt composition**

(1) *Aggregate* UIP deviations ($\theta > 1$) make FC bonds relatively cheaper.

(2) FC debt exposes firms to ER shocks and raises *idiosyncratic* default prob (Δ).

Financing and Mechanism

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$$\underbrace{\theta}_{\text{UIP Dev.}} \; E(s'|s)\,(1+r^*) = s\,(1+r) \tag{1}$$

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Default Prob.: $P_{z,s}\left(\Delta(k,b,b^*)\right)$. Default set: $\Delta_{k,b,b^*} = \left\{ (s,z) \text{ s.t. } V^R(s,z,k,b,b^*) \leq 0 \right\}$.

→ **Euler Equations:**

(1) Marginal benefit of FC debt (vis-à-vis LC): function of θ.

(2) Marginal cost of FC debt (vis-à-vis LC): function of rise in $P_{z,s}\left(\Delta(k,b,b^*)\right)$ ($\downarrow q$ and $\downarrow q^*$).

→ Borrow in FC : (1)=(2).

Euler Equations for LC and FC Debt

$$b': \quad \underbrace{q(\upsilon')}_{\text{direct benefit}} \leq \beta \underbrace{E_{z',s'}[1(1-\Delta(\upsilon'))]}_{\text{expected cost}}$$

$$b'^*: \quad \underbrace{sq^*(\upsilon')}_{\text{direct benefit}} \leq \beta \underbrace{E_{z',s'}[s'(1-\Delta(\upsilon'))]}_{\text{expected cost}}$$

where $\upsilon' = \{k', b', b'^*\}$

Euler Equations for LC and FC Debt

$$b': \quad \underbrace{\underbrace{q}_{\text{direct effect}} + \underbrace{\frac{\partial q}{\partial b'} b' + \frac{\partial q^*}{\partial b'} s b'^*}_{\text{indirect bond price effect}}}_{\text{benefit}} \leq \beta \underbrace{E_{z',s'}[1\,(1-\Delta(k',b',b'^*))]}_{\text{cost}}$$

$$b'^*: \quad \underbrace{\underbrace{s\,q^*}_{\text{direct effect}} + \underbrace{\frac{\partial q}{\partial b'^*} b' + \frac{\partial q^*}{\partial b'^*} s b'^*}_{\text{indirect bond price effect}}}_{\text{benefit}} \leq \beta \underbrace{E_{z',s'}[s'(1-\Delta(k',b',b'^*))]}_{\text{cost}}$$

where $q = \frac{1-E_{z',s'}\,(\Delta(k',b',b'^*))}{1+r}$ and $q^* = \frac{1-E_{z',s'}\,(\Delta(k',b',b'^*))}{1+r^*}$.

Mechanism: FC vs LC Borrowing

→ **FC vs LC borrowing decisions:**

$$\underbrace{(\theta - 1)\frac{\left[1 - E_{z',s'}(\Delta(k', b', b'^*))\right]}{(1+r)}}_{\text{relative benefit of FC debt}}$$

$$- \underbrace{\left[\left(\frac{\partial E_{z',s'}(\Delta(k', b', b'^*))}{\partial b'^*}\frac{1}{E(s'|s)} - \frac{\partial E_{z',s'}(\Delta(k', b', b'^*))}{\partial b'}\right)\left(\frac{b'}{(1+r)} + \frac{sb'^*}{(1+r^*)}\right) + \text{cov}\right]}_{\text{relative cost of FC debt}} \leq 0.$$

- Relative benefit:
  - If $\theta > 1$, FC borrowing is relatively cheaper.
- Relative cost:
  - Default probability rises relatively more: $\frac{\partial E_{z',s'}(\Delta(.))}{\partial b'^*}\frac{1}{E(s'|s)} > \frac{\partial E_{z',s'}(\Delta(.))}{\partial b'}$.
  - Decreases in firms' productivity.

Model's Implications

-Lemma 1. Selection:

Only highly productive firms borrow in foreign currency. These firms have higher investment rates.

-Lemma 2. Deviations from the UIP:

Higher UIP deviations increase foreign currency borrowing and investment. This expansion is higher for firms with high MPK.

Equilibrium Definition

A recursive equilibrium is a set of functions for (i) $V(s,z,\upsilon)$ and $V_e(s,\chi)$, $k'(s,z,\upsilon)$, $b'(s,z,\upsilon)$, $b'^*(s,z,\upsilon)$ and $\Delta(\upsilon)$, and (ii) $q(s,z,\upsilon)$ and $q^*(s,z,\upsilon)$ and (iii) bounded sequences of incumbents' measure $\{\Gamma_t\}_{t=1}^{\infty}$ and entrants' measure $\{\Omega_t\}_{t=0}^{\infty}$ such that:

1. given the bond price ($q(s,z,\upsilon)$ and $q^*(s,z,\upsilon)$), the value function $V(s,z,\upsilon)$, capital holdings $k'(s,z,\upsilon)$, debt choices $b'(s,z,\upsilon)$ and $b'^*(s,z,\upsilon)$, and default set $\Delta(\upsilon)$ satisfy the firm's optimization problem;
2. the bond price ($q(s,z,\upsilon)$ and $q^*(s,z,\upsilon)$) satisfy the zero expected profit condition,
3. for all Borel sets $Z \times K \subset \Re^+$ and $\forall t \geq 0$

$$\Omega_{t+1}(Z \times K) = M \int_Z \int_{B_e(K,s)} d\Upsilon(\chi) dH(z'|\chi),$$

where $B_e(K,s) = \{\chi \text{ s.t.} k'(s,\chi) \in K \text{ and } V_e(s,\chi) \geq c_e\}$

4. for all Borel sets $Z \times K \subset \Re^+ \times B \subset \Re^+ \times B^* \subset \Re^+ \times \Re^+ \text{and} \forall t \geq 0$

$$\Gamma_{t+1}(Z \times K \times B \times B^*) = \int_Z \int_{B(K,B,B^*,s)} d\Gamma_t(z,\upsilon) dH(z'|z) + \Omega_{t+1}(Z \times K \times B \times B^*),$$

where $B(s,K,B,B^*) = \{(s,\upsilon) \; s.t. \; V(s,z,\upsilon) > 0, k \in K, b \in B \; and \; b^* \in B^*\}$

Simulation Strategy

To simulate the years following the deregulation of FC loans in Hungary:

1. Solve the model without FC borrowing and find a stationary distribution.
2. Solve the model with foreign currency borrowing.
3. We simulate 160.000 firms from distribution in (1) using:
   - policies of the model with foreign currency and
   - realized ER shock between 2001-2010.

Calibration

→ Calibrate the model to Hungary

	Parameter Values	
	Value	Target
Parameters selected independently		
Foreign currency risk-free rate	$r^* = 1.76\%$	German Bund, 1 year rate
Domestic currency risk-free rate	$r = 7.35\%$	Hungarian Government Bond, 1 year rate
Exchange rate shock	$\rho_s = 0.86$ $\sigma_s = 0.3$	Euro-HUF Forint rate
Firm productivity	$\rho_z = 0.63$ $\sigma_z = 0.57$	Hungarian firms
Return to scale	$\alpha = 0.6$	Hungarian firms
Depreciation rate	$\delta = 10\%$	
Exchange rate pass-through	$\eta = 0$	
Jointly calibrated parameters		
Fixed cost of credit	$c = 0.7$	Share of firms borrowing (30%)
Fixed cost of FC debt	$c^* = 0.12$	FC share of borrowing firms (19%)
Fixed operational costs	$c_f = 2$	Default rate (2%)
Investment adjustment cost	$c_0 = 0.2$	Investment of firms borrowing (12%)
Discount factor	$\beta = 0.85$	Share of firms with only LC debt (21%)

Model's Validation

→ **We validate the model's implications in 3 different ways:**

1. The model matches key moments of the distribution of FC borrowing:
   - Divide firms in 3 groups: only LC, only FC and both:
     - Share of firms borrowing and share of FC loans.
     - Investment rate, relative productivity and capital. ▸ Table ▸ Graph

2. Test firm-level implications using the Hungarian data.

3. Simulate firm-level panel data and test quantitatively firm-level responses against data.

Outline

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Firm-Level Analysis: Lemma 1. Selection

→ **After the deregulation of FC loans (2001):**

1. Productive firms had a higher prob. of borrowing in FC and share of FC loans:

$$y_i = \beta \log z_i + \mu_j + \varepsilon_{ij}$$

y_i: FC Dummy$_i$, log FC Share$_i$ in 2005, z_i and RTFP$_i$ in productivity pre-reform (2000). μ_j: 4-digit FE.

