Trade, Misallocation, and Capital Market Integration*

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Abstract

Developing countries integrate to 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 on the aggregate, but increases among exporters. The reason is that financially constrained productive exporters increase their production only marginally, whereas unproductive, zombie exporters survive for longer and increase their size. Allowing capital inflows helps all firms, especially exporters, to expand, but also magnifies the losses from misallocation, because unproductive firms expand even more, leading to a decline in aggregate productivity. In the quantitative experiment calibrated to the Hungarian integration episode of the 90s, access to cheaper capital dominates the adverse effect on productivity, leading to higher output, consumption, and welfare than under closed capital markets. Moreover, Hungary could have gained an extra 1% measured in consumption equivalent welfare, on top of the overall gain of 6%, by immediately allowing capital inflows after the reduction in trade barriers.

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1 Introduction

The last century has seen the increased integration of national economies, facilitated primarily by increased trade in goods and services. After a reduction of trade barriers there is a reallocation of resources from non-exporting firms to productive exporters. Well-functioning financial markets facilitate reallocation, because exporters rely on external finance to sell their products abroad.[1] However, in countries with underdeveloped financial markets, capital is not allocated to productive producers and, moreover, not enough capital in the economy is available to exporters. Integrating capital markets and allowing foreign capital can mitigate the problems of an underdeveloped domestic financial markets.

Nevertheless, despite the trade integration, most developing countries kept their capital markets closed for as long possible. They had various reasons for this, such as maintaining control over the financial system and monetary policy. Historically, economies that did liberalize their capital accounts experienced a capital inflow,[2] increasing the available capital for firms and leading to higher output. On the other hand, evidence suggests that the inflow capital was not allocated efficiently to 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 the trade-offs associated with and the timing of capital market integration in an economy undergoing trade liberalization.

To study the consequences of capital market integration in an economy opening up to trade, 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 it's ability to borrow and to acquire capital, leading to the misallocation of capital. Because 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 want to export. Therefore, the combination of entry costs and financial frictions results in constraining the exporters' ability to acquire capital.

[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.

On the other hand, the most productive exporters amass a substantial amount of wealth and capital. Even when faced with a series of 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 has implications about welfare and inequality, because firms are owned by households. Households that choose not to own a firm can still invest indirectly and are employed by firms.

I calibrate the model to match the important features of Central-Eastern Europe in 2008, before the financial crisis hit the region. I show that both the data and model features exporters that are large and unproductive. Between 1989 and 2008, the region first liberalized their goods and, somewhat later, their capital market, resulting in a dramatic increase in trade openness and capital inflows. The main experiment with the model economy mimics this historical trade liberalization, either with, or without integrated capital markets.

In the long run, 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 that have the ability to expand are disproportionately favored by cheaper capital. The fraction of exporters that are unproductive and wealthy increase from 4% to 21%, leading to a decline in aggregate productivity. 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. because the inflow of capital dominates the effect of declining aggregate productivity. Trade liberalization leads to higher wealth inequality, because households that own an exporting firm gain the most. Under integrated capital markets, wealthy exporters and workers relying only on labor income gain even more, while the middle class relying on indirect capital income or domestic profits lose.

In the short run, 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, taking into account transition dynamics raises the benefits of capital market integration, because the gains are front loaded, whereas the increase in misallocation takes time.

Finally, I consider the optimal sequencing of trade and capital market integration. I find that these reforms are best combined, since in the short run, capital is allocated to productive firms. Hungary, by waiting for 10 years with opening capital markets passed on these added benefits along the transition path that I calculate to be around 1% in consumption equivalent welfare, on top of the overall gain of 6%.

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 only slightly affects misallocation when it arises from financial frictions.

The problem of liberalizing trade with underdeveloped financial markets has recently been studied by Brooks and Dovis (2019) and Kohn et al. (2018). Relative to them, I show that even if I raise the importance of a well-functioning financial market by allowing for transitory productivity shocks, financial development only changes standard gains from trade if a capital inflow to the economy occurs.

S. Prasad et al. (2003) find limited evidence for the gains of 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). If, however, increased trade flows and financial integration across countries lead to global imbal-

ances, as in Mendoza et al. (2009) or in Reyes-Heroles (2017), I show that capital market integration is welfare improving, despite the rise in misallocation and the decline in aggregate productivity.

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 referred to as entrepreneurs. Entrepreneurs hire capital and labor in centralized capital and labor markets. Exporting entrepreneurs are also allowed to sell their products domestically, but domestic entrepreneurs are only allowed to sell domestically. 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

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

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

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

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

$$a_{t+1} \geq 0 \tag{5}$$

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:

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

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

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

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 price, the allocations solve the household's, the entrepreneur's, and the final-goods producer's problem
- the labor market clears:

$$0 = \int \Big[l_t \big(\mathbf{1}_{\{e_{t+1}=d\}} + \mathbf{1}_{\{e_{t+1}=ex\}} \big) - \mathbf{1}_{\{e_{t+1}=w\}} \tag{9}$$

$$+ \mathbf{1}_{\{e_t \in \{w,d\}, e_{t+1}=ex\}} f_x \Big] dG_t \tag{10}$$

- the goods market clears:

$$\begin{aligned} \Big(\int_{I_t} X_t^{\frac{\sigma-1}{\sigma}}(j) dj + \int_{I_{F,t,x}} X_{F,t}^{\frac{\sigma-1}{\sigma}}(j) dj \Big)^{\frac{\sigma}{\sigma-1}} = \\ \int \Big(c_{it} + k_{t+1} - (1-\delta) k_t \Big) dG_t \end{aligned} \tag{11}$$

- capital market clearing depends on the level of integration. Define a country's

net financial asset position:

$$NFA_t = -\sum_e \int_{a,z} \Big[P_{t-1}k_t - a_t\Big] dG_t \tag{12}$$

– Closed capital markets:

$$NFA_t = 0 \tag{13}$$

– Integrated capital markets:

$$NFA_t + NFA_t^* = 0 \tag{14}$$

– Partially integrated capital markets, capital inflow given by $\{CC_t\}_{t=0}^{\infty}$:

$$NFA_t = -NFA_t^* \geq CC_t \tag{15}$$

- 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 fewer exports are required to receive the same amount of imports. 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.

However, this productivity measure is not the one constructed in the data. In appendix A, I consider alternative definitions of productivity, that are closer to the definitions used by statistical agencies. These are broadly categorized into "national-account-relevant" and "sales-based", "net of entry cost" and "nominal output based". For example, while the "national-account-relevant" productivity measure relies on the concept Solow-residual, real output is defined differently, as the total output produced by firms, hence it differs from "welfare-relevant" in how exports are treated. Terms of trade, that is, how exports are exchanged to imports are affected by not only the price level, but also, by the current account balance. There are other differences that arise, but overall, all productivity measures behave similarly and do not affect the main results.

3 Data and calibration

To understand how capital markets interact with trade in the model, I focus on the period of European Integration 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 Application to the European Integration

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 the relevant features of the NMS economy, I use aggregate, sectoral and firm-level data. Because NMS eventually integrated their capital markets, I also use data from 2008 assuming the model economy reached a steady state with liberalized trade and integrated capital markets.[4]

After 2001, Hungary, as well as most 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, that started in 1989.

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 how costly can misallocation be, I have to use a model where capital misallocation happens endogenously.

