Financial development, trade and misallocation

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- An exchange rate depreciation can stimulate domestic activity, through its effects on exports
- An exchange rate depreciation can tighten domestic financial conditions when debt is in foreign currency
- Kearns and Patel (2016) find that the second effects dominates in emerging markets
- In this paper we rationalize this fact to understand why

What we do

- Analyze role of financial development during depreciations
- We provide an empirical motivation to highlight the role that financial development has in determining the effect of a devaluation on firm performance
- Posit a theoretical model to rationalize why in economies with low financial development a devaluation does not have a positive impact on firms

What we do

- Two period small open economy (exogenous r^*) and uncertainty on future exchange rate
- Heterogeneous firms (capital and productivity) choose at $t = 1$ whether to borrow in foreign currency from abroad or borrow from domestic markets
  - Higher financial development implies flatter supply curve of domestic credit
  - To access international credit markets firms must pay fixed cost. Debt is in foreign currency
- At $t = 2$ firms choose whether to only produce for domestic consumption or also export
  - As in Melitz (2003) firms pay a fixed cost to access foreign markets

What we find

- In data for low financial development a real devaluation is associated with lower revenue for firms, while the opposite is true in economies with high financial development
  - Firms have a greater share of debt in foreign currency in economies with lower financial development
  - Firms are more likely to export after a devaluation in economies with greater financial development
- Numerical experiment: analyze equilibrium across economies with different degrees of financial development
- Lower financial development causes firms to be worse off with devaluations
  - More firms borrow in foreign currency
  - Less firms export

What we find

- Lower financial development causes more expensive domestic borrowing
- This causes misallocation
  - Productive firms with small initial capital more likely to pay fixed cost to borrow from abroad and scale up close to their benchmark size: fixed cost is spread among larger loan
  - Productive firms with high initial capital borrow from domestic markets, which is more expensive
- More expensive borrowing (paying fixed cost to access international credit markets or paying a higher interest rate for domestic credit) hinders firms to pay the fixed cost to export

Literature review

- Trade with firm heterogeneity and financial constraints: Amiti and Weinstein (2011), Beck (2002), Beck (2003), Caggese and Cuñat (2013), Fauceglia (2015), Kohn et al (2016), Manova (2013), Minetti and Zhu (2011), Muûls (2015). **We include trade and credit market choice and highlight the role that financial development has in diminishing misallocation**
- Relation between financial constraints and effect on trade decisions: Chaney (2016), Kohn et al (2020), Alfaro et al (2018). **We analyze how the misallocation caused by not having perfect financial development interacts with trade decisions**
- Firm balance sheet effects of a foreign exchange devaluation: Aghion et al (2004), Korinek (2010). **In our model devaluations incetivize to export, but can increase debt burden**

Data

- World Bank Enterprise Surveys
  - Around 95.000 firm level observations from 2006 to 2017 for close to 100 countries
  - Use data on total annual sales in US$ 2009 as independent variable and employees and ratio capital to labor as controls
- We use trade weighted REER as estimated by Darvas (2012):
  - Set $REER_{2007} = 100$ for all countries. If $REER_{ct} > 100$ for $t > 2007$ then there is an appreciation

▸ REER

- We use the Financial Development Index calculated by IMF ▸ FD
  - Re-scale index to go from 0 to 100, with 100 being full financial development

Estimation methodology

We estimate

$$\ln Rev_{ijct} = \beta_0 + \beta_1 FD_{ct} + \beta_2 REER_{ct} + \beta_3 FD_{ct} \times REER_{ct} + \alpha X_{ijct} + \sum_j \mu_j + \sum_c \upsilon_c + \sum_t \tau_t + \epsilon_{ijct}$$

Rev_{ijct} is annual revenue for firm i, in sector j, in country c, in year t;
$REER_{ct}$ is the real effective exchange rate for country c
FD_{ct} is the financial development index for country c
X is a vector with firm level control variables
Sector (μ), country (υ) and year fixed effects (ϵ).

Estimation methodology

We analyze the marginal effect of a devaluation on firm revenue,

$$\frac{\partial \ln Rev_{ijct}}{\partial REER_{ct}} = \beta_2 + \beta_3 FD_{ct},$$

and how this relation depends on the financial development of an economy

Estimation results

Evaluating *FD* at median:

$$-\frac{\partial \ln Rev_{ijct}}{\partial REER_{ct}} = \underset{(0.006)}{0.015} + \underset{(0.000)}{0.000} \times 30.59 = -0.210\%.$$

Change in revenue is increasing in financial development

- With *FD* at 10th percentile: -0.99%
- With *FD* at 90th percentile: 0.66%

▸ Firm level regression

Mechanism

- A firm in an economy with low financial development has a higher share of debt in foreign currency

  ▸ Share of loans in foreign currency

- A firm in an economy with high financial development is more likely to export when there is a devaluation

