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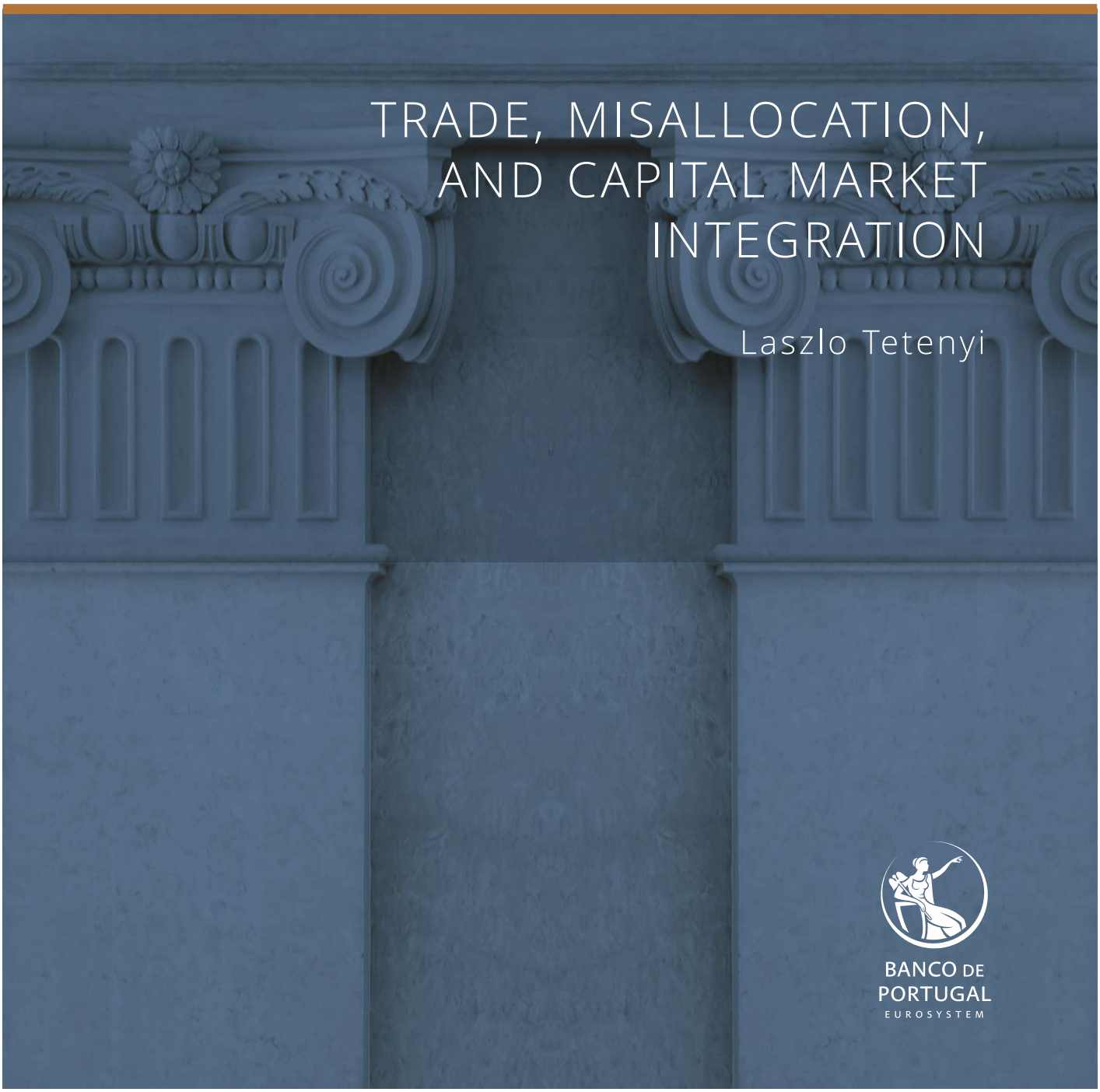

TRADE, MISALLOCATION, AND CAPITAL MARKET INTEGRATION

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EUROSYSTEM

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Lisboa, 2021 • www.bportugal.pt

Working Papers | Lisboa 2021 • Banco de Portugal Av. Almirante Reis, 71 | 1150-012 Lisboa • www.bportugal.pt •
Edition Economics and Research Department • ISBN (online) 978-989-678-802-5 • ISSN (online) 2182-0422

Trade, Misallocation, and Capital Market Integration

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December 2021

Abstract
Developing countries typically integrate into the world economy by first opening up to trade and then later, if at all, by integrating their capital markets. I study the effects of postponing the opening of capital markets in a standard trade model with financial frictions and firm dynamics. As trade barriers fall, the model predicts that capital misallocation declines in the aggregate, but increases among exporters. Allowing capital inflows helps all firms but it also magnifies the losses from misallocation. In the quantitative experiment calibrated to the Hungarian integration episode of the 90s, the benefit of cheaper capital dominates the adverse effect of growing capital misallocation on productivity, leading to higher output, consumption, and welfare than under closed capital markets. Moreover, Hungary could have gained an extra 1 % in welfare, on top of the overall gain of 7 %, by immediately allowing capital inflows after the reduction in trade barriers.

JEL: F15, F40

Keywords: Financial Development, Trade, Capital Market Integration, Misallocation.

Acknowledgements: I thank my advisors Jess Benhabib, Virgiliu Midrigan, Sharon Traiberman, and Michael Waugh, the seminar participants at NYU, Banco de Portugal, as well as the discussants at conferences in WUSTL, CompNet, Econometric Society Meetings, EEA and SED. Special thanks to CompNet and MTA-KRTK for providing access to their data. The analyses, opinions and conclusions expressed herein are the sole responsibility of the author and do not necessarily reflect the opinions of Banco de Portugal or the Eurosystem.

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1. Introduction

Over the last century, national economies have become increasingly integrated, primarily facilitated by increased international trade. After a reduction of trade barriers, there is typically a reallocation of resources from non-exporting firms to productive exporters. Well-functioning financial markets can facilitate this reallocation, because exporters rely on external finance to sell their products abroad[1]. In countries with underdeveloped financial markets, the opposite can occur with the financial system acting as an impediment to the allocation of capital to high-productivity producers and exporters. Integrating domestic and international capital markets can increase access to capital for these firms and mitigate this problem.

Many developing countries, while choosing to open up their goods and services markets to international trade, have kept their capital markets closed for much longer. There have been various rationales for this, including maintaining control over the financial system and monetary policy. Historically, economies that have opened their capital markets have experienced a capital inflow[2], increasing the available capital for firms and leading to higher output. However, there is evidence that these capital inflows were not always allocated efficiently to the most productive producers. For example, Gopinath *et al.* (2017) show that capital market integration in Southern Europe led to an increase in misallocation and lowered productivity. This paper evaluates how the timing of capital market integration matters for an economy undergoing trade liberalization, and the tradeoffs that policymakers face.

To study the interaction of capital market integration and trade liberalization, I build a general equilibrium model of firm dynamics. In the model, firms are heterogeneous with respect to their stochastic productivity, net worth, and their endogenous exporting status. Due to financial frictions, the net worth of a firm limits its ability to borrow and to acquire capital, leading to the misallocation of capital. Since only relatively productive firms want to expand their the capital stock, only productive firms are financially constrained. Given a one-time entry cost, only productive firms enter the export sector. Therefore, the combination of entry costs and financial frictions constrain exporters' ability to acquire capital. On the other hand, the most productive exporters amass a substantial amount of wealth and capital. Even when faced with a series of idiosyncratic negative productivity shocks, they still use disproportionately more capital than other exporters. Were capital to be reallocated from these unproductive, wealthy exporters to the productive, poor exporters, misallocation would decline and the productivity of the economy would improve. The model features asset market incompleteness and household

1. Auboin (2009) finds that around 90% of world trade relies on some form of external finance.

2. Buera and Shin (2017) show that capital can flow *out* of developing countries in response to economic reforms.

heterogeneity and therefore provides an environment where the broader implications of reforms on welfare and inequality can be studied.

I calibrate the model to match the relevant features of Central-Eastern Europe in 2008, before the financial crisis hit the region. I show that, in the data, large and unproductive firms are likely to be exporters. Between 1989 and 2008, the region first liberalized their goods market and, somewhat later, their capital market, resulting in a dramatic increase in trade openness and capital inflows. The main experiments mimic factual and counterfactual sequences of reforms.

There are three important results related to the long run, after the model economy has reached a steady state. First, irrespective of capital account openness, misallocation of capital increases among exporters, because unproductive exporters survive longer and productive exporters are still constrained. However, integrated capital markets amplify misallocation, because wealthy exporters with the ability to expand, are disproportionately favored by cheaper capital. The fraction of exporters that are unproductive and wealthy increases from 4% to 21%, leading to a decline in aggregate productivity.

Second, despite the adverse effect on productivity, opening up to trade with integrated capital markets increases welfare, consumption, and output by more than under closed capital markets. The benefits of the larger capital stock coming from abroad outweigh the cost of declining aggregate productivity, because even constrained, productive exporters expand substantially.

Third, trade liberalization causes an increase in inequality, because households owning exporting firms gain disproportionately. Under integrated capital markets, wealthy exporters gain even more, while the middle class relying on indirect capital income or domestic profits are worse off than before the reforms.

Considering the transition path of the economy shows that the benefits of capital market integration are even greater in the short run. This result arises because immediately after the reform, foreign capital is allocated to productive exporters, allowing them to expand faster. Thus, on impact, aggregate productivity increases more than with closed capital markets. The increased survival of unproductive exporters, which is magnified with integrated capital markets, affects the economy only several years later. In the medium term, consumption and output rises as aggregate productivity gradually declines. Overall, the gains are front loaded, whereas the increase in misallocation takes time.

Given these short run dynamics, I show that the optimal sequence of trade and capital market integration is to execute these reforms together. In fact, Hungary postponed capital market integration by 10 years after opening up to trade, passing up on the short-term benefits along the transition path which would have been worth 1% in consumption equivalent welfare.

Finally, I conduct two alternative experiments. First, I show that capital market integration without trade liberalization affects the economy less, highlighting the joint benefits of trade and capital market integration even in the steady state, not only along the transition path. Second, I show that with a more developed financial system, both trade and capital market integration increase welfare by less. While

for trade, the effect of development on the gains from trade is limited, the gains from capital market integration as well as the joint benefits of the reforms are greatly reduced.

This paper relates to several strands of the literature. The relationship between misallocation and trade has been studied by Bai *et al.* (2019) and Berthou *et al.* (2019). They show that exogenous misallocation can dampen the gains from trade. I focus on financial frictions to endogenize a potential source of misallocation that affects the transition dynamics as well. Edmond *et al.* (2015) show that misallocation from market power declines after a trade liberalization. I show that trade liberalization affects misallocation only slightly, when it arises from financial frictions.

The problem of liberalizing trade with underdeveloped financial markets is studied by Brooks and Dovis (2019) and Kohn *et al.* (2018). Relative to these papers, I show that even if the importance of a well-functioning financial market is increased by allowing for transitory productivity shocks, financial development changes the standard gains from trade only if a capital inflow to the economy occurs. Improving the financial system, and other reforms, are naturally related to trade integration, and Asturias *et al.* (2016) raises the problem of how to sequence these reforms. I show that the optimal sequence is "shock-therapy", immediate integration of capital markets and trade. However, the cost of delaying capital market integration is relatively low, as long as the government can credibly commit to integration.

S. Prasad *et al.* (2003) find limited evidence for gains from capital market integration in the data, consistent with the short-run response in the model economy—in the model, benefits are confounded by trade liberalization on impact. In the model, variable trade and entry costs amplify capital market imperfections as in Obstfeld and Rogoff (2000), but are still not enough to explain cross-country productivity differences, a finding supported by Midrigan and Xu (2014). Nevertheless I show that capital market integration improves welfare, even if financial integration across countries lead to global imbalances, as described in Mendoza *et al.* (2009) or in Reyes-Heroles (2017).

2. Model description

The world consists of two economies, Home and Foreign, populated by a continuum of infinitely lived households, with measure L and L^*, respectively.[3] Households are heterogeneous with respect to their entrepreneurial productivity z, their net wealth a and their occupation choice $e \in \{\text{Worker, Domestic firm, Exporting firm}\} = \{\text{w, d, ex}\}$. They can also save in two different assets, a risk-free bond and a capital stock. Households that choose to operate their firms are

3. Foreign production indexed with F, consumption with *, Home notation is suppressed. Time notation is suppressed whenever possible.

referred to as entrepreneurs. Entrepreneurs hire capital and labor on centralized capital and labor markets. Exporting entrepreneurs are also allowed to sell their products domestically, but domestic entrepreneurs are allowed to sell domestically only. All households consume the final good, Y_t, purchased at price P_t. Final output is produced by using the output of the entrepreneurs and is used for consumption and investment.

2.1. Setup

In this section, I describe the preferences of households, the production technology of entrepreneurs and final good producers, and the market structure of the Home economy. The Foreign economy faces the same environment, albeit with different parameters, and is therefore omitted from the description.

2.1.1. Households. Households are infinitely lived, expected utility maximizers, with discount factor β, and per-period utility given by $u(c) = \log(c)$, where c is the local consumption good. They can imperfectly insure themselves against uncertainty by purchasing assets. They can choose to become workers or entrepreneurs. Workers earn wage W_t without facing any income risk. Entrepreneurs earn profits and no labor income. Households that were not entrepreneurs have to pay an entry cost. Profits Π^{ex} and Π^{d} are earned based on productivity z and capital stock k. Entrepreneurs that become exporters choose how much to export and sell domestically.

2.1.2. Asset structure. Households can borrow in a risk-free asset, b_{t+1}, denominated in Foreign final good, at the interest rate r_{t+1}. A household with $b_{t+1} > 0$ is borrowing and with $b_{t+1} < 0$ is saving. Hence, future repayment on debt must equal $(1 + r_{t+1})b_{t+1}$. Households can also accumulate local capital, k_{t+1}, that depreciates at rate δ and can be used in production next period. The risk-free asset is pooled by a competitive financial sector lending it to the intermediate-goods-producing sector. Effectively, the risk-free asset is used to reallocate capital to households that would like to use more capital for production than what they currently own. However, the household's borrowing activity is subject to agency frictions — borrowers might renege on the contract, and hence they can only borrow b_{t+1} up to θ fraction of the value of their capital stock $P_t k_{i,t+1}$. Denoting $a_{t+1} := P_t k_{i,t+1} - b_{t+1}$, the borrowing constraint becomes:

$$P_t k_{t+1} \leq \frac{a_{t+1}}{1-\theta} \tag{1}$$

As is common in the misallocation literature (see Midrigan and Xu (2014)), I assume that once the productivity shock is realized, households are allowed to adjust their portfolio without incurring any cost, but are not allowed to change their total savings. This assumption reduces the state space from the two assets (b, k) to only a, referred to as net worth or wealth.

