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# Trade, Misallocation, and Capital Market Integration

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# Trade, Misallocation, and Capital Market Integration*

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## Abstract

I study how cross-country capital market integration affects the gains from trade in a model with financial frictions and heterogeneous, forward-looking firms. The model predicts that misallocation among exporters increases as trade barriers fall, even as misallocation decreases in the aggregate. The reason is that financially constrained productive exporters increase their production only marginally, while unproductive exporters survive for longer and increase their size. Allowing capital inflows magnifies misallocation, because unproductive firms expand even more, leading to a decline in aggregate productivity. Nevertheless, under integrated capital markets, access to cheaper capital dominates the adverse effect on productivity, leading to higher output, consumption and welfare than under closed capital markets. Applied to the period of European integration between 1992 and 2008, I find that underdeveloped sectors experiencing higher export exposure had more misallocation of capital and a higher share of unproductive firms, thus the data is consistent with the model's predictions. A key implication of the model is that TFP is a poor proxy for consumption growth after trade liberalisation.



*Keywords: financial development, misallocation, capital market integration, trade liberalisation*

*JEL Classification: F4, O4*



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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. A major benefit of reducing trade barriers is the reallocation of resources from non-exporting firms to productive exporters.[1] Well-functioning financial markets facilitate reallocation, because exporters rely on external finance to sell their products abroad.[2] 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.

Can integrating capital markets help these countries realize the gains from trade? Historically, economies liberalizing capital accounts experienced a capital inflow,[3] increasing the available capital for firms and leading to higher output. On the other hand, evidence suggests that capital is not allocated 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 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. On the other hand, the most productive exporters amass a sub-

[1] Either because productive firms self-select into exporters, or they become more productive because of learning by doing as shown by De Loecker (2007).

[2] Auboin (2009) finds that around $90\%$ of world trade relies on some form of external finance.

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

stantial 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 operated by households. All other households invest indirectly in, and are employed by firms.

I calibrate the model to the economy of Central-Eastern Europe in 1989. At the time, Central-Eastern European countries liberalized their goods market and faced the choice of whether to integrate their capital markets. Therefore, in the main experiment with the model economy, I perform a 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 exporters that are unproductive and wealthy increase by $50\%$, leading to a decline in aggregate productivity and eliminating all productivity gains from trade. Despite the adverse effect on productivity, opening up to trade with integrated capital markets increases welfare, consumption, and output by more than under closed capital markets. The inflow of capital dominates the effect of declining productivity. Trade liberalization leads to higher wealth inequality, because households that own an exporting firm gain the most. Under integrated capital markets, exporters gain even more, hence inequality increases even more.

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.

To show that the model is consistent with the data, I show that Hungarian firms' exporting decisions on the intensive and on the extensive margin after 2005, depended on access to external finance. To provide evidence for the transition dynamics, I show that underdeveloped European industries with a higher export share experienced more capital misallocation, driven by the increased survival of unproductive firms.

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 does not affect 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 — benefits are confounded by trade liberalization on impact. In the model, variable and fixed trade 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 imbalances, 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.[4] Households are heterogeneous with respect to their entrepreneurial productivity $z$, their net wealth $a$ and their occupation choice $e \in$ {Worker, Domestic firm, Exporting firm} $=$ {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 $\beta$, and per-period utility given by $u(c) = \log(c)$, where $c$ is the local consumption good. They can imperfectly insure themselves against uncertainty by purchasing assets. They can choose to become workers or entrepreneurs. Workers earn wage $W_t$, without facing any income risk. Entrepreneurs earn profits and no labor income. Households that were not entrepreneurs have to pay an entry cost. Profits $\Pi^{ex}$ and $\Pi^{d}$ are earned based on productivity $z$ and capital stock $k$.

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

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 $\delta$ 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 $\theta$ 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 $\theta$ 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

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

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

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

$f_d$ and $f_{ex}$ are the one-time labor cost of entering into the domestic and 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 $\alpha$ 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 $\tau_t$ 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:

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

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

- 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 $\pi_z$ 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:

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

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

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

$\pi_x$ is an increasing function of aggregate demand in both countries, the trade costs, and (linearly) depends on trade balance. If trade balance is declining, $\pi_x$ *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 $\lambda$ 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 Calibration and data

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). Trade liberalization affected all country groups, but 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 calibration of the model is based on the 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.[5]

## 3.2 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 Core economy. Calibration parameters and targets are shown in Table 1. The borrowing tightness $\theta$ and the discount factor $\beta$ jointly determine the financial development in the economy. Lower $\theta$ prevents the reallocation of capital to productive firms, but also leads to *lower* demand for capital and a lower rental rate. A lower rental rate would be counterfactual, as proxied by the real interest rate, but more importantly, it would generate a capital outflow from the Home economy. There, the discount factor must also be lower and is important to capture the direction of capital flows. Differences in discount factors capture the idea that the NMS capital market was not "deep" enough in the early 1990s. Trade costs are used to capture the extent of the trade liberalization. Because intermediate-good producers in the model do not use intermediates to produce, gross imports and exports 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, whereas the innovations to productivity capture the sales

[5] In late 2008, the crisis unfolded in Europe too, but mostly affected aggregate variables in 2009. I am considering a quantitative exercise with a credit supply shock hitting the economies to account for the simultaneous decline in trade and misallocation.

Table 1: Calibrated parameters and moments

| Parameter | Value | Target | Source & Year | Data | Model |
|---|---|---|---|---|---|
| **Financial Development** | | | | | |
| Borrowing tightness, $\theta$ | 0.6 | $\frac{\text{Domestic Credit}}{\text{GDP}}$ | BIS 1990 | 38.0 | 44.0 |
| Home discount factor, $\beta$ | 0.84 | Hungarian Real interest rate $r$ | WB 1991 | 9.5 | 9.7 |
| Foreign discount factor,$\beta^*$ | 0.93 | German Real interest rate $r^*$ | WB 1989 | 6.8 | 6.8 |
| **Trade** | | | | | |
| Initial import trade cost, $\tau_0$ | 0.13 | Initial $\frac{\text{Import}}{\text{GDP}}$ | WB 1992/TiVA 1995 | 20.0 | 21.0 |
| Final import trade cost, $\tau_\infty$ | 0.03 | Final $\frac{\text{Import}}{\text{GDP}}$ | WB 2008/TiVA 2008 | 42.0 | 44.6 |
| Initial export trade cost, $\tau_0^*$ | 0.13 | NMS to Core/Germany Initial $\frac{\text{Export}}{\text{GDP}^*}$ | IMF DOT 1992/TiVA 1995 | 2.2 | 2.4 |
| Final export trade cost, $\tau_\infty^*$ | 0.03 | NMS to Core Final $\frac{\text{Export}}{\text{GDP}^*}$ | IMF DOT 2008//TiVA 2008 | 5.1 | 8.0 |
| Avg. export entry cost, $f_{ex}$ | $1000\%$ | Share of exporting firms | CompNet 1999 | 12 | 15.6 |
| **Firm dynamics** | | | | | |
| Avg. domestic entry cost, $f_d$ | $45\%$ | Entry rate to exports | CompNet 1999 | 30.00 | 24.1 |
| s.d. of LN productivity innovation, $\sigma_z$ | 0.06 | s.d. sales growth | Firm level, Hungary | 1.02 | 0.90 |