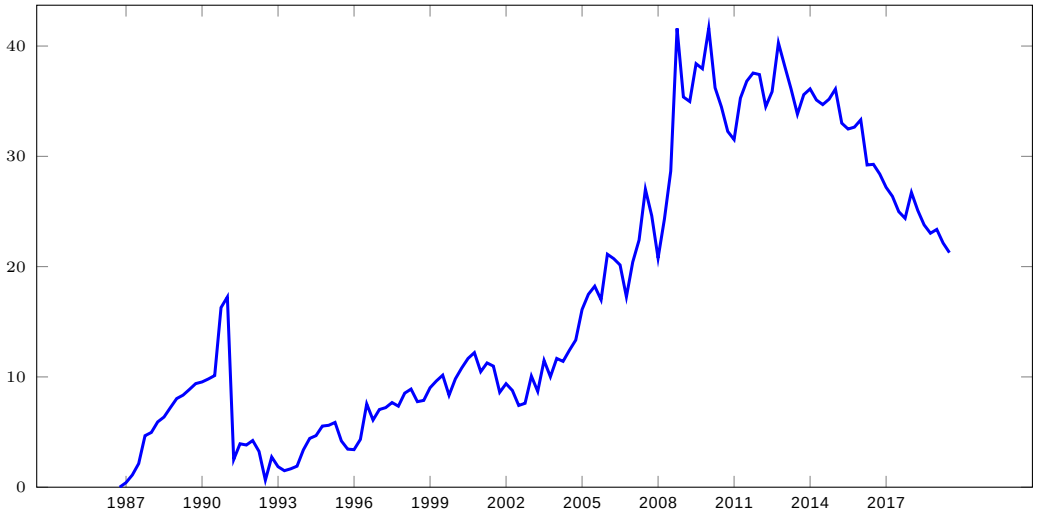
3.2 Exporters in the microdata

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

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

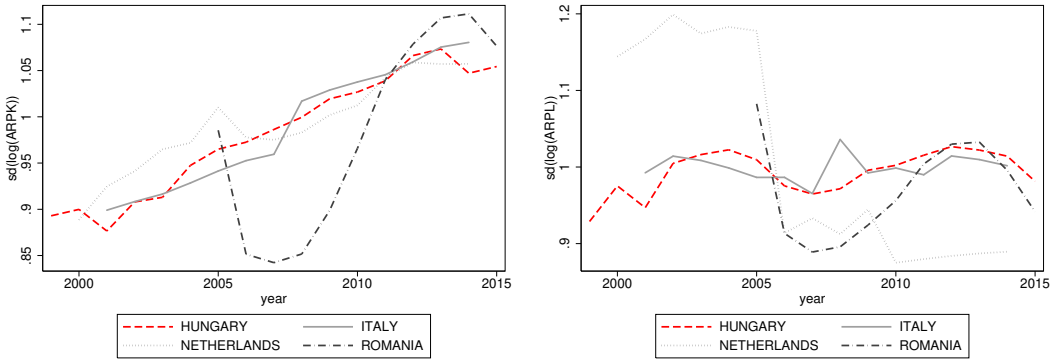
[5] It is worth noting that this measure is not necessarily related to productivity or misallocation, as shown by Haltiwanger et al. (2018) for example.

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



The BIS does not directly report foreign credit provided to domestic non-financial firms, for construction, see Appendix B. 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.

Figure 2: Dispersion of average products



(a) Average revenue product of capital

(b) Average revenue product of labor

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.

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.

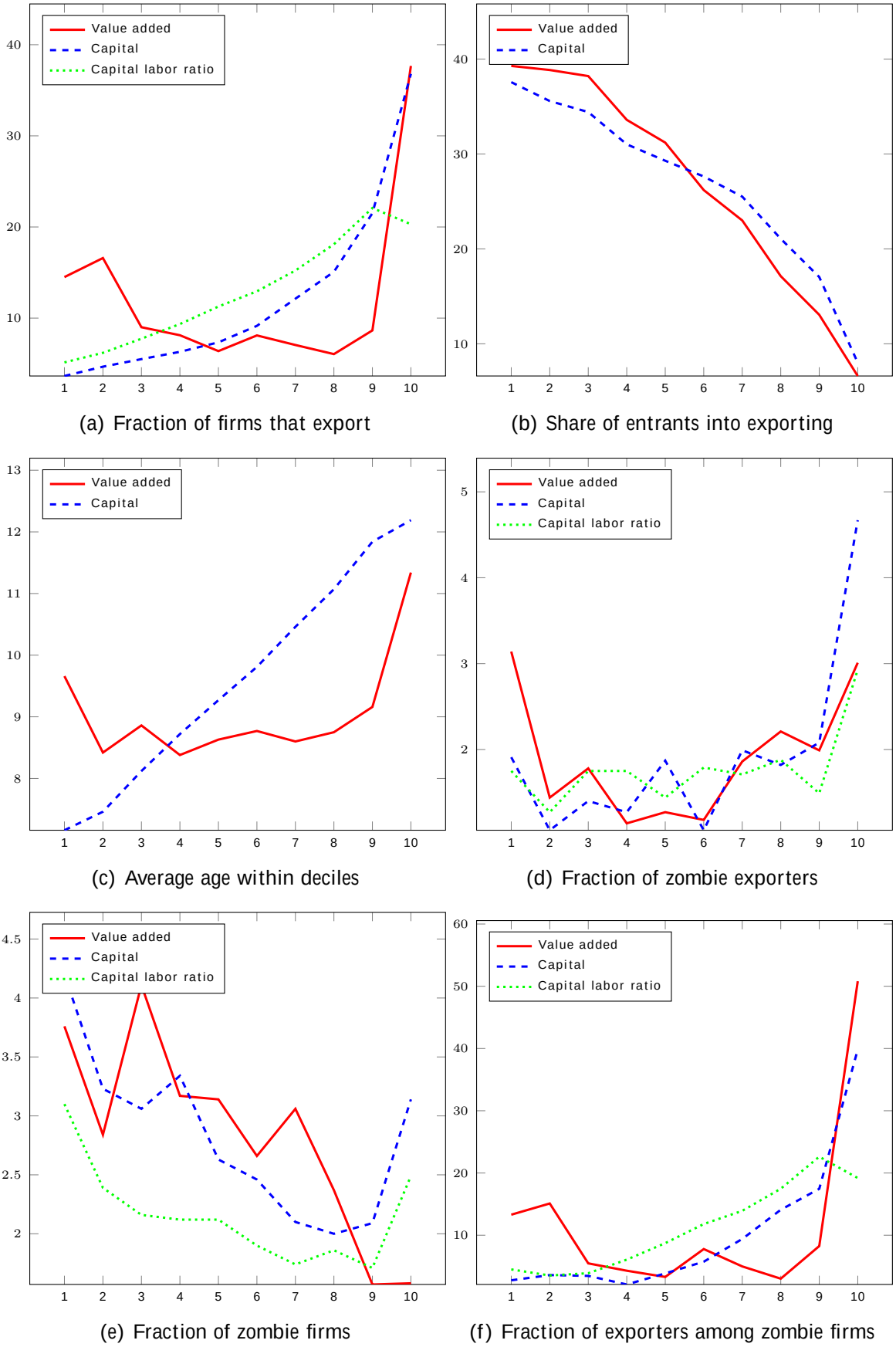
Exporters with low value added, but high capital intensity and capital stock are the group of firms that are potentially the most important for capital misallocation. They are unlikely to be entrants into exporting, because as Panel b) shows the share of entrants into exporting falls with higher value added and 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. These 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 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. Even though the net effect is positive from opening up goods and capital markets, the quantitative exercise uncovers that the losses from misallocation are precisely incurred from these zombie exporters.