The financial sector has two roles in the model economy. First, it allows a frictionless exchange of capital and the risk-free asset, assuming the latter is positive. Second, it allows additional lending of capital to entrepreneurs albeit with agency frictions where repayment occurs once profits have been realized. The borrowing tightness θ is one of the crucial parameters controlling the speed of reallocation of capital among producers. The net financial income from holding capital and debt, but without any income from using capital in production, is

$$\begin{aligned} & P_t k_t(1-\delta) - b_t(1+r_t) - P_t k_{t+1} + b_{t+1} \\ & = a_t(1+r_t) - a_{t+1} - P_{t-1}k_t(1 + r_t - \frac{P_t}{P_{t-1}}(1-\delta)) \end{aligned} \tag{2}$$

Denote the rental rate as $R_t = P_{t-1}(1 + r_t - \frac{P_t}{P_{t-1}}(1-\delta))$. Then, the Bellman equation characterizing the problem of a household follows

$$V_t(z_t, a_t, e_t) = \max_{c_t, a_{t+1}, e_{t+1}} u(c_t) + \beta \mathbb{E} V_{t+1}(z_{t+1}, a_{t+1}, e_{t+1}) \tag{3}$$

$$\begin{aligned} \text{s.t.: } P_t c_t + a_{t+1} &= (1+r_t)a_t + \mathbf{1}_{e_{t+1}=w} W_t + \mathbf{1}_{e_{t+1}=d}\Pi^d(z_t, a_t) \\ &\quad + \mathbf{1}_{e_{t+1}=ex}(\Pi^{ex}(z_t, a_t) - \mathbf{1}_{e_t \in \{w,d\}} W_t f_{ex}) \qquad (4) \\ a_{t+1} &\geq 0 \qquad (5) \end{aligned}$$

f_{ex} is the one-time labor cost of entering into the exporting sector, respectively. Entry costs do not have to be paid again until the household decides to shut down the firm and find employment as a worker. However, the entry cost is non-recoverable and non-pledgeable. $\Pi^{ex}(z_t, a_t)$ and $\Pi^{ex}(z_t, a_t)$ denote the profits that can be obtained by becoming an entrepreneur producing intermediate goods. The assumption that the portfolio can be reallocated between the different assets allows me to disentangle the production decisions of entrepreneurs from the household's problem. Households solve a simpler dynamic problem, and entrepreneurs solve a static problem of profit maximization.

2.1.3. Entrepreneurs. Households are all endowed with a unique variety j. If they decide to become entrepreneurs, they compete monopolistically with other producers, taking into account the demand when they decide about production. They combine capital k, labor l, and productivity z_t to produce their output $z_t F(k,l) = z_t k^\alpha l^{1-\alpha}$, where α is the capital intensity. If they become exporters, they have to decide how much to sell abroad. Net worth a_t is only relevant for production, because the leverage constraint implies their capital choice is restricted. z_t is assumed to follow a first-order autoregressive process, with idiosyncratic shocks that are log-normally distributed.

2.1.4. Exporters. Exporters earn revenue pX from domestically sold goods X, and revenue p^*X^* from exported goods X^*. Non-exporting entrepreneurs solve an analogous, restricted problem compared to exporters, because they cannot earn revenues from abroad. Because only households that choose to become producers

can become debtors, the leverage constraint is included in their problem:

$$\Pi^{ex}(z_t, a_t) = \max_{X, X^*, k, l} pX + p^* X^* - W_t l - R_t k_t$$
$$X + (1+\tau_t)X^* \leq z_t F(k,l) \qquad (\mu)$$
$$P_{t-1}k \leq \frac{a_t}{1-\theta} \qquad (\lambda)$$

The decision rules for exporters are obtained by solving this static problem — for details, see Appendix A.

2.1.5. Final-goods producer. The final-good producer competitively produces country-specific consumption and investment goods, solely by using intermediate inputs with constant elasticity of substitution (CES) technology. Intermediate inputs can be purchased either from entrepreneurs in Home or imported from exporters in Foreign. For one unit of imported good to arrive, $1+\tau_t$ units must be transported as τ_t melts away:

$$\max P_t Y_t - \int_{I_t \cup I_{t,x}} p_t(j) X_t(j) dj - \int_{I_{F,t,x}} p_{F,t}(j) X_{F,t}(j) dj \qquad (6)$$
$$\text{s.t.: } Y_t = \Big(\int_{I_t \cup I_{t,x}} X_t^{\frac{\sigma-1}{\sigma}}(j) dj + \int_{I_{F,t,x}} X_{F,t}^{\frac{\sigma-1}{\sigma}}(j) dj \Big)^{\frac{\sigma}{\sigma-1}} \qquad (7)$$

where $p_t(j)$, $X_t(j)$ denotes the price and quantity of the j-th variety and I_t, $I_{t,x}$, $I_{F,t,x}$ denotes the measure of domestic and exporting (Home or Foreign) firms. Let P_t denote the optimal price index:

$$P_t = \left(\int (p_t(j))^{1-\sigma} dj + \int (p_{F,t}(j) dj)^{1-\sigma} \right)^{\frac{1}{1-\sigma}} \qquad (8)$$

Solving the final-good producer's problem yields isoelastic inverse demand functions for the intermediate inputs, derived in Appendix A. Entrepreneurs take these demand functions into account in their profit-maximization problem.

2.2. Competitive equilibrium

Let $G_t(a,z,e)$ be the cumulative density function for the joint distribution of households, and let $Q_t(a,z,e,a',z',e')$ the transition function. Then the objects

$$\{G_t(a,z,e), Q_t(a,z,e,a',z',e')\}_{t=0}^{\infty} \qquad (9)$$

allocations (as functions of the state variables (a,z,e)): $\{X_t, X_t^*, c_t, l_t, k_t, a_{t+1}, e_{t+1}\}_{t=0}^{\infty}$ and prices: $\{P_t, p_t, p_t^*, W_t, r_t\}_{t=0}^{\infty}$ and trade costs $\{\tau_t\}_{t=0}^{\infty}$ and their foreign counterparts constitute an equilibrium if:

- given prices, the allocations solve the household's, the entrepreneur's, and the final-goods producer's problem

- the labor market clears:

$$0 = \int \Big[l_t\big(\mathbf{1}_{\{e_{t+1}=d\}} + \mathbf{1}_{\{e_{t+1}=ex\}}\big) - \mathbf{1}_{\{e_{t+1}=w\}} \tag{10}$$

$$+ \mathbf{1}_{\{e_t \in \{w,d\}, e_{t+1}=ex\}} f_x \Big] dG_t \tag{11}$$

- the goods market clears:

$$\Big(\int_{I_t} X_t^{\frac{\sigma-1}{\sigma}}(j)dj + \int_{I_{F,t,x}} X_{F,t}^{\frac{\sigma-1}{\sigma}}(j)dj \Big)^{\frac{\sigma}{\sigma-1}} = \int \Big(c_{it} + k_{t+1} - (1-\delta)k_t \Big) dG_t \tag{12}$$

- capital market clearing depends on the level of integration. Define a country's net financial asset position:

$$NFA_t = -\sum_e \int_{a,z} \Big[P_{t-1}k_t - a_t \Big] dG_t \tag{13}$$

  - Closed capital markets:

$$NFA_t = 0 \tag{14}$$

  - Integrated capital markets:

$$NFA_t + NFA_t^* = 0 \tag{15}$$

- Distribution evolves:

$$G_{t+1} = \int Q_t(a, z, e, a', z', e')dG_t \tag{16}$$

- $\forall\ \mathcal{S} = \{\mathcal{A}, \mathcal{Z}, \mathcal{X}\}$ measurable subset of the power set of the state space, the transition function becomes

$$Q_t(\mathcal{S}, (a', z', e')) = \mathbf{1}_{a' \in a_{t+1}(\mathcal{S})} \pi_z(\mathcal{Z}, z_{t+1}) \mathbf{1}_{e' \in e_t(\mathcal{S})} \tag{17}$$

  where π_z is defined by the productivity process of the entrepreneurs.

2.2.1. Productivity. To measure the economy's effectiveness in utilizing the factors of production, I construct aggregate productivity in the model and relate it to firm-level and aggregate variables. Aggregate productivity is based on the concept of Solow residuals: $TFP = \frac{RGDP}{K^\alpha L^{1-\alpha}}$, with $RGDP$ equal to real GDP, K and L are the total amount of capital and labor in the economy. My baseline productivity measure defines "Real GDP" as Y, the final output in the country. First, I decompose TFP to the sum of domestic and exporter productivity:

$$TFP^{\frac{\sigma-1}{\sigma}} = TFP_d \left(\frac{K_d}{K}\right)^\alpha \left(\frac{L_d}{L}\right)^{1-\alpha} + \pi_x \cdot TFP_x \left(\frac{K_x}{K}\right)^\alpha \left(\frac{L_x}{L}\right)^{1-\alpha} \tag{18}$$

where TFP_s denotes the productivity in sector $s \in \{d, x\}$, K_s and L_s are the total amount of capital and labor available to firms in their respective sectors. Firms that are exporting not only sell abroad, but domestically too, hence exporters increase aggregate productivity by a factor $\pi_x > 1$. All these terms can be further decomposed as a function of firm level and aggregate variables:

$$\pi_x = \pi_x(Y, Y^*, \tau, TB) \tag{19}$$

$$TFP_s \propto \int_{I_s} (z \cdot MRPK^{-\alpha})^{\sigma-1} dG \text{ with} \tag{20}$$

$$\log(MRPK) = \log(\lambda + R) = mrpk \tag{21}$$

π_x is an increasing function of aggregate demand in both countries, the trade costs, and (linearly) depends on trade balance. If trade balance is declining, π_x *improves* because for the same amount of imports, the economy can export less. Sectoral productivity is the sum of firms' inherent productivity interacted with differences in return to capital. In addition, internal return to capital is higher for firms that are more constrained, because they can not rent enough capital through the financial sector. Intuitively, higher correlation between the inherent productivity z and the Lagrange multiplier λ implies *lower* sectoral and aggregate productivity. It can be shown that, in a model without endogenous entry and lognormal shock process, the losses from financial friction are going to simplify sectoral TFP to the standard deviation of $mrpk$. Hence I use the standard deviation of $mrpk$ to measure misallocation in the data.

There are three key considerations that I take into account when I define productivity. First, intermediate goods are traded across countries, hence capital and labor is used for exports, not only for the domestic production of output. Second, variety effects are present in the model affecting aggregate productivity. Third, trade is unbalanced because the country can have current account imbalance in the case of integrated capital markets. Motivated by Burstein and Cravino (2015), who find that the change in aggregate productivity predict the welfare gains, I use the productivity measure that is most likely to explain changes in welfare. This "welfare-relevant" productivity values exports based on the amount of local final goods that exports can be traded for, because this determines the total goods available for final consumption and investment by households.

3. Data and calibration

To understand how capital markets interact with trade in the model, I focus on the period of European integration to the EU after 1989 until 2008. The availability of rich firm-level and industry-level data is an advantage of focusing on Europe. Appendix B provides the details about the data construction and also contains additional reduced-form evidence.

3.1. Historical context

Starting with ratification of the Maastricht Treaty in Europe in 1992, until the financial crisis in 2008, European countries increased goods, services, labor, and capital market integration. Some important differences emerged across groups of countries, commonly referred to as South, Core, and New Member States (NMS). While trade liberalization affected all country groups similarly, compared to NMS, the Core and the South already had integrated capital markets in 1992. Moreover, countries in the South and NMS have less developed financial markets than countries in Core. After the fall of communism, NMS countries faced the choice of whether to integrate their capital markets while trade liberalization was already under way. Hence, the quantitative exercise is based on the historical situation that NMS countries faced after 1989. To capture relevant features of the NMS economy, I use aggregate, sectoral and firm-level data as well. Because NMS eventually integrated their capital markets, I also use data from 2008 assuming that the model economy reached a steady state with liberalized trade and integrated capital markets.[4]

By 2001, Hungary and most other NMS countries integrated their capital markets that led to an increase in indirectly foreign-owned corporate credit (Figure 1). Most of the capital inflow to the corporate sector happened later than the trade liberalization which started in 1989. Capital market integration is not exactly the same as financial integration. NMS countries allowed Foreign Direct Investment much earlier, but indirect capital inflows only increased gradually, and indirect flows dominated until 2008.

Capital market integration could have contributed to the the misallocation of resources. Figure 2 shows the dispersion of the revenue products [5]. Remarkably, the dispersion in the returns to capital increased for most EU economies, while the dispersion in labor productivity did not. Therefore the argument that capital market integration led to misallocation is not entirely without merit, but to understand the evolution of misallocation, the model has to be able to generate it.

3.2. Exporters in the microdata

To understand the main mechanism between trade and misallocation, I explore how exporters, on the one hand were the most exposed group to capital inflows and on the other hand, potentially were contributing the most to the misallocation of capital. I use Hungarian firm-level financial statement (balance sheet and profit and loss accounts) data from 2001 until 2017, mostly focusing on 2008 as that is the final period in the quantitative analysis, before the financial crisis unfolded.

4. In late 2008, the crisis unfolded in Europe too, hence I will target data from early 2008 if available.

5. It is worth noting that this measure is not necessarily related to productivity or misallocation, as shown by Haltiwanger *et al.* (2018) for example.

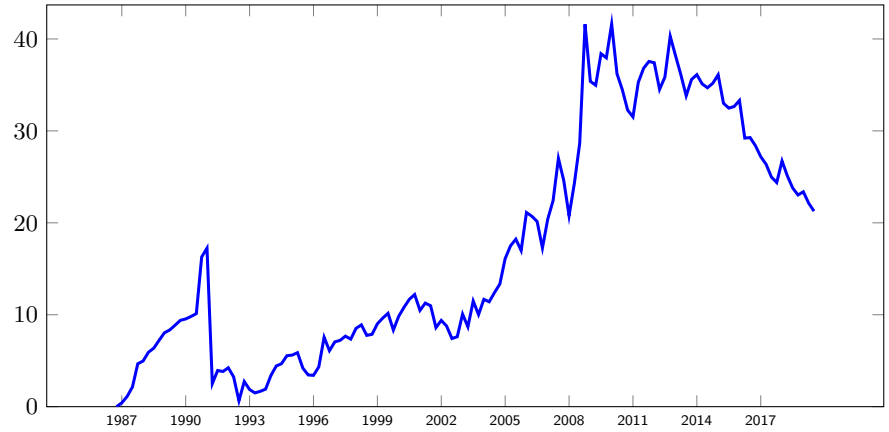


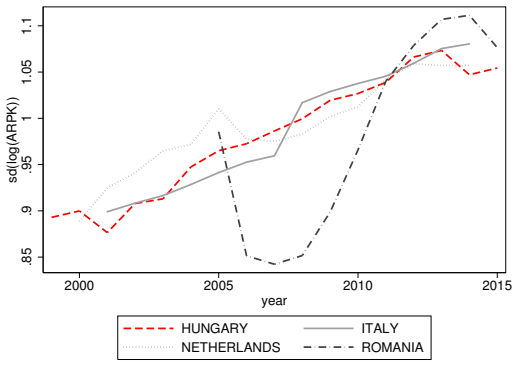
Figure 1: Foreign credit to non-financial corporations in Hungary, % GDP

Notes: The BIS does not directly report foreign credit provided to domestic non-financial firms, for construction, see Appendix B.1. Obtaining the data for "corporate" credit for Hungary is further complicated by the dominance of state owned enterprises until the early 90s as a legacy of the communist economic system.

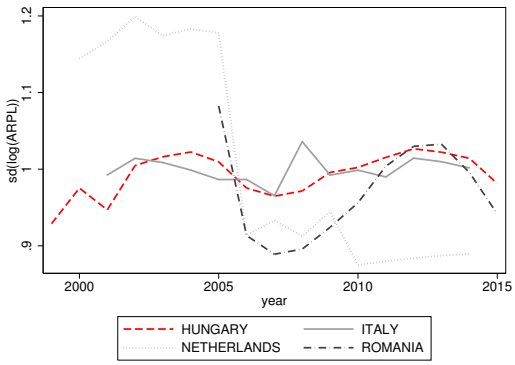
Not all exporters are large or productive firms as Figure 3 demonstrates. In Panel a) I show a U-shaped relationship between firm value added and the share of exporters. Exporters make up 15% and 40% of firms in the lowest and the highest value added deciles. Exporters tend to use more capital on average and are more capital intensive. This indicates that any policy, in particular capital market integration, that affects the price of capital and in turn affects the more capital-intensive firms more, and these firms are likely to be exporters.