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

Table 2: Preassigned parameters

| Parameter | Value | Source | Comments |
|---|---|---|---|
| Home population, $L$ | 1 | - | Normalization |
| Foreign population, $L^*$ | 4 | UN 1989 | Population ratio, Core vs. NMS |
| Elasticity of substitution, $\sigma$ | 4 | Simonovska and Waugh (2014) | Trade, not substitution |
| Foreign borrowing tightness, $\theta^*$ | 0.86 | Midrigan and Xu (2014) | Korean firm data |
| Avg. export entry cost, $f_{ex}^*$ | $300\%$ | CompNet 1999 | Share of exporting firms to NMS |
| Avg. domestic entry cost, $f_d^*$ | $22.5\%$ | CompNet 1999 | Entry rate to exports to NMS |
| AR(1) of LN productivity innovation, $\rho_z$ | 0.9 | David and Venkateswaran (2019) | Firm level, Hungary Sales AR(1) |

Note: Some parameters are under calibration

growth in the panel data of Hungarian firms. I compare the exporting dynamics in the data and in the model in detail in the next section.

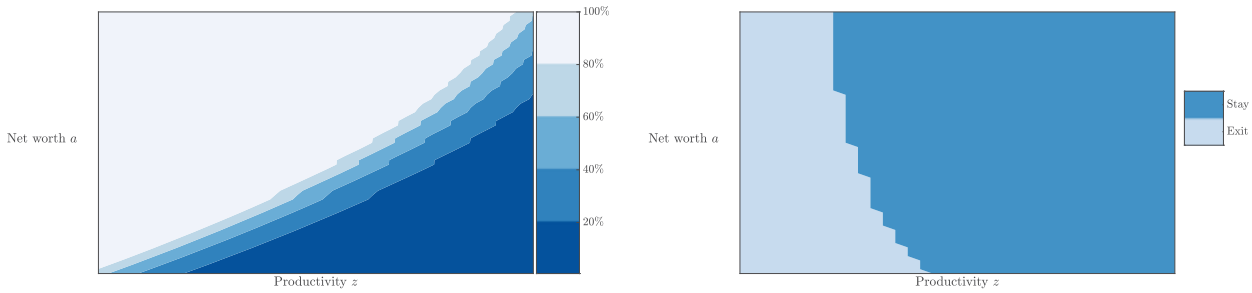
Table 2 contains parameters that are not calibrated. The elasticity of substitution is a key parameter capturing the gains from trade through controlling the value of a new variety. Borrowing tightness abroad is assumed to be higher, because the Core economies are characterized by lower financial frictions and higher financial development. To justify the lower share of firms that export in Core to NMS, the fixed cost does not have to be as high as for the other direction, because Home is a much smaller economy.[6] The productivity process has a high autocorrelation, but the model counterpart in sales fails to generate as much autocorrelation as in the data. This failure is driven primarily by endogenous entry and exit in the model. Allowing for permanent productivity shocks in the model would help in matching the high autocorrelation, but is not included in the model yet.

[6]Considerable heterogeneity exists in exporting costs; see Dickstein and Morales (2018).

Table 3: Non-targeted moments

| Description | Data | Model | Source & Year |
|---|---|---|---|
| Aggregate s.d. $mrpk$ | 1.06 | 0.52 | Firm level, Hungary |
| Domestic s.d. $mrpk$ | 1.07 | 0.51 | Firm level, Hungary |
| Exporter s.d. $mrpk$ | 0.77 | 0.46 | Firm level, Hungary |
| % of total debt owned by Domestic | 62 | 67 | Firm level, Hungary |
| % of total debt owned by Exporter | 39 | 33 | Firm level, Hungary |
| Top 10% wealth share | 47 | 46 | HFCN 2014 |
| Top 10% income share | 22 | 27 | WID 1992 |
| Top 1% income share | 5 | 7 | WID 1992 |

Figure 1: Exporter's decision depends on productivity and net worth




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

(b) Occupation choice: $e'(a, z, ex)$

The important non-targeted moments are summarized in Table 3. 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 difference in productivity is necessary to justify the observed higher development and larger size of the Core economy. 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 high fixed cost of entry magnifies the aggregate dispersion in the marginal revenue product of capital, but the model can only explain around $25\%$ of the variance.[7] External finance is more important for exporters, because they tend to be more productive firms and therefore they hold disproportionately higher share of total debt in the economy both in the data and in the model.

To illustrate the relationship between exporting and finance in the model, the left panel of Figure 1 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

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

Table 4: Distribution of exporters

| | Low Productivity | High Productivity |
|---|---|---|
| Low Wealth | 3 | 8 |
| High Wealth | 22 | 67 |

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. The right panel of Figure 1 shows that exiting patterns depend on net worth too.

The implication is that the majority of firms are constrained and hold considerable amounts of wealth. In Table 4 I categorize exporters into 4 groups based on their productivity and wealth. Low productivity is defined as an exporter below the average productivity of the entire population. Low wealth exporters hold less than twice the average national wealth.

## 3.3 Exporting dynamics in the data and in the model

To understand firm-level exporting dynamics in the data and in the model, I analyze Hungarian firm-level balance-sheet data from 2005 until 2017[8]. 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 margin) and the growth rate of exports conditional on exporting (intensive margin). The extensive margin regression is given by

$$\mathbf{1}(X_{it} > 0) = \beta_1 \mathbf{1}(X_{i,t-1} > 0) + \beta_2 \log \frac{\text{Asset}}{\text{Equity}}_{i,t} + \gamma Controls_{i,t} + \alpha_i + \epsilon_{i,t} \tag{22}$$

where $\beta_1$ 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 22 is estimated using Arellano and Bond (1991) estimator, because the lagged dependent variable is included as an explanatory variable. The intensive

[8]Details provided in Appendix B.

margin regression is given by

$$\Delta X_{it} = \beta_1 \frac{\text{Asset}}{\text{Equity}}_{i,t} + \gamma Controls_{i,t} + \epsilon_{i,t} \tag{23}$$

$\Delta X_{it}$ denotes the growth rate of export sales and $\beta_1$ is the effect of external finance. Table 5 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 23 - this step is crucial, because the inverse Mills ratio, $\kappa$, 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 6. I simulate 25 million households for 13 periods[9], 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.