  ▸ Probability of exporting

Model

- Two-period, small open economy, with heterogeneous firms along two margins: (k, z)
- At $t = 1$ firms choose where to borrow from:
  - domestic market in domestic currency, with a supply with positive slope that depends on financial underdevelopment
  - foreign market, at r^*, in foreign currency. Firms pay a fixed cost to access this market
- At $t = 2$ the stochastic exchange rate is realized
- Firms then choose whether to only sell for domestic consumption or to also export
  - to access foreign markets they pay a fixed cost

Demand

- Firms produce under monopolistic competition with exogenous demand for the variety that they produce
  - Domestic demand

$$y(\omega) = \left(\frac{1}{p(\omega)}\right) C^d$$

  - Foreign demand

$$y^x(\omega) = \left(\frac{1}{p^x(\omega)}\right) C^x$$

Firms

- At the beginning of $t = 1$ firms draw k and z from independent distributions and choose k' and credit market
- International credit market
  - exogenous r^*
  - loan is in foreign currency
  - firms pay fixed cost f_r to access this market
- Domestic credit market
  - Loan in domestic currency
  - Reduced form supply of funds

$$r^{\rho}(B) = r^* + \exp(\rho B) - 1, \quad \rho \geqslant 0,$$

ρ: financial underdevelopment
B: aggregate demand of domestic credit

Firms

- Firms produce at $t = 2$ using capital as only input
- At $t = 2$ exchange rate ξ is realized and firms choose whether to export or not
- Firms take demand as given to produce
  - domestic production: use $k^d = k' - k^x$ (endogenous) to produce
  $$y^d = zk^d$$
  - production to export: use k^x (endogenous) and pay fixed cost f^x to produce
  $$y^x = z\left(k^x - f^x\right)$$

Choice to trade

- At $t = 2$ firms have chosen k' and the credit market where they borrowed
  - k' may be different depending on the credit market that they choose: k'^{ρ} and k'^{*}
- Firms choose whether to only produce domestically

$$\pi^{\rho d}(k'^{\rho}) \equiv \max_{p} py(p; k'^{\rho}) - (1 + r^{\rho})(k'^{\rho} - (1 - \delta)k)$$

$$\pi^{* d}(k'^{*}) \equiv \max_{p} py(p; k') - \xi(1 + r^{*})(f_r + k'^{*} - (1 - \delta)k)$$

- or also export

$$\begin{aligned}\pi^{\rho x}(k'^{\rho}) \equiv & \max_{p, p^x, k^x} py(p; k'^{\rho} - k^x) + \xi p^x y^x(p^x; k^x) \\ & - (1 + r^{\rho})(k'^{\rho} - (1 - \delta)k) \\ \pi^{* x}(k'^{*}) \equiv & \max_{p, p^x, k^x} py(p; k' - k^x) + \xi p^x y^x(p^x; k^x) \\ & - \xi(1 + r^{*})(f_r + k'^{*} - (1 - \delta)k)\end{aligned}$$

Choice to trade

- Profits at $t = 2$ are

$$\pi^{\rho}(k'^{\rho};\xi) = \max\left\{\pi^{\rho d}(k'^{\rho}), \pi^{\rho x}(k'^{\rho})\right\}$$
$$\pi^{*}(k'^{*};\xi) = \max\left\{\pi^{*d}(k'^{*}), \pi^{*x}(k'^{*})\right\}$$

Choice of credit market

- Firms choose at $t = 1$ how much capital to use for $t = 2$, taking into account the profits at $t = 2$ for each realization of ξ and the total expected profits from each choice:

$$v^{\rho}(k, z) \equiv \max_{k'^{\rho}} \mathbb{E}_{\xi} \left[\pi^{\rho}(k'^{\rho}; \xi) \right]$$

$$v^{*}(k, z) \equiv \max_{k'^{*}} \mathbb{E}_{\xi} \left[\pi^{*}(k'^{*}; \xi) \right]$$

