The Micro and Macro Dynamics of Capital Flows

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Abstract

We study empirically and theoretically the effects of international capital flows on resource allocation. Using the universe of firms in Hungary, we show that financial openness triggers input-cost and consumption channels, with the latter dominant and reallocating resources toward high expenditure elasticity activities in the short-run. A multi-sector heterogeneous firm trade model replicates these dynamics. In the long-run, the model predicts that resources will shift towards manufacturing exports to service debt. Owing to endogenous terms of trade dynamics, countries face a trade-off between the speed of convergence and their long-run capital stock; thus, financial openness can lead to welfare losses.

Keywords: firm dynamics, financial liberalization, reallocation, capital flows, welfare, non-homothetic preferences.

JEL classification: F15, F41, F43, F63.

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1 Introduction

Over the past half-century, capital flows across countries have increased substantially, and thereby shaped the evolution of many economies. In recent years, there has been a recognition among scholars and policy makers that understanding the effects of capital inflows requires a deep empirical and theoretical assessment of their micro and macro dynamics. Empirical research has thus focused on their short-term impact on the reallocation of resources within manufacturing firms but, so far, there is no evidence of their impact on the entire population of firms –including services, which constitute the vast majority of firms, inputs, and output in modern economies. From a theory perspective, little is known about the long-term effects of capital inflows on the structure of the economy and, through it, their welfare implications. This paper brings together firm-level census data around a capital account liberalization and a calibrated heterogeneous firm-dynamics model to assess the short-term and long-term implications of capital flows.

This paper makes two contributions to our understanding of the dynamics of capital inflows. Our first contribution is empirical. We employ comprehensive data covering the population of Hungarian firms across all economic sectors and a policy reform deregulating international financial flows to document two channels prevalent in the short-term. There is an input-cost channel, as capital inflows reduce the relative price of capital and favor capital-intensive firms. There is also a consumption channel, as inflows increase current consumption and expand the demand of firms producing goods with high expenditure elasticities. Our empirical analysis shows that the consumption channel dominates in the short term and resources reallocate towards high expenditure elasticities activities, which are mainly in services. Our second contribution is theoretical. We develop and calibrate a multi-sector, heterogeneous firm, trade, dynamic open economy model, and use it to study the short-run and long-run effects of an unexpected financial liberalization. Our model's implications are consistent with the short-term patterns observed in the data; in addition, our model yields novel long-term dynamics. Foreign debt repayment requires increased exports, which shifts resources towards the manufacturing sector and undoes the reallocation towards services dominant in the short term. In turn, higher exports decreases terms of trade and the long-term level of capital. This lower capital stock entails welfare loses that can dominate the welfare gains arising from the faster speed of convergence to the steady state of the neoclassical model. Notably, our model shows that there is room for welfare-improving capital controls, as countries face a trade-off between speed of convergence and long-run capital stock.

Our empirical investigation is centered around the capital account liberalization in Hungary in 2001 for three main reasons. First, while many countries perform financial and trade reforms jointly, Hungary presents an unusual *quasi* natural experiment of a deregulation of capital controls that liberalized only financial flows. Second, our firm-level data (APEH) is unique as it provides information on balance sheets for the universe of firms in all economic activities for more than fifteen years (1992-2008). Finally, this extensive dataset allows us to dissect movements in the extensive margin, as it reports firms' creation and destruction. We can then study –for the first time– the impact of capital inflows by building from firm individual data to aggregate outcomes.

We start by documenting that the financial liberalization in Hungary led to large capital inflows and to a reduction in the domestic interest rate. Five years after the reform, the net capital flows had increased by four-times and the net international investment position had dropped 25 percentage points of GDP. These flows translated into a decrease in the lending interest rate by 3 percentage points and a three-fold increase in the wage-to-interest rate ratio. Capital inflows were also associated with increased demand, as consumption expenditure over GDP rose by 3 percentage points.

To motivate our empirical strategy, we develop a simple version of our quantitative model and show how the relative input-cost and consumption channels affect firms' outcomes through two structural parameters of the model, i.e. the capital and expenditure elasticities. The model's structural relationships allow us to construct a difference-in-difference estimator and exploit three sources of variation to identify the impact of capital inflows: reform (time), and heterogeneity in capital and expenditure elasticities across industries (cross section).