	Foreign Currency Loan Dummy				Log Share of Foreign Currency Loans			
	Model		Data		Model		Data	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Log productivity	0.027***	0.024***	0.020***	0.012***	0.012***	0.011***	0.005***	0.003**
	(0.001)	(0.001)	(0.002)	(0.002)	(0.000)	(0.000)	(0.002)	(0.001)
Log capital		0.007***		0.032***		0.002***		0.009***
		(0.001)		(0.002)		(0.000)		(0.001)
Sector FE			Yes	Yes			Yes	Yes
R^2	0.008	0.009	0.028	0.053	0.006	0.006	0.028	0.035
N	156,806	156,806	33,327	33,327	156,806	156,806	33,327	33,327

Notes: *, **, *** significant at the 10, 5, and 1 percent level. Standard errors in parentheses. Source: APEH and Credit Register.

Firm-Level Analysis: Lemma 1. Selection

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Log productivity	0.027***	0.024***	0.020***	0.012***	0.012***	0.011***	0.005***	0.003**
	(0.001)	(0.001)	(0.002)	(0.002)	(0.000)	(0.000)	(0.002)	(0.001)
Log capital		0.007***		0.032***		0.002***		0.009***
		(0.001)		(0.002)		(0.000)		(0.001)
Sector FE			Yes	Yes			Yes	Yes
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Firm-Level Analysis: Lemma 1. Selection

→ **After the deregulation of FC loans (2001):**

1. Productive firms had a higher prob. of borrowing in FC and share of FC loans.
2. Firms borrowing in FC associate with $\approx 7\%$ higher investment rates (and sales).

$$y_{it} = \beta \left(R_t \times \text{FC Dummy}_i \right) + \iota_t + \phi_i + \varepsilon_{it},$$

	Log Investment Rate			
	Model		Data	
	(1)	(2)	(3)	(4)
R*FC dummy	0.321***	0.138**	0.207***	0.071***
	(0.032)	(0.061)	(0.020)	(0.027)
Firm FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
FC d.*time trend		Yes		Yes
R^2	0.218	0.218	0.511	0.512
N	1,568,060	1,568,060	393,149	393,149

Notes: *, **, *** significant at the 10, 5, and 1 percent level. Standard errors in parentheses. R is a dummy for the period 2001-2005. Period 1996-2005. Source: APEH and Credit Register.

Firm-Level Analysis: Lemma 2. UIP Deviations

→ **Higher deviations from UIP:**

1. increase probability of FC borrowing, particularly of high MPK firms.

$$y_{it} = \beta \log \text{UIP}_t + \phi_i + \varepsilon_{it}$$

$$y_{it} = \beta \log(\text{UIP}_t \times z_i) + \phi_i + \iota_t + \varepsilon_{it}$$

$$y_{it} = \beta_1 \log(\text{UIP}_t \times Q_{HLi}) + \beta_2 \log(\text{UIP}_t \times Q_{HHi}) + \beta_3 \log(\text{UIP}_t \times Q_{LLi}) + \beta_4 \log(\text{UIP}_t \times Q_{LHi}) + \phi_i + \iota_t + \mu_{jt} + \varepsilon_{it}$$

	FC Dummy					
	Model			Data		
	(1)	(2)	(3)	(4)	(5)	(6)
Log Dev. UIP	0.071**			0.150***		
	(0.028)			(0.017)		
Log (Dev. UIP x Productivity)		0.055***			0.047***	
		(0.014)			(0.008)	
Log (Dev. UIP x Q_{HL})			0.246***			0.196***
			(0.029)			(0.031)
Log (Dev. UIP x Q_{HH})			0.230***			0.142***
			(0.025)			(0.042)
Log (Dev. UIP x Q_{LL})			0.180***			0.088***
			(0.025)			(0.029)
Log (Dev. UIP x Q_{LH})			0.177***			0.163***
			(0.016)			(0.040)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE		Yes	Yes		Yes	Yes
Sector* Year FE					Yes	Yes
R^2	0.419	0.501	0.21	0.742	0.688	0.743
N	1,005,783	1,005,783	1,005,783	892,584	892,584	892,584

Notes: *, **, *** significant at the 10, 5, and 1 percent level. Standard errors in parentheses. Period 2005-2010.
Source: APEH and Credit Register.

Firm-Level Analysis: Lemma 2. UIP Deviations

→ **Higher deviations from UIP:**

2. increase FC share, particularly of high MPK firms.

$$y_{it} = \beta \log \text{UIP}_t + \phi_i + \varepsilon_{it}$$

$$y_{it} = \beta \log(\text{UIP}_t \times z_i) + \phi_i + \iota_t + \varepsilon_{it}$$

$$y_{it} = \beta_1 \log(\text{UIP}_t \times Q_{HLi}) + \beta_2 \log(\text{UIP}_t \times Q_{HHi}) + \beta_3 \log(\text{UIP}_t \times Q_{LLi}) + \beta_4 \log(\text{UIP}_t \times Q_{LHi}) + \phi_i + \iota_t + \mu_{jt} + \varepsilon_{it}$$

	Log Share of Foreign Currency Loans					
	Model			Data		
	(1)	(2)	(3)	(4)	(5)	(6)
Log Dev. UIP	0.063***			0.084***		
	(0.015)			(0.010)		
Log (Dev. UIP x Productivity)		0.022***			0.025***	
		(0.008)			(0.019)	
Log (Dev. UIP x Q_{HL})			0.177***			0.092***
			(0.018)			(0.017)
Log (Dev. UIP x Q_{HH})			0.148***			0.076***
			(0.015)			(0.024)
Log (Dev. UIP x Q_{LL})			0.170***			0.033*
			(0.015)			(0.017)
Log (Dev. UIP x Q_{LH})			0.117***			-0.018
			(0.010)			(0.023)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE		Yes	Yes		Yes	Yes
Sector* Year FE					Yes	Yes
R^2	0.402	0.515	0.208	0.716	0.655	0.712
N	1,005,783	1,005,783	1,005,783	892,584	892,584	892,584

Notes: *, **, *** significant at the 10, 5, and 1 percent level. Standard errors in parentheses. Period 2005-2010.
Source: APEH and Credit Register.

Firm-Level Analysis: Lemma 2. UIP Deviations

→ **Higher deviations from UIP:**

3. increase investment rate (and sales), particularly of high MPK firms.

$$y_{it} = \beta \log \text{UIP}_t + \phi_i + \varepsilon_{it}$$

$$y_{it} = \beta \log(\text{UIP}_t \times z_i) + \phi_i + \iota_t + \varepsilon_{it}$$

$$y_{it} = \beta_1 \log(\text{UIP}_t \times Q_{HLi}) + \beta_2 \log(\text{UIP}_t \times Q_{HHi}) + \beta_3 \log(\text{UIP}_t \times Q_{LLi}) + \beta_4 \log(\text{UIP}_t \times Q_{LHi}) + \phi_i + \iota_t + \mu_{jt} + \varepsilon_{it}$$

	Log Investment Rate					
	Model			Data		
	(1)	(2)	(3)	(4)	(5)	(6)
Log Dev. UIP	0.099***			0.136***		
	(0.027)			(0.026)		
Log (Dev. UIP x Productivity)		0.190***			0.315***	
		(0.031)			(0.020)	
Log (Dev. UIP x Q_{HL})			4.708***			0.150**
			(0.026)			(0.071)
Log (Dev. UIP x Q_{HH})			1.032***			0.116
			(0.027)			(0.079)
Log (Dev. UIP x Q_{LL})			0.079***			0.064
			(0.025)			(0.062)
Log (Dev. UIP x Q_{LH})			-5.598***			-0.097
			(0.027)			(0.083)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE		Yes	Yes		Yes	Yes
Sector* Year FE					Yes	Yes
R^2	0.42	0.412	0.706	0.575	0.525	0.670
N	1,005,783	1,005,783	1,005,783	892,584	892,584	892,584

Notes: *, **, *** significant at the 10, 5, and 1 percent level. Standard errors in parentheses. Period 2005-2010.
Source: APEH and Credit Register.