- the choice of credit market is given by

$$v(k, z) = \max \left\{ v^{\rho}(k, z), v^{*}(k, z) \right\}$$

Equilibrium

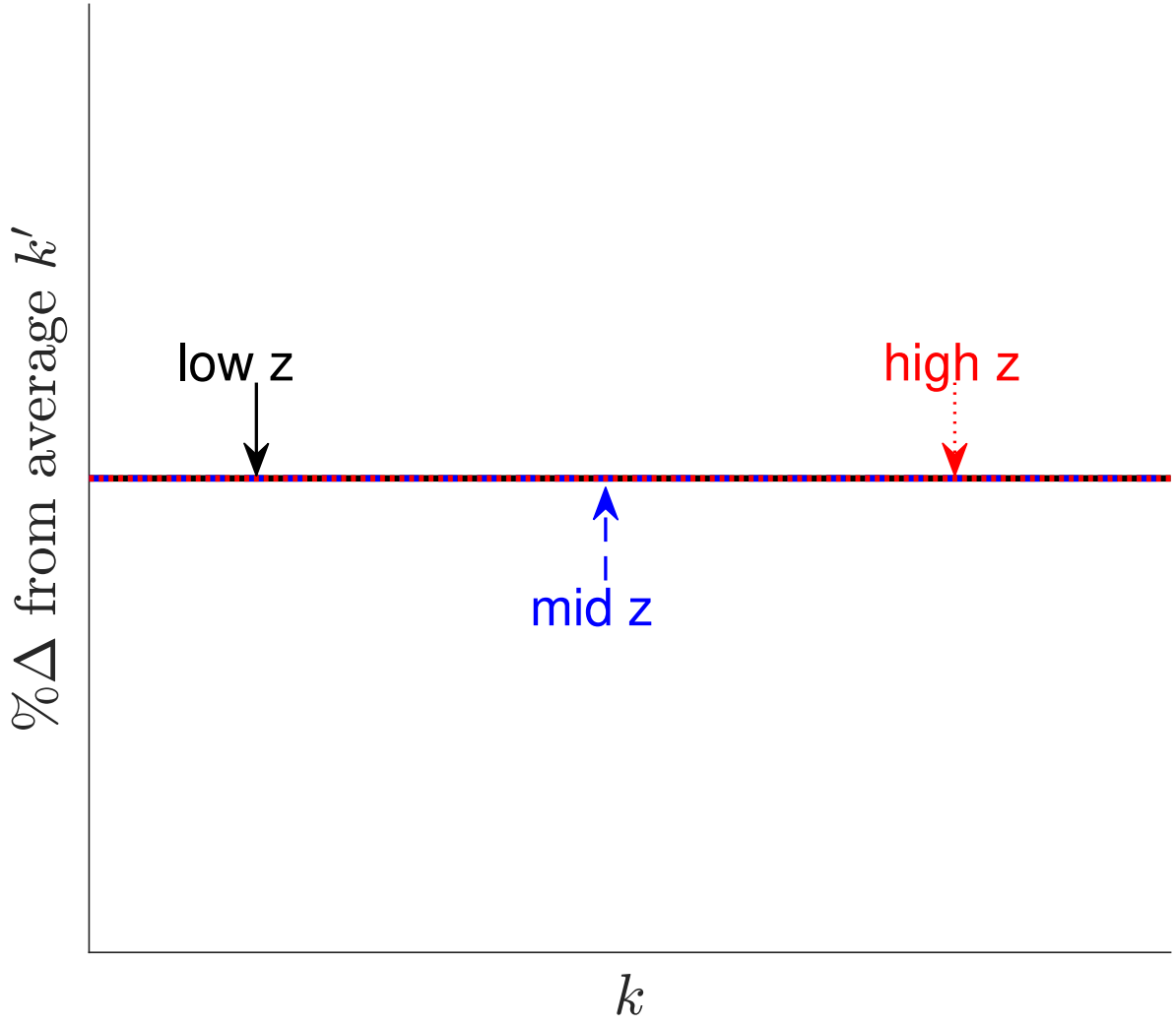
An equilibrium in this economy is r^ρ, $\{k'\}_{(k,z)}$, sets $\mathcal{F}^\rho$, $\mathcal{F}^*$ on (k,z) and $\{\mathcal{F}^d, \mathcal{F}^x\}_{\{\xi\}}$ such that given r^*

1. given r^ρ, $\{k'\}_{\{(k,z)\}}$ is a solution to the problem of firms ;
2. given r^ρ, $(k,z) \in \mathcal{F}^\rho$ if and only if $v(k,z) = v^\rho(k,z)$;
3. given r^ρ, $(k,z) \in \mathcal{F}^*$ if and only if $v(k,z) = v^*(k,z)$;
4. the domestic credit market clears;
5. and for each realization of ξ,
    1. $(k,z) \in \mathcal{F}^x(\xi)$ if an only if firm (k,z) exports and $(k,z) \in \mathcal{F}^d(\xi)$ if and only if firm (k,z) only produces for domestic consumption;

Numerical exercise

- Assume $\mathbb{E}[\xi] = 1$ and consider a benchmark economy with $\rho = 0$. This implies $r^{\rho} = r^{*}$.
- Compare the benchmark equilibrium with equilibria for greater values of ρ
- With greater ρ there is misallocation:
  - Productive firms with low k borrow from international credit market and choose greater k' than equally productive firms with greater k
- Greater ρ causes higher costs when borrowing and causes less firms to export
  - Firms can take less advantage of devaluations: are more likely to borrow from abroad and less likely to export