Table 5: Exporting dynamics and external finance in the data

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

Table 6: Exporting dynamics and external finance in the model

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

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

# 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 and capital market integration.

## 4.1 Steady state

In Table 7, I show the most important changes in the economy following a trade liberalization with closed capital markets (middle columns), or integrated capital markets (right column), compared to the initial steady state (left column).

Trade liberalization under closed capital markets increases aggregate productivity by around $7\%$. The increase in productivity is not driven by the decline in capital misallocation as the measured dispersion of returns to capital declines only modestly. Aggregate output and consumption gains are similar to productivity gains. Consumption-equivalent welfare change, compared to the initial steady state is lower than the change in aggregate consumption, because the gains from trade are not equally distributed among households. Overall, despite the fact that the model violates all three macro restrictions considered in Arkolakis et al. (2012), the back-of-the-envelope approximation of the welfare change, based on the change in the import share of around $20\%$ and trade elasticity of $4$, yields a $7\%$ increase in welfare. Hence, despite all the additional ingredients in the model, the welfare gains from trade under closed capital markets are similar to that of

Table 7: Trade liberalization under closed and integrated capital markets

| Variable | Initial | Only open trade | Open trade and CM |
|---|---|---|---|
| **Productivity** | | | |
| TFP | 100 | 107 | 99 |
| s.d. $mrpk$ | 0.52 | 0.50 | 0.58 |
| **Aggregates** | | | |
| Output | 100 | 107 | 112 |
| Consumption | 100 | 108 | 113 |
| Capital | 100 | 105 | 135 |
| **CE Welfare change** | | | |
| Average | 0 | 4.3 | 6.6 |
| Conditional | 0 | 6.8 | 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 | 108 | 111 |
| $r - r^*$ | 2.9 | 4.5 | 0 |
| **Trade** | | | |
| $\frac{\text{Import}}{\text{GDP}}$ | 21 | 43 | 45 |
| $\frac{\text{Export}}{\text{GDP}^*}$ | 2 | 4 | 5 |
| Share of exporters | 16 | 31 | 35 |
| CPI | 156 | 144 | 144 |
| $\frac{\text{NFA}}{\text{GDP}}$ | 0 | 0 | -18 |

a simple Armington model. Import share changes predict changes in aggregate productivity and welfare.

A stark contrast arises when both trade and capital markets are integrated. Aggregate productivity declines and capital misallocation increases. However, output and consumption increases further. Wealth inequality increases even more; hence, welfare gains are somewhat lower than the aggregate increase in consumption. The welfare gains from trade are no longer linked to the "gains" in aggregate productivity. 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. Because most countries liberalizing their trade do allow some form of capital inflow, empirical analysis investigating welfare gains from trade based on the (decomposition of) aggregate productivity is undermined. Therefore, changes in aggregate productivity should only provide a lower bound for the implied wel-

Table 8: Effect of trade liberalization on different sectors

| Description | Initial | Only open trade | Open trade and CM |
|---|---|---|---|
| **s.d.** $mrpk$ | | | |
| Domestic | 0.51 | 0.47 | 0.50 |
| Exporter | 0.46 | 0.48 | 0.54 |
| **Productivity loss** | | | |
| Domestic | 5.7 | 5.0 | 5.8 |
| Exporter | 4.1 | 4.8 | 6.0 |
| % firms that export | 16 | 31 | 35 |

fare change. But even in economies with a medium level of financial development, this lower bound can be negative. Next, I show the reasons why aggregate productivity declines in the long run, both qualitatively and quantitatively.

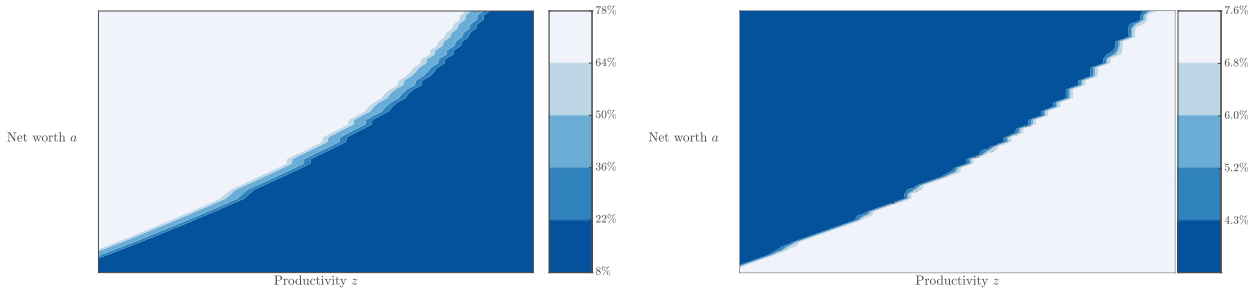
## 4.2 Understanding changes in productivity

In Table 8, 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 with free reallocation of factors of production across producers within the sector (exporters or domestic firms). 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. Initially the domestic sector is more affected and 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 within misallocation has a larger impact on aggregate productivity.

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

Figure 2: % Change in capital




(a) Open Capital Markets

(b) Closed Capital Markets

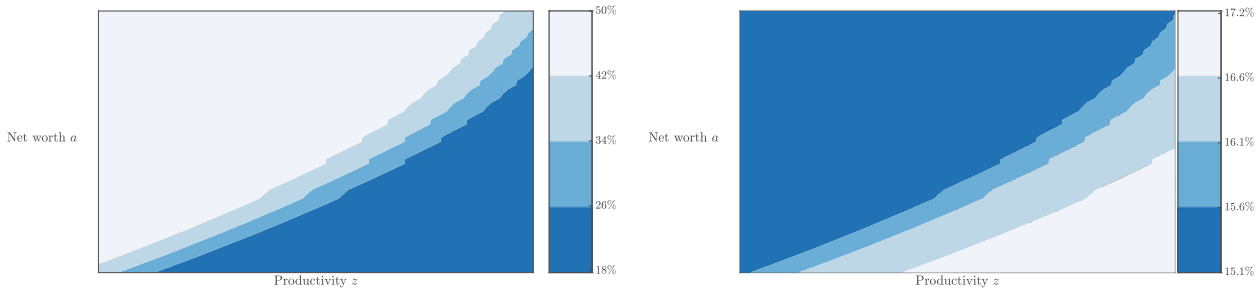
hire more factors of production, driving up wages and the rental rate. Including financial frictions affect the changes in potential exporting profits $\Pi^{ex}$:

$$\frac{\Delta \Pi^{ex}}{\Delta \tau} = \frac{\Delta \Pi^{ex}}{\Delta l}\frac{\Delta l}{\Delta \tau} + \frac{\Delta \Pi^{ex}}{\Delta k}\frac{\Delta k}{\Delta \tau} + \text{Direct effect} \tag{24}$$

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.