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

Figure 3: Exporters in Hungary across deciles in 2008



(a) Fraction of firms that export

(b) Share of entrants into exporting

(c) Average age within deciles

(d) Fraction of zombie exporters

(e) Fraction of zombie firms

(f) Fraction of exporters among zombie firms

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 treating Foreign as the economy of the Core, Western European countries. The final steady state is calibrated to 2008, mostly because the data quality improved significantly after 2004, especially for smaller firms. 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 it's 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

Table 1: Calibrated parameters and moments

Parameter	Value	Target	Source & Year	Data	Model
Financial Development					
Borrowing tightness, θ	0.66	Domestic Credit to nonfinancials, %GDP	BIS 2008	29	29
Home discount factor, β	0.85	Foreign Credit to nonfinancials, %GDP	BIS 2008	33	33
Foreign discount factor,β^*	0.948	Bank lending rate in Germany r^*	ECB 2008 January	5	5
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	0.42

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

Table 2: Preassigned and miscellaneous parameters

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%	$f_{ex}\times$ The inverse ratio of market size	$Y^* \simeq 6 \times Y$

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

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.

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

[7] This failure is well known in the literature, see for example Gopinath et al. (2017).

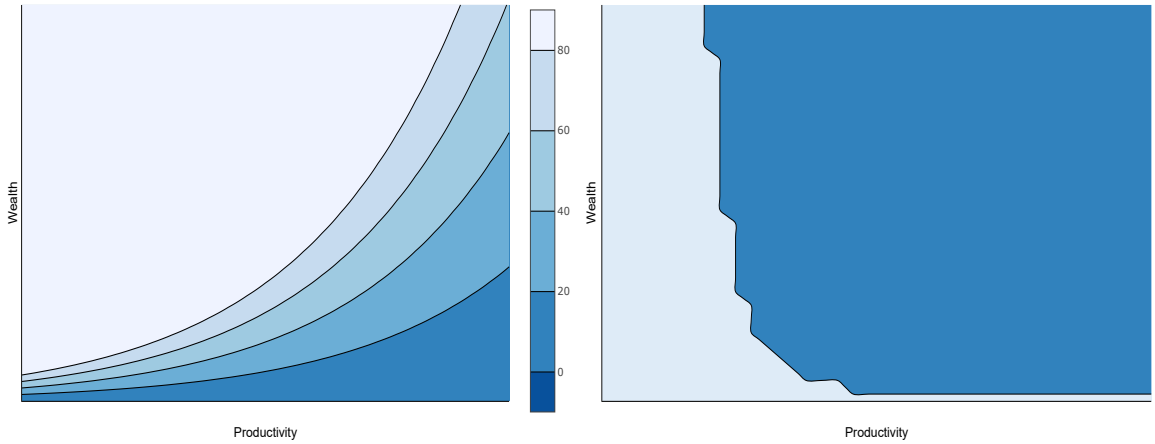
Table 3: Non-targeted moments

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

model, there are more exporters than in any of the datasets — but as can be seen, the range of exporting firms is large. Among financial variables, the model qualitatively captures the fact that lower average leverage ratio of exporters, despite the fact that exporters use external finance the most — more so in the model as there are more exporters. 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 and income shares very well, both before reforms and afterwards. 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

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



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

(b) Exit (pale azure) decision of incumbent exporters

that exiting patterns depend on net worth too.

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 transition dynamics, interpreted as the short-run response and the implications for welfare. 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 the capital markets. Finally, I also show how improvements in financial development affect the gains from trade. 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 market 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 columns), or integrated capital

Table 4: Trade liberalization under closed and integrated capital markets

Variable	Initial	Only open trade	Open trade and CM
Productivity			
TFP	100	109	104
s.d. $mrpk$	0.33	0.34	0.5
Aggregates			
Output	100	116	127
Income	100	107	106
Consumption	100	104.9	105.4
Capital	100	99	133
CE Welfare change			
Steady state only	0	8	13
Transition dynamics	0	6	13
Inequality			
Top 10% wealth share	46	44	57
Top 10% income share	25	26	28
Top 10% consumption share	16	17	22
Factor prices			
Real wage	100	107	106
$r - r^*$	9	9	0
Trade			
$\frac{\text{Import}}{\text{GDP}}$	21	42	42
$\frac{\text{Export}}{\text{GDP}^*}$	2	4	4
Share of exporters	32	46	40
CPI	140	133	137
$\frac{\text{Domestic Credit}}{\text{GDP}}$	57	50	29
$\frac{\text{Foreign Credit}}{\text{GDP}}$	0	0	33

markets (right column), compared to the initial[8] steady state (left column).

Trade liberalization under 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 even productivity, as the economy spends more on entry costs, due to the increase in share of exporters. Consumption-equivalent welfare change, compared to the initial steady state, is higher than the change in aggregate consumption, because the gains from trade are more equally distributed among households as measured by wealth inequality. Overall, despite that

[8] Initial refers to the hypothetical state of the economy in 1991.

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. Hence, despite all the additional ingredients in the model, the welfare gains from trade under closed capital markets are similar 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 pay for the borrowed 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 should only provide a lower bound for the implied welfare change. But even in economies with a medium level of financial development, this lower bound can be negative and not useful. To understand the results I focus on decomposing changes in aggregate productivity, on the long run, both qualitatively and quantitatively.

4.2 Understanding changes in productivity

In Table 5, I show how firms in different sectors (domestic or exporter) productivity changes after trade liberalization with closed and open capital markets. To understand the TFP loss at the sectoral level, I define TFP_i^e as the sectoral TFP that would occur if all firms in the sector would be able to obtain their unconstrained input choice. I use this measure to compute the sectoral level productivity loss from misallocation $1 - \frac{TFP_i}{TFP_i^e}$. The productivity loss is positively correlated with capital misallocation s.d. $mrpk$. Initially the domestic sector is more affected and

Table 5: Effect of trade liberalization on different sectors

Description	Initial	Only open trade	Open trade and CM
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

the productivity loss is higher than among exporting firms.

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 exporting sector expands and therefore within misallocation in the export sector has a larger impact on aggregate capital misallocation.

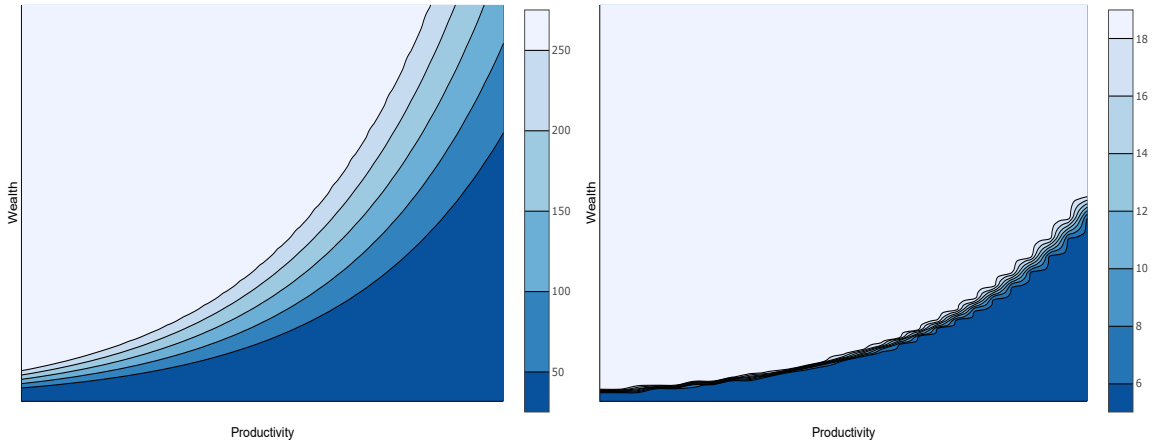
What is the reason for the increase in misallocation at the micro level? The mechanism of firm selection is analogous to the mechanism considered by Melitz (2003). Allocative efficiency is affected in general equilibrium because certain type of firms are encouraged to participate in exporting as their potential profits increase disproportionately more. Without financial frictions and capital market integration, more productive producers receive higher gains and they can afford to hire more factors of production, driving up wages and the rental rate. Including financial frictions affect 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 $X^*_{\text{new}} > X^*_{\text{old}}$, *holding the factors of production constant*. Every potential exporter would like to hire more capital and labor. Ultimately, the increased demand for labor leads to the increase in real wages regardless of capital market integration.