Firm-Level Analysis: Mechanism

Firms borrowing in FC pay lower interest rates.

$$y_i = \beta \log \text{FC Dummy}_i + \mu_j + \varepsilon_{ij}$$

	LC Interest Rate	FC Interest Rate	Interest Rate		
	Model		Data		
	(1)	(2)	(3)	(4)	(5)
FC Dummy	-0.016***	-0.013***	-0.011**	-0.009*	-0.009*
	(0.001)	(0.001)	(0.005)	(0.004)	(0.006)
Firm Level Controls					Yes
Sector FE				Yes	Yes
R^2	0.002	0.003	0.014	0.033	0.042
N	156,806	156,806	291	291	291

Notes: *, **, *** significant at 10, 5, and 1 percent. Standard errors in parentheses. Column 1 and 2 derive firms' implicit interest rate from the price of their LC and FC bonds. Firm-level controls in column 5 are age, employment, export status and dummy for foreign-owned firm. Source: BEEPS 2005, Hungary, the World Bank and the European Bank for Reconstruction and Development.

Robustness Tests

- ✓ UIP deviations: 1) without adjusting for sovereign default premium and 2) realized exchange rates. ▸ More
- ✓ FC share: 1) controlling for valuation effects (ER=2005) and 2) current ER. ▸ More
- ✓ Pass-through: differential pass-through across 4-digit industries. ▸ More
- ✓ Sample: including exporters and MNC firms. ▸ Lemma 1 ▸ Lemma 2
- ✓ MPK: computing firms' MPK measure. ▸ More
- ✓ Productivity: 1) RTFP estimated with Olley and Pakes (1996) and 2) Labor productivity.
- ✓ Additional controls: access to credit prior to the reform and firms' age. ▸ Lemma 1 ▸ Lemma 2
- ✓ Currencies: results hold across currencies.

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Aggregate Implications: Numerical Exercises

→ FC borrowing leads to higher investment and aggregate sales, and lower default.

	Benchmark	No FC Borrowing
	(1)	(2)
	Panel A. Firm-level results	
FC debt share	12.1	-
Investment rate	10.8	8.5
E(K)	19.9	17.6
Default rate	2.8	3.5
Productivity threshold	1.2	-
	Panel B. Aggregate results (wrt column 1)	
Sales	100.0	89.2
Capital	100.0	84.3
Coef. of var. sales	100.0	-
Coef. of var. capital	100.0	-

Notes: Rows 1, 2 and 3 are in percentage. Rows 6-9 are with respect to column 1. Rows 6 and 7 are in levels, rows 8 and 9 present the coefficient of variation. Columns 1-5 show the moments for an economy with and without foreign currency borrowing, and with no heterogeneity in productivity and capital. In each experiment, we simulate approximately 160,000 firms from the stationary distribution without foreign currency loans, using the realized exchange rate shocks in Hungary and the policy functions of each experiment. Results reflect the average of the period between 2001 to 2010.

Aggregate Implications: Numerical Exercises

→ No heterogeneity in pty or capital leads to ***misallocation*** and ***balance sheet effects***.

	Benchmark	No FC Borrowing	No Heterogeneity in Prod. & Capital		
	(1)	(2)	(3)		
	Panel A. Firm-level results				
FC debt share	12.1	-	40.8		
Investment rate	10.8	8.5	8.9		
E(K)	19.9	17.6	23.2		
Default rate	2.8	3.5	8.3		
Productivity threshold	1.2	-	-		
	Panel B. Aggregate results (wrt column 1)				
Sales	100.0	89.2	74.7		
Capital	100.0	84.3	73.6		
Coef. of var. sales	100.0	-	425.3		
Coef. of var. capital	100.0	-	255.6		

Notes: Rows 1, 2 and 3 are in percentage. Rows 6-9 are with respect to column 1. Rows 6 and 7 are in levels, rows 8 and 9 present the coefficient of variation. Columns 1-5 show the moments for an economy with and without foreign currency borrowing, and with no heterogeneity in productivity and capital. In each experiment, we simulate approximately 160,000 firms from the stationary distribution without foreign currency loans, using the realized exchange rate shocks in Hungary and the policy functions of each experiment. Results reflect the average of the period between 2001 to 2010.

Aggregate Implications: Numerical Exercises

→ No heterogeneity in productivity leads to ***misallocation***.

	Benchmark	No FC Borrowing	No Heterogeneity in Prod. & Capital	No Heterogeneity in Productivity
	(1)	(2)	(3)	(4)
	Panel A. Firm-level results			
FC debt share	12.1	-	40.8	7.8
Investment rate	10.8	8.5	8.9	9.8
E(K)	19.9	17.6	23.2	17.8
Default rate	2.8	3.5	8.3	3.7
Productivity threshold	1.2	-	-	-
	Panel B. Aggregate results (wrt column 1)			
Sales	100.0	89.2	74.7	87.7
Capital	100.0	84.3	73.6	83.4
Coef. of var. sales	100.0	-	425.3	19.3
Coef. of var. capital	100.0	-	255.6	72.2

Notes: Rows 1, 2 and 3 are in percentage. Rows 6-9 are with respect to column 1. Rows 6 and 7 are in levels, rows 8 and 9 present the coefficient of variation. Columns 1-5 show the moments for an economy with and without foreign currency borrowing, and with no heterogeneity in productivity and capital. In each experiment, we simulate approximately 160,000 firms from the stationary distribution without foreign currency loans, using the realized exchange rate shocks in Hungary and the policy functions of each experiment. Results reflect the average of the period between 2001 to 2010.

Aggregate Implications: Numerical Exercises

→ No heterogeneity in capital leads to ***balance sheet effects***.

	Benchmark	No FC Borrowing	No Heterogeneity		
			in Prod. & Capital	in Productivity	in Capital
	(1)	(2)	(3)	(4)	(5)
	Panel A. Firm-level results				
FC debt share	12.1	-	40.8	7.8	40.8
Investment rate	10.8	8.5	8.9	9.8	15.4
E(K)	19.9	17.6	23.2	17.8	31.2
Default rate	2.8	3.5	8.3	3.7	6.8
Productivity threshold	1.2	-	-	-	-
	Panel B. Aggregate results (wrt column 1)				
Sales	100.0	89.2	74.7	87.7	100.8
Capital	100.0	84.3	73.6	83.4	114.9
Coef. of var. sales	100.0	-	425.3	19.3	121.4
Coef. of var. capital	100.0	-	255.6	72.2	419.1

Notes: Rows 1, 2 and 3 are in percentage. Rows 6-9 are with respect to column 1. Rows 6 and 7 are in levels, rows 8 and 9 present the coefficient of variation. Columns 1-5 show the moments for an economy with and without foreign currency borrowing, and with no heterogeneity in productivity and capital. In each experiment, we simulate approximately 160,000 firms from the stationary distribution without foreign currency loans, using the realized exchange rate shocks in Hungary and the policy functions of each experiment. Results reflect the average of the period between 2001 to 2010.

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Policy Experiments: Financial Development

$\rightarrow$ Lower financial development (poor screening) lowers investment and rises default.

	Benchmark	Financial Development		(High) Economic	ER Policy	
		Unobserved z	Misreported z	Development	Low ($\sigma_s = 0.15$)	High ($\sigma_s = 0.45$)
	(1)	(2)	(3)	(4)	(5)	(6)
	Firm-level results					
FC debt share	12.1	8.0	13.7	12.8	42.9	0.0
Investment rate	10.8	10.4	8.16	8.2	11.9	9.5
E(K)	19.9	19.4	29.8	23	21.6	18.8
Default rate	2.8	2.9	3.6	2.2	2.5	3.1
Productivity threshold	1.2	1.2	1.17	1.2	1.0	1.3

Notes: Rows 1, 2 and 3 are in percentage. Columns 1 shows the moments for the benchmark calibration. Columns 2 and 3 show an economy with a low level of financial development. Column 4 presents the results of an economy with larger firms. Columns 5 and 6 report the results for low and high volatility of the exchange rate. In each experiment, we simulate approximately 160,000 firms from the stationary distribution without foreign currency loans, using the realized exchange rate shocks in Hungary and the policy functions of each experiment. Results reflect the average of the period between 2001 to 2010.

Policy Experiments: Economic Development (Capital Scarcity)

$\rightarrow$ A capital-scarce country will see higher investment rates, but also higher default.

	Benchmark	Financial Development		(High) Economic	ER Policy	
		Unobserved z	Misreported z	Development	Low ($\sigma_s = 0.15$)	High ($\sigma_s = 0.45$)
	(1)	(2)	(3)	(4)	(5)	(6)
	Firm-level results					
FC debt share	12.1	8.0	13.7	12.8	42.9	0.0
Investment rate	10.8	10.4	8.16	8.2	11.9	9.5
E(K)	19.9	19.4	29.8	23	21.6	18.8
Default rate	2.8	2.9	3.6	2.2	2.5	3.1
Productivity threshold	1.2	1.2	1.17	1.2	1.0	1.3

Notes: Rows 1, 2 and 3 are in percentage. Columns 1 shows the moments for the benchmark calibration. Columns 2 and 3 show an economy with a low level of financial development. Column 4 presents the results of an economy with larger firms. Columns 5 and 6 report the results for low and high volatility of the exchange rate. In each experiment, we simulate approximately 160,000 firms from the stationary distribution without foreign currency loans, using the realized exchange rate shocks in Hungary and the policy functions of each experiment. Results reflect the average of the period between 2001 to 2010.