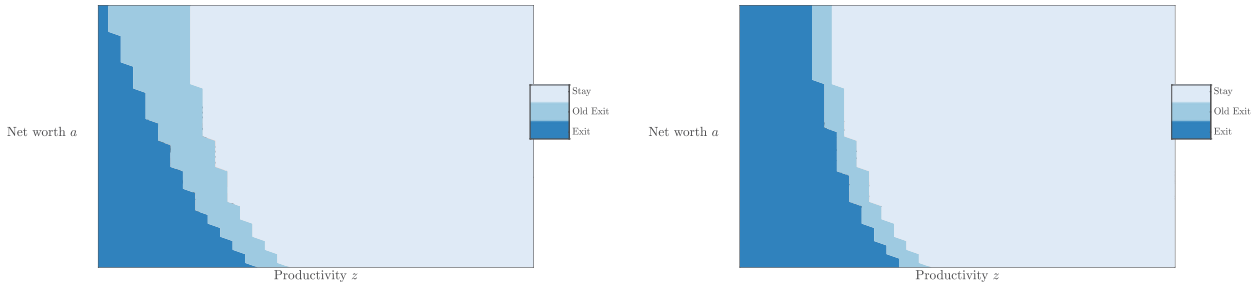
Financial frictions affect which types of firms can increase their capital stock. Unconstrained firms, which have a high wealth-to-productivity ratio, are unaffected by financial frictions and are the firms that *can* expand. Constrained firms, which have a low wealth-to-productivity ratio, however, *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 2 shows that under integrated capital and goods market, unproductive, wealthy exporters increase their capital stock by almost $80\%$, whereas productive, poor exporters can only increase their capital stock by $8\%$. Trade integration yields almost exactly the same gains for productive, poor exporters. On the other hand, unproductive, wealthy exporters expand, but by less than $8\%$. The change in capital

Figure 3: % Change in exporting profits




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

Figure 4: Change in the exit decision of exporters




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

stock explains the change in profits, as Figure 3 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. Moreover, profits increase more 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 4 shows that regardless of capital market openness, trade 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.

In 9 I show the change in the steady-state distributions of exporters. Relative to the initial steady-state, trade liberalization with closed capital markets results in

Table 9: Distribution of exporters in $\%$

| Type | Initial | Only open trade | Open trade and CM |
|---|---|---|---|
| Low wealth and low productivity | 3 | 4 | 3 |
| Low wealth and high productivity | 8 | 10 | 6 |
| High wealth and low productivity | 22 | 24 | 34 |
| High wealth and high productivity | 67 | 61 | 58 |

more firms that have lower than twice the average wealth[10]. Due to the increase in the rental rate, exporters change the factor intensity and need less wealth to get capital. Nevertheless, the overall effect is that capital misallocation does not change on the extensive margin due to firm selection.

Liberalizing trade and integrating capital market affect the distribution in line with the changes in profits. The measure of "High wealth and low productivity" type exporters increase by more than $50\%$ or $12$p.p. Even worse, exporters that have low wealth and high productivity decline by $25\%$ or $2$ p.p, mainly because entrants face a higher entry cost that is adjusted by the nominal wage.

Therefore a clear prediction of the model is that more export-intensive sectors/countries will have higher capital misallocation, driven by unproductive, wealthy exporters, if financial frictions are important in the economy. In the empirical literature, these firms are commonly referred to as zombie firms, and I show evidence for this mechanism in the data in the empirical section.

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 in misallocation.[11] I compare the allocations to the second best productivity under liberalized trade and closed capital markets. More precisely, reference productivity is the productivity when I allow the planner to reallocate resources both within and across sectors. The main reason for not choosing the unconstrained planner's allocation is that the planner would alter the capital stock and choose a different set of firms to operate in the first place.

Table 10 shows the results of the decomposition. Each row corresponds to a fraction of the total TFP loss attributed to a particular channel: the lack of within-

[10]Categorization is always relative to the initial steady-state wealth. While average wealth does increase, this does not change the qualitative results.

[11]I show the details in appendix A3

Table 10: TFP loss decomposition

| Source of TFP loss | Initial | Only open trade | Open trade and CM |
|---|---|---|---|
| **Factors** | **57** | **100** | **83** |
| Within | 40 | 63 | 42 |
| Across | 17 | 37 | 41 |
| Residual | 43 | - | 17 |

sector or across-sector reallocation of resources. The last row is the residual term, which corresponds to the loss associated with inefficient firm allocation and terms of trade. In the initial steady state, the high variable trade cost prevents firms from exporting, and the within-sector misallocation is also high. Opening up to trade with closed capital markets does not change the relative importance of across- and within-sector productivity losses, most of the increase in productivity is due to the expansion of the exporting sector and the improvements in the residual component — terms of trade and productive firms are reallocated to the exporting sector. The small decline in the marginal revenue product dispersion does not contribute to the increase in aggregate productivity.

Quantitatively, trade and capital market liberalization decreases productivity. Most importantly, exporting firms own too much capital, which drives up across sector misallocation. Within-sector misallocation remains important. Jointly, these two sources of misallocation explain more than $80\%$ of the total productivity loss. The residual term improves, but not by as much as under closed capital markets. Overall, the contribution of misallocation is the most important factor explaining the loss in aggregate productivity. Differences across aggregate productivity measures do not affect qualitatively the results, because the losses in productivity do not rely on the specific method chosen to account for export revenues.

## 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 5 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 21. The bilateral variable trade cost is gradually

reduced for four years to the final level. In the case of integrated capital markets, the policy is also announced in period 2, but it only affects the capital stock in period 3. Perfect foresight is supported in the particular 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. [12]

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

[12] Timeline included in Appendix B.