Financial frictions affect which types of firms can increase their capital stock. Unconstrained firms, which have a high wealth-to-productivity ratio, are unaffected

Figure 5: % Change in capital

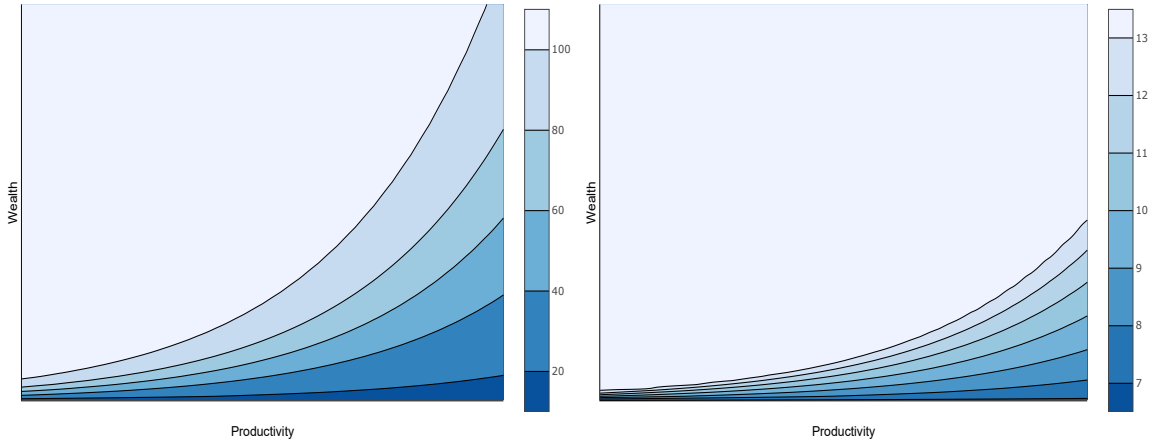


(a) Open Capital Markets (b) Closed Capital Markets

by financial frictions and are the firms that *can* expand. Constrained firms, which have a low wealth-to-productivity ratio, however, *cannot* expand their capital stock, only after accumulating more wealth. Still, the general equilibrium effect on the rental rate is what explains which type of entrepreneur finds it *optimal* to expand. Consider first the change in capital choice 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%. Only trade integration 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 stock explains the change in profits, as Figure 6 shows. Because profits are also affected by labor cost, the increase in profits tends to be lower in the case of open capital markets than the change in capital stock. Still, exporting profits increase more for unproductive firms. In the case of closed capital markets, profits increase more than the change in capital stock, because capital becomes more expensive. Profits still increase less for productive firms, though all exporters benefit from the direct effect of trade liberalization.

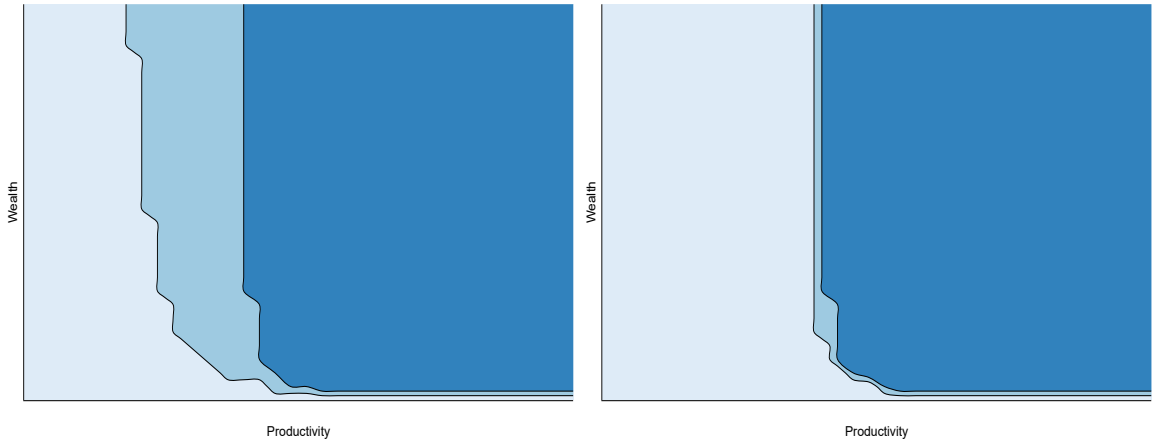
The change in profits, changes the dynamic incentive for firms to become and to stay exporters. Figure 7 shows that regardless of capital market openness, trade

Figure 6: % Change in exporting profits



(a) Open Capital Markets (b) Closed Capital Markets

Figure 7: Changes in the exit decision of exporters



(a) Open Capital Markets (b) Closed Capital Markets

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

Table 6: Distribution of exporters in %

Type	Initial	Only open trade	Open trade and CM
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

liberalization shifts the exit decision to the left in the state space. But the shift is greater 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 the steady states. In Table 6 exporters are categorized based on their wealth — depending if they are wealthier than the twice the national average in the initial steady state — and on their productivity — based on the average productivity of all households, including workers. Relative to the initial steady-state, trade liberalization with closed capital markets results in more firms that have lower than twice the average wealth. Exporters need less wealth to get capital due to the appreciation of the Home currency, shifting their borrowing constraint (recall Equation λ). Nevertheless, the share of unproductive exporters increase 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.

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 for European economies after 2000.

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

Table 7: TFP loss decomposition

Source of TFP loss	Initial	Only open trade	Open trade and CM
Factors	**65**	**66**	**100**
Within	4	6	9
Across	61	60	91
Trade	4	0	0
Capital	31	34	0

in misallocation.[9] I compare the allocations to the second best productivity under liberalized trade and closed capital markets. More precisely, reference productivity is the productivity of a new economy without financial frictions, with free capital mobility and after trade liberalization.

Table 7 shows the results of the decomposition. 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. Across misallocation is compared to the productivity that would reallocate firms across sectors *to where the planner would allocate them* and with them, their capital stock, but still requiring that their choice of capital and labor are constrained. Quantitatively, the across channel is dominating, highlighting the importance of financial frictions on the extensive margin. In relative terms, there is only a slight increase in within sector misallocation after trade liberalization.

The last two rows of the table correspond to the misallocation due to trade costs and the lack of capital mobility. The latter occurs because with higher capital mobility, we would observe lower price level, but section 4.7 will describe the economy without financial frictions.