Policy Experiments: Exchange Rate Policy

$\rightarrow$ Lower ER volatility lowers the risk & encourages FC borrowing. Higher investment, but the economy is exposed to ER swings.

	Benchmark	Financial Development		(High) Economic	ER Policy	
	($\sigma_s = 0.3$)	Unobserved z	Misreported z	Development	Low ($\sigma_s = 0.15$)	High ($\sigma_s = 0.45$)
	(1)	(2)	(3)	(4)	(5)	(6)
	Firm-level results					
FC debt share	12.1	8.0	13.7	12.8	42.9	0.0
Investment rate	10.8	10.4	8.16	8.2	11.9	9.5
E(K)	19.9	19.4	29.8	23	21.6	18.8
Default rate	2.8	2.9	3.6	2.2	2.5	3.1
Productivity threshold	1.2	1.2	1.17	1.2	1.0	1.3

Notes: Rows 1, 2 and 3 are in percentage. Columns 1 shows the moments for the benchmark calibration. Columns 2 and 3 show an economy with a low level of financial development. Column 4 presents the results of an economy with larger firms. Columns 5 and 6 report the results for low and high volatility of the exchange rate. In each experiment, we simulate approximately 160,000 firms from the stationary distribution without foreign currency loans, using the realized exchange rate shocks in Hungary and the policy functions of each experiment. Results reflect the average of the period between 2001 to 2010.

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Sensitivity Analysis: SDF, Aggregate Productivity Shock and ER Pass-through

	Benchmark	SDF	SDF + Aggregate Shock	SDF+ Aggregate Shock + Pass-Through
	(1)	(2)	(3)	(4)
	Firm-level results			
FC debt share	12.1	10.4	10.4	24.3
Investment	10.8	12.5	12.0	12.0
E(K)	19.9	25.9	25.8	25.3
Default rate	2.8	2.8	3.0	2.5
Productivity threshold	1.2	1.2	1.2	1.1

Notes: Rows 1, 2 and 3 are in percentage. Columns 1 shows the moments for the benchmark calibration. Column 2 includes the investor's stochastic discount factor. Column 3 adds the SDF and an aggregate productivity shock. Column 4 includes the SDF, the aggregate productivity shock and the exchange rate pass-through. In each experiment, we simulate approximately 160,000 firms from the stationary distribution without foreign currency loans, using the realized exchange rate shocks in Hungary and the policy functions of each experiment. Results reflect the average of the period between 2001 to 2010.

▸ More

Conclusion

→ Allocation of FC loans across firms is key to understand aggregate consequences.

→ Cross-sectional heterogeneity in FC borrowing in two dimensions:

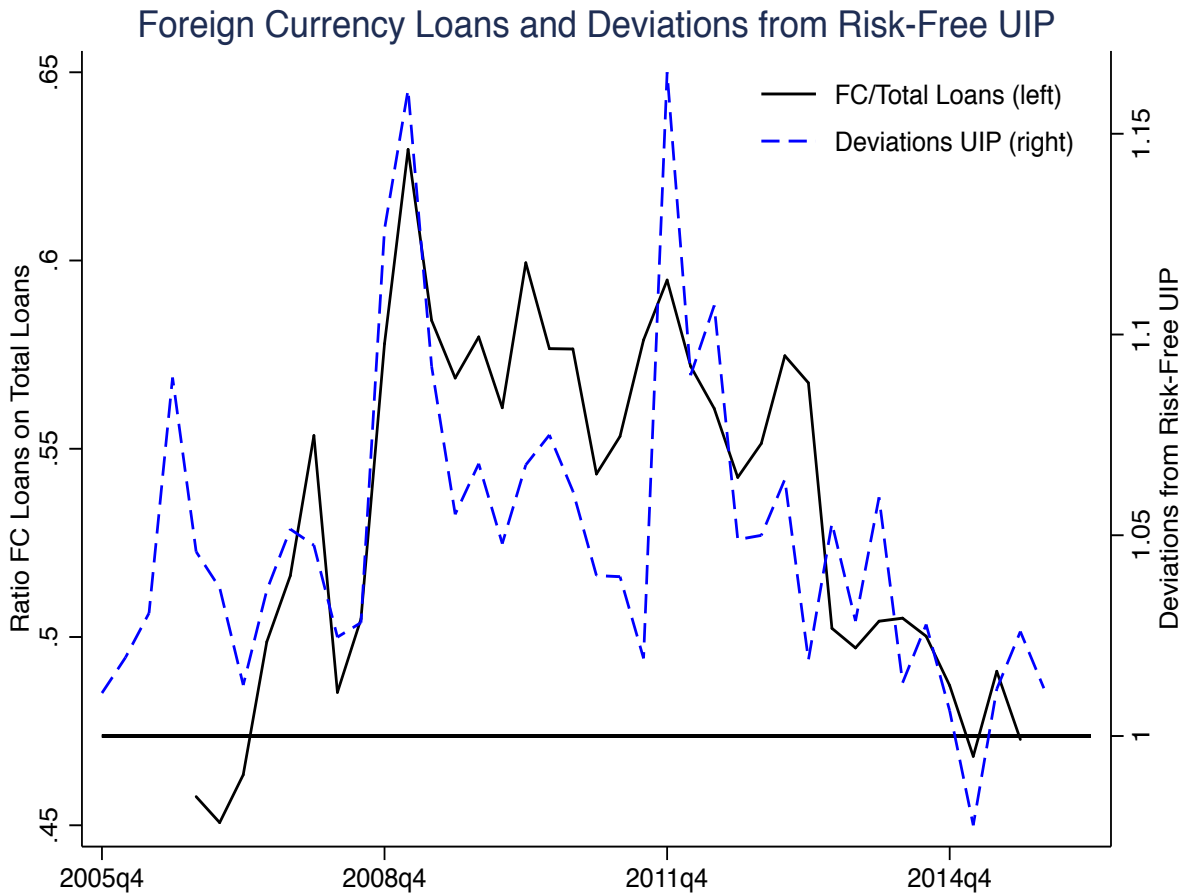
- *Selection* of productive firms into FC borrowing.
- High MPK firms use FC loans more intensively.

→ High financial development is critical to maximize the growth and minimize balance sheet effects.

→ Large exchange rate market interventions can create systemic risk.