Our empirical results provide evidence for the relative input-cost channel, as firms in sectors with a higher capital elasticity increased their value-added and capital by more. Additionally, our results also point to the presence of a consumption channel, as firms in higher expenditure elasticity industries increase their value added by more. The estimated coefficients imply that moving from the 25th percentile (p25) to the 75th percentile (p75) of capital elasticity – such as from retail trade to machinery and equipment – leads to an increase in value added by 3.5%, and capital by 5%. Similarly, moving from the p25 to the p75 expenditure elasticity – such as moving from wholesale to other business activities– raises value added by 4%. Standardized beta coefficients indicate that the expansion in expenditure elasticity activities is larger, suggesting that at the firm level the consumption channel is stronger than the input-cost channel.

The granularity of the data allows us to study the reallocation of resources within sectors. We show that there is an expansion of the extensive margin in high expenditure elasticity industries, which is driven by a rise of entrants. This expansion is statistically and economically significant. Going from the p25 to the p75 of the expenditure elasticity leads to a 20% higher net entry and a 15% higher entry. This implies that an industry with an expenditure elasticity of 1.8 –as restaurants and bars– has on average more than 1,500 new firms created per year, which is 1,200 more firms than an industry with low expenditure elasticity (such as agriculture). Importantly, after the reform, entrants are less productive and smaller-domestic firms with –on average– three employees. Industries with high capital elasticity experience the opposite image with less entry and entrants being more productive.

We then build from the micro data to analyze the aggregate implications of input-cost and consumption channels. In line with our finding that firms in high expenditure elasticity sectors expand by more and the increase in the extensive margin in these sectors, our data indicates that the consumption channel dominates in the short term and leads to reallocation of resources towards industries with high expenditure elasticity. On the aggregate, we observe that the share of value added, employment and number of firms in high expenditure elasticities increases after the financial liberalization. Being activities with high expenditure elasticity chiefly in the service sector, we additionally document a short term reallocation of resources towards services.

The empirical identification of the effect of the financial liberalization is based on the heterogeneous capital and expenditure elasticities across industries. To test that the observed effects correspond to the liberalization and not something else, we conduct a full set of robustness tests. First, we estimate a dynamic difference-in-difference and show that, while firms in sectors with different capital and expenditure elasticities shared similar growth trends prior to the reform, they grow differentially after it. Second, we show that the expansion in high expenditure elasticity activities is not driven by an ease of financial constraints, as results are robust to excluding firms with credit and to controlling for different measures of dependence on external finance.[1] Third, results are robust to controlling for export status, foreign ownership and using different methods to estimate the capital and the expenditure elasticities. Fourth, the general context around the liberalization minimizes reverse causality concerns, as it was part of a general program of fourteen transition economies to join the European Union (EU). Importantly, by 2001, the deregulation of capital controls in Hungary was the only missing requirement to join the EU, and trade and foreign direct investment (FDI) flows remained constant around the reform.

We then build a dynamic, heterogeneous firms, small open economy model to rationalize our short-term empirical findings and assess the long-term micro and macro dynamics of capital inflows and their welfare implications. In our model, there are two sectors: manufacturing and services that differ in two key features. They differ in the capital elasticity of their production technology and their expenditure elasticities of demand. Another standard difference is that only manufactured goods can be traded (exported and imported). Imports of manufactured goods are used for consumption and investment. Within each sector, there is a continuum of monopolistically competitive firms with heterogeneous productivity à la Melitz. The economy faces an exogenously given world real interest rate and capital controls, in the form of a tax on each unit of foreign borrowing, that potentially limit capital flows. Our model economy is in transition to its long-run steady state.

We calibrate the model primarily to match annual micro and macroeconomic data from Hungary. In particular, the model matches the differential capital and expenditure elasticities between manufacturing and service sectors at the core of the input-cost and consumption channels. Initially, the level of capital controls is sufficiently high that the real return to capital is lower than the domestic real interest rate; thus, trade is balanced and the economy is in financial autarky. When this economy is at 55% of its steady-state capital stock, we introduce a financial liberalization that eliminates the tax on foreign debt. We then investigate how the unexpected decrease in capital controls affects the within sector and cross sector allocation of resources, as well as the evolution of the macroeconomic variables. We show that the financial liberalization triggers endogenous trade and current account dynamics that affect the country's external debt position during the transition and the long-run steady state.