4.3 Transition dynamics after a trade shock

Investigating transition dynamics is important because the timing of the gains and losses from trade liberalization and capital market integration is of particular concern for policymakers. Figure 8 compares the effect of a gradual 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 pol-

[9] I show the details in appendix A3

icy is also announced in period 2, but it only affects the capital stock in period 3. Perfect foresight is supported in this application for NMS, because after 1989, the fact that NMS countries will be integrated into the EU eventually was common knowledge. The debate mainly concerned capital market integration. By 1995, trade liberalization was almost complete. Capital market integration was also very rapid for Hungary, though arguably not complete in the course of a year. [10]

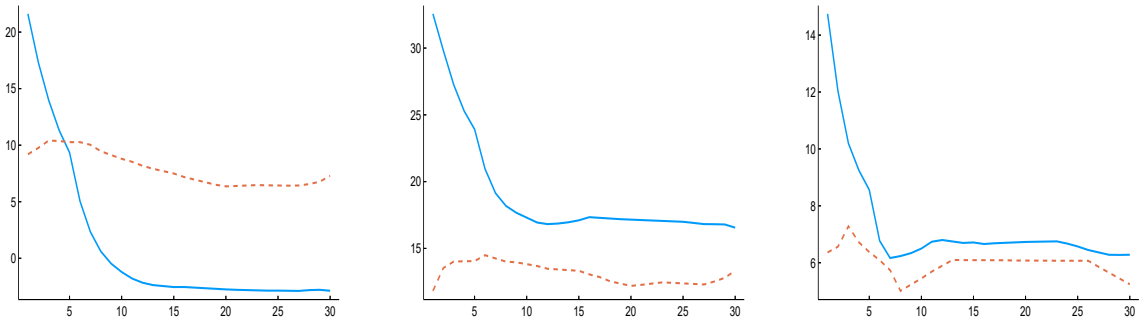
The key to understanding short-term dynamics is through productivity. TFP increases on impact, irrespective of capital market integration, albeit *more* so for integrated capital markets. The hump-shaped response of productivity happens because, initially, only productive exporters are present, and any additional capital allocated to them alleviates the financial constraints and they can expand more than under closed capital markets. The negative effects of capital market integration, that is, the increase in misallocation, take a few periods to realize. Exporters that 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. Along the transition, both consumption and output increases. An overshooting of GDP occurs at the announcement of the policy changes, mostly due to the jump in aggregate investment on impact. Then, consumption and GDP increase steadily.

After the first few year, under open capital markets, aggregate productivity declines despite the increase in aggregate consumption and welfare. Moreover, within-sector misallocation is high under both regimes initially, and across-sector misallocation is low. The main reason for the divergence in aggregate productivity in the medium term is that across-sector misallocation increases under open capital markets, and within-sector misallocation decreases under closed capital markets.

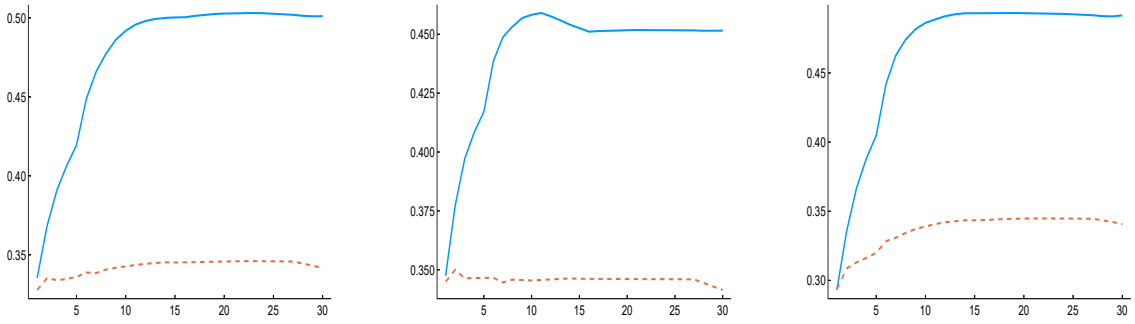
Overall, accounting for transition dynamics increases the benefits and decreases the losses of capital market integration. The reason is that in the short run, productivity improves more than under closed capital markets. On top of the level effect of having higher capital stock in the economy, initially productive exporters expand more. Moreover, as can be seen on Figure ??, the export premium increases more

[10] Timeline included in Appendix B.

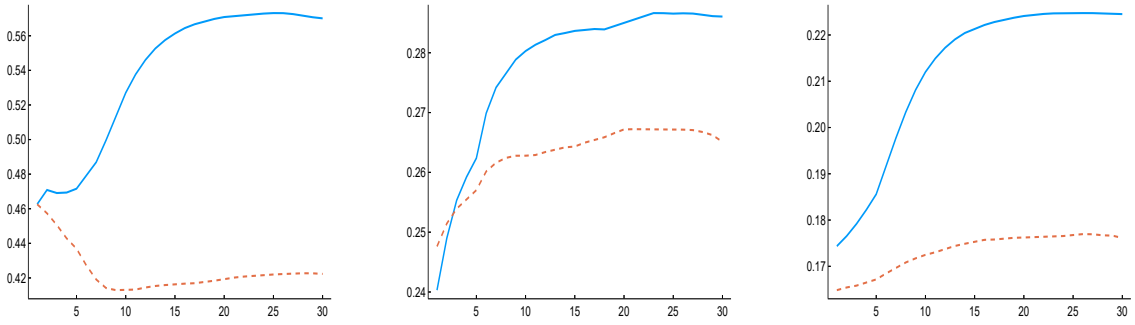
Figure 8: Transition dynamics after trade liberalization with closed (dashed line) or with open capital markets



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

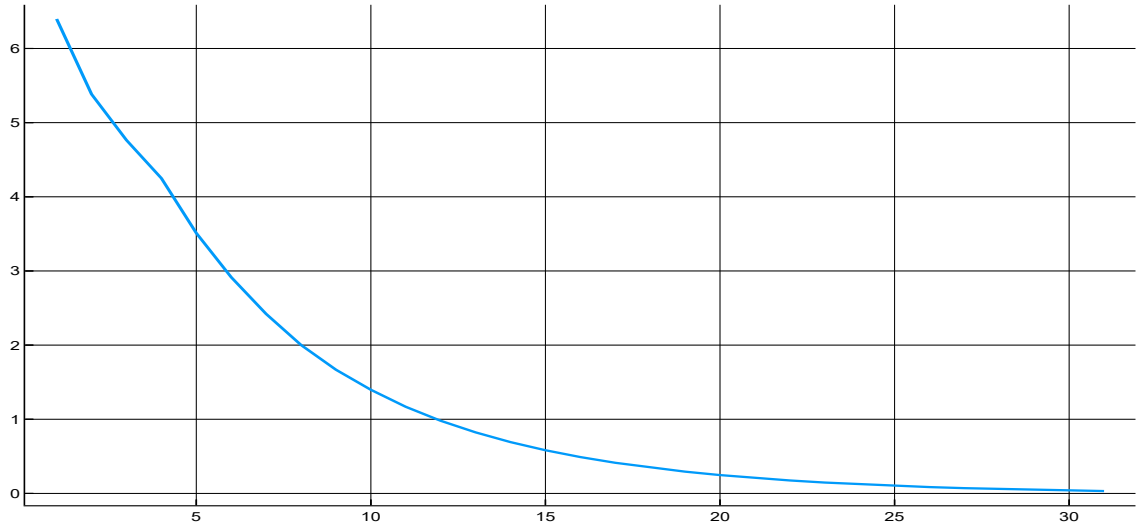


(d) s.d. $mrpk$ (e) Domestic s.d. $mrpk$ (f) Exporter s.d. $mrpk$



(g) Top 10 % wealth share (h) Top 10 % income share (i) Top 10 % cons. share

Figure 9: Consumption equivalent welfare benefits of introducing capital market integration t period after trade liberalization



under integrated capital markets, because Foreign demand increases more. Equation 18 implies that higher export premium leads to higher productivity. After the initial demand shock, more entrepreneurs and varieties remain primarily for domestic consumption, resulting in a slow decline in productivity.

This hump-shaped response of the gains under integrated capital market is in stark contrast to the partial equilibrium setting in Gopinath et al. (2017). The transition path there lowers consumption gains and in the long run, productive firms overcome the increase in misallocation. This difference comes from the nature of the financial frictions: the discrete state variable e here versus the continuous state space there. General equilibrium, notably the increase in real wages, also play a part — allowing for capital flow will lead to higher labor demand, higher wages, and increased consumption.

4.4 Optimal sequence of reforms

See the decreasing benefits over time of the delayed implementation of capital market integration on Figure 9. Hungary opened up capital markets 10 years after opening up to trade, therefore the gain is only 1.4%. In contrast, if the two reforms are implemented at the same time, the overall gain is 6.5%.