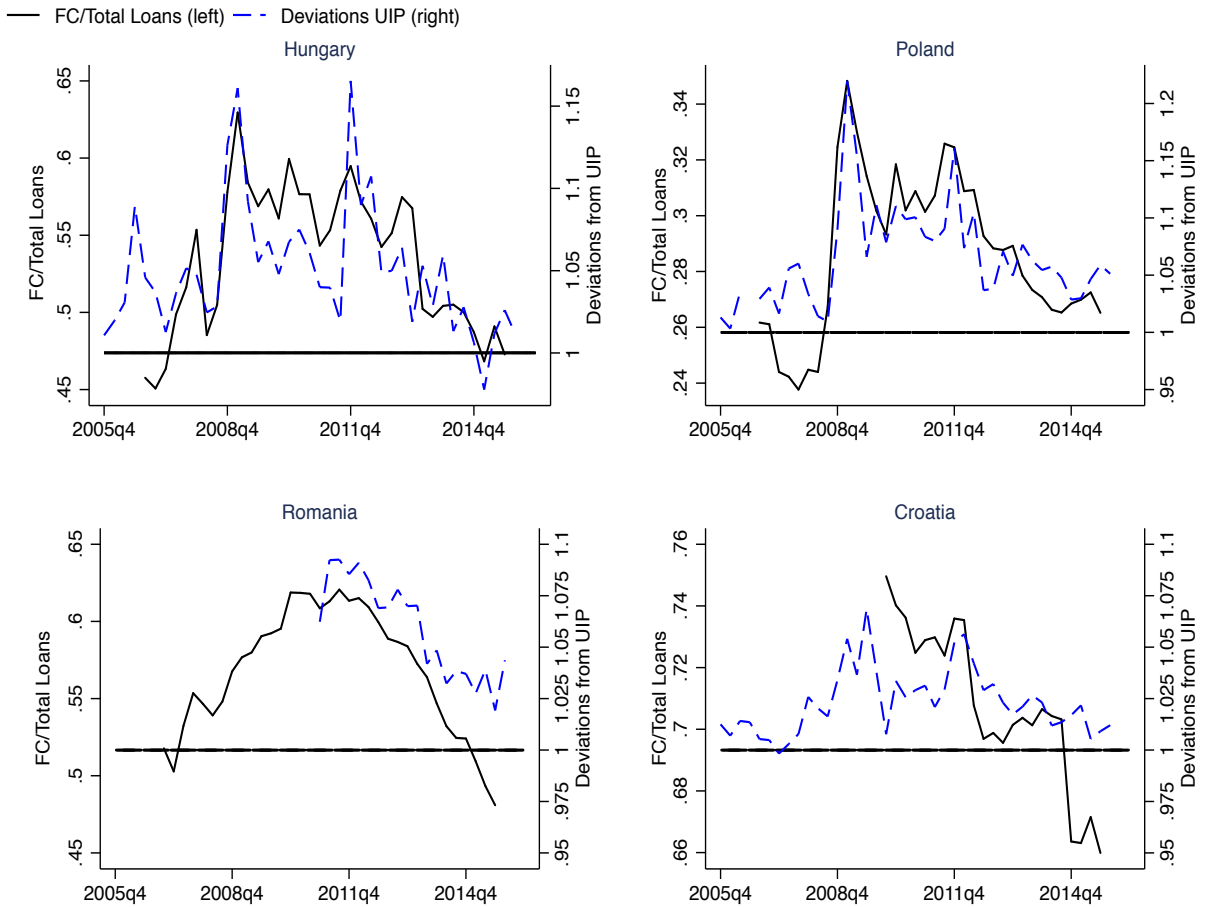
Extra Slides

Hungary: FC Loans and Deviations from UIP

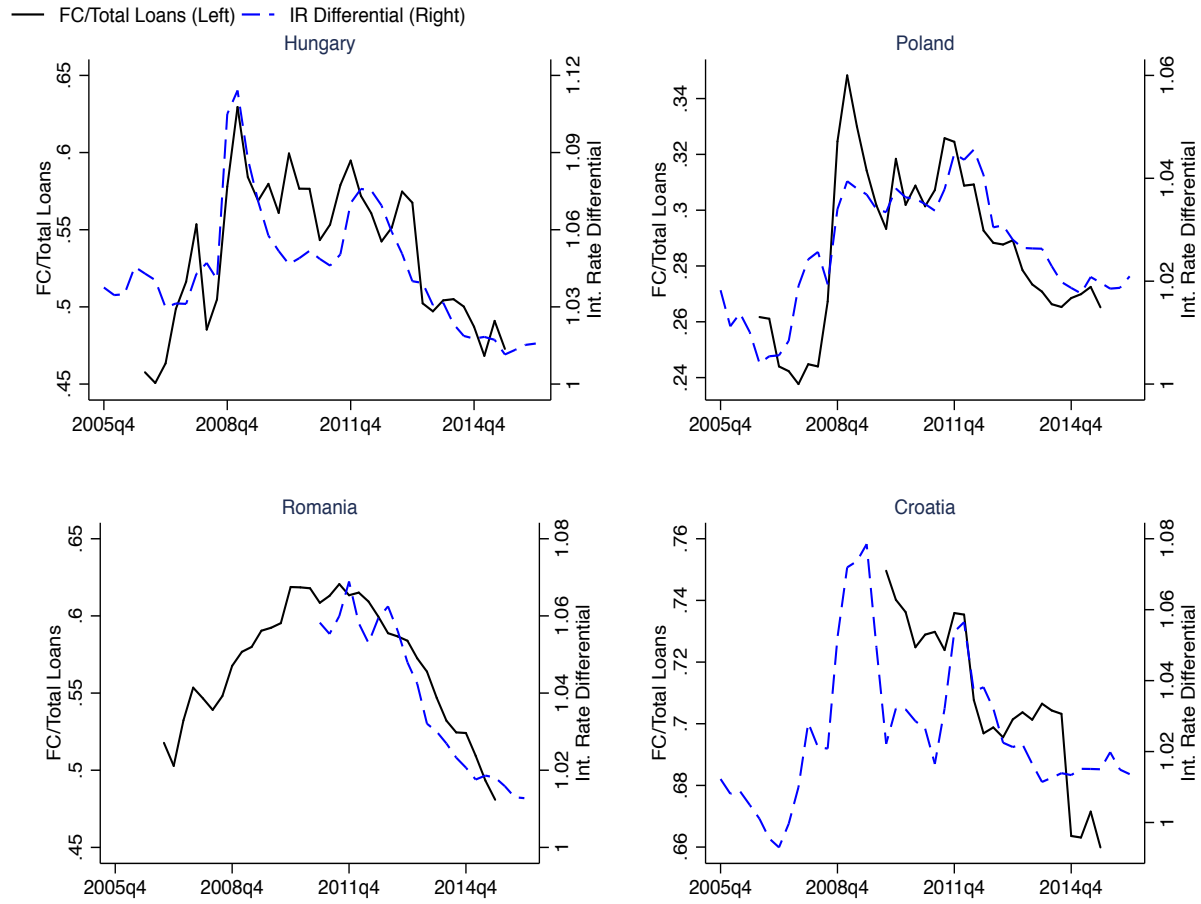


→ Without taking into account CDS.

Stylized Facts

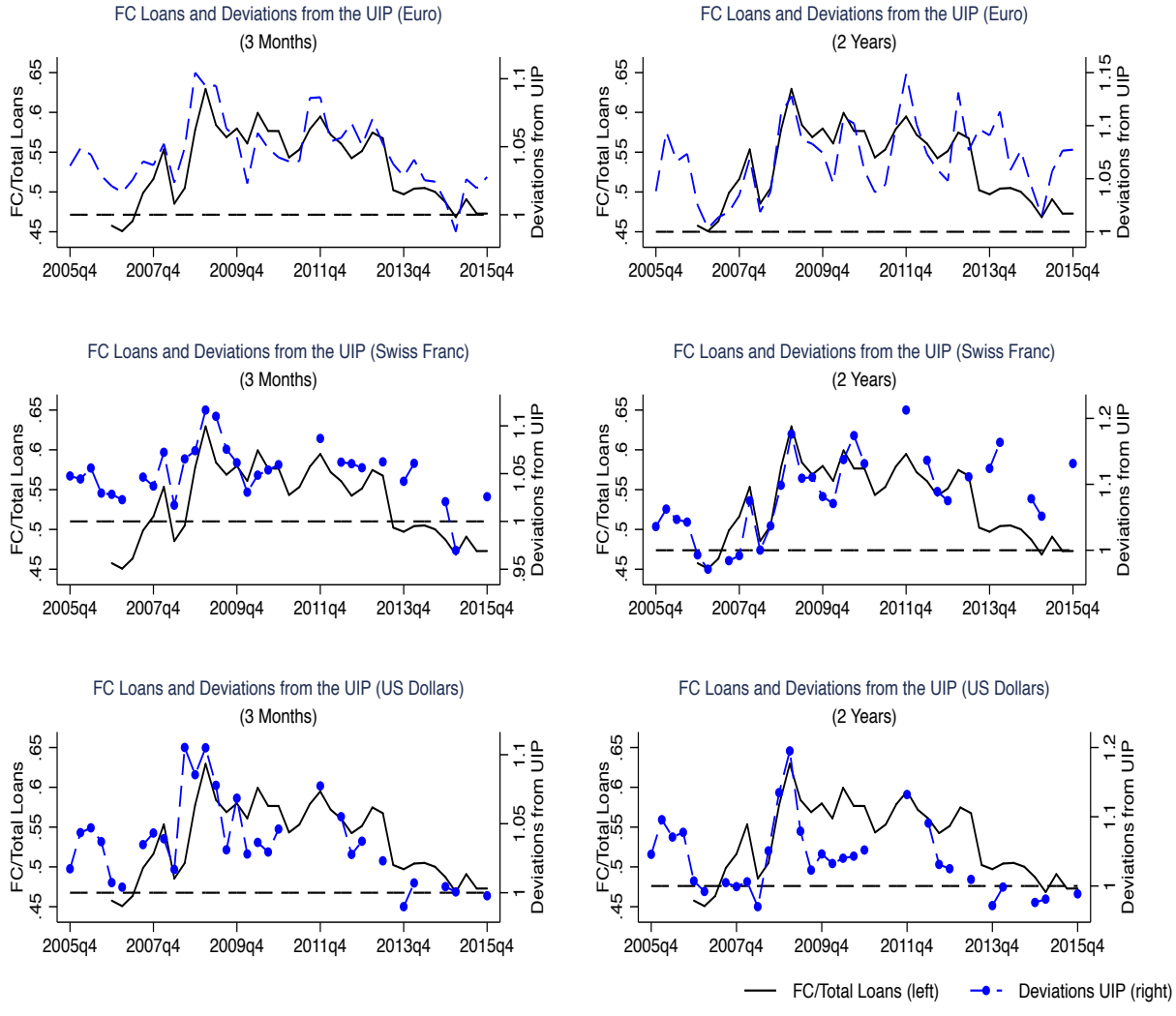


FC Loans and Interest Rate Differential in Developing Countries



$\rightarrow$ $\text{IR Diff}_t = \frac{(1+r_t)}{(1+r_t^*)} > \mathbf{1}$

Foreign Currency Loans and Deviations from the UIP (3M & 2Y)