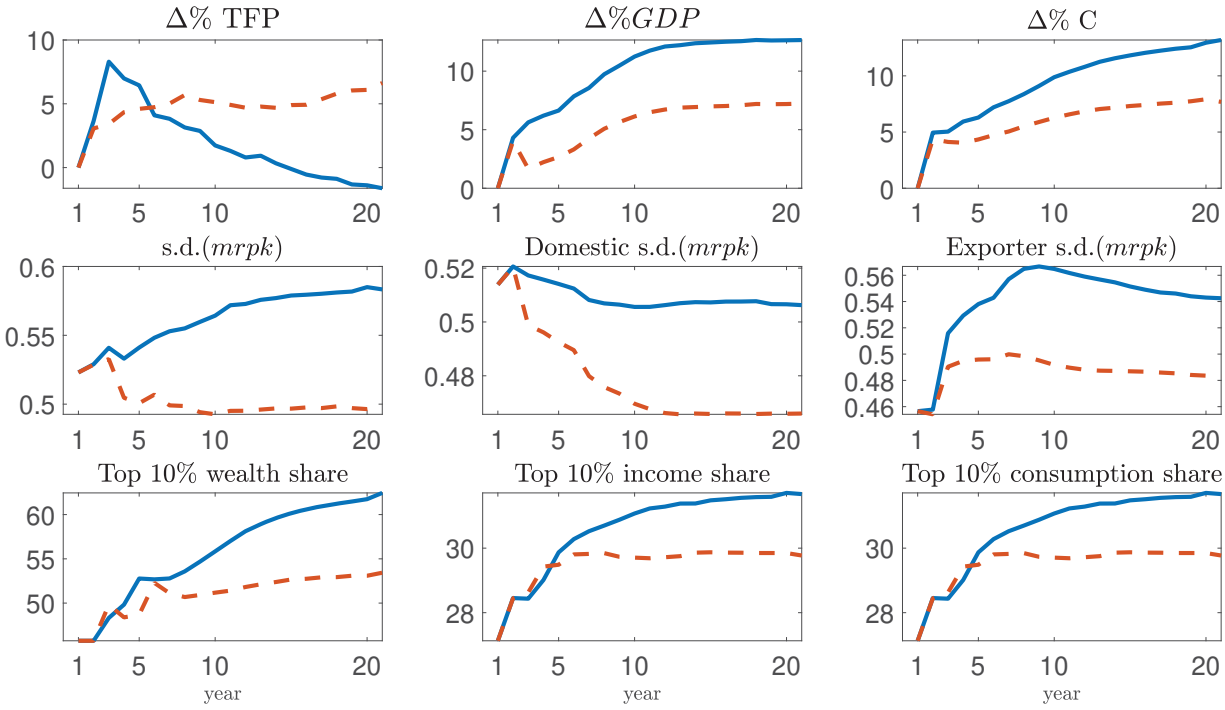



Figure 5: Transition dynamics after trade liberalization with closed (dashed line) or with open capital markets

effect of having higher capital stock in the economy, initially productive exporters expand more. 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 continous 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 Inequality and welfare

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

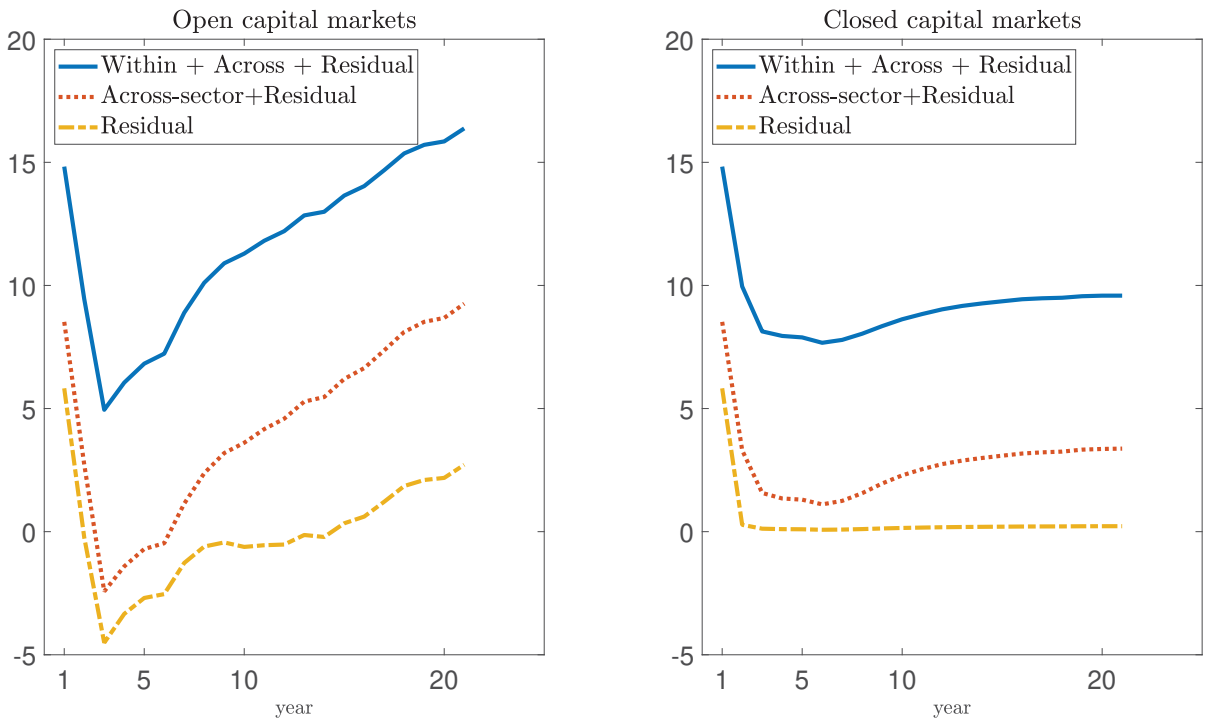



Figure 6: Productivity loss decomposition after trade liberalization

affected by capital market integration. Table 7 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 7 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.

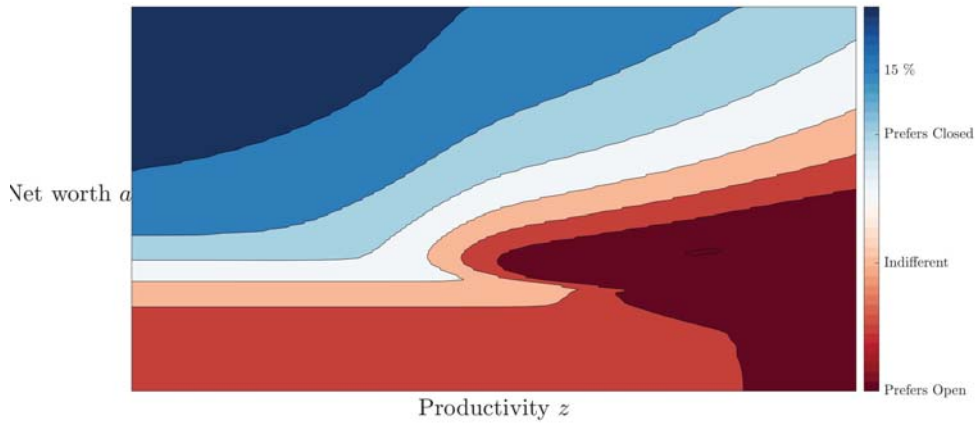



Figure 7: Welfare changes — Preference of the population to liberalize trade w/o integrated capital markets

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 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.

## 4.5 Capital market integration without trade liberalization

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 11. 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 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.

Table 11: 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 |

## 4.6 Higher financial development

Table 12 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 $\theta$ and the discount factor $\beta$.