4.5 Inequality and welfare

[This section is under review] The model implies different paths for welfare and inequality under different capital market regimes. Despite the fact that every household benefits from increased trade, inequality increases, and more so under integrated capital markets. Households that benefit the least from trade liberalization are further negatively affected by capital market integration. Table 4 shows welfare changes accounting for the transition path, by making households indifferent to the trade liberalization along the transition. All households either receive the same relative increase in consumption (utilitarian) or receive increase based on their state variables (conditional). Either way, welfare increases more under open capital markets than under closed capital markets. Conditional welfare changes relative to the steady-state to steady-state comparison (9.5%) is around 1 pp. higher under open capital markets by accounting for the transition path, whereas it is unchanged under closed capital markets. Opening up capital markets allow for a faster realization of the gains from trade, because the losses take years to materialize.

Measured as conditional welfare change in Figure 10 I show which type of agents prefer trade liberalization with closed (blue area) or integrated (red area) capital markets along the transition. Household relying on labor income or exporting profits prefer integrated capital markets as real wages are higher while the borrowing cost of capital declines. However by decreasing the incentives of owning risk free bonds, the steady state distribution of households is also affected. Only household in the production sector find it optimal to hold wealth, workers quickly consume their assets after exiting production. There is a decline in social mobility 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 wages, and this is much tougher as the return on the only savings instrument available for the workers yields a lower return. Meanwhile, unproductive exporters receive higher return on their investments as they take advantage of cheap capital.

The increase in real wages negatively affect domestic profits, despite the decrease in the rental rate under integrated capital markets. On the other hand, the negative effect is more pronounced under closed capital markets, because domestic

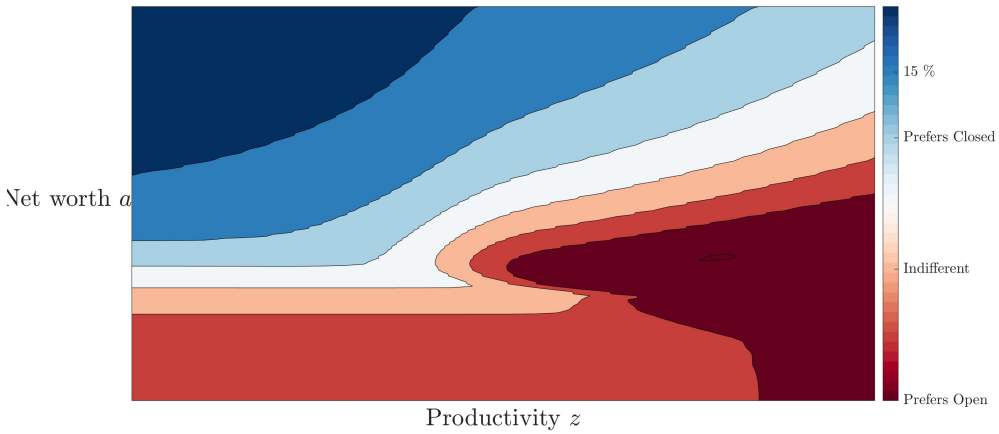


Figure 10: Welfare changes — Preference of the population to liberalize trade w/o integrated capital markets

producers also experience an increase in the rental rate. Firms are monopolistically competitive, therefore domestic producers face an increase in competing varieties, further decreasing their profits. This is important welfare, because in the model, becoming a domestic entrepreneur is a stepping stone to become an exporting entrepreneur. Any change that decreases domestic profits have a direct negative effect on social mobility.

4.6 Capital market integration without trade liberalization

[This section is under review] So far, I have shown that capital market integration is important to evaluate the gains from trade. Yet, one could argue that trade is an irrelevant detail in the model, and capital market integration alone can account for the differences in outcomes across steady states. To address this concern, I show the gains from integrating capital markets depend on the level trade integration. This result is in line with the literature, as Obstfeld and Rogoff (2000) show the benefits of capital market integration are amplified by lower trade costs.

Specifically, I leave the variable trade cost across the two economies at the initial level and only integrate capital markets. The steady-state result is shown in Table 8. The drop in aggregate productivity is higher, and capital misallocation increases. Domestic output slightly declines. On the one hand, domestic investment increases as Foreign capital flows to Home. On the other hand, this additional capital is allocated

Table 8: Only capital market integration

Variable	Initial	Only open CM	Open trade and CM
Productivity			
TFP	100	85.3	99
s.d. $mrpk$	0.52	0.59	0.58
Aggregates			
Output	100	99	112
Consumption	100	101	113
Capital	100	116	135
CE Welfare change			
Conditional	0	0.5*	10.2
Inequality			
Top 10% wealth share	46	53	62
Top 10% income share	27	30	32
Top 10% consumption share	21	24	27
Factor prices			
Real wage	100	100	111
$r - r^*$	2.9	0	0
Trade			
$\frac{\text{Import}}{\text{GDP}}$	21	19	45
$\frac{\text{Export}}{\text{GDP}^*}$	2	3	5
Share of exporters	16	21	35
CPI	156	154	144
$\frac{\text{NFA}}{\text{GDP}}$	0	-14	-18

to unproductive firms. The effect on welfare and aggregate consumption, therefore, is limited; welfare only increases by 0.5%. The increase in inequality explains why welfare changes less than aggregate consumption. The general message is still true: Capital market integration increases welfare, despite the counterfactual collapse of aggregate productivity and the unrealistic inflow of capital.

4.7 Higher financial development

[This section is under review] Table 9 shows what happens in the model economy after it is recalibrated to have a high financial development. Financial development is primarily measured as $\frac{\text{Domestic Credit}}{\text{GDP}}$ (44 % in the initial calibration) I increase it to 57 % and perform exactly the same trade liberalization exercise as before. The parameters that have changed substantially are the tightness of the borrowing constraint θ and the discount factor β.

First, the initial steady-state changes compared to the steady state with lower

Table 9: Trade liberalization with higher financial development

Variable	Initial	Only open trade	Open trade and CM
Productivity			
TFP	105	110	104
s.d. $mrpk$	0.48	0.47	0.51
Aggregates			
Output	113	117	121
Consumption	112	118	121
Capital	137	143	162
CE Welfare change			
Conditional*	9.2	15.4	17.5
Inequality			
Top 10% wealth share	42	53	55
Top 10% income share	27	29	30
Top 10% consumption share	18	21	24
Factor prices			
Real wage	117	123	125
$r - r^*$	1.3	2	0
Trade			
$\frac{\text{Import}}{\text{GDP}}$	21	42	42
$\frac{\text{Export}}{\text{GDP}^*}$	2	5	5
Share of exporters	15	33	34
CPI	151	143	144
$\frac{\text{NFA}}{\text{GDP}}$	0	0	-14

Note: $\beta = 0.88$, $\theta = 0.65$ Welfare calculations only for steady state comparisons

development,because there is an increase in welfare of around 9 % conditional consumption equivalent. These gains are not only because of the reduction in misallocation, measured as s.d. $mrpk$, but also the change in the aggregate capital stock.

Second, the economy benefits somewhat less from increased trade, despite the fact that import changes are roughly similar. This is important and shows that trade liberalization can indeed be more important for countries with less developed financial markets.

Finally, capital market integration affects the economy less. Both gains and losses are muted.

5 Conclusion

In this paper I investigate how opening up capital markets affects the gains from trade in economies with financial frictions. I find that, quantitatively, capital market

integration is always welfare improving and amplifies the gains from trade, despite the potential adverse effect on productivity. A key implication of the model is that empirically, aggregate productivity gains provide a lower bound for the welfare gains of trade that is often too conservative to be useful. Productivity losses are driven by misallocation among exporters both at the intensive and at extensive margin, but access to cheaper capital will always have 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. The losses are much easier to document in the data. I show that in Europe, after capital market integration has already happened, underdeveloped sectors had a positive correlation between capital misallocation and export exposure, driven by the proposed channel in the model economy — unproductive firms survive for longer, despite the increase in the share of constrained firms.