◂ Return

Characteristics of Firms Holding Foreign Currency Loans in 2005

	Non FC Debt	FC Debt
	(1)	(2)
Share of FC Debt	0	64
Share of Non-Exporters	91	73
Interest Rate	13.4	12.3
Employment	17	45
Log RTFP	6.5	6.7
Corr(FC Share, Log RTFP)	-	0.02
Corr(FC Share, Log Capital)	-	-0.05
Number of firms	147,166	13,493

Notes: Rows 1-3 are in %. The difference in means and correlation are statistically significant at one percentage point. Source: APEH, Credit Register data BEEPs (World Bank and EBRD).

Data

	Sector	Number of firms	
		All	Borrowing in FC
		(1)	(2)
A	Agriculture, forestry and fishing	7,511	748
B	Mining and quarrying	351	30
C	Manufacturing	22,656	3,083
D	Electricity, gas steam and air conditioning supply	357	50
E	Water supply, sewerage, waste management and remediation activities	1,099	119
F	Construction	19,334	1,738
G	Wholesale and retail trade, repair or motor vehicles and motorcycles	48,198	4,485
H	Transportation and storage	6,291	631
I	Accommodation and food service activities	9,305	611
J	Information and communication	8,153	351
M	Professional, scientific and technical activities	18,522	814
N	Administrative and support service activities	10,014	525
R	Arts, entertainment and recreation	3,933	97
S	Other service activities	4,935	211
Total		160,659	13,493

Notes: Nace Rev.2 Industry Classification. Source: APEH.

◂ Return

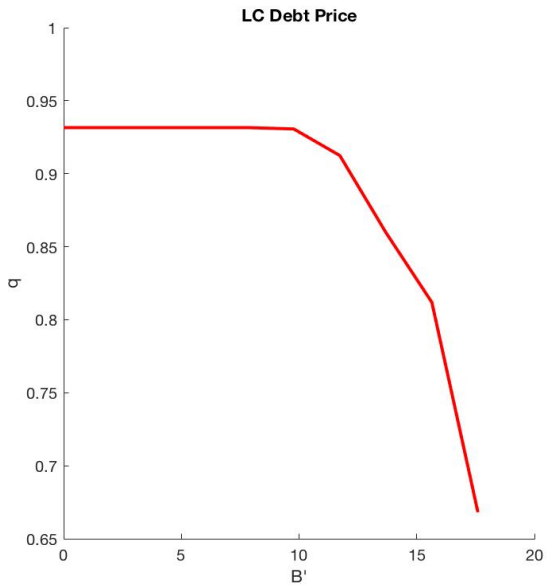
Non-Targeted Moments

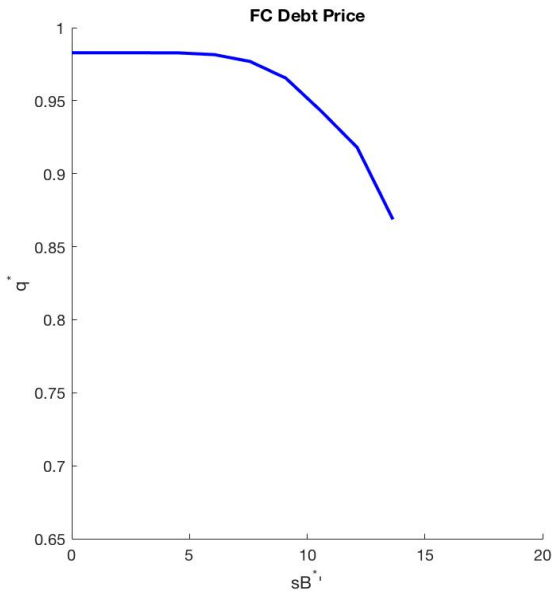
Moment	Group	Model (1)	Data (2)
Firm share (%)	LC & FC debt	6	6
	FC debt only	2	3
Relative productivity*	LC debt only	0.97	0.99
	LC & FC debt	1.02	1.02
	FC debt only	1.07	1.05
Relative capital*	LC debt only	1	0.97
	LC & FC debt	1.02	1.06
	FC debt only	0.91	0.99
Investment rate (%)	LC debt only	9	9
	LC & FC debt	18	18
	FC debt only	22	19
FC Share (%)	LC & FC debt	59	50
	FC debt only	100	100

Notes: 2005-2006. We simulate approximately 160,000 firms from the stationary distribution of no foreign currency. In this simulation, we use the realized exchange rate shocks between 2001 to 2010 and the optimal policies of the model with foreign currency borrowing to obtain the moments for 2001-2010.*Relative productivity and capital are considered with respect to firms with credit.

◂ Return

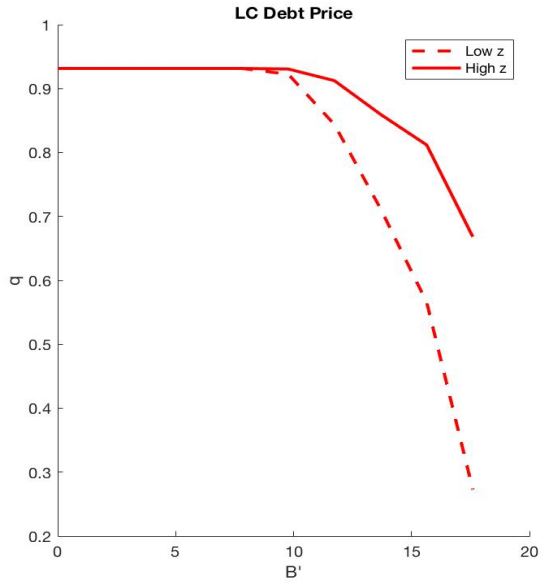
Mechanism: Bonds' Prices

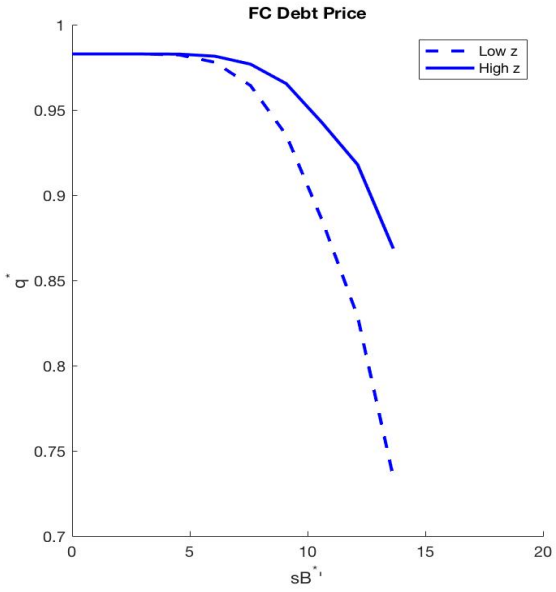




$$q = \frac{\left[1 - P_{z,s}\left(\Delta_{(k,b,b^*)}\right)\right]}{1 + r} \qquad q^* = \frac{\left[1 - P_{z,s}\left(\Delta_{k,b,b^*}\right)\right]}{1 + r^*}$$