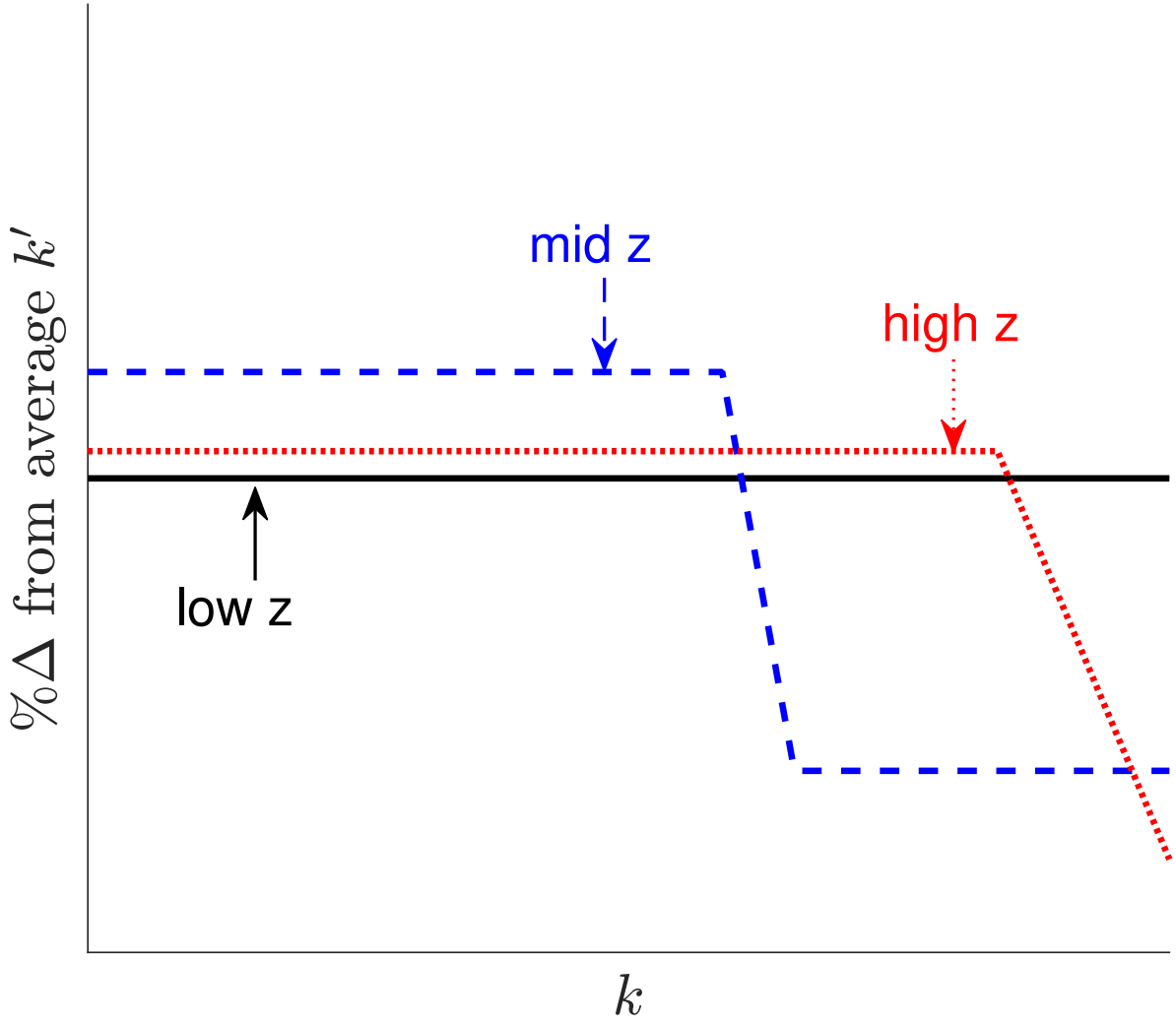
Misallocation



$\rho = 0$

As ρ increases, so does misallocation

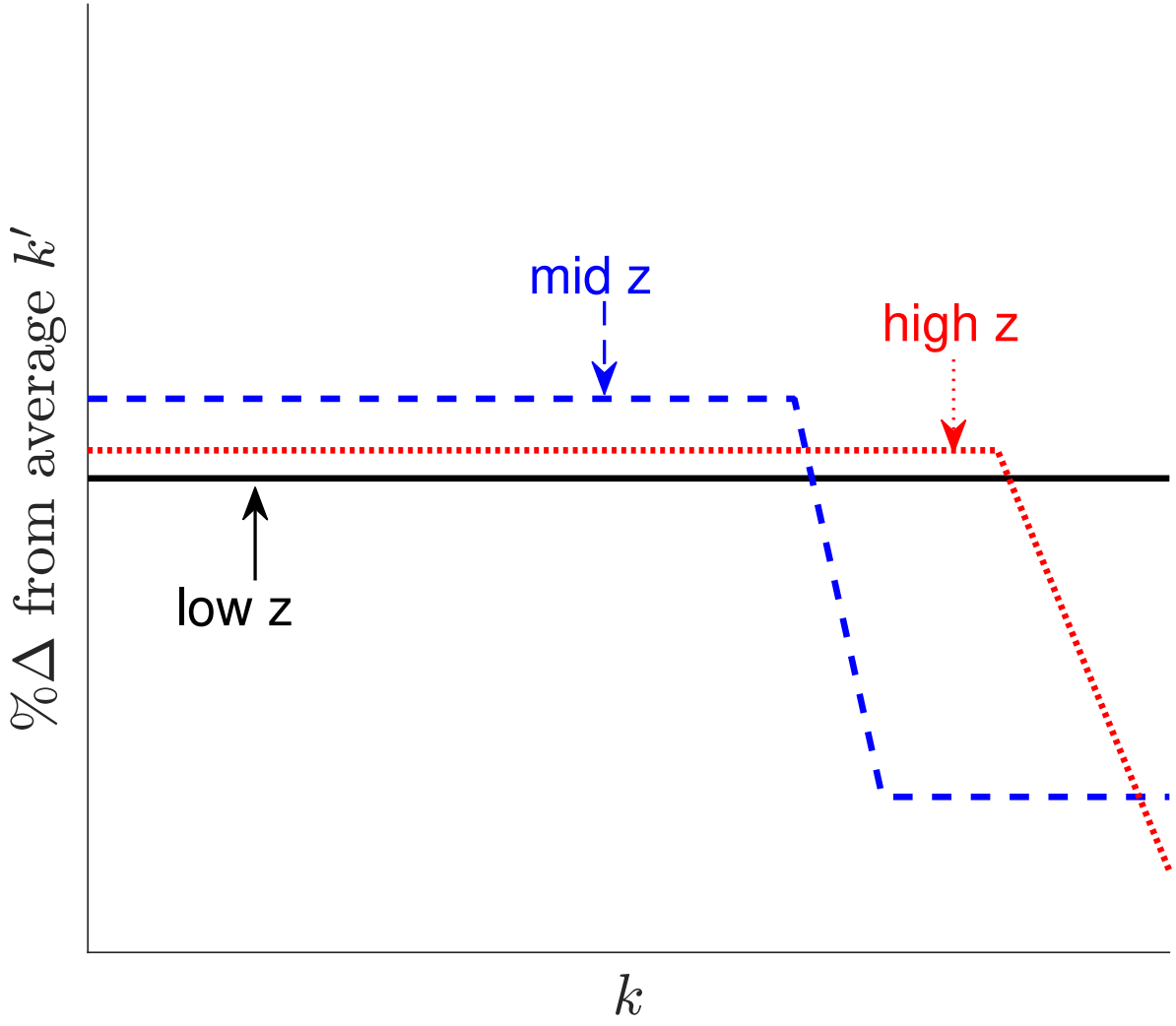
Misallocation



mid ρ

As ρ increases, so does misallocation

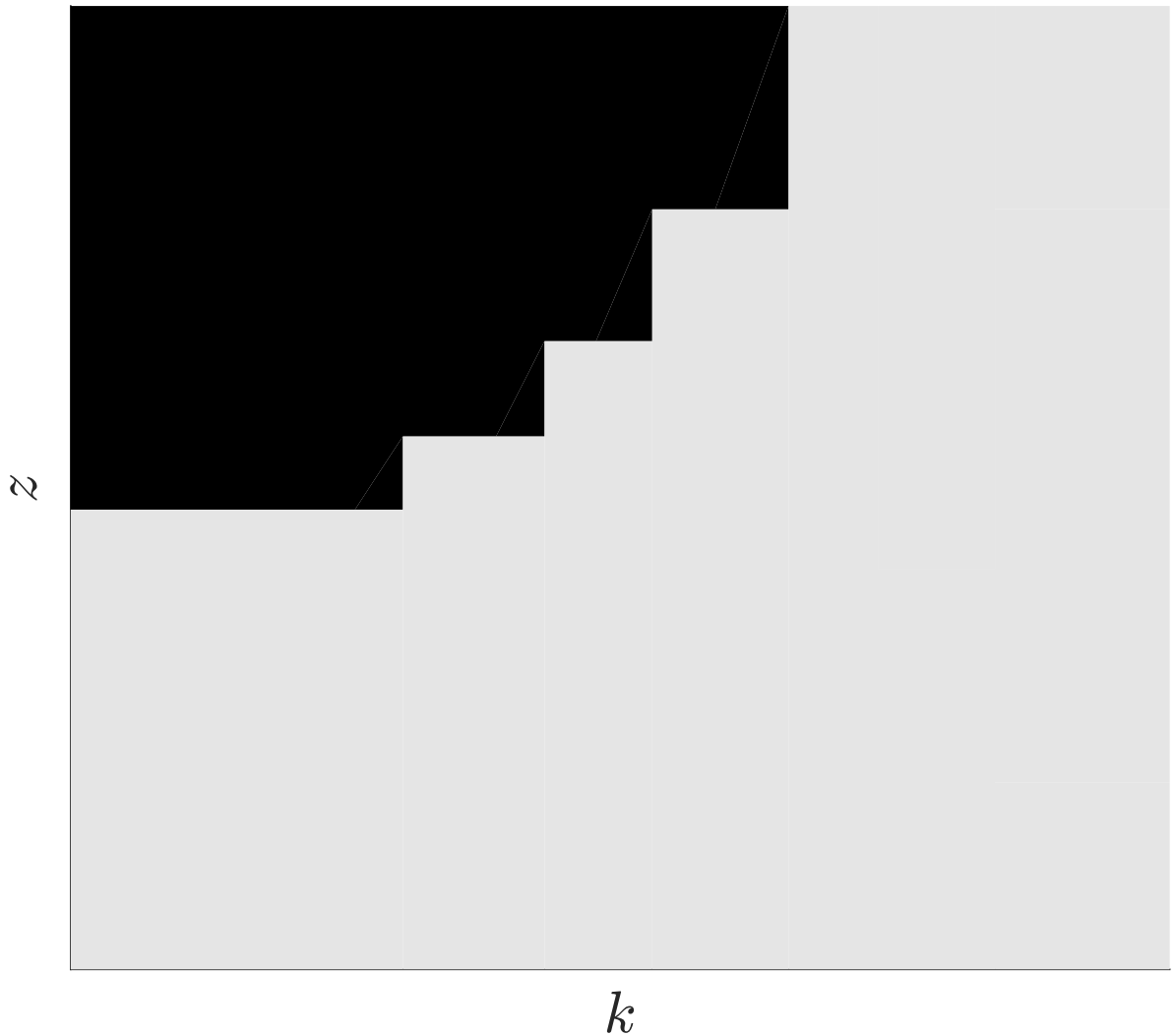
Misallocation



high ρ

As ρ increases, so does misallocation

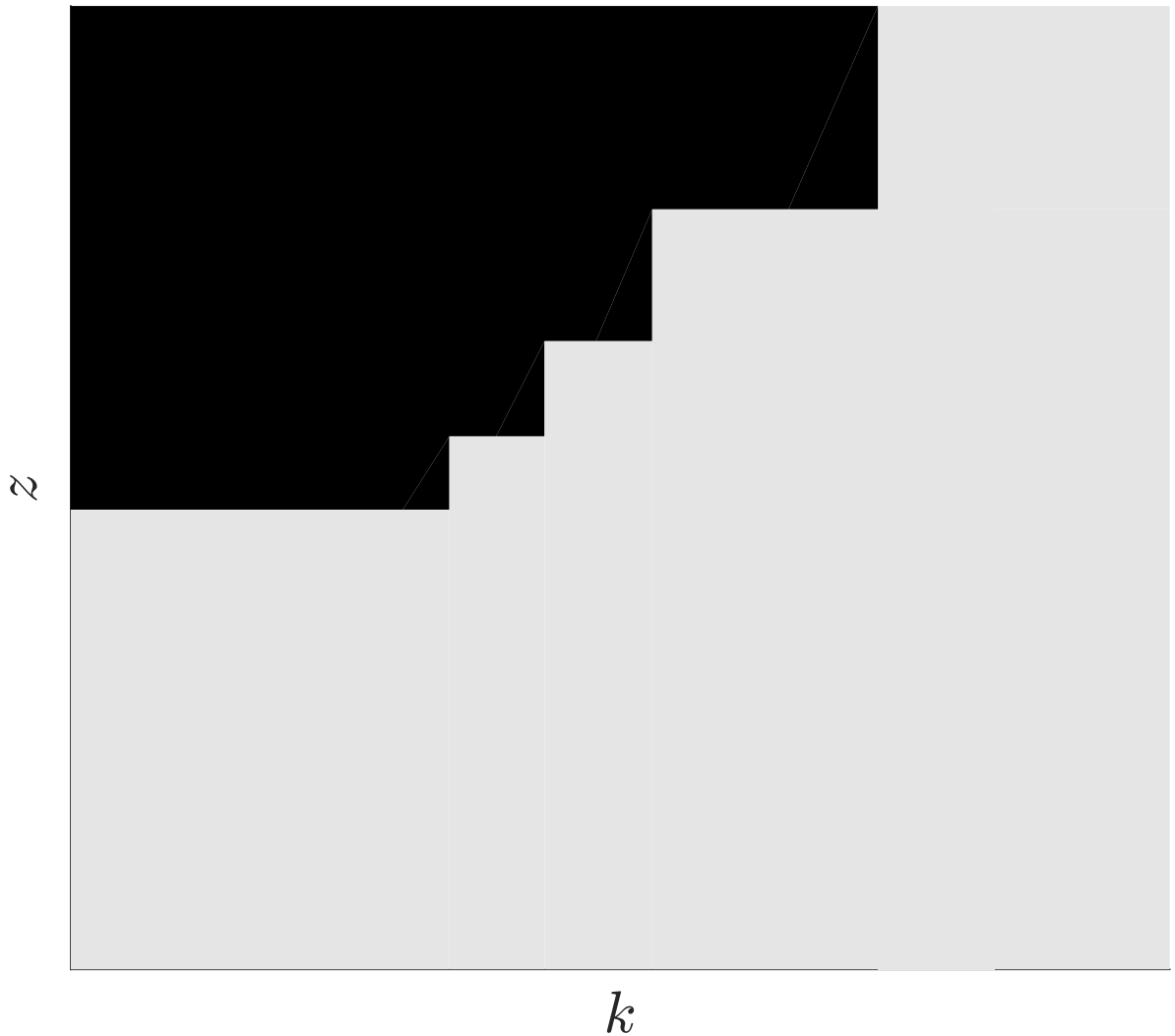
Choice of credit market



mid ρ

As ρ increases, more firms borrow from international credit market

Choice of credit market



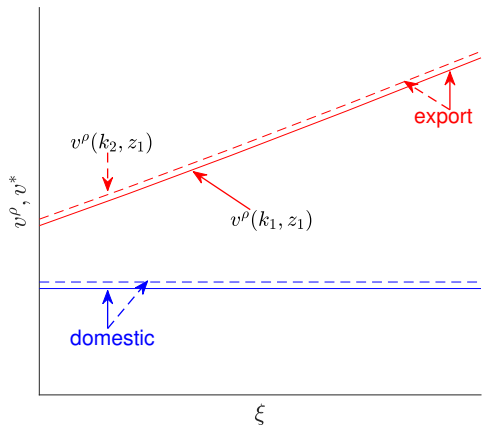
high ρ

As ρ increases, more firms borrow from international credit market

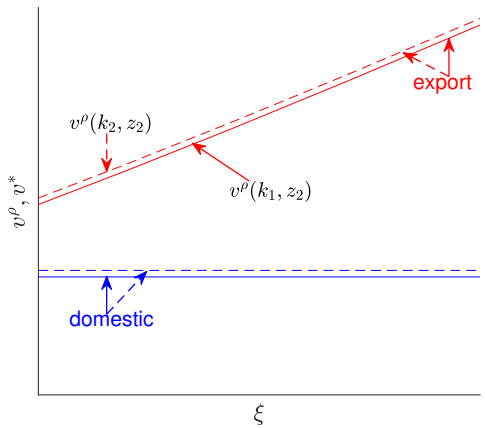
Choice of trade

In benchmark firms borrow domestically and are more likely to export

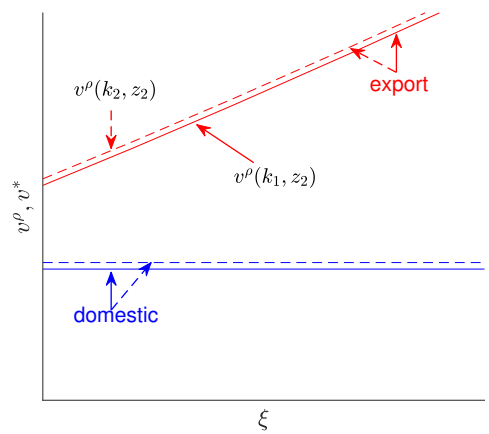
(a) z_1



(b) z_2