Exporters with low value added, but high capital intensity and capital stock are the group of firms that are potentially the most important for capital misallocation. This group of firms are unlikely to be entrants into exporting for two reasons. First, Panel b) shows the share of entrants into exporting falls with higher value added. Second, with higher capital, the average age (Panel c)) is U-shaped along capital.

Indeed, the group of firms that contribute to misallocation the most, not only use a lot of capital to produce little value added, but also for a long period of time. While productivity is not directly recoverable from the data without additional assumptions, there is a group of firms that is identified as problematic in the literature. These are the so-called zombies — firms that did not have positive pre-tax profits for three consecutive years, in this case, since at least 2005 — are investigated in the last three subfigures. Panel d) shows that almost 5% are zombies among the largest exporters, and, moreover, these largest exporters are the most likely to be zombies. Among all firms (Panel e)), larger firms are less likely to be



(a) Average revenue product of capital



(b) Average revenue product of labor

Figure 2: Dispersion of average products

zombies[6]. Finally, Panel f) shows that among the zombies that use the most capital are in the highest decile, exporters are overrepresented, even more than what Panel a) would otherwise indicate.

All these suggest that the group of firms that have the potential to amplify the losses from misallocation are exporters. Despite that the net effect is positive from the opening up of goods and capital markets, the quantitative exercise uncovers that losses from misallocation are incurred from these large and unproductive exporters.

3.3. Model calibration

I calibrate the model economy at the annual frequency, with the general idea of treating Home as the entire economy of Central Eastern Europe (NMS), and

6. Apart from the largest firms, where exporters are overrepresented, as Panel a) indicates

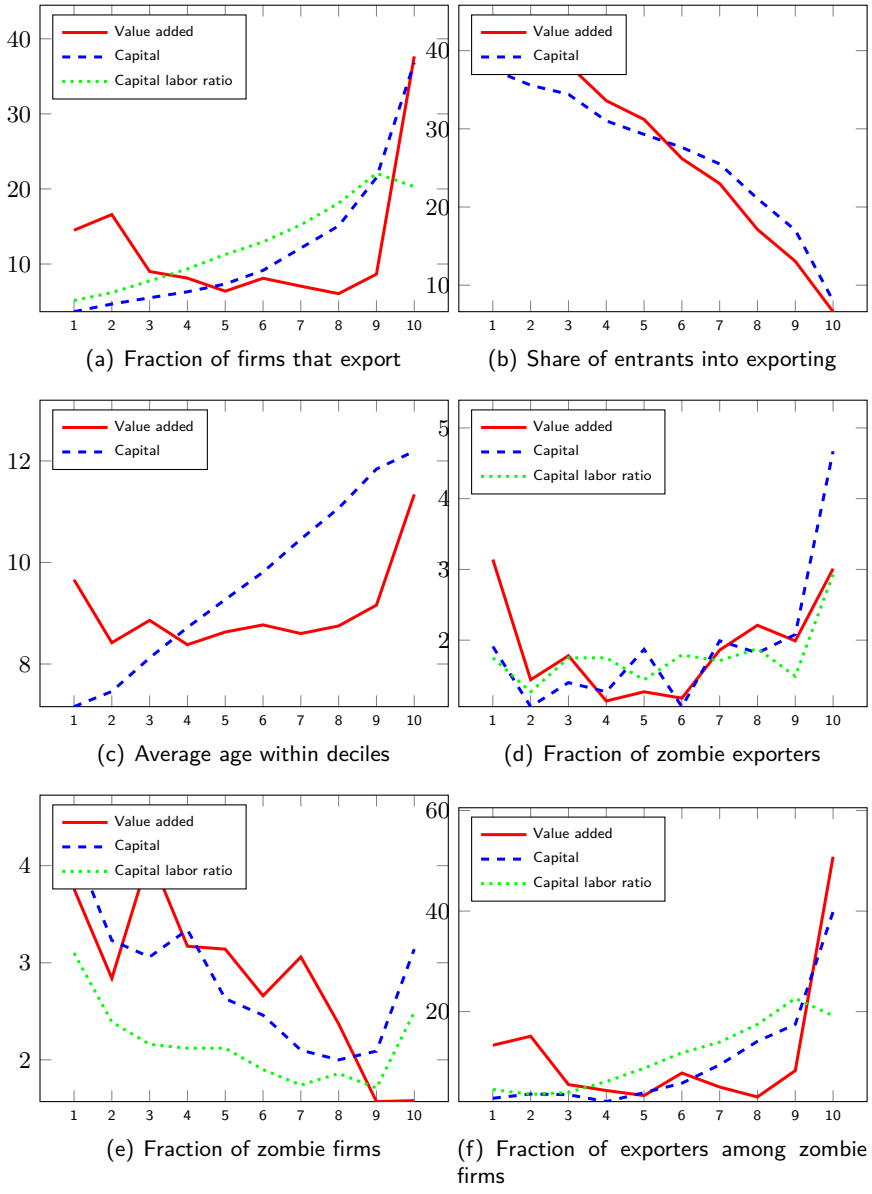


Figure 3: Exporters in Hungary across deciles in 2008

treating Foreign as the economy of the Core, Western European countries. Instead of calibrating the initial, pre-integration economy, the final steady state after trade and capital market integration is calibrated to 2008. Data quality improved significantly after 2004, especially for smaller firms and for industries other than manufacturing.

Parameter	Value	Target	Source & Year	Data	Model
Financial Development					
Borrowing tightness, θ	0.66	Total Credit to nonfinancials, %GDP	BIS 2008	62	62
Foreign discount factor,β^*	0.948	Bank lending rate in Germany r^*	ECB 2008 January	5	5
Home discount factor, β	0.85	Foreign Credit to nonfinancials, %Total credit	BIS 2008	53	53
Trade					
Initial import trade cost, τ_0	0.53	Initial $\frac{\text{Import}}{\text{GDP}}$	WB 1991/TiVA 1995	21	21
Final import trade cost, τ_∞	0.35	Final $\frac{\text{Import}}{\text{GDP}}$	WB 2008/TiVA 2008	42	42
Firm dynamics					
Avg. export entry cost, f_{ex}	450%	Entry rate to exports	CompNet 1999	27	24
s.d. of LN productivity innovation, σ_z	0.045	s.d. value added	Firm level, Hungary	0.86	0.83
AR(1) of LN productivity innovation, ρ_z	0.92	Auto-correlation of value added	Firm level, Hungary	0.4	0.43

Table 1. Calibrated parameters and moments

Note: Sources described in Appendix B.
Initial years differ due to data availability and to avoid measurement issues.

Calibration parameters and targets are shown in Table 1. The borrowing tightness θ and the discount factor β jointly determine the financial development in the economy, measured as the domestic credit to GDP. Lower θ prevents the reallocation of capital to productive firms, but also leads to *lower* demand for capital and a lower rental rate, because financially constrained firms are unable to increase their borrowing. A lower rental rate would generate a capital *outflow* from the Home economy after the integration of capital markets. Therefore to generate an inflow of capital to Home, the discount factor must also be lower. Differences in discount factors capture the idea that domestic NMS capital markets were not "deep" enough in the early 1990s. Differences in discount factors lead to a permanent trade and capital account imbalance across economies, even in the steady state.

Variable trade costs are used to match the aggregate import share, before and after trade liberalization in the Home economy. Because intermediate-good producers in the model do not use intermediates to produce, gross imports and exports in the data are transformed to value-added terms using the domestic content in gross exports.

Entry costs are used to capture the extensive margin of exporting dynamics, specifically targeting the number of entrants to exporting. The entry cost is important in its potential to amplify misallocation. Due to the under-reporting of export status by smaller firms, the fraction of firms that export can vary between $2 - 38\%$, depending on the methodology and dataset used, whereas the entry rate varies much less.

Finally, the model captures realistic features of firm dynamics, focusing on the autocorrelation and standard deviation of value added in the data. As the model does not have permanent productivity differences or different locations within the economy, both regional and industry level fixed effects are regressed out. Moreover, as the model features endogenous entry and exit I only calculate autocorrelation and growth rates of surviving firms, both in the model and in the data.

Parameter	Value	Source/Target	Comments
Pre-assigned			
Home population, L	1	-	Normalization
Foreign population, L^*	4	UN 1989	Population ratio, Core vs. NMS
Elasticity of substitution, σ	4	Simonovska and Waugh (2014)	Trade, not substitution
Foreign borrowing tightness, θ^*	0.86	Midrigan and Xu (2014)	Developed countries (Korean) firm data
Depreciation, δ	0.06	Midrigan and Xu (2014)	-
Other			
Avg. export entry cost, f_{ex}^*	0.75%	$f_{ex}\times$ Market size proportional to cost	$\left[\frac{Y^*}{Y}\right]^{\frac{1}{\sigma}}\frac{w^*}{w} * P = 6$

Table 2. Preassigned and miscellaneous parameters

Note: Parameters not mentioned are exactly the same as in Home, including variable export costs.

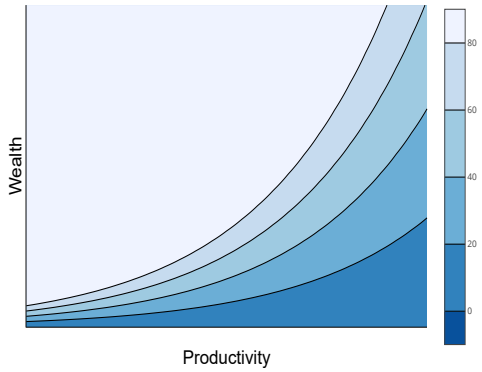
Description	Data	Model	Source & Year
Production			
Aggregate s.d. $arpk$	1.06	0.5	Bisnode, Hungary, 2008
s.d. of log capital growth	0.72	0.66	KRTK, Hungary
Fraction of firms that export	$[2, 38]$	40	Bisnode/KRTK, Hungary, 2000-2017
Finance			
Fraction of total debt credited to exporters	39	66	Bisnode, Hungary, 2008
Mean leverage	67	52	KRTK, Hungary, 2008
Mean leverage within exporters	56	50	KRTK, Hungary, 2008
Fraction of zombie exporters	2.0	6.4	KRTK, Hungary
Inequality			
GDP per capita in NMS	$[20, 80]$	28	WB, 2008
Top 10% wealth share	53	57	HSO 2014
Top 10% income share	34	28	WID 2008
Top 1% income share	11	6	WID 2008
Top 10% income share	24	25	WID 1991
Top 1% income share	6	5	WID 1991

Table 3. Non-targeted moments

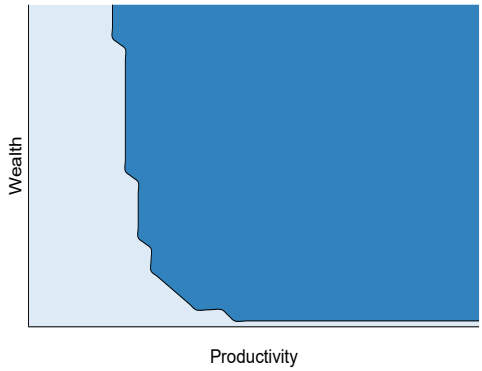
Table 2 contains the rest of the parameters. The elasticity of substitution captures the gains from trade through controlling the value of a new variety. Borrowing tightness abroad is assumed to be higher, because the Core economies are characterized by lower financial frictions and higher financial development. The fixed cost of entry to exporting is set to a lower value than in Home, to match the difference in the size of the markets.

The important non-targeted moments are summarized in Table 3. The model can explain around half of the standard deviation of the dispersion of returns to capital, which is the main measure of capital misallocation. The fixed cost of entry somewhat amplifies the aggregate dispersion in the marginal revenue product of capital, but even then, the model can explain around 25% of the variance.[7] In the model, there are more exporters than in any of the datasets — but as can be seen, the ratio of exporting firms varies a lot. The model qualitatively captures the lower average leverage ratio of exporters, despite the fact that exporters use external finance the most.

7. This feature of financial frictions is known, see for example Gopinath *et al.* (2017).



(a) Capital choice: $k(a,z)/k^{opt}(z)$



(b) Exit (pale) decision of incumbent exporters

Figure 4: Exporter's decision depends on productivity and net worth

The larger population of Foreign ensures TFP will be higher than in Home, due to the increased number of domestic varieties, and therefore no exogenous differences in the mean firm level productivity across countries is necessary to justify the observed higher development and larger size of the Core economy.

Finally, the model captures the top wealth shares well both before and after reforms, despite underestimating income inequality. With endogenous returns to wealth, the model captures higher wealth than income inequality, as is well known in the literature, see Benhabib and Bisin (2018).

To illustrate the relationship between exporting and finance in the model, the left panel of Figure 4 shows how constrained the capital choice of exporters are in the state space, relative to the unconstrained capital choice. The optimal capital stock absent financial frictions is increasing in productivity; therefore, for a fixed level of net worth, the firm is more and more constrained as productivity rises. The financial friction thus leads to heterogeneity in capital choice relative to the optimal capital stock. Firms that have lower productivity tend to obtain capital closer to

their optimal size, implying $corr(\lambda, z_t) > 0$, because only firms that have a reason to expand can be constrained and have a positive λ. The right panel of Figure 4 shows that exiting patterns depend on net worth too, exporters with higher net worth do not exit even with lower productivity.

4. Quantitative Analysis

In this section, I use the model to understand the main trade-offs involved in the integration of capital markets. First, I discuss steady-state results that I interpret as the long-run response of the economy. To explain the long run response I focus on the changes in productivity. Then, I discuss the implications for welfare and the transition dynamics, interpreted as the short-run response. To show that capital market integration without liberalized trade has a muted effect on the Home economy, I also construct an alternative counterfactual where the country keeps the barriers of trade, but opens up capital markets. Finally, I also show how improvements in financial development affect the gains from trade and capital inflows. Unless otherwise indicated, the analysis exclusively focuses on the Home economy, because due to the size differences, the Foreign economy is much less affected by goods or capital markets integration.

4.1. Steady state

In Table 4, I show the most important changes in the economy following a trade liberalization with closed capital markets (middle column), or integrated capital markets (right column), compared to the initial[8] steady state (left column).

Trade liberalization with closed capital markets increases aggregate productivity by around 9%. The increase in productivity is not driven by the decline in capital misallocation as the measured dispersion of returns to capital remains at the same level. Aggregate output gains are greater than productivity gains, because there is also an appreciation of the Home currency and changes in the aggregate capital stock. Aggregate consumption increases much less than productivity, as the economy spends more on entry costs, due to the increase in share of exporters. Consumption equivalent welfare change is roughly the same as the change in aggregate consumption, because the gains from trade are more equally distributed among households as measured by the almost unaffected wealth inequality. Overall, despite that the model violates all three macro restrictions considered in Arkolakis *et al.* (2012), the back-of-the-envelope approximation of the welfare change, based on the change in the import share of around 20% and trade elasticity of 4, yields a 7% increase in welfare. All the additional ingredients in the model do not change

8. Initial refers to the hypothetical state of the economy in 1991, even though the calibrated economy corresponds to the last column.