Mechanism: Bonds' Prices for Low and High Productive Firms

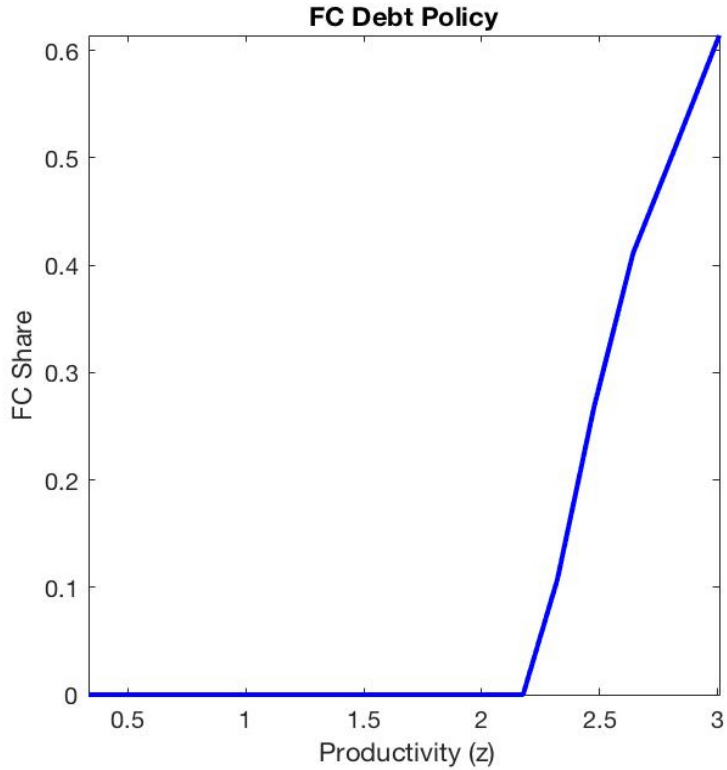




$$q = \frac{\left[1 - P_{z,s}\left(\Delta_{(k,b,b^*)}\right)\right]}{1+r} \qquad q^* = \frac{\left[1 - P_{z,s}\left(\Delta_{k,b,b^*}\right)\right]}{1+r^*}$$

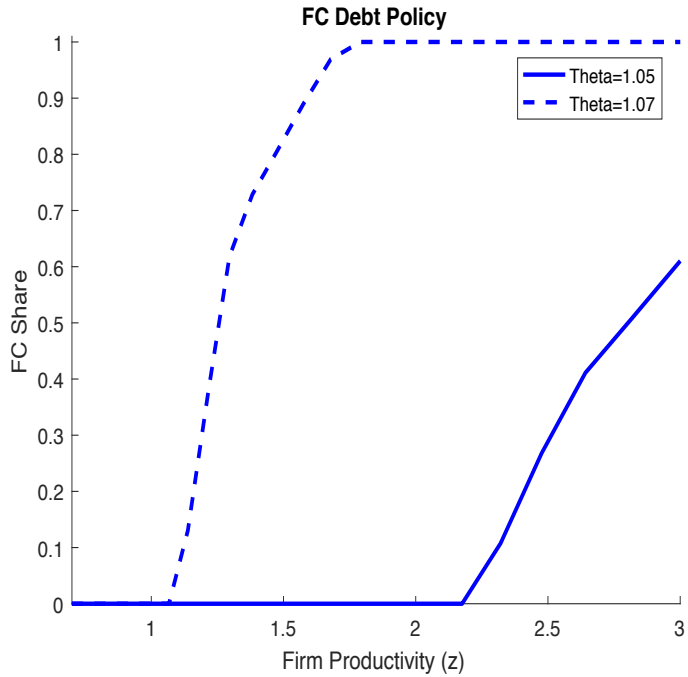
Model's Implications I

-Lemma 1. Only high productive firms borrow in foreign currency. These firms have higher investment rates and grow faster.



Model's Implications II

-Lemma 2. Higher deviations from the risk-free UIP increase foreign currency borrowing and decrease the productivity level to use this financing. Importantly, these deviations raise investment and sales for firms issuing foreign bonds.



◂ Return

Calibration: Shocks

– Firms' productivity process:

$$\log z_{ijt} = \rho_z \log z_{ijt_{t-1}} + \phi_i + \mu_{jt} + \varepsilon_{ijt},$$

where ϕ_i and μ_{jt} are firm and four-digit NACE industries-year FE.

– Exchange rate process:

$$\log s_t = \rho_s \log s_{t-1} + \varepsilon_t.$$

Sensitivity Analysis

1) Stochastic Discount Factor:

$$m' = \beta\left(\frac{s'}{s}\right)^{\gamma} \qquad \text{and} \qquad m'^{*} = \frac{1}{(1+r^{*})}$$

where $\beta = (0.93, 1.02)$ to match the mean and variance of the local interest rate and the mean of UIP deviation.

2) Aggregate Shock:

$$Z = s^{-\zeta} \qquad \text{and} \qquad F(s,z,k) = s^{-\zeta} z k^{\alpha}$$

where $\zeta = 0.05$ from a regression of TFP and exchange rate in Hungary, 1992-2015.

3) Exchange Rate Pass-Through

$$e = s^{\eta}[zk^{\alpha} - i(k,k') - \psi(k,k') - c_f] - [b + sb^{*}] + [qb' + q^{*}sb'^{*} - s^{\eta}c_{I_{(b'+b'^{*}>0)}} - s^{\eta}c^{*}_{I_{(b'^{*}>0)}}]$$

where $\eta = 0.2$ from a regression of consumer price index on exchange rate in Hungary, 1992-2015.

◂ Return

Robustness Test: Lemma 1. Selection

	Panel A. Foreign Currency Loan Dummy					
	(1)	(2)	(3)	(4)	(5)	(6)
Log productivity	0.014***	0.015***	0.016***	0.013***	0.011***	0.020***
	(0.002)	(0.002)	(0.002)	(0.003)	(0.002)	(0.002)
Log capital	0.036***	0.030***	0.031***	0.031***	0.030***	0.030***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Log LC leverage		0.008***	0.008***	0.007***	0.008***	0.012***
		(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Log age			-0.020***	-0.016***	-0.018***	-0.017***
			(0.003)	(0.003)	(0.003)	(0.003)
Sector FE	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.060	0.060	0.061	0.060	0.064	0.056
N	37,051	33,327	33,327	33,327	34,478	35,783
	Panel B. Log Share of FC Loans					
Log productivity	0.005***	0.003**	0.004***	0.004**	0.004**	0.004***
	(0.001)	(0.001)	(0.001)	(0.002)	(0.001)	(0.001)
Log capital	0.013***	0.009***	0.010***	0.012***	0.010***	0.010***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Log LC leverage		0.002***	0.002***	0.002***	0.002***	0.004***
		(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Log age			-0.012***	-0.011***	-0.011***	-0.008***
			(0.002)	(0.002)	(0.002)	(0.002)
Sector FE	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.048	0.039	0.041	0.036	0.043	0.038
N	37,051	33,327	33,327	33,327	34,478	35,783

Note: *, **, *** significant at the 10, 5, and 1 percent level. Standard errors in parentheses. Column 1 includes exporters. Column 2 includes controls for local currency leverage prior to the deregulation. Column 3 controls for age. Column 4 uses RTFP measured with the Olley and Pakes' (1996) methodology. Column 5 employs labor productivity as a proxy for firms' RTFP. Column 6 employs the average for 1998-2000 as initial conditions. Source: APEH and Credit Register.

Return

Robustness Test: Lemma 1. Investment

	Log Investment Rate	Log Sales		
	Data	Model	Data	
	(1)	(2)	(3)	(4)
R*FC dummy	0.056**	0.063***	0.048***	0.055***
	(0.025)	(0.010)	(0.017)	(0.015)
Firm FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
FC d.*time trend	Yes	Yes	Yes	Yes
R^2	0.475	0.570	0.866	0.870
N	432,864	1,568,060	458,883	500,343

Notes: *, **, *** significant at the 10, 5, and 1 percent level. Standard errors in parentheses. R is a dummy for the period 2001-2005. Period 1996-2005. Column 1 includes exporters. Column 2 presents the estimated results for sales using the simulated data. Column 3 and 4 present the results for sales for non-exporting and exporting firms respectively. Source: APEH and Credit Register.

◂ Return

Robustness Tests: Lemma 2. UIP Deviations (Country's Risk Premium)

	FC Dummy			Log Share of FC Loans			Log Investment Rate		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Log Dev. UIP	0.119***			0.071***			0.080***		
	(0.019)			(0.011)			(0.029)		
Log (Dev. UIP x Productivity)		0.039***			0.023***			0.330***	
		(0.009)			(0.005)			(0.020)	
Log (Dev. UIP x Q_{HL})			0.170***			0.074***			0.213***
			(0.034)			(0.017)			(0.076)
Log (Dev. UIP x Q_{HH})			0.047			0.047**			0.169*
			(0.046)			(0.024)			(0.087)
Log (Dev. UIP x Q_{LL})			0.053*			0.009			0.108*
			(0.031)			(0.018)			(0.065)
Log (Dev. UIP x Q_{LH})			0.078*			0.062**			-0.020
			(0.044)			(0.025)			(0.079)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE		Yes	Yes		Yes	Yes		Yes	Yes
Sector* Year FE		Yes	Yes		Yes	Yes		Yes	Yes
R^2	0.742	0.688	0.743	0.716	0.655	0.712	0.575	0.525	0.709
N	892,584	892,584	892,584	892,584	892,584	892,584	436,455	436,455	436,455

Notes: *, **, *** significant at the 10, 5, and 1 percent level. Standard errors in parentheses. Period 2005-2010. This table employs UIP deviations computed using credit default swaps to deduct the sovereign risk premium from the interest rate and control for the country's risk premium. Source: APEH and Credit Register.