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

Table 12: 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 | | |

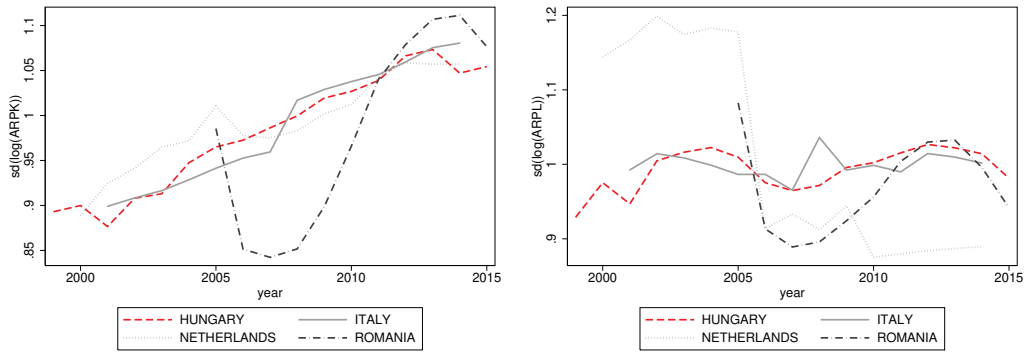
trade liberalization can indeed be more important for countries with less developed financial markets.

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

# 5 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

Figure 8: Dispersion of average products




(a) Return on capital

(b) Labor productivity

about the universe of firms within the industry.

During this time period, capital market frictions, as measured by the average revenue product of capital dispersion, were increasing in most EU countries (left panel in Figure 8). On the other hand, dispersion in labor productivity did not increase (right panel in Figure 8). Hence, capital market frictions were potentially the more important in accounting for differences in productivity across European countries.

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 13 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.

Table 13: Misallocation and trade exposure

| | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| | $\sigma(ARPK)$ | $\sigma(ARPL)$ | % Zombie firms | Avg. t. Zombie | % firms constrained | $\frac{\text{Fixed capital}}{\text{Assets}}$ |
| $\frac{\text{Export}}{\text{Output}}$ | 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

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

[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.

# 6 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. Preliminary results suggest that policies that increase redistribution among households are more important in underdeveloped economies undergoing integration. Limiting capital inflow can be an efficient tool to reduce inequality despite that the welfare gains from trade are lower.

For future work, it is useful to consider a natural implication of the analysis: after integrating capital markets and opening up to trade, the economy becomes vulnerable to credit supply shocks. This can explain the trade collapse observed during the crisis, at the same time when measured misallocation was declining.

However, while a uniform reduction in the borrowing limit will eliminate zombie firms, one can expect that the long run effect will be less productive entrants in the exporting sector, leading to slower recovery and low productivity growth.

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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:

$$\frac{\sigma - 1}{\sigma} \omega P_t Y_t^{\frac{1}{\sigma}} X^{\frac{-1}{\sigma}} = \mu \tag{$X$}$$

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

$$\alpha_2 \mu z_t k^{\alpha_1} l^{\alpha_2 - 1} = W_t \tag{$l$}$$

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

Denote:

$$C_d = \omega P_t Y_t^{\frac{1}{\sigma}} \tag{25}$$

$$C_x = \frac{1 - \omega}{1 + \tau_t} P_t^* (Y_t^*)^{\frac{1}{\sigma}} \tag{26}$$

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

$$X^* = \left(\frac{C_x}{C_d}\right)^{\sigma} X \tag{27}$$

$$X = C_d^{\sigma} \frac{z_t k^{\alpha_1} l^{\alpha_2}}{\left(C_d^{\sigma} + (1 + \tau_t) C_x^{\sigma}\right)} \tag{28}$$

Implying that the Lagrange multiplier on the resource constraint ($\mu$) is:

$$\mu = \frac{\sigma - 1}{\sigma} C_d X^{-\frac{1}{\sigma}} \tag{29}$$

Furthermore dividing $(k)$ with $(l)$ yields:

$$\frac{\lambda + R_t}{W_t} = \frac{\alpha_1}{\alpha_2}\frac{l}{k} \tag{30}$$

$$W_t = \alpha_2 \frac{\sigma - 1}{\sigma} z_t^{\frac{\sigma-1}{\sigma}} k^{\alpha_1 \frac{\sigma-1}{\sigma}} l^{\alpha_2 \frac{\sigma-1}{\sigma}} \left( C_d^\sigma + (1+\tau_t) C_x^\sigma \right)^{\frac{1}{\sigma}} \tag{31}$$

$$= \tilde{\alpha_2} C_z k^{\tilde{\alpha_1}} l^{\tilde{\alpha_2}-1} \tag{32}$$

With the notation:

$$\tilde{\alpha}_1 = \alpha_1 \frac{\sigma - 1}{\sigma} \tag{33}$$

$$\tilde{\alpha}_2 = \alpha_2 \frac{\sigma - 1}{\sigma} \tag{34}$$

$$C_z = z_t^{\frac{\sigma-1}{\sigma}} \left( C_d^\sigma + (1+\tau_t) C_x^\sigma \right)^{\frac{1}{\sigma}} \tag{35}$$

The solution of the problem is:

$$l = \left( \tilde{\alpha}_2^{1-\tilde{\alpha}_1} \tilde{\alpha}_1^{\tilde{\alpha}_1} C_z (\lambda + R_t)^{-\tilde{\alpha}_1} W_t^{\tilde{\alpha}_1 - 1} \right)^\sigma \tag{36}$$

$$k = \left( \tilde{\alpha}_2^{\tilde{\alpha}_2} \tilde{\alpha}_1^{1-\tilde{\alpha}_2} C_z (\lambda + R_t)^{\tilde{\alpha}_2 - 1} W_t^{-\tilde{\alpha}_2} \right)^\sigma \tag{37}$$

If $k$ implied by (37) with $\lambda = 0$ would be such that it violates $(\lambda)$, then $k = \frac{a_t}{P_{t-1}(1-\theta)}$ and (37) is used to recover the value of $\lambda$.