Variable	Initial	Trade	Trade and capital
Productivity			
TFP	100	109	104
s.d. $mrpk$	0.33	0.34	0.5
Aggregates			
Output	100	116	127
Income	100	110	110
Consumption	100	104.9	105.4
Capital	100	99	133
Welfare and Inequality			
Consumption equivalent welfare	0	5	13*
Top 10% wealth share	46	44	57
Factor prices			
Real wage	100	107	106
Interest rate premium $\%$: $r - r^*$	9	9	0
Trade			
$\frac{\text{Import}}{\text{GDP}}$	21	42	42
$\frac{\text{Export}}{\text{GDP}^*}$	2	4	4
Entrepreneurship rate	21	20	22
Share of exporters	32	46	40
CPI	140	133	137
$\frac{\text{Credit}}{\text{GDP}}$	57	50	62
$\frac{\text{Foreign Credit}}{\text{Credit}}$	0	0	53

* With immediate integration - postponing by 10 years reduces gains by 1%.

Table 4. Trade liberalization under closed and integrated capital markets

the welfare gains from trade under closed capital markets relative to that of a simple Armington model. Import share changes predict changes in welfare relatively well.

A stark contrast arises when both trade and capital markets are integrated, relative to the case when capital markets are kept closed while opening up to trade. Aggregate productivity declines and capital misallocation increases. However, output and consumption increases further. As the economy is forced to pay for the borrowed foreign capital, aggregate income declines. Wealth inequality increases, resulting in welfare gains that are no longer linked to the "gains" in aggregate productivity or aggregate consumption. This result is quite robust to changes in parameters — as long as capital flows into the economy, the productivity gains are going to be lower than the welfare gains. This is important because most countries liberalizing their trade do allow some form of capital inflow, therefore empirical analysis investigating welfare gains from trade based on the (decomposition of) aggregate productivity is undermined. Changes in aggregate productivity only provides a lower bound for the implied welfare change. To understand the results I decompose aggregate productivity on the long run, both qualitatively and quantitatively.

4.2. Understanding changes in productivity

In Table 5, I show how productivity of different sectors (domestic or exporter) changes after trade liberalization with closed and open capital markets. To

Description	Initial	Trade	Trade and capital
s.d. $mrpk$			
Domestic	0.35	0.34	0.47
Exporter	0.29	0.34	0.48
Productivity loss			
Domestic	2.7	2.6	4.7
Exporter	1.8	2.5	4.8
Extensive margin			
% firms that export	32	46	40
Zombie % of exporters	5.1	5.1	6.4
Avg. duration (years) of export status	2.3	2.5	4.1

Table 5. Effect of trade liberalization on different sectors

understand the TFP loss at the sectoral level, I define TFP_i^e as the sectoral TFP that would occur if all firms in sector i would be able to obtain their unconstrained input choice. I use this measure to compute sectoral level productivity losses from misallocation $\frac{TFP_i^e - TFP_i}{TFP_i^e}$. The productivity loss is positively correlated with capital misallocation s.d. $mrpk$. In the initial steady state, the domestic sector is more affected and the productivity loss is higher than among exporting firms.

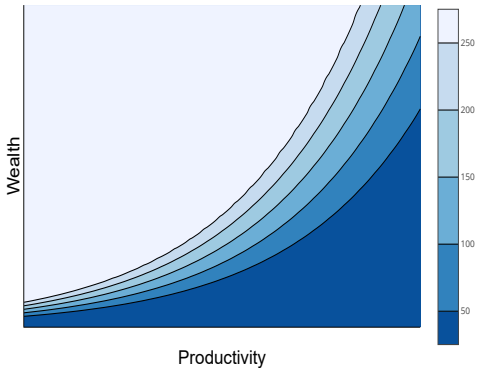
The exporting sector expands with trade liberalization and therefore within misallocation in the export sector has a larger impact on aggregate capital misallocation. Capital misallocation increases within the exporting sector in both cases, resulting in higher TFP losses within the exporting sector. If capital markets are integrated, capital misallocation within both domestic and exporting sectors increases.

The reason for the increase in misallocation at the micro level is analogous to the mechanism considered by Melitz (2003). Productivity and allocative efficiency is affected in general equilibrium because certain type of firms are encouraged to participate in exporting as their potential profits increase disproportionately more. Without financial frictions, more productive producers receive higher gains and they can afford to hire more factors of production, driving up wages and the rental rate. Productivity increases and allocative efficiency is not affected due to no misallocation of resources in the first place. With financial frictions, the productivity of producers are no longer the only dimension relevant for determining the gains. To see why I decompose the changes in potential exporting profits Π^{ex}:

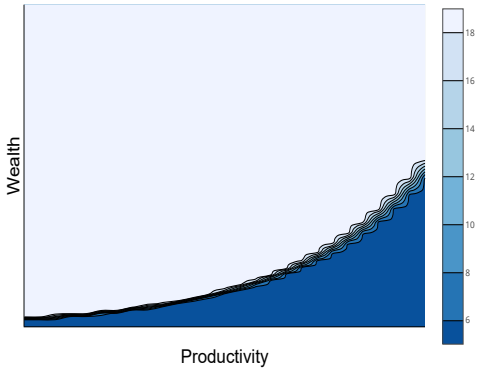
$$\frac{\Delta \Pi^{ex}}{\Delta \tau} = \frac{\Delta \Pi^{ex}}{\Delta l}\frac{\Delta l}{\Delta \tau} + \frac{\Delta \Pi^{ex}}{\Delta k}\frac{\Delta k}{\Delta \tau} + \text{Direct effect} \tag{22}$$

The direct effect is proportionally the same for all agents, because it comes from the higher foreign sales due to lower trade cost, *holding the factors of production constant*. The indirect effect driving the differences across producers is determined by financial frictions and factor prices.

Financial frictions affect a firm's ability to expand, depending on their wealth level. Unconstrained firms, which have a high wealth-to-productivity ratio, are unaffected by financial frictions and are the firms that *can* expand. Constrained firms, which have a low wealth-to-productivity ratio, however, *cannot* expand their



(a) Open Capital Markets



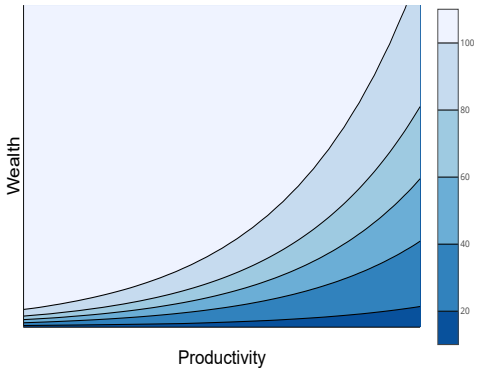
(b) Closed Capital Markets

Figure 5: $\%$ Change in capital

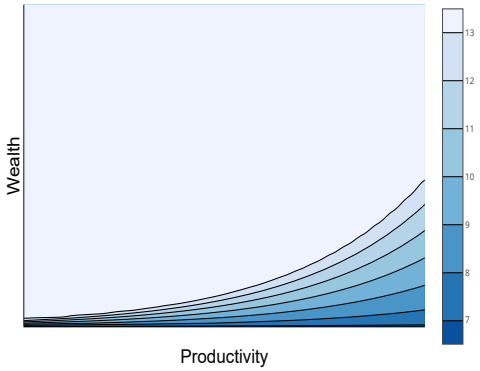
capital stock, only after accumulating more wealth. Constrained firms tend to be the more productive ones, hence financial frictions primarily impede the expansion of productive firms. Still, the changes in the rental rate explains which type of entrepreneur finds it *optimal* to expand.

Consider first the change in capital input used in production by firms across the state space in the two final steady states, relative to the pre-trade liberalization steady state. Figure 5 shows that under integrated capital and goods market, unproductive, wealthy exporters increase their capital stock by almost 250%, whereas productive, poor exporters can only increase their capital stock by 50%. Trade integration without an inflow of capital compresses the gains for all exporters, and even though unproductive, wealthy exporters still expand more, differences across exporters are much more limited, limiting the increase in misallocation.

The change in capital drives the change in profits, as Figure 6 shows. As profits are also affected by labor cost, the increase in profits tends to be more compressed than the change in capital stock. Still, potential exporting profits increase more



(a) Open Capital Markets



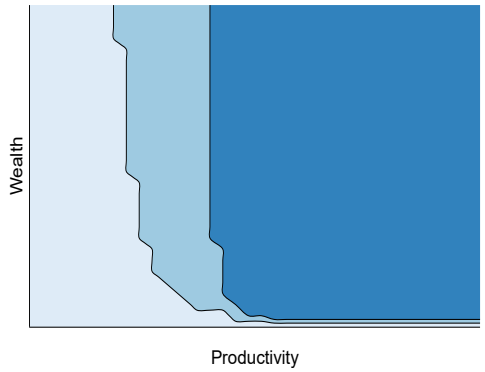
(b) Closed Capital Markets

Figure 6: $\%$ Change in exporting profits

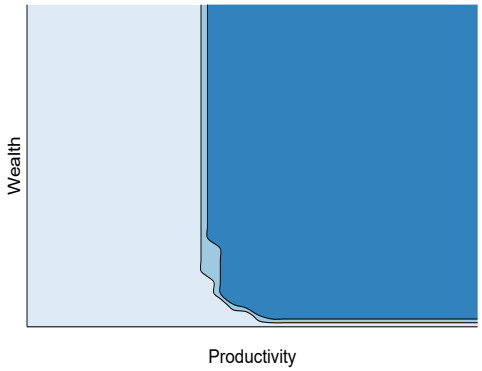
for unproductive firms. In the case of closed capital markets. Profits still increase less for productive firms, but the changes are compressed and the direct effect dominates.

The change in profits changes the dynamic incentive for firms to become and to stay exporters. Figure 7 shows that, regardless of capital market openness, trade liberalization shifts the exit decision to the left in the state space. But the shift is more pronounced and tilted towards unproductive, wealthy firms in the case of integrated capital markets.

Changes in the exit decisions of exporters drastically change the composition of exporters in steady states. In Table 6 I categorize exporters into 4 bins based on their wealth and productivity. Relative to the initial steady-state, trade liberalization with closed capital markets results in 52% more exporters that are relatively poorer, since there are 44% more exporting firms in the economy, and some entrants find it optimal to enter into the exporting sector with lower wealth. On the other hand,



(a) Open Capital Markets



(b) Closed Capital Markets

Figure 7: Changes in the exit decision of exporters

Note: Lighter color indicates the shifting of the exit decision from the initial steady state (light azure) to the final steady state (pale azure)

Type	Initial		Trade	Trade and capital
Low wealth and low productivity	4	8	7	
Low wealth and high productivity	25	36	13	
High wealth and low productivity	4	6	21	
High wealth and high productivity	67	50	59	

Table 6. Distribution of exporters in $\%$

Notes: High wealth: $a > 2\times$ national avg. High productivity: $z >$ national avg.

the share of unproductive exporters increases even more from 8% to 14%. The overall effect is that capital misallocation increases only slightly.

Liberalizing trade and integrating capital markets affect the distribution in line with the changes in profits. The measure of "High wealth and low productivity" type exporters increase by more than 17p.p. Even worse, exporters that have low wealth and high productivity decline by 12 p.p, mainly because entrants face a higher entry cost that is adjusted by the nominal wage. Unproductive firms now make up more than a quarter of all exporters, driving the increase in capital misallocation. The drastic increase in the fraction of unproductive firms do not directly increase the fraction of zombie[9] firms, since some of them will get a positive shock so that they earn higher profits than the wage rate at least once out of 3 consecutive periods. Therefore the group of firms that drive the increase in misallocation are somewhat different than zombie firms. Arguably, some of the zombie firms are poor, unproductive exporters that deleveraged over time and do not have much effect on misallocation.

Therefore a prediction of the model is that more export-intensive sectors/countries have higher capital misallocation, driven by unproductive, wealthy exporters, especially if financial frictions are important in the economy. Clearly this is the case for Hungary before 2008, but I also consider the broader implications in appendix B for European economies after 2000.

To assess the quantitative importance of the different channels, I decompose the changes in productivity. By allowing the planner to redistribute resources, either within or between sectors, I can trace out the quantitative contribution of the increase in misallocation[10].

In table 7 I compare the allocations relative to the second best productivity under liberalized trade, open and more developed capital markets. Factor misallocation is decomposed into two parts. Within misallocation is compared to productivity that would occur if the planner would provide the unconstrained factor choices to every producer. Between misallocation is compared to the productivity of an economy with higher financial development, that would occur with a reallocation of firms , capital and labor between sectors but still requiring that firm's choice of capital and labor are constrained and that they pay high trade and borrowing costs. From the initial state of the economy, eliminating constrained factor choices increase productivity, but reordering firms and resources as in the economy with more developed financial system *decreases* productivity. As it is discussed when comparing economies based on their development in section 4.6, the primary reason for this is the decline in entrepreneurship, decreasing the number of varieties.

Better financial system has an ambiguous effect on productivity. On the one hand, firms are less constrained individually, increasing productivity. On the other hand, less productive firms exit, decreasing productivity. Average firm productivity increases, but the aggregate capital stock and labor can be used less efficiently if enough firms exit, as the number of varieties decrease.

9. The definition of zombie firms is adjusted by the outside option, that is, being a worker.

10. I show the details in appendix A3

Source of TFP loss	Initial	Trade	Trade and capital
Factors	$\mathbf{-3}$	$\mathbf{40}$	$\mathbf{100}$
Within	13	27	36
Between	-16	13	64
External Reforms	103	60	0
Total TFP loss $\%$	$\mathbf{19}$	$\mathbf{11}$	$\mathbf{16}$

Table 7. TFP loss decomposition

The majority of productivity gains are due to cheap capital and lower trade costs as these reforms help the most efficient firms under a more efficient financial system. To further decompose these to a trade and capital market integration component, the second and third columns compare the productivity level of the economy after trade, and after capital and trade liberalization.

Compared to the productivity of the developed and integrated economy, once trade is liberalized, around 40 $\%$ of productivity loss is due to underdeveloped financial markets, and 60 $\%$ is due to insufficient capital stock. There is a large potential therefore in capital market integration ex ante. But as I show when discussing the more developed economy, a more developed capital market not only decreases firm level differences in returns to capital, but result in the increase of capital stock, effectively reducing the benefits of capital market integration.

The last column shows that the decline in aggregate productivity in the initial steady state attributed to the lack of factor reallocation is not only due to decreasing entrepreneurship, but also due to changes in the firm distribution after trade and capital market integration. After full integration, 36 $\%$ of the productivity loss is due to cross-sectional differences in factor allocation, but 64 $\%$ of the loss is due to the mismatch in occupations — mostly exporters that should have exited. Moreover, as TFP losses are higher with full external reforms, the mismatch in occupations is costly and reduces the gains from capital market integration.

4.3. Inequality and welfare

Trade liberalization under different capital market regimes implies different paths for the inequality in the economy and for individual's welfare. Inequality increases with trade liberalization, and more so under integrated capital markets. As Table 8 shows, while wealth inequality slightly contracts under opening up to trade only, this underestimates "true" wealth as it excludes exporting rights. Consumption and income inequality as measured by the share owned by the top 10 $\%$, increases. After integrating both goods and capital markets, wealth and consumption inequality increases further. Wealth was primarily held by exporters even before trade liberalization as wealth is necessary to borrow more capital for production. Exporters need to accumulate a larger fraction of wealth to finance the expansion of the exporting sector, increasing wealth inequality as a by-product. The scarcity of capital under closed capital markets partially offsets the increase in

Variable	Initial	Trade	Trade and capital
Aggregates			
Income	100	107	106
Consumption	100	104.9	105.4
Capital	100	99	133
Welfare change			
Steady state only	0	8	13
Transition dynamics	0	5	13*
Inequality			
Top 10% wealth share	46	44	57
Top 10% income share	25	26	28
Top 10% consumption share	16	17	22
Wealth owned by exporters	15	22	38
Factor prices			
Real wage	100	107	106
Interest rate premium $r - r^*$	9	9	0

Table 8. Trade liberalization under closed and integrated capital markets

* With immediate integration - postponing by 10 years reduces gains by 1%.

wealth concentration due to the expansion of the exporting sector as the domestic sector contracts substantially.