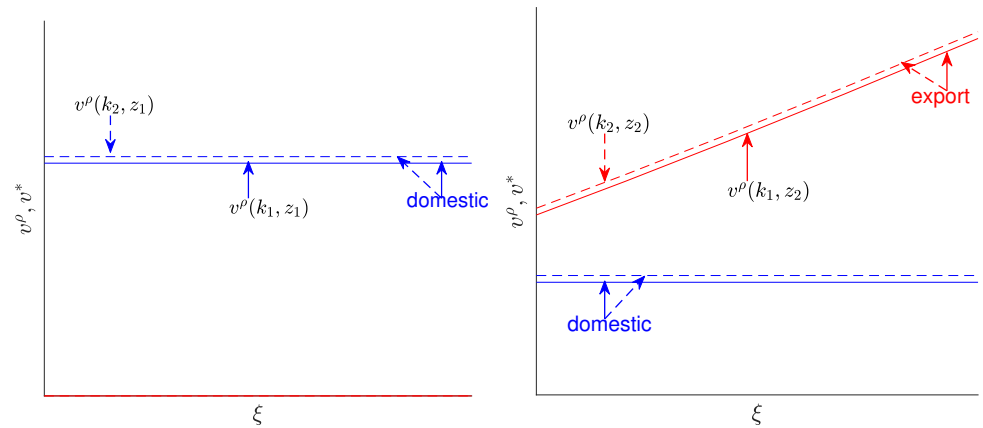
(c) z_3



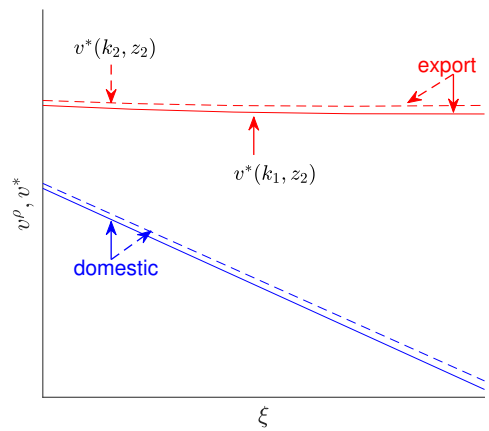
Choice of trade

Mid ρ, less firms export, more borrow from abroad

(a) z_1 (b) z_2



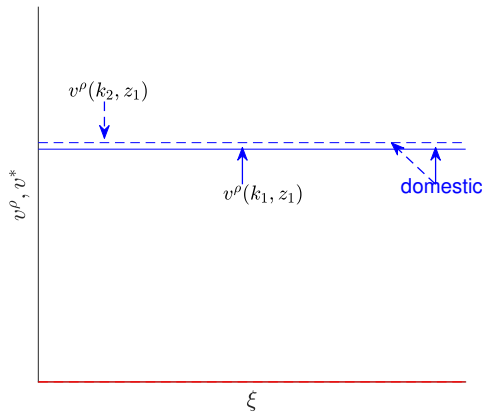
(c) z_3



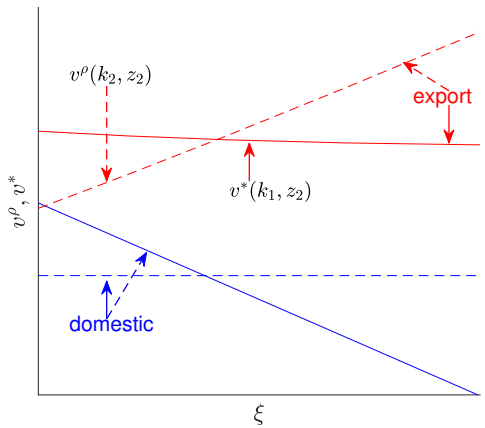
Choice of trade

High ρ, even less firms export, and more borrow from abroad

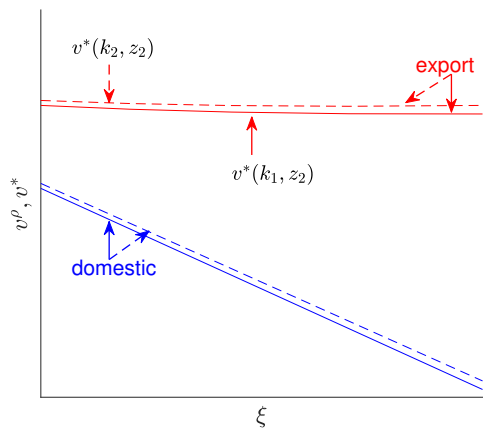
(a) z_1



(b) z_2



(c) z_3



Conclusion

- We posit a model to rationalize the fact that in economies with lower financial development a devaluation does not have a positive impact on firms
- In our model, less financial development implies that more firms borrow from abroad and less firms export
- Lower financial development causes misallocation due to more expensive domestic borrowing