◂ Return

Robustness Tests: Deviations from the Risk-Free UIP (Realized Exchange Rate)

	FC Dummy			Log Share of FC Loans			Log Investment Rate		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Log Dev. UIP	0.043***			0.028***			0.205***		
	(0.012)			(0.004)			(0.066)		
Log (Dev. UIP x Productivity)		0.013**			0.071***			0.318***	
		(0.006)			(0.007)			(0.019)	
Log (Dev. UIP x Q_{HL})			0.132***			0.051***			0.363***
			(0.039)			(0.019)			(0.047)
Log (Dev. UIP x Q_{HH})			0.090***			0.029*			-0.284***
			(0.029)			(0.016)			(0.060)
Log (Dev. UIP x Q_{LL})			0.063*			0.021			0.499***
			(0.033)			(0.018)			(0.052)
Log (Dev. UIP x Q_{LH})			0.095***			0.045***			-0.695***
			(0.027)			(0.016)			(0.060)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE		Yes	Yes		Yes	Yes		Yes	Yes
Sector* Year FE		Yes	Yes		Yes	Yes		Yes	Yes
R^2	0.742	0.687	0.753	0.717	0.680	0.731	0.575	0.525	0.585
N	892,584	892,584	892,584	892,584	892,584	892,584	436,455	436,455	436,455

Notes: *, **, *** significant at the 10, 5, and 1 percent level. Standard errors in parentheses. Period 2005-2010. This table controls employs realized exchange rate to compute the UIP deviation. Source: APEH and Credit Register.

Robustness Tests: Deviations from the Risk-Free UIP (Exporters and Foreign Firms)

	FC Dummy			Log Share of FC Loans			Log Investment Rate		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Log Dev. UIP	0.139***			0.083***			0.079*		
	(0.018)			(0.011)			(0.042)		
Log (Dev. UIP x Productivity)		0.035***			0.022***			0.328***	
		(0.008)			(0.004)			(0.017)	
Log (Dev. UIP x Q_{HL})			0.189***			0.085***			0.235***
			(0.032)			(0.016)			(0.071)
Log (Dev. UIP x Q_{HH})			0.080**			0.064***			0.188**
			(0.041)			(0.022)			(0.082)
Log (Dev. UIP x Q_{LL})			0.050*			0.003			0.129**
			(0.030)			(0.017)			(0.060)
Log (Dev. UIP x Q_{LH})			0.089**			0.063***			-0.019
			(0.041)			(0.024)			(0.071)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE		Yes	Yes		Yes	Yes		Yes	Yes
Sector* Year FE		Yes	Yes		Yes	Yes		Yes	Yes
R^2	0.741	0.696	0.742	0.714	0.663	0.716	0.033	0.042	0.700
N	1,019,461	1,019,461	1,019,461	1,019,461	1,019,461	1,019,461	513,116	513,116	513,116

Notes: *, **, *** significant at the 10, 5, and 1 percent level. Standard errors in parentheses. Period 2005-2010. This table includes exporters and foreign firms. Source: APEH and Credit Register.

◂ Return

Robustness Tests: Deviations from the Risk-Free UIP (Valuation Effects)

	Log Share of FC Loans					
	Current Exchange Rate			Exchange Rate in 2005		
	(1)	(2)	(3)	(4)	(5)	(6)
Log Dev. UIP	0.062***			0.053***		
	(0.010)			(0.010)		
Log (Dev. UIP x Productivity)		0.020***			0.018***	
		(0.004)			(0.004)	
Log (Dev. UIP x Q_{HL})			0.074***			0.066***
			(0.017)			(0.017)
Log (Dev. UIP x Q_{HH})			0.037*			0.018
			(0.022)			(0.023)
Log (Dev. UIP x Q_{LL})			0.007			0.002
			(0.018)			(0.018)
Log (Dev. UIP x Q_{LH})			0.051**			0.035
			(0.024)			(0.025)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE		Yes	Yes		Yes	Yes
Sector* Year FE		Yes	Yes		Yes	Yes
R^2	0.717	0.663	0.718	0.716	0.662	0.717
N	892,584	892,584	892,584	892,584	892,584	892,584

Notes: *, **, *** significant at the 10, 5, and 1 percent level. Standard errors in parentheses. Period 2005-2010. Columns 1-3 employ year current exchange rate to compute the share of foreign currency loans on total loans and columns 4-6 employ the exchange rate in 2005 to estimate this share. Source: APEH and Credit Register.

◂ Return

Robustness Tests: Deviations from the Risk-Free UIP (MPK)

	FC Dummy	Log Share of FC Loans	Log Investment Rate
	(1)	(2)	(3)
Log (Dev. UIP x MPK)	0.021***	0.014***	0.054**
	(0.005)	(0.003)	(0.023)
Firm FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Sector* Year FE	Yes	Yes	Yes
R^2	0.695	0.649	0.513
N	892,584	892,584	436,455

Notes: *, **, *** significant at the 10, 5, and 1 percent level. Standard errors in parentheses. Period 2005-2010. Source: APEH and Credit Register.

◂ Return

Robustness Tests: Deviations from the Risk-Free UIP (Exchange Rate Pass-Through)

	FC Dummy			Log Share of FC Loans		
	(1)	(2)	(3)	(4)	(5)	(6)
Log Dev. UIP	0.109***			0.050***		
	(0.024)			(0.012)		
Log (Dev. UIP x Productivity)		0.017***			0.008***	
		(0.004)			(0.002)	
Log (Dev. UIP x Q_{HL})			0.234***			0.103***
			(0.040)			(0.020)
Log (Dev. UIP x Q_{HH})			0.106**			0.072***
			(0.053)			(0.027)
Log (Dev. UIP x Q_{LL})			0.118***			0.038*
			(0.037)			(0.021)
Log (Dev. UIP x Q_{LH})			0.142***			0.090***
			(0.048)			(0.028)
Log Producer Price Index	0.007	-0.001	0.011	0.014***	0.008*	0.016***
	(0.008)	(0.008)	(0.008)	(0.004)	(0.004)	(0.004)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.742	0.686	0.742	0.716	0.653	0.716
N	892,584	892,584	892,584	892,584	892,584	892,584

Notes: *, **, *** significant at the 10, 5, and 1 percent level. Standard errors in parentheses. Period 2005-2010. Source: APEH and Credit Register.

◂ Return

Robustness Tests: Deviations from the Risk-free UIP (Age)

	FC Dummy		Log FC Share		Log Investment Rate		Log Sales	
	Model	Data	Model	Data	Model	Data	Model	Data
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Log (Dev. UIP x Q_{HY})	0.435***	0.315***	0.258***	0.096***	4.054***	0.209***	6.186***	0.700***
	(0.040)	(0.047)	(0.021)	(0.025)	(0.033)	(0.062)	(0.091)	(0.165)
Log (Dev. UIP x Q_{HO})	0.177***	0.032	0.119***	0.054***	3.463***	0.183**	5.979***	0.047
	(0.040)	(0.034)	(0.021)	(0.017)	(0.033)	(0.073)	(0.088)	(0.169)
Log (Dev. UIP x Q_{LY})	0.137***	0.172***	0.108***	0.056***	-1.649***	0.008	-5.142***	0.567***
	(0.040)	(0.039)	(0.021)	(0.021)	(0.032)	(0.065)	(0.082)	(0.163)
Log (Dev. UIP x Q_{LO})	-0.231***	-0.024	-0.081***	-0.003	-2.156***	0.161***	-5.370***	-0.125
	(0.039)	(0.034)	(0.020)	(0.019)	(0.032)	(0.054)	(0.079)	(0.185)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sector*Year FE		Yes		Yes		Yes		Yes
R^2	0.42	0.742	0.403	0.717	0.623	0.700	0.748	0.919
N	940,836	1,019,461	940,836	1,019,461	940,836	513,116	940,836	765,611

Notes: *, **, *** significant at the 10, 5, and 1 percent level. Standard errors in parentheses. Period 2005-2010. Source: APEH and Credit Register.

◂ Return