I define utilitarian welfare change as the consumption bundle that provides *individual* households the same utility as the steady state or as the transition path of different reforms. Capital market integration increases the welfare gains from trade liberalization. In general, households relying on exporting profits prefer integrated capital markets as the borrowing cost of capital declines. However, as Figure 8 shows, workers with savings but low *entrepreneurial* productivity are worse off, suffering a 20 $\%$ consumption equivalent welfare loss. The main reason is that wealthy, but unproductive households earn lower capital income from their savings. In turn, capital income, wealth and welfare of Foreign households increase as they now rent capital to firms in Home.

Moreover, capital market integration changes the life-cycle profile of households. Only households in the production sector find it optimal to hold wealth, and workers quickly consume their assets after exiting production. There is a general decline in social mobility[11] and an increase in inequality — to enter the exporting sector, on average, workers have to save up more as the entry cost is indexed by nominal wages — recall Equation 4 — and this is much tougher as the return on the only savings instrument available for the workers yields a lower return. Meanwhile, staying in the labor market is more profitable, since nominal wages are higher.

The left panel shows that under closed capital markets gains are lower, but no member of the society is worse off. Potential entrants into the export sector

11. Measured as the expected duration in each occupation.

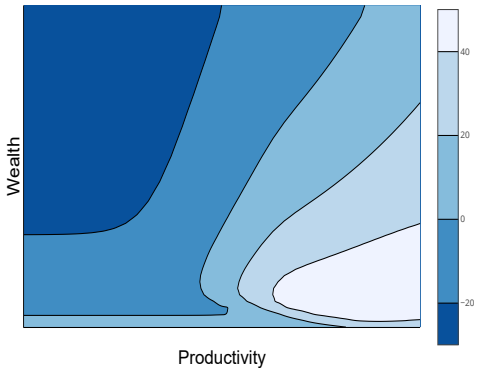
are in the segment of the (Home) society that is the least well off, since they are forced to accumulate expensive risk-free assets just to be able to reach their optimal scale - but after this wealth level is reached, they benefit the most from trade liberalization.

Domestic producers, on Figure 9, have similar gains and losses as workers, because the increase in real wages negatively affect domestic profits. The decline in the rental rate of capital under integrated capital markets offsets the effect for some of the producers, just as it does for workers. Nevertheless, domestic producers face an increase in competing varieties, further decreasing their profits. This is important for welfare because, in the model, becoming a domestic entrepreneur is a stepping stone to become an exporting entrepreneur. Any change that decreases domestic profits has a direct negative effect on social mobility.

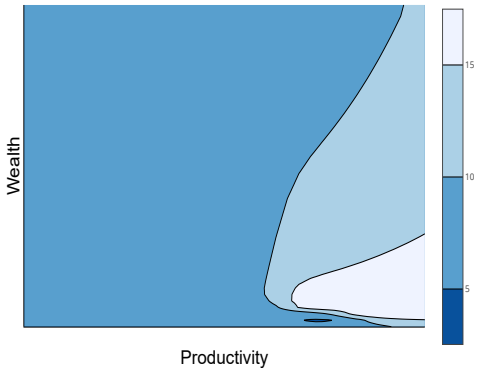
Those already exporters (Figure 10) see their net worth to matter somewhat less for their welfare gains and even unproductive exporters receive higher returns on their investments as they take advantage of cheap capital.

Figure 11 shows the welfare differences across households under the different reform scenarios. Assuming uniform distribution of households along grid-points — true for productivity, not for wealth — the majority of the population opposes capital market integration. The political economy consequence of the integration can be the loss of support. Worse, when capital and trade is integrated, trade liberalization itself is discredited, even though it improves the welfare of all households.

Finally, considering the steady state only overstates the gains from opening up to trade with closed capital markets by 3%, as it takes time to reach the final steady state. Under integrated capital markets, gains are not affected, because there are additional short term benefits of capital market integration.

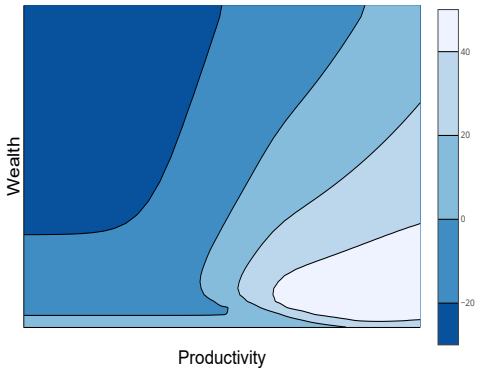


(a) Open Capital Markets

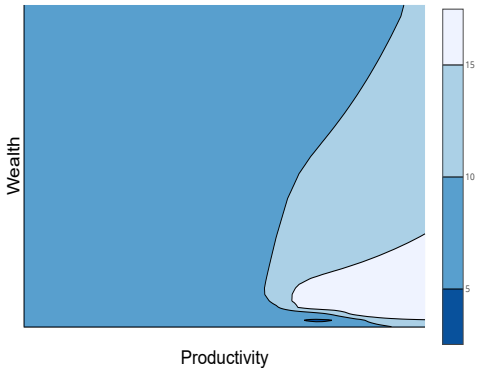


(b) Closed Capital Markets

Figure 8: % in consumption equivalent welfare for workers

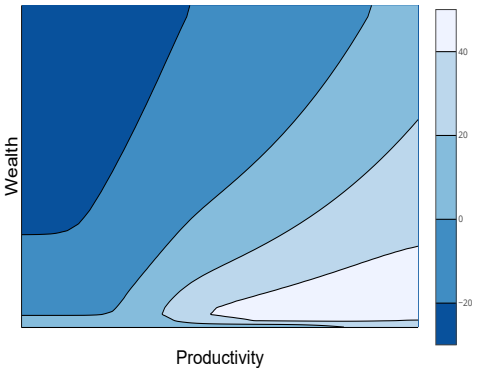


(a) Open Capital Markets

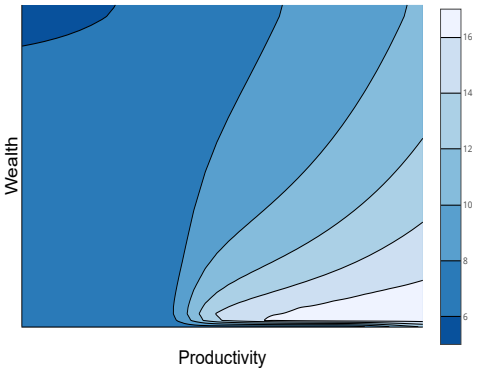


(b) Closed Capital Markets

Figure 9: % in consumption equivalent welfare for domestic producers

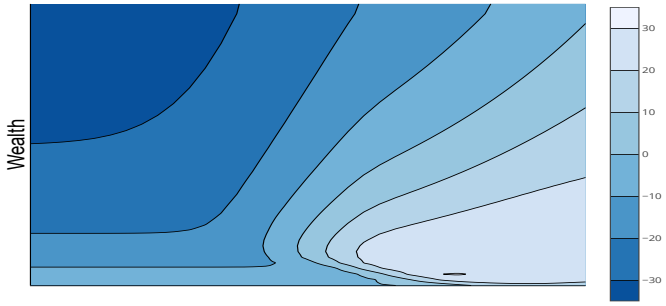


(a) Open Capital Markets

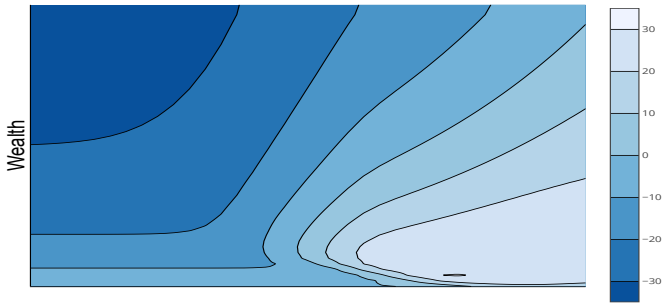


(b) Closed Capital Markets

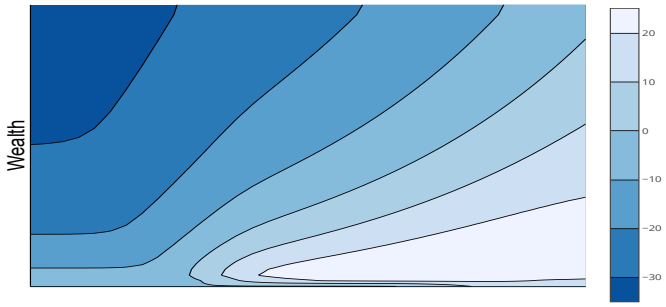
Figure 10: % in consumption equivalent welfare for exporters



(a) Workers



(b) Domestic Producers



(c) Exporters

Figure 11: Consumption equivalent welfare change of opening up with open capital markets relative to closed capital markets

4.4. Transition dynamics after a trade shock

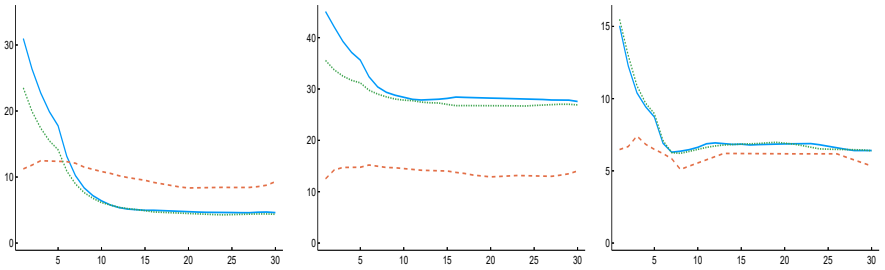
There are two reasons why studying transition dynamics is important. First, the sequencing of reforms like trade liberalization or capital market integration is of particular concern for policymakers, because short term losses can undermine the credibility of reforms. Second, the short term dynamics of reforms do differ from steady state, altering the *overall* gains and losses. Figure 12 compares the effect of a gradual (completed within 4 years) bilateral trade liberalization, announced in period 2 with perfect foresight afterwards until the final steady state is reached in period 31. The bilateral variable trade cost is gradually reduced for four years to the final level. In the case of integrated capital markets, the policy is also announced in period 2, but it only affects the capital stock in period 3. Perfect foresight is supported in this integration episode because after 1989, NMS were in agreement with the EU for their accession plan, that included the path to abolish tariffs. The debate mainly concerned capital market integration. By 1995, trade liberalization abolished most tariff and other non-tariff barriers[12]. Capital market integration was also very rapid for Hungary, though arguably not complete in the course of a year[13].

The key to understanding short-term dynamics in the model is through productivity. TFP increases initially, irrespective of capital market integration, albeit *more* so for integrated capital markets. The overshooting of productivity happens because, initially, only productive exporters are present, and any additional capital allocated to them alleviates the financial constraints and they can expand more than under closed capital markets. The negative effect of capital markets and trade integration, i.e. the increase in misallocation among exporters, takes a few periods to realize. Despite the fact that misallocation increases for both exporters and domestic producers equally, as exporters are wealthier than domestic producers, they are responsible for the eventual decline in aggregate productivity. The main reason for the increase in misallocation among exporters is that those who were productive initially, but become unproductive due to the mean-reverting productivity process, no longer exit. Because their net worth is still considerable, they draw resources from other productive firms.

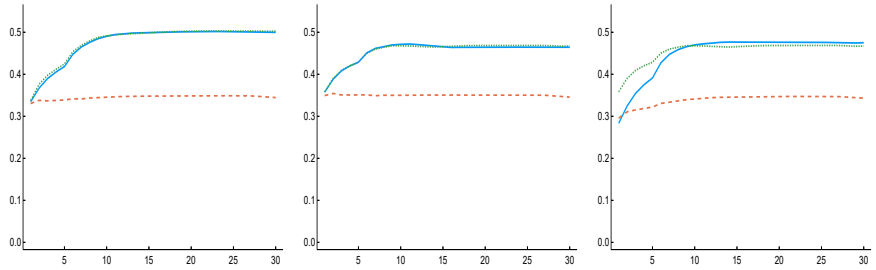
Mirroring productivity, both consumption and output increases. Overall, relative to the steady state results, accounting for transition dynamics magnifies the benefits and lowers the losses of capital market integration. The reason is that in the short run, productivity improves more than under closed capital markets. On top of the level effect of having higher capital stock in the economy, initially productive exporters expand more. After the initial demand shock, more entrepreneurs and varieties remain not only for exporting, but also for domestic consumption, resulting

12. Initially trade liberalization consisted of a bilateral tariff reduction, later on, in preparation of accession to EU demanded the removal of non-tariff trade barriers. It is also interesting to note that the bilateral tariff reduction was lead by the EU, and they allowed NMS countries to lag in their import tariff reduction by a year for some industries — I abstract from this unilateralism

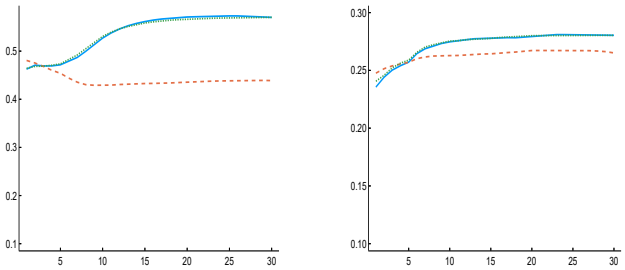
13. Timeline included in Appendix B.4



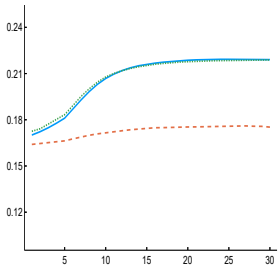
(a) TFP (b) GDP (c) Zombies among exporters



(d) s.d. $mrpk$ (e) Domestic s.d. $mrpk$ (f) Exporter s.d. $mrpk$



(g) Top 10 % wealth share (h) Top 10 % income share



(i) Top 10 % cons. share

Figure 12: Transition dynamics after trade liberalization with closed (dashed line), delayed opening of capital markets(dotted line) or open capital markets

in a slow decline in productivity and in an increase in inequality, measured by the share owned by the top 10 % of the population.

The evolution of the gains under integrated capital market is different to the results in Gopinath *et al.* (2017). The transition path there lowers consumption gains but in the long run, productive firms overcome misallocation. The difference comes from the nature of the financial frictions: here, the discrete state variable e, the extensive margin, is important. General equilibrium, notably the increase in real wages, also play a part — allowing for capital flow will lead to higher labor demand, higher nominal wages, and increased consumption.

Finally, the dotted line shows the results of the historical compromise between fully opening capital markets or keeping it completely closed. In period 2 it is announced that following the gradual trade liberalization in the next 4 years, in year 11, capital markets are going to be integrated. Consumption equivalent welfare in this case is only 1% lower for the population in period 1, therefore, while postponing does have some cost, the economy adopts almost the same path as the economy with the sudden integration. While the initial increase in productivity is lower than under immediate and full integration, exporters behave similarly on the extensive margin as under full integration, despite the fact that there is no inflow of cheap capital.