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 political economy aspect inequality. Taking transition dynamics into account is also important, as the gains from trade under closed capital markets materialize later.

For future work, misallocation and trade might affect innovation, and therefore can change these results to 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 an Klenow (2020).

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A Derivations for the Model

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:

$$C_d = \omega P_t Y_t^{\frac{1}{\sigma}} \qquad (23)$$

$$C_x = \frac{1 - \omega}{1 + \tau_t} P_t^* (Y_t^*)^{\frac{1}{\sigma}} \qquad (24)$$

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

$$X^* = \left(\frac{C_x}{C_d}\right)^{\sigma} X \tag{25}$$

$$X = C_d^{\sigma} \frac{z_t k^{\alpha_1} l^{\alpha_2}}{\left(C_d^{\sigma} + (1+\tau_t) C_x^{\sigma}\right)} \tag{26}$$

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

$$\mu = \frac{\sigma - 1}{\sigma} C_d X^{-\frac{1}{\sigma}} \tag{27}$$

Furthermore dividing (k) with (l) yields:

$$\frac{\lambda + R_t}{W_t} = \frac{\alpha_1}{\alpha_2} \frac{l}{k} \tag{28}$$

$$W_t = \alpha_2 \frac{\sigma - 1}{\sigma} z_t^{\frac{\sigma-1}{\sigma}} k^{\alpha_1 \frac{\sigma-1}{\sigma}} l^{\alpha_2 \frac{\sigma-1}{\sigma}} \left(C_d^{\sigma} + (1+\tau_t) C_x^{\sigma}\right)^{\frac{1}{\sigma}} \tag{29}$$

$$= \tilde{\alpha_2} C_z k^{\tilde{\alpha_1}} l^{\tilde{\alpha_2} - 1} \tag{30}$$

With the notation:

$$\tilde{\alpha}_1 = \alpha_1 \frac{\sigma - 1}{\sigma} \tag{31}$$

$$\tilde{\alpha}_2 = \alpha_2 \frac{\sigma - 1}{\sigma} \tag{32}$$

$$C_z = z_t^{\frac{\sigma-1}{\sigma}} \left(C_d^{\sigma} + (1+\tau_t) C_x^{\sigma}\right)^{\frac{1}{\sigma}} \tag{33}$$

The solution of the problem is:

$$l = \left(\tilde{\alpha}_2^{1-\tilde{\alpha}_1} \tilde{\alpha}_1^{\tilde{\alpha}_1} C_z (\lambda + R_t)^{-\tilde{\alpha}_1} W_t^{\tilde{\alpha}_1 - 1} \right)^{\sigma} \tag{34}$$

$$k = \left(\tilde{\alpha}_2^{\tilde{\alpha}_2} \tilde{\alpha}_1^{1-\tilde{\alpha}_2} C_z (\lambda + R_t)^{\tilde{\alpha}_2 - 1} W_t^{-\tilde{\alpha}_2} \right)^{\sigma} \tag{35}$$

If k implied by (35) with $\lambda = 0$ would be such that it violates (λ), then $k = \frac{a_t}{P_{t-1}(1-\theta)}$ and (35) is used to recover the value of λ.

A.2 Final good producers

Isoelastic demand for the intermediate inputs is given by:

$$p_t(j) = Y_t^{\frac{1}{\sigma}}(X_t(j))^{-\frac{1}{\sigma}}P_t \tag{36}$$

$$p_{F,t}(j) = \frac{1}{1+\tau_t}Y_t^{\frac{1}{\sigma}}(X_{F,t}(j))^{-\frac{1}{\sigma}}P_t \tag{37}$$

$$p^*_{F,t}(j) = (Y^*_t)^{\frac{1}{\sigma}}(X^*_{F,t}(j))^{-\frac{1}{\sigma}}P^*_t \tag{38}$$

$$p^*_t(j) = \frac{1}{1+\tau_t}(Y^*_t)^{\frac{1}{\sigma}}(X^*_t(j))^{-\frac{1}{\sigma}}P^*_t \tag{39}$$

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 closed capital markets, allowing both within and between sector reallocation.

$$\begin{aligned}\text{Total loss} &= \frac{TFP^* - TFP}{TFP^*} \\ &= \frac{TFP^* - TFP^B + TFP^B - TFP}{TFP^*} \\ &= \frac{TFP^* - TFP^B + (TFP^A - TFP) + (TFP^W - TFP)}{TFP^*}\end{aligned}$$

with

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

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

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

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

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

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

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 10: Empirical strategy

B Data Sources and auxiliary empirical analysis

Table 10 summarizes the interaction between productivity, misallocation, financial heterogeneity, trade liberalization and capital integration that can be detected using different datasets and identification levels.

B.1 Description of the CompNet dataset

- Sectoral level aggregated data containing firm level distributional statistics from 1999
- Focusing on cross-country comparability
- Trade statistics only focus on manufacturing data
- Entry and exit is limited

In order to ensure consistency with the country-level analysis in Table 11, I show that country level TFP is negatively correlated with all measures of capital misallocation and in Table 12, financial development measured at country level is positively correlated with the median firm's trade credit to asset ratio at the sector level.

	$Log(TFP)$	$Log(TFP^*)$	$Log(TFP)$
σ of return to capital	-0.00631	-0.00752*	-0.00183*
	(0.00332)	(0.00318)	(0.000766)
σ of labor productivity	0.000390	-0.0105***	0.0155***
	(0.00299)	(0.00286)	(0.00160)
N	7819	7819	7011
Time fixed effects	✓	✓	✓
Country fixed effects	✓	✓	✓
Sector fixed effects	✓	✓	✓
Measure	Average	Average	V-A Sector

Robust standard errors in parentheses.

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 11: Total factor productivity and misallocation

TFP is the welfare based Solow residual whereas TFP^* is only revenue based. Measures of misallocation: average return, marginal revenue/value-added product based on (macro)-sector production function.

	(1) $\frac{\text{Credit}}{\text{GDP}}$
$\frac{\text{Trade credit}}{\text{Assets}}$	10.95 ***
	(1.81)
Time fixed effects	✓
Country fixed effects	✓
Sector fixed effects	✓
N	6097

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 12: Financial development and trade credit

B.2 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, as I myself participated in the assembly of the dataset. Due to the fact that I cannot provide access to this latter dataset, I chose to conduct the analysis on the former dataset - but I made sure that the analysis are consistent across datasets.

HAS-KRTK dataset Contains all firms excluding self employed and govern-

ment sector between 2001 and 2018. It mainly consists of standard balance sheet data, but the total number of employees is included since 2001. It is collected and maintained by Hungarian Academy of Sciences, Centre for Economic and Regional Studies (KRTK). The 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 liabilities 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. Sales are directly reported by firms, sometimes further decomposed to domestic and exporting sales. All variables, but capital, are the residuals of regressing them on both industry and regional dummies.

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, see for example Halpern et al. (2015). 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.

The 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 intnagible 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 liabilities 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. Sales are directly reported by firms, sometimes further decomposed to domestic and exporting sales.

Because exporting is highly concentrated, I do *not* winsorize the data of outliers. I plot the kernel density of the obtained average return to capital in Figure 11, after removing extreme values. 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.

A key variable of the 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 percent of exporters. A firm is obliged to report export revenues above an industry-specific threshold of approximately 10000 euros. 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 non-manufacturing firms that is below 3 %, much lower than is reported in the literature.