The liberalization produces rich short-term adjustments that match key features of the Hungarian experience. In particular, the domestic interest rate drops on impact and capital inflows occur. Financial openness breaks the trade-off between investment and consumption, and both expand simultaneously. These dynamics lead to reallocation of resources across and within sectors. Across sectors, the lower cost of capital triggers the relative input-cost channel, which leads to higher investment and manufacturing activity. Higher capital accumulation and borrowing for consumption smoothing increase aggregate consumption, which – through non-homothetic preferences – tilts sectoral consumption towards services. Whether production reallocates resources towards manufacturing or services depends on the strength of the relative input-cost and consumption channels. In the short run, the consumption channel dominates and production reallocates towards services. There is also extensive within sector reallocation upon the

[1] These results are in line with Cingano and Hassan (2020), who using detailed bank-firm level data show that increased capital inflows do not lead banks to expand their credit supply to service firms.

liberalization. The relative increase in the demand for services leads to a decrease in the productivity cut-off to operate, encouraging entry. Within the manufacturing sector, the lower relative demand and a real exchange appreciation raise the operational cut-off of domestic and exporting firms.

We then go beyond the time horizon of our empirical analysis, and leverage the calibrated model to investigate the financial liberalization's long-run implications. The long-run implications are closely tied to the short-term capital inflows, because the inflows lead to external debt and repayment obligations. The external debt associated with a negative long-run net foreign asset position implies that the economy must run a permanent trade surplus. At the sectoral level, this requires resources and production shifting from non-traded services towards tradable manufacturing and, particularly, towards exporting firms. The external debt implies lower domestic consumption and induces a real exchange depreciation, which –in turn– reduces the productivity cut-off for exporting and promotes exports.

The financial liberalization thus leads to long-term reallocation of recourses, which depends on the timing of the liberalization. An economy that liberalizes earlier in its transition path is more capital scarce; hence, it experiences larger inflows at the onset of the liberalization. These larger inflows imply a higher long-run debt and debt repayment and, thus, a larger long-run trade surplus, compared to an economy that liberalizes later in its transition path. Hence, an economy with large capital inflows at the time of liberalization has a steady-state more tilted towards manufacturing production and exports.

Importantly, in our model the level of capital stock in the long term is endogenously determined and depends on how the financial liberalization affects the price of the exportable goods and, hence, the country's terms of trade. In particular, the higher exports required to repay the external debt, lower the export goods' prices, which, in equilibrium, leads to lower prices of the non-exported manufacturing and service goods. These lower sectoral prices decrease the return on capital (or, equivalently, raises the required marginal product of capital), which lowers long-run investment and the long-run capital stock. Put differently, the lower long-term level of capital stock arises from a pecuniary externality, because the representative household does not internalize the effect that higher exports will have on long-run export prices and, thus, the long-run terms of trade. To illustrate this mechanism clearly, we develop a one-sector representative firm version of our model with endogenous pricing of exports (Appendix D). We show analytically that, when the price elasticity of the export demand is relatively elastic, a lower level of capital at the onset of the liberalization implies a higher long-term level of external debt, which, in turn, is associated with lower long-term export prices and, through them, a lower capital stock in the long-run.

Our calibrated model generates a trade-off between the speed of convergence and long-run capital that has welfare implications. Economies that liberalize earlier in their transition path reach their open economy steady state more quickly, but they have lower terms of trade and capital stock in the long-term. Hence, faster speed of convergence generates welfare gains as in the standard neoclassical model (Gourinchas and Jeanne 2006), but lower long-term capital stock induces welfare losses. Our model features a consumption equivalent welfare loss. To decompose the welfare effects arising from the endogenous terms of trade and from firm heterogeneity, we calibrate two other models: a representative firm model with exogenous export pricing and a representative firm model with endogenous terms of trade, and compare them with our model. The model with exogenous pricing of the tradable good is similar to Gourinchas and Jeanne (2006) and also yields welfare gains from a financial liberalization.

However, the model with endogenous terms of trade has welfare losses, as in our model. This result is consistent with the main theme from much of the research on the welfare consequences of trade policies and capital controls that what matters is the terms of trade. Interestingly, this model has a larger welfare loss than our model. In particular, in our heterogeneous-firm model, lower long-term consumption triggers selection and reduces the number of firms in the long term. Less varieties implies a higher price level (through a love for variety effect) and, hence, a higher long-term capital stock. Hence, through selection, firm heterogeneity reduces the welfare losses generated by the endogenous terms of trade.