The historical compromise scenario highlights just how important to model exporters as dynamic decision makers with costly access to external funds. Exporters are less willing to exit if they know that there will be a negative cost-shock a decade later because of the high entry cost. Hence the whole economy will behave as if the cost shock have happened immediately, even though the discount factor is low. Governments contemplating the sequencing of their integration to the rest of the world therefore do get considerable short term boost even if they only commit themselves to future capital market integration, relative to the case where they decide to rely on their own capital markets.

4.5. Capital market integration without trade liberalization

The extent to which capital market integration has an effect on the economy depends on the level of trade integration as in Obstfeld and Rogoff (2000). In table 9, I compare economies with integrated capital markets, but with different levels of trade openness[14].

Aggregate productivity slightly increases despite the increase in capital misallocation. The primary reason for this increase in productivity is the rise in entrepreneurship and hence more varieties in the economy. Nevertheless, the benefits, taking into account a large inflow of capital, are limited, both in terms of welfare and consumption. Moreover, the welfare gains of only trade liberalization

14. Variable trade costs change as in Table 1. Initial steady state is the pre-trade, pre-capital markets economy, just as in Table 4

Variable	Initial	Trade	Trade and capital
Productivity			
TFP	100	101	104
s.d. $mrpk$	0.33	0.5	0.5
Aggregates			
Output	100	114	127
Income	100	104	110
Consumption	100	100	105.4
Capital	100	126	133
Welfare and Inequality			
Transition dynamics	0	5	13*
Top 10% wealth share	46	54	57
Factor prices			
Real wage	100	100	106
Interest rate premium $r - r^*$	9	0	0
Trade			
$\frac{\text{Import}}{\text{GDP}}$	21	23	42
$\frac{\text{Export}}{\text{GDP}^*}$	2	2	4
Entrepreneurship rate	21	24	22
Share of exporters	32	24	40
CPI	140	141	137
$\frac{\text{Credit}}{\text{GDP}}$	57	65	62
$\frac{\text{Foreign Credit}}{\text{Credit}}$	0	49	53

Table 9. Only capital market integration

(5 $\%$) and only capital market integration (5 $\%$) do not add up to those of the full reform (13 $\%$), indicating that indeed there are benefits if both reforms are implemented.

4.6. Higher financial development

To show how the development of the financial system in the economy affects the gains and losses from external reforms, I change the financial development of Home. Table 10 shows what happens in the model economy after it is recalibrated to have the same parameters of financial development (θ and β) as the Foreign economy. There are large differences between this more developed economy and the initial economy, even though the level of aggregate productivity is almost the same. Aggregate capital stock increases by 360 $\%$, as firms can borrow more, even for the same wealth, and because the patience of borrowers increased. The large increase in capital stock filters through the economy, increasing wages, and hence, decreasing entrepreneurship rate, as more people choose to be workers. Wealth inequality declines, because wealth hoarding is no longer as necessary for exporters as before. Firms are more likely to enter the export sector, as the wealth threshold for economies of scale declines.

Even with these large changes in the internal market structure, the economy does not become more open, as measured by the import to GDP ratio. Trade costs still prevent a more open economy, and are still relevant — this more developed

Variable	Initial	Developed
Productivity		
TFP	100	99
s.d. $mrpk$	0.33	0.13
Aggregates		
Output	100	142
Income	100	157
Consumption	100	144
Capital	100	360
Welfare and Inequality		
Steady state	0	46
Top 10% wealth share	46	21
Top 10% income share	25	21
Top 10% consumption share	16	12
Factor prices		
Real wage	100	169
$r - r^*$	9	1
Trade		
$\frac{\text{Import}}{\text{GDP}}$	21	22
$\frac{\text{Export}}{\text{GDP}^*}$	2	4
Entrepreneurship rate	21	17
Share of exporters	32	45
CPI	140	129
$\frac{\text{Credit}}{\text{GDP}}$	57	182
$\frac{\text{Foreign Credit}}{\text{Credit}}$	0	0

Table 10. Effects of developed internal capital markets

economy can still benefit from increased trade. Capital is still flowing into Home, even though now the only difference between Home and Foreign is that Foreign has 4 times larger population than Home. The developed Home economy is a useful benchmark for comparing productivity levels, exploited in section 4.2, more so than the frictionless economy, included in Appendix B5.

Table 11 shows the results of external reforms in the developed economy. Both aggregate output and productivity increases more than in the economy with lower financial development, but capital stock contracts. Without capital market integration, the economy quickly adjust to the trade shock, but the welfare gains are similar as they were before, only slightly lower. The effect of trade reform depends negatively on the development of the economy, but only marginally, in line with the findings of Kohn *et al.* (2018) and Brooks and Dovis (2019).

With both capital and trade integration, the inflow of capital allows Home households to decrease their savings, leading to a boom in welfare during the transition period. Credit market contracts, domestic credit declines by almost 50 $\%$. There is a slight expansion of entrepreneurship, but not in the fraction of exporters. Financial integration does not have a deteriorating effect on productivity, the change in the savings behavior dominates. Much of the increase in TFP is due to the expansion of capital stock in Foreign, because now Foreign households experience higher interest rate and increase their savings and their production, improving the value of foreign imports and stabilizing the depreciating Home exchange rate

Variable	Initial	Trade	Trade and capital
Productivity			
TFP	100	115	123
s.d. $mrpk$	0.14	0.15	0.22
Aggregates			
Output	100	124	135
Income	100	103	100
Consumption	100	103	98
Capital	100	98	93
Welfare change			
Steady state only	0	5	1
Transition dynamics	0	5	7
Inequality			
Top 10% wealth share	20	33	26
Top 10% income share	21	22	23
Top 10% consumption share	12	12	12
Factor prices			
Real wage	100	105	106
Interest rate premium $r - r^*$	1	1	0
Trade			
$\frac{\text{Import}}{\text{GDP}}$	22	44	41
$\frac{\text{Export}}{\text{GDP}^*}$	4	6	5
Entrepreneurship rate	17	16	19
Share of exporters	45	57	41
CPI	129	127	128
$\frac{\text{Credit}}{\text{GDP}}$	182	153	136
$\frac{\text{Foreign Credit}}{\text{Credit}}$	0	0	38

Table 11. Trade liberalization with higher financial development under closed and integrated capital markets

(CPI). The welfare gains are nevertheless much lower than in the baseline economy, because capital abundance does not make the economy more capital intensive.

Overall, the results show that higher financial development decreases the benefits of external reforms. Trade integration is still valuable, and only marginally effected by financial development, but capital inflows no longer complement trade integration as much.

5. Conclusion

In this paper I investigate how opening up capital markets affects the gains from trade in economies with financial frictions, by focusing on historical integration episode of Eastern Europe. I find that, quantitatively, capital market integration is welfare improving and amplifies the gains from trade, despite the potential adverse effect on productivity. Capital inflows complement trade liberalization well, especially if domestic capital markets are underdeveloped. Productivity losses are driven by misallocation among exporters both at the intensive and at extensive margin, but access to cheaper capital has the more important effect.

Capital misallocation increases gradually along the transition, and hence the gains of capital market integration are front loaded, whereas the losses are back loaded. This explains why the benefits of capital market integration are difficult to detect in the data: gains are associated with the trade liberalization that frequently accompanies structural reforms like capital market integration.

Another concern is that capital market integration leads to higher inequality in consumption, income, and wealth, amplifying the increase in inequality due to trade liberalization. A policy implication is that countries contemplating trade liberalization should take into account the financial development of the economy and the political economy aspect of inequality. Taking transition dynamics into account is also important, as the gains from trade under closed capital markets materialize later than under open capital markets.

There are two dimensions not considered in the analysis that have the potential to alter the results. First, misallocation and trade might affect innovation, and therefore can increase the benefits of keeping capital markets closed and rely only on domestic savings. This direction has been investigated by Gourinchas and Jeanne (2013) and by Hsieh *et al.* (2019).

Second, foreign direct investment can be a substitute to capital inflows through banks, mitigating the misallocation channel. Bau and Matray (2020) provides ample evidence for this to be the case. For this reason, there is a fierce competition for foreign direct investment among developing countries, and in general after capital account liberalization, the inflow of indirect finance dominates.

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Appendix A: For Online Publication: Derivations for the Model

The online appendix at my github repository contain the Julia code necessary to obtain the results of the model. Upon request, I can provide a legacy Matlab code and all Stata do files required for data construction.

A.1. Derivation of the exporter's problem

Denote $\alpha_1 = \alpha$ and $\alpha_2 = 1 - \alpha$ and substitute the inverse demand functions in, the necessary first order condition are:

$$\frac{\sigma - 1}{\sigma} \omega P_t Y_t^{\frac{1}{\sigma}} X^{\frac{-1}{\sigma}} = \mu \qquad (X)$$

$$\frac{\sigma - 1}{\sigma} \frac{1 - \omega}{(1 + \tau_t)} P_t^* (Y_t^*)^{\frac{1}{\sigma}} X^{*\frac{-1}{\sigma}} = \mu \qquad (X^*)$$

$$\alpha_2 \mu z_t k^{\alpha_1} l^{\alpha_2 - 1} = W_t \qquad (l)$$

$$\alpha_1 \mu z_t k^{\alpha_1 - 1} l^{\alpha_2} = \lambda + R_t \qquad (k)$$

Denote:

$$C_d = \omega P_t Y_t^{\frac{1}{\sigma}} \qquad \text{(A.1)}$$

$$C_x = \frac{1 - \omega}{1 + \tau_t} P_t^* (Y_t^*)^{\frac{1}{\sigma}} \qquad \text{(A.2)}$$

as the aggregate demand for domestic and exported goods. This implies that the amount exported is:

$$X^* = \left(\frac{C_x}{C_d}\right)^{\sigma} X \qquad \text{(A.3)}$$

$$X = C_d^{\sigma} \frac{z_t k^{\alpha_1} l^{\alpha_2}}{\left(C_d^{\sigma} + (1 + \tau_t) C_x^{\sigma}\right)} \qquad \text{(A.4)}$$

Implying that the Lagrange multiplier on the resource constraint (μ) is:

$$\mu = \frac{\sigma - 1}{\sigma} C_d X^{-\frac{1}{\sigma}} \qquad \text{(A.5)}$$

Furthermore dividing (k) with (l) yields:

$$\frac{\lambda + R_t}{W_t} = \frac{\alpha_1}{\alpha_2} \frac{l}{k} \qquad \text{(A.6)}$$

$$W_t = \alpha_2 \frac{\sigma - 1}{\sigma} z_t^{\frac{\sigma - 1}{\sigma}} k^{\alpha_1 \frac{\sigma - 1}{\sigma}} l^{\alpha_2 \frac{\sigma - 1}{\sigma}} \left(C_d^{\sigma} + (1 + \tau_t) C_x^{\sigma}\right)^{\frac{1}{\sigma}} \qquad \text{(A.7)}$$

$$= \tilde{\alpha_2} C_z k^{\tilde{\alpha_1}} l^{\tilde{\alpha_2} - 1} \qquad \text{(A.8)}$$

With the notation:

$$\tilde{\alpha}_1 = \alpha_1 \frac{\sigma - 1}{\sigma} \tag{A.9}$$

$$\tilde{\alpha}_2 = \alpha_2 \frac{\sigma - 1}{\sigma} \tag{A.10}$$

$$C_z = z_t^{\frac{\sigma-1}{\sigma}} \left(C_d^{\sigma} + (1 + \tau_t) C_x^{\sigma} \right)^{\frac{1}{\sigma}} \tag{A.11}$$

The solution of the problem is:

$$l = \left(\tilde{\alpha}_2^{1-\tilde{\alpha}_1} \tilde{\alpha}_1^{\tilde{\alpha}_1} C_z (\lambda + R_t)^{-\tilde{\alpha}_1} W_t^{\tilde{\alpha}_1 - 1} \right)^{\sigma} \tag{A.12}$$

$$k = \left(\tilde{\alpha}_2^{\tilde{\alpha}_2} \tilde{\alpha}_1^{1-\tilde{\alpha}_2} C_z (\lambda + R_t)^{\tilde{\alpha}_2 - 1} W_t^{-\tilde{\alpha}_2} \right)^{\sigma} \tag{A.13}$$

If k implied by (A.13) with $\lambda = 0$ would be such that it violates (λ), then $k = \frac{a_t}{P_{t-1}(1-\theta)}$ and (A.13) is used to recover the value of λ.

A.2. Final good producers

Isoelastic demand for the intermediate inputs is given by:

$$p_t(j) = Y_t^{\frac{1}{\sigma}} (X_t(j))^{-\frac{1}{\sigma}} P_t \tag{A.14}$$

$$p_{F,t}(j) = \frac{1}{1 + \tau_t} Y_t^{\frac{1}{\sigma}} (X_{F,t}(j))^{-\frac{1}{\sigma}} P_t \tag{A.15}$$

$$p^*_{F,t}(j) = (Y^*_t)^{\frac{1}{\sigma}} (X^*_{F,t}(j))^{-\frac{1}{\sigma}} P^*_t \tag{A.16}$$

$$p^*_t(j) = \frac{1}{1 + \tau_t} (Y^*_t)^{\frac{1}{\sigma}} (X^*_t(j))^{-\frac{1}{\sigma}} P^*_t \tag{A.17}$$

A.3. TFP loss decomposition

Instead of solving the problem of the unconstrained planner, I choose TFP^* to be the productivity after trade liberalization with open and developed capital markets, allowing both within and between sector reallocation. When the planner is allowed to reallocate both withing and between sectors, the financial system is no longer an impediment to higher productivity, hence all remaining effect are attributed to the reduction in trade costs and capital inflows, categorized as external reforms.

$$\begin{aligned}
\text{Total loss} &= \frac{TFP^* - TFP}{TFP^*} \\
&= \frac{TFP^* - TFP^{Both} + TFP^{Both} - TFP}{TFP^*} \\
&= \frac{TFP^* - TFP^{Both} + (TFP^{Between} - TFP) + (TFP^{Within} - TFP)}{TFP^*}
\end{aligned}$$

Level	Country	Sector	Firm
Data	World 1950-2014	EU 2000-2014	Hungary 2005-2017
Source	IMF + WB + PWT	CompNet + WIOD	Administrative
Productivity	TFP	TFPR/RVA	TFPR
Resource allocation	—	s.d. (MRPK) & zombie	s.d. (ARPK) & entry/ exit
Trade liberalization	$\frac{\text{Import}}{\text{GDP}}$	$\frac{\text{Export revenue}}{\text{Total revenue}}$	Export revenue
Financial development	$\frac{\text{Domestic Credit}}{\text{GDP}}$	$\frac{\text{Trade Credit}}{\text{Asset}}$	$\frac{\text{Asset}}{\text{Equity}}$
Capital Market Integration	Chinn and Ito (2006) index	—	—

Table B.1. Empirical strategy

with

$$TFP^{Within} = \left[TFP_d^{eff}\left(\left(\frac{K_d}{K}\right)^{\alpha}\left(\frac{L_d}{L}\right)^{1-\alpha}\right)^{\frac{\sigma-1}{\sigma}} + \pi_x \cdot TFP_x^{eff}\left(\left(\frac{K_x}{K}\right)^{\alpha}\left(\frac{L_x}{L}\right)^{1-\alpha}\right)^{\frac{\sigma-1}{\sigma}}\right]^{\frac{\sigma}{\sigma-1}}$$

$$TFP^{Between} = \left[TFP_d\left(\left(\frac{K_d^{eff}}{K}\right)^{\alpha}\left(\frac{L_d^{eff}}{L}\right)^{1-\alpha}\right)^{\frac{\sigma-1}{\sigma}} + \pi_x \cdot TFP_x\left(\left(\frac{K_x^{eff}}{K}\right)^{\alpha}\left(\frac{L_x^{eff}}{L}\right)^{1-\alpha}\right)^{\frac{\sigma-1}{\sigma}}\right]^{\frac{\sigma}{\sigma-1}}$$

$$TFP^{Both} = \left[TFP_d^{eff}\left(\left(\frac{K_d^{eff}}{K}\right)^{\alpha}\left(\frac{L_d^{eff}}{L}\right)^{1-\alpha}\right)^{\frac{\sigma-1}{\sigma}} + \pi_x \cdot TFP_x^{eff}\left(\left(\frac{K_x^{eff}}{K}\right)^{\alpha}\left(\frac{L_x^{eff}}{L}\right)^{1-\alpha}\right)^{\frac{\sigma-1}{\sigma}}\right]^{\frac{\sigma}{\sigma-1}}$$

$$\text{Within} = \frac{(TFP^W - TFP)}{TFP^*}/\text{Total loss}$$

$$\text{Between} = \frac{(TFP^A - TFP)}{TFP^*}/\text{Total loss}$$

$$\text{Both} = \frac{(TFP^B - TFP)}{TFP^*}/\text{Total loss}$$

Appendix B: Data Sources and auxiliary empirical analysis

Table B.1 summarizes the the additional analysis regarding productivity, misallocation, financial heterogeneity, trade liberalization and capital integration that can be detected using various datasets and identification levels. The goal of the analysis is to augment and motivate the arguments made with the quantitative model.