## A.2 Final good producers

Isoelastic demand for the intermediate inputs is given by:

$$p_t(j) = Y_t^{\frac{1}{\sigma}} (X_t(j))^{-\frac{1}{\sigma}} P_t \tag{38}$$

$$p_{F,t}(j) = \frac{1}{1+\tau_t} Y_t^{\frac{1}{\sigma}} (X_{F,t}(j))^{-\frac{1}{\sigma}} P_t \tag{39}$$

$$p^*_{F,t}(j) = (Y_t^*)^{\frac{1}{\sigma}} (X^*_{F,t}(j))^{-\frac{1}{\sigma}} P_t^* \tag{40}$$

$$p^*_t(j) = \frac{1}{1+\tau_t} (Y_t^*)^{\frac{1}{\sigma}} (X^*_t(j))^{-\frac{1}{\sigma}} P_t^* \tag{41}$$

## 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

$$\begin{aligned}
TFP^W &= \Big[TFP_d^{eff}\Big(\Big(\frac{K_d}{K}\Big)^{\alpha}\Big(\frac{L_d}{L}\Big)^{1-\alpha}\Big)^{\frac{\sigma-1}{\sigma}} + \pi_x \cdot TFP_x^{eff}\Big(\Big(\frac{K_x}{K}\Big)^{\alpha}\Big(\frac{L_x}{L}\Big)^{1-\alpha}\Big)^{\frac{\sigma-1}{\sigma}}\Big]^{\frac{\sigma}{\sigma-1}} \\
TFP^{Across} &= \Big[TFP_d\Big(\Big(\frac{K_d^{eff}}{K}\Big)^{\alpha}\Big(\frac{L_d^{eff}}{L}\Big)^{1-\alpha}\Big)^{\frac{\sigma-1}{\sigma}} + \pi_x \cdot TFP_x\Big(\Big(\frac{K_x^{eff}}{K}\Big)^{\alpha}\Big(\frac{L_x^{eff}}{L}\Big)^{1-\alpha}\Big)^{\frac{\sigma-1}{\sigma}}\Big]^{\frac{\sigma}{\sigma-1}} \\
TFP^B &= \Big[TFP_d^{eff}\Big(\Big(\frac{K_d^{eff}}{K}\Big)^{\alpha}\Big(\frac{L_d^{eff}}{L}\Big)^{1-\alpha}\Big)^{\frac{\sigma-1}{\sigma}} + \pi_x \cdot TFP_x^{eff}\Big(\Big(\frac{K_x^{eff}}{K}\Big)^{\alpha}\Big(\frac{L_x^{eff}}{L}\Big)^{1-\alpha}\Big)^{\frac{\sigma-1}{\sigma}}\Big]^{\frac{\sigma}{\sigma-1}} \\
\text{Within} &= \frac{(TFP^W - TFP)}{TFP^*}/\text{Total loss} \\
\text{Across} &= \frac{(TFP^A - TFP)}{TFP^*}/\text{Total loss} \\
\text{Both} &= \frac{(TFP^B - TFP)}{TFP^*}/\text{Total loss}
\end{aligned}$$

# B Data Sources and auxiliary empirical analysis

Table 14 summarizes the interaction between productivity, misallocation, financial heterogeneity, trade liberalization and capital integration that can be detected using different datasets and identification levels. The general purpose is to inform the structural model presented in the next section. Aggregate evidence shows that TFP gains are

CompNet:

- Sectoral level aggregated data containing firm level distributional statistics

Table 14: Empirical strategy

| 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 | — | — |

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 15, I show that country level TFP is negatively correlated with all measures of capital misallocation and in Table 16, financial development measured at country level is positively correlated with the median firm's trade credit to asset ratio at the sector level. Hungarian firm level data:

Table 15: Total factor productivity and misallocation

| | $Log(TFP)$ | $Log(TFP^*)$ | $Log(TFP)$ |
|---|---|---|---|
| $\sigma$ of return to capital | -0.00631 | -0.00752$^*$ | -0.00183$^*$ |
| | (0.00332) | (0.00318) | (0.000766) |
| $\sigma$ 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.

$^*$ $p < 0.05$, $^{**}$ $p < 0.01$, $^{***}$ $p < 0.001$

$TFP$ 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.

- All firms excluding self-employed and govt sector since 2005
- Balance sheet data but employment only since 2008

Table 16: Financial development and trade credit

| | (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

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

## B.1 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 segmen-

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

tation.

Table 17: TFP and trade

| | $\log(\frac{Import}{GDP})$ | $\log(\frac{Credit}{GDP})$ | $\log(\frac{Import}{GDP}) \times \log(\frac{Credit}{GDP})$ | $CMI$ | $\log(\frac{Import}{GDP}) \times CMI$ |
|---|---|---|---|---|---|
| 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

## B.2 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 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 9 I provide a timeline for Hungary, which is a typical NMS country experiencing integration. There is substantial heterogeneity in how external reforms were implemented even within NMS countries: Hungary liberalized capital markets relatively early but never adopted the Euro and therefore never completed capital market integration, whereas most NMS countries chose to delay opening up capital markets for as long as possible.

The increasing integration of the European Union led to a rapid increase in intra-European trade. [16] Measured as the change in the import to GDP ratio relative to the ratio in 1992, Figure 10 shows that all countries, especially Eastern European economies engaged in a large scale trade liberalization. However, Figure

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

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

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

Table 19: Initial conditions in trade and capital markets

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

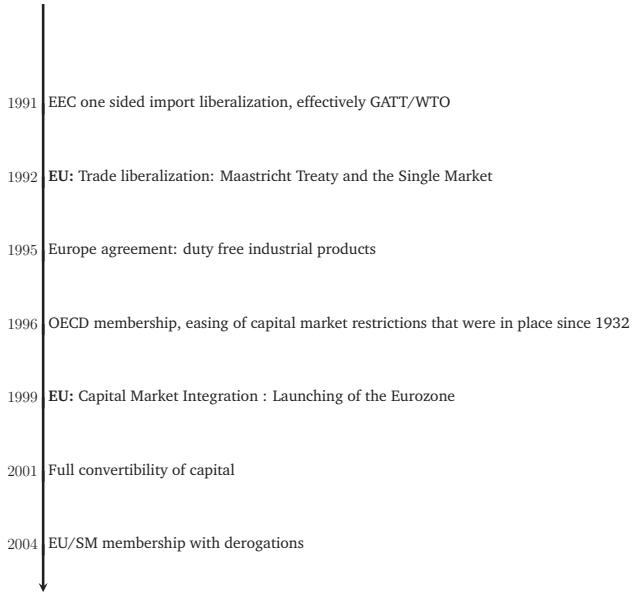


Figure 9: External reforms in Hungary and in Europe (**EU**)

11 also shows that changes in total factor productivity have not been proportional to the scale of trade liberalization: Southern European countries have experienced limited or no gains even though they have opened up to trade to a similar extent as Core EU countries. Eastern Europe, on the other hand, have opened up to trade but their growth in TFP can be partially attributed to the internal reforms implemented after the fall of communism.

On Figure 12, 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 13, I plot the Chinn and Ito (2006) index measuring capital market openness. Both South and NMS have opened up their capital markets, albeit NMS did so on average later and to a lesser extent.