B.3 Exporting dynamics in the data and in the model

To further examine firm-level exporting dynamics in the data and in the model, I analyze Hungarian firm-level balance-sheet data from 2005 until 2017[11]. In Table 13 I show the distribution of exporters with respect to their equity and leverage ratio. In the data, based on 82355 observations, we see that a substantial fraction of firms with higher than average equity also have higher than average leverage ratio. The model 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.

Let X_{it} be the export sales of a firm. The purpose is to uncover how access to external finance, measured by $\frac{\text{Asset}}{\text{Equity}}$, affects the decision to export at all (extensive

[11] Details provided in Appendix B.

Figure 11: Kernel density plot of the average revenue product of capital of Hungarian firms

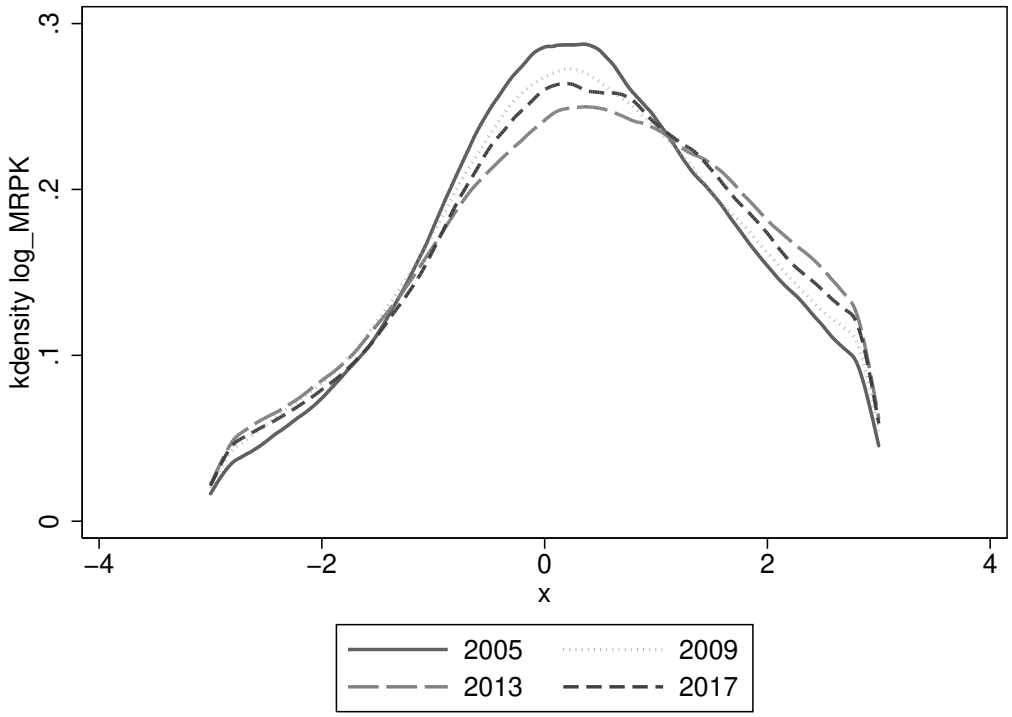

Table 13: Leverage ratio and equity

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

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

margin) and the growth rate of exports conditional on exporting (intensive margin). The extensive margin regression is given by

$$\mathbf{1}(X_{it} > 0) = \beta_1 \mathbf{1}(X_{i,t-1} > 0) + \beta_2 \log \frac{\text{Asset}}{\text{Equity}}_{i,t} + \gamma Controls_{i,t} + \alpha_i + \epsilon_{i,t} \quad (40)$$

where β_1 denotes the persistence in a linear probability model, taking firm-level fixed effects into account. Size and productivity-related variables are used as controls. Equation 40 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

$$\Delta X_{it} = \beta_1 \frac{\text{Asset}}{\text{Equity}}_{i,t} + \gamma Controls_{i,t} + \epsilon_{i,t} \quad (41)$$

ΔX_{it} denotes the growth rate of export sales and β_1 is the effect of external finance. Table 14 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 41 - this step is crucial, because 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. Preliminary results from the model are shown in Table 15. I simulate 25 million households for 13 periods[12], 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.

[12] The starting point is drawn from the stationary distribution of households.

	$\mathbf{1}(X_{i,t-1}>0)$	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 14: 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 15: Exporting dynamics and external finance in the model

B.4 Suggestive evidence

To investigate the effects of the transition dynamics of trade liberalization in the data, I combine the World Input-Output Database by Timmer et al. (2015) and the CompNet dataset by López-Garcia et al. (2018). In this dataset, 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 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 economies - it measures the trust firms have toward each other for substituting out short-term loans.

The model links firms in the economy to aggregate productivity through the allocative efficiency[13]; hence, Table 16 shows that larger trade exposure is not necessarily correlated with better allocation of capital, because higher export exposure increases misallocation in sectors with lower development.[14] 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 equilbrium 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	✓	✓	✓	✓	✓	✓

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 16: Misallocation and trade exposure

[13] In Appendix B I provide evidence that indeed there is a negative correlation between measures of misallocation and TFP at the country level.

[14] 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.

B.5 Aggregate evidence

To understand the correlation between trade, TFP and finance, I estimate the following reduced form regression:

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

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 17 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 interpret the economic significance of the model I substitute in the financial development and capital market integration of Germany, Italy and Hungary as they were in 1992. Then, assuming that they all had the same level of import of 30% share, [15] Table 18 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 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)

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

Table 17: TFP and trade

B.6 Additional details for the differences across EU countries

South consists of Spain, Italy, Portugal and Greece. Core consists of Western European countries, excluding countries contained in South, but including countries

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

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 18: The effect of an increase of the import share from 30% to 40%

that are not members of the European Union (Iceland, Norway, Switzerland) as they also participated in the process of European integration. 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. Table 19 describes the difference across country groups. In Figure 12 I provide a timeline for Hungary, which

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

Table 19: Initial conditions in trade and capital markets

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. [16] Measured as the change in the import to GDP ratio relative to the ratio in 1992, Figure ?? shows that all countries, especially Eastern European economies engaged in a large scale trade liberalization. However, Figure ?? 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

[16] European countries trade mostly with each other and this has not changed over time - [GRAPH MISSING]

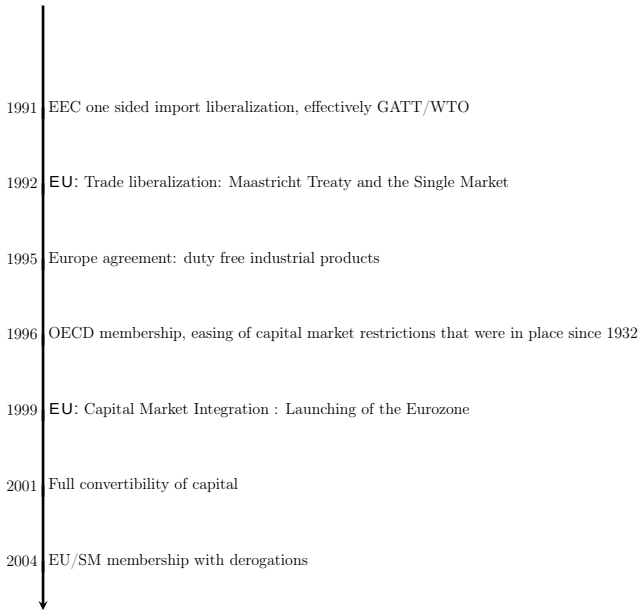

Figure 12: External reforms in Hungary and in Europe (EU)

their growth in TFP can be partially attributed to the internal reforms implemented after the fall of communism.

On Figure ??, 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 to attract further sources of external finance. On Figure ??, 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.