B.1. Country-level evidence

For the country-level analysis I combine the datasets of Chinn and Ito (2006), Penn World Table (PWT) 7.1 (Heston *et al.* (2012)), World Bank Indicators (WBI) and Bank of International Settlements (BIS) data. The first dataset is used to obtain capital market integration measures, the second one for productivity and output, the third one for trade data and the fourth one for credit data.

First, I explain the construction of Figure 1 and the relevant entries in Table 1. BIS data contains total credit available for non-financial corporations (NFC). Unfortunately, this variable is not divided into a domestic and a foreign component. Therefore I make two crucial assumption in creating domestic and foreign credit to NFC. First, that foreigners invest the same fraction in NFC as to all other assets:

$$\text{Foreign credit to NFC} = \frac{\text{Foreign credit}}{\text{Credit}} \times \text{Credit to NFC} \tag{B.1}$$

I assume that foreign credit to *NFC* did not exist in 1989. Almost all relevant NFC were at least partially state-owned, hence any credit allocated to these firms was part of the sovereign public debt. The communist economic policy between 1985 and 1988, the so-called "acceleration" consisted of a large-scale increase in sovereign debt that financed the expansion of capital investment of mostly manufacturing firms, in the last attempt to lift the economy from the downturn. Foreign debtors considered their loans public debt. Moreover, the privatization of said companies took considerable time. Hence, I also assume, that there is a fraction of foreign credit to NFC that goes to (partially) state-owned companies. That is, modify Equation B.1 by:

$$\text{Foreign credit to NFC} = -\bar{C} + \frac{\text{Foreign credit}}{\text{Credit}} \times \text{Credit to NFC} \tag{B.2}$$

$$\bar{C} = \frac{\text{Foreign credit}_{1987}}{\text{Total credit}_{1987}} \times \text{Credit to NFC}_{1987} \tag{B.3}$$

The main quantitative exercise shows that aggregate productivity does not necessarily increase with higher goods or capital market integration. To show this in the data, I analyze the interaction between trade, TFP and finance. I estimate the following reduced form regression:

$$\begin{aligned}\log(TFP_{it}) =& \beta_0 + \beta_1 \log(\frac{Import}{GDP})_{it} + \beta_2 \log(\frac{Credit}{GDP})_{it} \\ &+ \beta_3 \Big[\log(\frac{Import}{GDP})_{it} \times \log(\frac{Credit}{GDP})_{it} \Big] \\ &+ \beta_4 CMI_{it} + \beta_5 \Big[\log(\frac{Import}{GDP})_{it} \times CMI_{it} \Big] + \alpha_t + \alpha_i + \varepsilon_{it}\end{aligned}$$

where CMI denotes the Chinn and Ito (2006) index, $Credit$ the domestic credit provided by the financial sector to nonfinancial corporations and households, $Import$ the gross imports and GDP the Gross Domestic Product of a country i in year t. The results in Table B.2 show that, on average, countries benefit from opening up to trade. Moreover, higher financial development leads to higher gains from trade but higher capital market integration decreases these gains. To evaluate the economic significance of the model I conditionally ex post forecast the change in productivity for Germany, Italy and Hungary as they from 1992 by substituting their financial development and capital market integration. Then, assuming that they all had the same level of import of 30% share, [15] Table B.3 column 3 and 4 shows the regression implied TFP change of a trade liberalization leading to a 10% increase in the import share. Without taking capital market integration into

15. Even though they had similar import share they were not exactly equal to 30%.

account, Germany benefits three times more from increased trade than Hungary, and 0.8% more, even after taking into account that Germany already had integrated capital markets whereas Hungary had complete capital market segmentation.

	$\log(\frac{Import}{GDP})$	$\log(\frac{Credit}{GDP})$	$\log(\frac{Import}{GDP}) \times \log(\frac{Credit}{GDP})$	CMI	$\log(\frac{Import}{GDP}) \times CMI$
Log(TFP)	0.184***	0.185***	0.1061***	-0.0343	-0.0889***
s.e.	(0.0183)	(0.0107)	(0.008)	(0.0216)	(0.0168)

Table B.2. TFP and trade

Note: Standard errors in parentheses. N = 3983, Country and time FE.

B.2. Industry-level evidence

I use the CompNet dataset (López-Garcia *et al.* (2018)), collected from national statistics institutes in the EU. Firm level data is carefully aggregated on the sectoral level, containing distributional statistics, starting from 1999. It focuses on cross-country comparability, containing trade statistics for the manufacturing sector. Entry and exit data is limited, though there are plans to incorporate it in further waves.

To investigate the effects of the transition dynamics of trade liberalization in the data, I combine the CompNet dataset with the World Input-Output Database (WIOD) by Timmer *et al.* (2015). Following Berthou *et al.* (2019), each record is a two-digit industry in an EU country between 2000 and 2014. Apart from an export share variable constructed from WIOD, multiple other variables are available for each industry that contain information about the universe of firms within the industry.

I exploit sector-level variation to connect the increase in capital market frictions to trade as in the structural model. Each sector has somewhat different level of development and react differently to increased export exposure. While the model economy has no industries, I view a record as a particular realization of the entire Home economy, because most industries in the dataset are in the periphery countries (South or NMS). Realizations differ in financial development and trade costs, but I assume that capital market liberalization has already occured.

To control for differences in financial development, the idea is to exploit the variation in trade credit across sectors, following Fisman and Love (2003). They show that trade credit is an important source of growth even in less developed

Country	$\frac{\text{Credit}}{\text{GDP}}$	$\Delta TFP_{\emptyset CMI}$	ΔTFP_{CMI}
Germany	88.7	4.9	2.6
Italy	58.15	3.6	2.3
Hungary	32.2	1.8	1.8

Table B.3. The effect of an increase of the import share from 30% to 40%

economies - it measures the trust firms have toward each other for substituting short-term loans. An argument against using trade credit as a measure of financial development is that higher access to trade credit seem to increase misallocation. Looking at other quantiles seem to maintain the relationship to varying degree. The variation in access to trade credit across firms seems to be crucial.

The quantitative trade model links firms in the economy to aggregate productivity through the allocative efficiency. Table B.4 shows that in the data, larger trade exposure is not necessarily correlated with better allocation of capital, because higher export exposure increases misallocation in sectors with lower development. To test the mechanism for the increase of misallocation provided by the model, I look at zombie firms — firms that have negative profits for more than three consecutive years and are not high-growth firms according to the OECD criteria. The main finding is that higher export exposure leads to a higher number (column 3) of zombie firms that exists for longer (column 4) in sectors with lower development. Although bad firms survive for longer, higher export exposure leads to a tightening of the borrowing constraint (column 5) for the average firm. This finding is in line with the predictions of the model for the long-run equilibrium and provide justification for the interaction between trade liberalization and capital market integration.

	(1) $\sigma(ARPK)$	(2) $\sigma(ARPL)$	(3) % Zombie firms	(4) Avg. t. Zombie	(5) % firms constrained	(6) $\frac{\text{Fixed capital}}{\text{Assets}}$
$\frac{\text{Export}}{\text{Output}}$	0.0513*	0.0276	0.0377***	0.419***	0.0282*	-37.47**
	(0.0212)	(0.0202)	(0.00910)	(0.109)	(0.0111)	(13.51)
$\frac{\text{Trade credit}}{\text{Assets}}$	0.202**	0.0439	-0.0649*	-0.479	0.0307	-53.08
	(0.0754)	(0.0515)	(0.0281)	(0.298)	(0.0448)	(28.44)
$\frac{\text{Trade credit}}{\text{Assets}} \times \frac{\text{Export}}{\text{Output}}$	-0.245*	-0.104	-0.194***	-1.830***	-0.284***	175.3**
	(0.117)	(0.0934)	(0.0484)	(0.515)	(0.0540)	(60.10)
N	6115	6115	3667	2236	4132	6152
Time fixed effects	✓	✓	✓	✓	✓	✓
Country fixed effects	✓	✓	✓	✓	✓	✓

Table B.4. Misallocation and trade exposure

Note: Financial development: measured as $\log$ of the ratio of credit to private sector to GDP.

B.3. Hungarian firm level data

There are two sources of the Hungarian firm level data. The one that is used in the paper is generously provided to me by the Hungarian Academy of Sciences - the advantage of this dataset is the somewhat longer time horizon (from 2001 to 2017) and that I can provide access to the dataset to referees. The other dataset is what I had when I started this paper. The advantage of the dataset is that it consists roughly 10-20 $\%$ more, especially small and medium enterprises, and is somewhat more consistent with some of the variables such as debt. I myself participated in the assembly of the dataset, as an assistant to my father, Dr. Tamas Tetenyi. Due to the fact that I cannot provide access to this latter dataset, I chose to conduct the analysis in the main sections of the paper on the HAS-KRTK dataset.

HAS-KRTK dataset Contains all firms excluding self employed and government sector between 2001 and 2018. It mainly consists of standard balance sheet data, but the total number of employees is appended too. It is collected and maintained by Hungarian Academy of Sciences, Centre for Economic and Regional Studies (KRTK), see for example Halpern *et al.* (2015). Accessible upon request for referees and to other researchers with affiliation to HAS-KRTK.

BisNode dataset Contains all firms excluding self employed and government sector between 2005 and 2018. It mainly consists of standard balance sheet data, but the total number of employees is included since 2008. It is collected by Bisnode Hungary Ltd. and is generously provided to me by Equinox Consulting Ltd. The dataset is similar to the traditional administrative dataset available to researchers studying Hungary. The main reason for why data is only available since 2005 is that there has been a significant change in the accounting standards in 2000 and 2004 in preparation for the EU accession. This would be of particular concern for non-manufacturing firms in the dataset, and because the focus of this study is on exporting firms.

For both datasets, firm level variables are constructed as follows. Value added is defined as the sum of net operating profits, depreciation and other personal expenditures. Capital stock is the sum of tangible and intangible capital. Industry price indexes are downloaded from the website of the Hungarian Statistical Office for each year at the 2 digit industry level. Debt is both short and long term debt, defined as total assets minus equity. Average revenue product of capital is constructed as the difference between the log of value added deflated by the industry price index, minus the log of capital stock. Assets are defined as total assets of the firm. Net (of value added tax) sales are directly reported by firms, sometimes further decomposed to domestic and exporting sales. All variables apart from capital stock are defined as the residuals of regressing them on both industry and regional dummies. Variables are windsorized for the calibration tables and for the additional analysis provided here.

I plot the kernel density of the obtained average return to capital in the BisNode dataeset in Figure B.1. The crisis shifted the distribution, more firms are on the tails after 2009 and the recovery has been slow, consistent with the simultaneous rise of zombie firms on the left tail and constrained firms on the right tail. Winsorization is only performed when obtaining data moments for Table 1.

A key variable of the BisNode dataset is the exporting status and the date the company started operating, allowing the identification of entry and exit of firms both into production and into exporting. A firm exports if it reports positive export revenues, however, this underestimates the fraction of exporters. A firm is obliged to report export revenues above an industry-specific threshold of approximately 10000 euros. This threshold is augmented in the HAS-KRTK dataset. Most firms that ever reported exports continue to report their export revenues even if they fall below the threshold. Moreover, exporters may under-report exports to EU countries due to the lack of borders. The end result is that I obtain share of exporters for

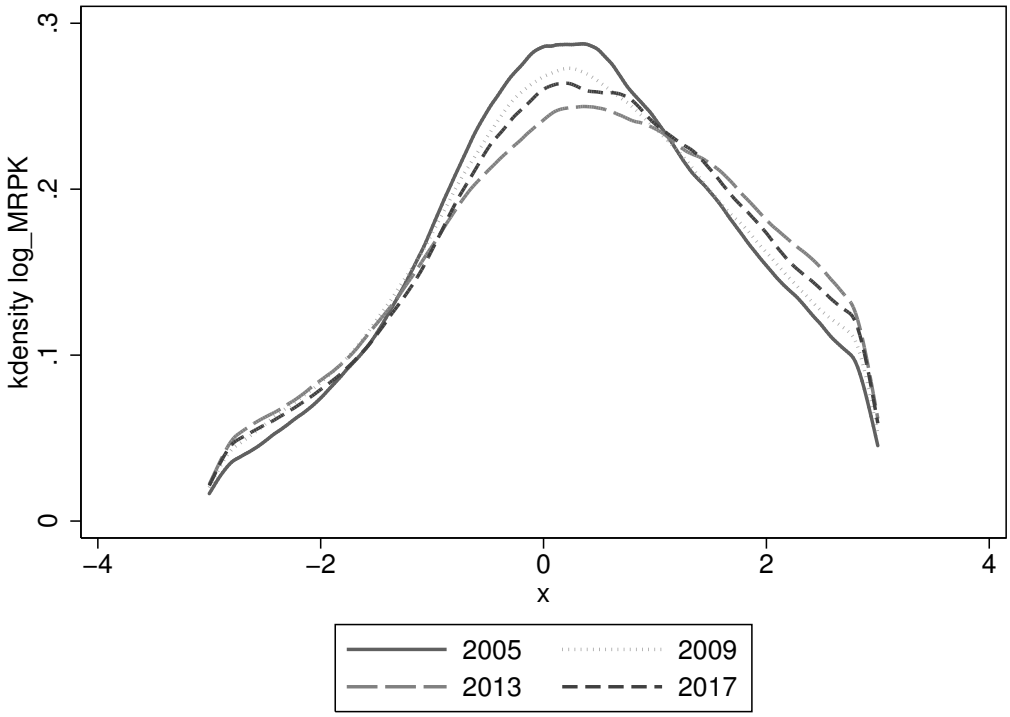

Figure B.1: Kernel density plot of the average revenue product of capital of Hungarian firms

	Data		Model	
	Low Leverage	High Leverage	Low Leverage	High Leverage
Low Equity	13	18	8	31
High Equity	41	28	31	30

Table B.5. Leverage ratio and equity

Note: The four categories are based on the mean of the leverage ratio and equity.

non-manufacturing firms that is below 3 %, much lower than is reported in the literature, mainly relying on the HAS-KRTK dataset.