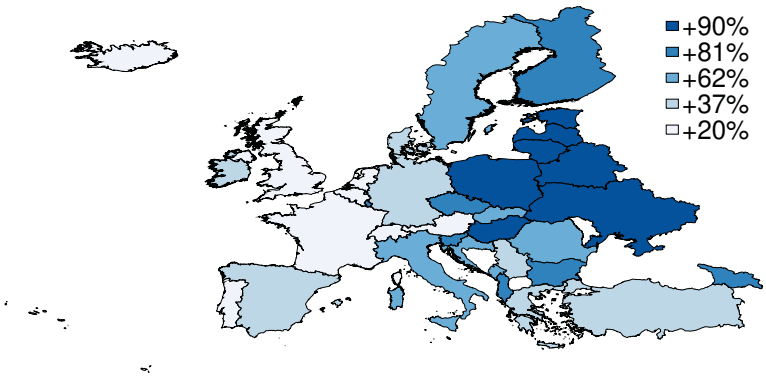


Figure 10: $\Delta_{1992-2008} \frac{\text{Import}}{\text{GDP}} / \frac{\text{Import}}{\text{GDP}}_{1992}$

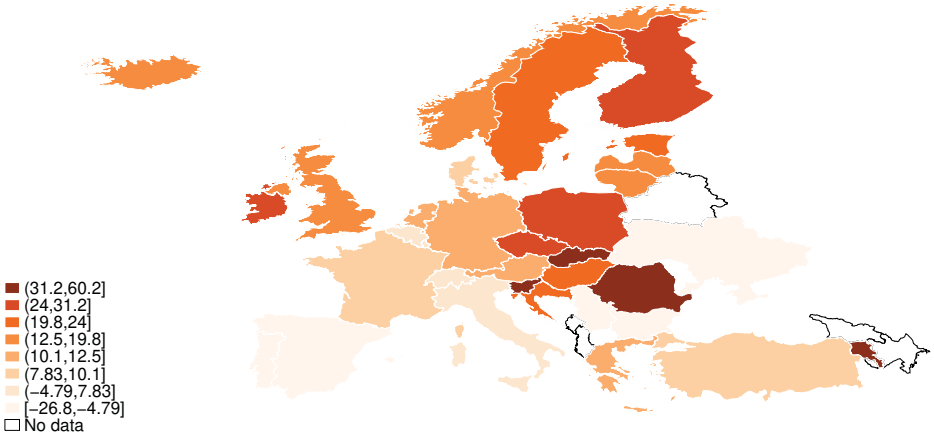


Figure 11: Changes in TFP

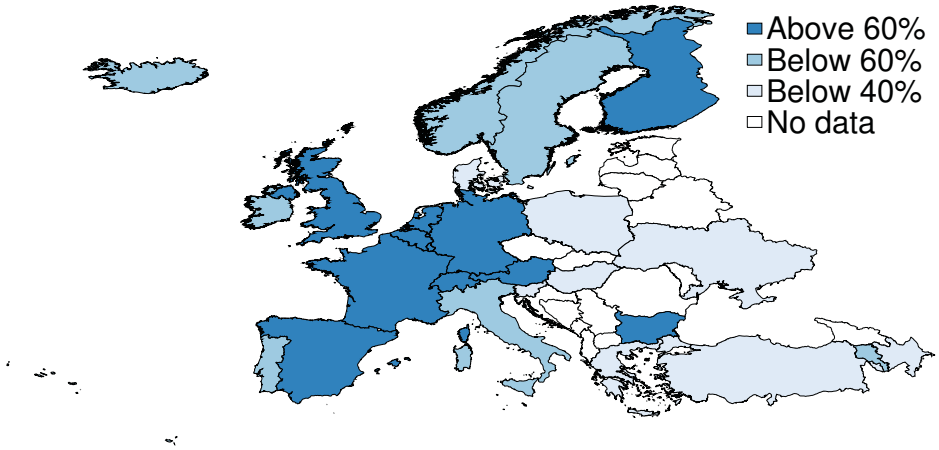


Figure 12: $\frac{\text{Credit}}{\text{GDP}}$

The empirical facts that provide the backbone of the calibration are summarized in Table 20.

Table 20: Summary of empirical findings

- Macro facts:
  - More developed countries benefit more from opening up to trade
  - Capital market opening has a negative impact on the productivity gains from trade
  - Capital flows from the developed to the less developed country [a]
- Sector level facts for a country with lower financial development. Higher export share:
  - Increases capital misallocation
  - More zombie firms survive and for longer
  - However, the median firm is more constrained
- Micro facts:
  - Exporting probability is highly persistent and positively correlated with access to finance
  - Export sales growth is also dependent on external finance

[a] Lane and Milesi-Ferretti (2007) shows that up until 2004 it was most indirect investment, but then there was a rapid increase in FDI. I am considering an extension of the model to allow direct investment as in Mendoza et al. (2009)

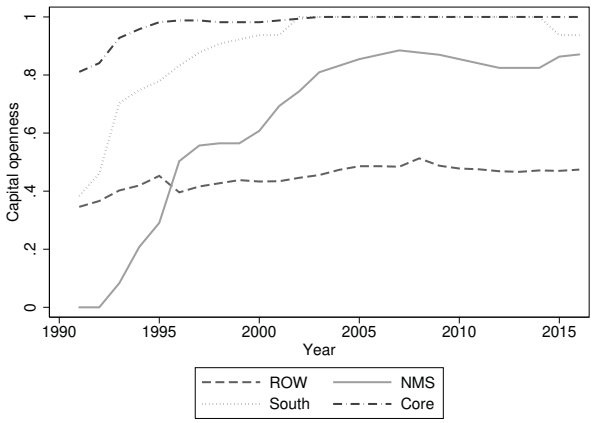


Figure 13: Capital market integration, (unweighted) average within country groups.

Table 21: Non-targeted moments, work in progress

| Description | Data | Model | Source & Year |
|---|---|---|---|
| Aggregate s.d. $mrpk$ | 1.06 | 0.52 | Firm level, Hungary |
| Domestic s.d. $mrpk$ | 1.07 | 0.51 | Firm level, Hungary |
| Exporter s.d. $mrpk$ | 0.77 | 0.46 | Firm level, Hungary |
| % of total debt owned by Domestic | 61.50 | 66.93 | Firm level, Hungary |
| % of total debt owned by Exporter | 38.50 | 33.07 | Firm level, Hungary |
| Top 10% wealth share | 47.00 | 45.74 | HFCN 2014 |
| Top 10% income share | 21.50 | 27.13 | WID 1992 |
| Top 1% income share | 5.20 | 6.98 | WID 1992 |
| NMS size to Core % | 11.80 | 6.56 | Eurostat 2008 |
| NMS nominal wage relative to Core % | 31.7 | 43.76 | Eurostat 2019 |
| Domestic TFP loss % | - | 5.73 | - |
| Exporter TFP loss % | - | 4.11 | - |
| Top 1% consumption share | - | 4.36 | - |

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