  - Firms with low initial capital get bigger than firms with higher initial capital, since they borrow from different credit markets

REER

Darvas (2012) estimates trade weighted REER for 178 countries between 1960 and 2017

$$REER_{ct} = NEER_{ct} \frac{CPI_{ct}}{CPI^*_{ct}}$$

with

$$NEER_{ct} = \Pi_{c'} S^{w_{cc'}}_{cc't} \quad CPI^*_{ct} = \Pi_{c'} CPI^{w_{cc'}}_{c't}$$

$S^{w_{cc'}}_{cc't}$: units of currency in c' per 1 unit of currency in c
$w_{cc'}$: weight of billateral trade between and c and c'

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FD

- Summarizes development of financial institutions and financial markets in terms of depth, access and efficiency
- Indices for over 180 countries since 1980 at annual frequency

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Table 1: Effect of financial development and devaluation on firm profits

Variables	(1) ln *Rev*	(2) ln *Rev*	(3) ln *Rev*	(4) ln *Rev*
REER	-0.003	0.024***	0.030***	0.015***
	(0.003)	(0.008)	(0.010)	(0.006)
FD	0.031**	0.036	0.085**	0.036*
	(0.012)	(0.034)	(0.036)	(0.020)
REER × *FD*	-0.000	-0.000	-0.001**	-0.000**
	(0.000)	(0.000)	(0.000)	(0.000)
Log Competitors		-0.023	-0.093**	0.011
		(0.042)	(0.044)	(0.025)
TFPR			0.375***	0.299***
			(0.012)	(0.007)
Log Employees				1.226***
				(0.007)
Constant	12.894***	10.654***	9.070***	7.480***
	(0.279)	(0.933)	(1.181)	(0.663)
Observations	91,665	20,547	16,417	16,412
R^2	0.278	0.312	0.367	0.801

Standard errors in parentheses. All regressions include time, sector and country fixed effects. *** p<0.01, ** p<0.05, * p<0.1

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Table 2: Effect of financial development on debt in foreign currency

Variables	Share of borrowing in foreign currency
Assets	0.000***
	(0.000)
FD	-73.024***
	(4.009)
Assets$\times FD$	-0.000***
	(0.000)
Constant	28.918***
	(1.686)
Observations	5,118
R^2	0.109

Standard errors in parentheses. All regressions include time and sectorfixed effects. *** p<0.01, ** p<0.05, * p<0.1

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Table 3: Effect of financial development and the probability of exporting

Variables	Probability of exporting
$REER$	0.007***
	(0.002)
FD	0.035***
	(0.009)
$FD \times REER$	-0.000***
	(0.000)
Constant	-1.457***
	(0.210)
Observations	94,393

Standard errors in parentheses. All regressions include time and sectorfixed effects. *** p<0.01, ** p<0.05, * p<0.1

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