To further examine firm-level exporting dynamics in the data and in the model, in Table B.5 I show the distribution of exporters with respect to their equity and leverage ratio. A substantial fraction of firms with higher than average equity also have higher than average leverage ratio. The model qualitatively replicates this pattern, while also being able to generate firms in the other bins, showing that financial frictions and fix costs generate realistic exporting firm dynamics in the model.

To uncover how access to external finance, measured by $\frac{\text{Asset}}{\text{Equity}}$, affects the decision to export at all (extensive margin) and the growth rate of exports conditional on exporting (intensive margin). The extensive margin regression is given by

$$\mathbf{1}(X_{it} > 0) = \beta_1 \mathbf{1}(X_{i,t-1} > 0) + \beta_2 \log \frac{\text{Asset}}{\text{Equity}}_{i,t} + \gamma Controls_{i,t} + \alpha_i + \varepsilon_{i,t} \tag{B.4}$$

where β_1 denotes the persistence in a linear probability model, taking firm-level fixed effects into account, X_{it} the export sales of a firm. Size and productivity-related variables are used as controls. Equation B.4 is estimated using Arellano and Bond (1991) estimator, because the lagged dependent variable is included as an explanatory variable. The intensive margin regression is given by

$$\Delta X_{it} = \beta_1 \frac{\text{Asset}}{\text{Equity}}_{i,t} + \gamma Controls_{i,t} + \varepsilon_{i,t} \tag{B.5}$$

ΔX_{it} denotes the growth rate of export sales and β_1 is the effect of external finance. Table B.6 summarizes the results from both regressions. Exporting is highly persistent even after controlling for size and productivity, and depends positively on the leverage ratio. The implication is that a model with high fixed cost is consistent with observed firm behavior - permanent productivity differences cannot account for differences in exporting probability. Access to external finance positively correlates with the exporting decision both at the extensive and at the intensive margin. Because only a small fraction of firms export, I account for selection by applying the Heckman (1978) correction procedure to equation B.5 - this step is crucial, and the inverse Mills ratio, κ, is significant.

The firm level evidence motivates a structural model of the economy in which the exporting decision is affected by financial variables and entry costs. Results from the model are shown in Table B.7. I simulate 25 million households for 13 periods, starting from the stationary distribution of households, and only keep them in the sample if they are entrepreneurs for the entire 13 years. In the model, successful entrepreneurs become exporters, hence there are few firms that operate only on the domestic market. This implies that selection is pivotal and that results should only be compared qualitatively.

	$\mathbf{1}(X_{i,t-1} > 0)$	κ	$\log \frac{\text{Asset}}{\text{Equity}}$	Controls	Firm FE	N
$\mathbf{1}(X_{i,t} > 0)$	0.46^{***}	-	0.000747^{***}	Rev, K, ARPK	✓	1713052
s.e.	(0.00196)	-	(0.000162)	-	-	
ΔX	-	55.77^{***}	0.074^{***}	ARPK	✓	64257
s.e.	-	(4.965)	(0.0102921)	-	-	-

Table B.6. Exporting dynamics and external finance in the data

	$\mathbf{1}(X_{i,t-1}>0)$	κ	$\log \frac{\text{Asset}}{\text{Equity}}$	Controls	Firm FE	N
$\mathbf{1}(X_{i,t}>0)$	0.57***	-	0.0591695***	K	✓	800172
s.e.	(.0006691)	-	(0.001)	-	-	
ΔX	-	-0.64 ***	2.93***	-	✓	766183
s.e.	-	(0.0030514)	(0.0022207)	-	-	-

Table B.7. Exporting dynamics and external finance in the model

B.4. Additional details

South consists of Spain, Italy, Portugal and Greece. New Member States (NMS) are a subset of Central-Eastern European (CEE) countries that have already joined the European Union in 2004 or later: Czechia, Estonia, Hungary, Latvia, Lithuania, Poland, Slovakia, Slovenia, Romania, Bulgaria and Croatia. Core comprises all other EU and EFTA member countries. Table B.8 describes the difference across country groups.

Region	Trade liberalization	Capital markets	
		Developed	Integrated
NMS	✓	×	×
South	✓	×	✓
Core	✓	✓	✓

Table B.8. Initial conditions in trade and capital markets

In Figure B.2, I provide a timeline for Hungary, which is a typical NMS country experiencing integration. There is substantial heterogeneity in how external reforms were implemented even within NMS countries: Hungary liberalized capital markets relatively early but never adopted the Euro and therefore never completed capital market integration, whereas most NMS countries chose to delay opening up capital markets for as long as possible.

The increasing integration of the European Union led to a rapid increase in intra-European trade. European countries trade mostly with each other and this has not changed over time. Measured as the change in the import to GDP ratio relative to the ratio in 1992, Figure B.3 shows that all countries, especially Eastern European economies engaged in a large scale trade liberalization. However, Figure B.4 also shows that changes in total factor productivity have not been proportional to the scale of trade liberalization: Southern European countries have experienced limited or no gains even though they have opened up to trade to a similar extent as Core EU countries. Eastern Europe, on the other hand, have opened up to trade but their growth in TFP can be partially attributed to the internal reforms implemented after the fall of communism.

On Figure B.5, I plot the differences in financial depth in 1992, as a proxy for financial development, showing that countries in Core in general were more financially developed than countries in South or NMS. Economies in South and in NMS were aware that financial development, might be insufficient and thus wanted

Figure B.2: External reforms in Hungary and in Europe (**EU**)

to attract further sources of external finance. On Figure B.6, I plot the Chinn and Ito (2006) index measuring capital market openness. Both South and NMS have opened up their capital markets, albeit NMS did so on average later and to a lesser extent.

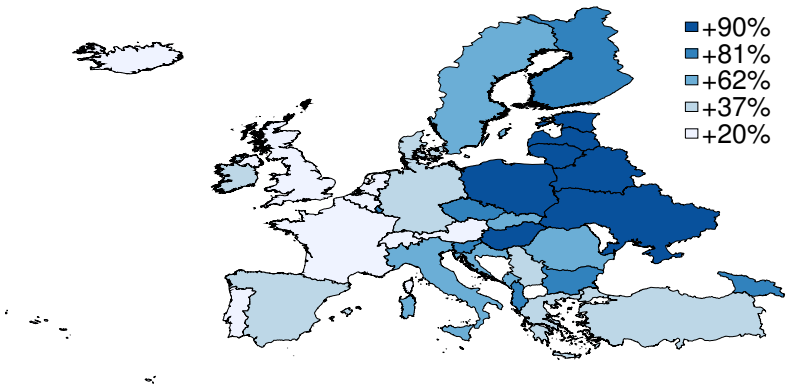

Figure B.3: $\Delta_{1992-2008} \frac{\text{Import}}{\text{GDP}} / \frac{\text{Import}}{\text{GDP}}_{1992}$

B.5. Economy without financial frictions

Table B.9 shows the integration in an economy without financial frictions but with the discount factors, as in the initial calibration. Aggregate productivity is

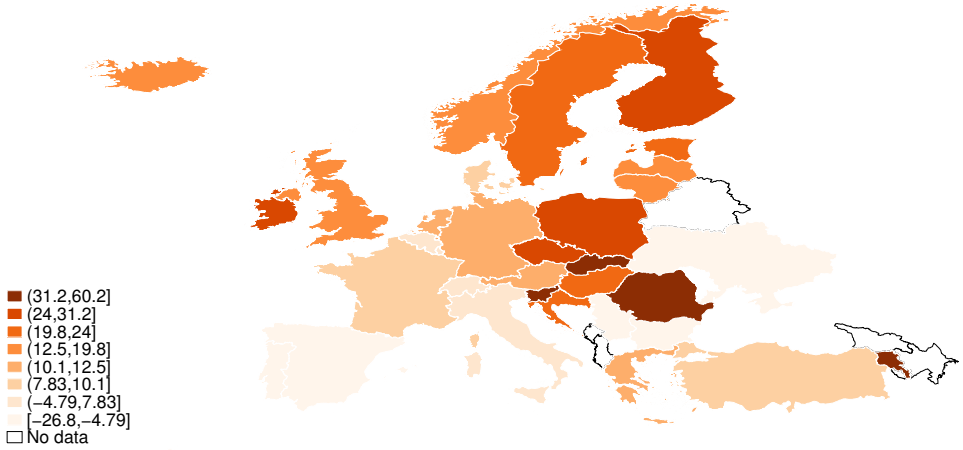

Figure B.4: Changes in TFP

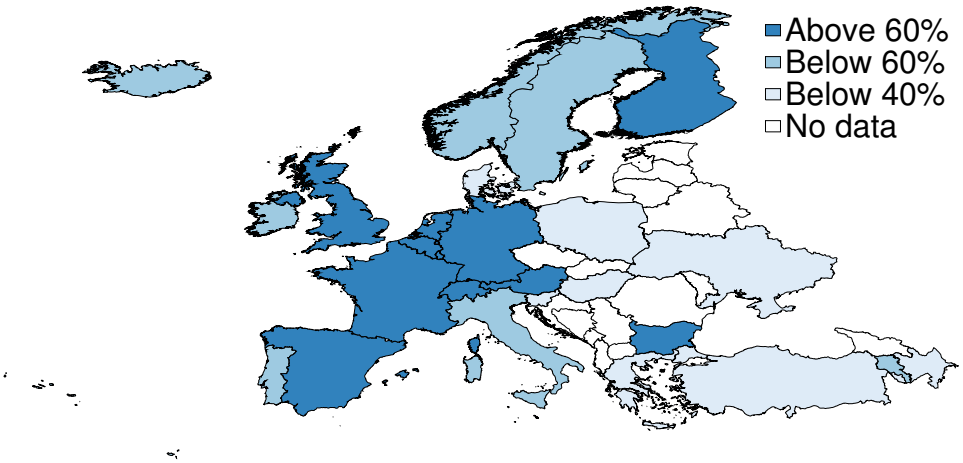

Figure B.5: $\frac{\text{Credit}}{\text{GDP}}$

predicting the change in the economy even less, as there are large changes in the number of firms operating. The big reform in this case is capital market liberalization.

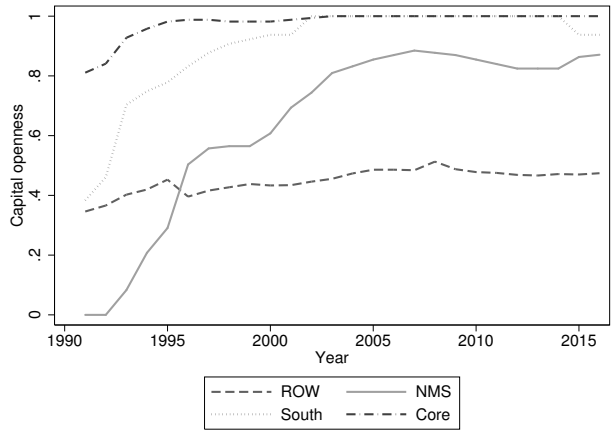

Figure B.6: Chinn-Ito (2006) index for capital inflows, (unweighted) average within country groups.

Variable	Initial	Trade	Trade and capital
Productivity			
TFP	100	80	62
s.d. $mrpk$	0.0	0.0	0.0
Aggregates			
Output	100	78	90
Income	100	105	121
Consumption	100	105	121
Capital	100	106	341
Welfare change			
Steady state only	0	8	36
Inequality			
Top 10% wealth share	30	62	97
Top 10% income share	20	24	24
Top 10% consumption share	15	20	18
Factor prices			
Real wage	100	107	141
Interest rate premium $r - r^*$	13	13	0
Trade			
$\frac{\text{Import}}{\text{GDP}}$	34	45	28
$\frac{\text{Export}}{\text{GDP}^*}$	2	5	6
Share of exporters	22	53	41
CPI	143	130	123
$\frac{\text{Domestic Credit}}{\text{GDP}}$	66	91	5
$\frac{\text{Foreign Credit}}{\text{GDP}}$	0	0	275

Table B.9. Trade and capital market integration without financial frictions

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Hossein Hassani | António Rua | Emmanuel Sirimal Silva | Dimitrios Thomakos

14|19 ECB, BoE and Fed Monetary-Policy announcements: price and volume effects on European securities markets
Eurico Ferreira | Ana Paula Serra

15|19 The financial channels of labor rigidities: evidence from Portugal
Edoardo M. Acabbi | Ettore Panetti | Alessandro Sforza

16|19 Sovereign exposures in the Portuguese banking system: determinants and dynamics
Maria Manuel Campos | Ana Rita Mateus | Álvaro Pina

17|19 Time vs. Risk Preferences, Bank Liquidity Provision and Financial Fragility
Ettore Panetti

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Cláudia Duarte | José R. Maria | Sharmin Sazedj

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Luísa Farinha | Sónia Félix | João A. C. Santos

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Daniel A. Dias | Carlos Robalo Marques

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António Antunes | Tiago Cavalcanti | Caterina Mendicino | Marcel Peruffo | Anne Villamil

2020

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Diana Bonfim | Geraldo Cerqueiro | Hans Degryse | Steven Ongena

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Diego B. P. Gomes | Felipe S. Iachan | Cezar Santos

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Gabriel Zsurkis | João Nicolau | Paulo M. M. Rodrigues

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Diana Bonfim | Sónia Felix

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Diana Bonfim | João A. C. Santos

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Giordano Mion | Luca David Opromolla | Gianmarco I.P. Ottaviano

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Nuno Lourenço | António Rua

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Luiz Brotherhood | Philipp Kircher | Cezar Santos | Michèle Tertilt

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Luiz Brotherhood | Tiago Cavalcanti | Daniel Da Mata | Cezar Santos

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Tiago Alves | João Amador | Francisco Gonçalves

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Tiago Cavalcanti | Zeina Hasna | Cezar Santos

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Nuno Alves | Fátima Cardoso | Manuel Coutinho Pereira

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Ana Isabel Sá

2021

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João Amador | Pedro G. Rodrigues

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Marina Balboa | Paulo M. M. Rodrigues Antonio Rubia | A. M. Robert Taylor

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Jagjit S. Chadha | Germana Corrado | Luisa Corrado | Ivan De Lorenzo Buratta

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Matei Demetrescu | Iliyan Georgiev | Paulo M. M. Rodrigues | A.M. Robert Taylor

5|21 Spectral decomposition of the information about latent variables in dynamic macroeconomic models
Nikolay Iskrev

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Vasco Gabriel | Ioannis Lazopoulos | Diana Lima

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Lucas Avezum | Vítor Oliveiral | Diogo Serra

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Paulo Júlio | José R. Maria | Sílvia Santos

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Katja Neugebauer | Vítor Oliveira | Ângelo Ramos

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Bernardino Adão | Borghan Narajabad | Ted Temzelides

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Anabela Carneiro | Pedro Portugal | Pedro Raposo | Paulo M.M. Rodrigues

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Sónia Félix | Sudipto Karmakar | Petr Sedláček

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João Amador | Carlos Melo Gouveia | Ana Catarina Pimenta

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Diana Bonfim | Cláudia Custódio | Clara Raposo

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Daniel Abreu | Sónia Félix | Vítor Oliveira | Fátima Silva

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Alexandre Carvalho | João Valle e Azevedo | Pedro Pires Ribeiro

18|21 On the Cleansing Effect of Recessions and Government Policy: Evidence from Covid-19
Nicholas Kozeniauskas | Pedro Moreira | Cezar Santos

19|21 Trade, Misallocation, and Capital Market Integration
Laszlo Tetenyi