The trade-off between the timing of liberalization, on the one hand, and the long-run capital stock and welfare, on the other hand, opens the door to welfare-improving capital controls. We consider a simple parametric, but flexible, class of liberalizations. Within this class, we find that a protracted financial liberalization could have generated welfare gains, rather than the welfare losses from our baseline model.

Related Literature. Our paper relates to the theoretical and empirical literature on the effects of international financial integration. On the theoretical side, a key focus has been the welfare effects of financial integration. Our paper is close to Gourinchas and Jeanne (2006), which assesses an open economy version of the neoclassical growth model and found modest gains from international financial integration. Hoxha, Kalemli-Ozcan, and Vollrath (2013) extend this analysis by including imperfect substitutability between domestic and foreign capital goods and estimate larger welfare gains. In recent work, Coeurdacier, Rey, and Winant (2020) revisit the neoclassical framework in a two-country model with aggregate uncertainty and show that, once risk sharing is included in the analysis, the welfare gains from financial integration are quantitatively small. Our paper contributes to these studies by showing that international financial integration can instead generate welfare losses, which arise from lower long-term capital stock and decreases in terms of trade. Our paper relates to Heathcote and Perri (2016), who show that capital controls can improve terms of trade and generate positive welfare effects in a two-country setting with incomplete markets.[2] Our model shows that, even in a small open economy with complete markets, international financial integration can lead to welfare losses. Our model highlights the positive role of firm heterogeneity and selection at reducing these losses and shows that a protracted liberalization can turned welfare losses into welfare gains.

On the empirical side, our paper also relates to the cross-country studies documenting that expansions owing to capital inflows lead to resources shifting away from tradable activities towards services in the short term (see, for example, Tornell and Westermann 2005; Reis 2013; Benigno, Converse, and Fornaro 2015). Our paper contributes to this literature by using – for the first time – firm-level data on the universe of firms (including services) and a policy reform to dissect the forces triggered by capital inflows and identify at the firm level a channel reallocating resources towards services. There is a recent literature assessing the impact of capital flows on misallocation within the manufacturing sector (Gopinath, Kalemli-Ozcan, Karabarbounis, and Villegas-Sanchez 2017 and Varela 2018). Our paper extends this research by focusing on services firms, in addition to manufacturing firms, and provide new evidence on the extensive margin of firms. Our paper also establishes the importance of two

[2]There are also theoretical papers on the effects of capital controls and trade policy on welfare in a dynamic setting, including Edwards (1989), Costinot, Lorenzoni, and Werning (2014), and Fanelli and Straub (2021).

transmission channels, the input-cost and consumption channels and presents novel evidence for them. Our quasi-natural experiment allows us to show empirically that, following an increase in aggregate consumption, differences in sectoral expenditure elasticities lead to a shift in spending and resources towards high expenditure elasticity activities and, in particular, services. This holds true even after controlling for firms' access to external finance.

Our paper relates to Acemoglu and Guerrieri (2008), which investigates capital accumulation and sectoral reallocation in a framework with different capital elasticities across sectors. We extend their analysis by introducing non-homothetic preferences –as in Herrendorf, Rogerson, and Valentinyi (2013); Boppart (2014) and Comin, Lashkari, and Mestieri (2021) – in a small open economy model and evaluating the input cost and consumption channels together in a unified framework. Our consumption channel suggests the importance of non-homotheticities in preferences, which we build into our multi-sector model. Hence, our paper relates to the literature showing that differences in expenditure elasticities across sectors can lead, in response to a trade liberalization, for example, those with higher incomes to shift their consumption basket toward services, which – in turn – affects the income distribution further, reallocation across sectors, aggregate outcomes, and the long-term path of economies (Cravino and Levchenko 2017; Cravino and Sotelo 2019; Borusyak and Jaravel 2018; Fieler 2011; Hubmer 2018, among others). Our paper contributes to this literature by assessing the impact of non-homotheticities in a dynamic open economy model with heterogenous firms, and by studying how they affect the reallocation within and across sectors at the short and long horizons.[3]

The paper is organized as follows. Section 2 reviews the financial liberalization in Hungary, and Section 3 overviews the data we use. Section 4 presents our identification strategy and empirical results. Section 5 lays out our model and Section 6 presents our quantitative analysis. Section 7 concludes.

2 Financial Liberalization in Hungary

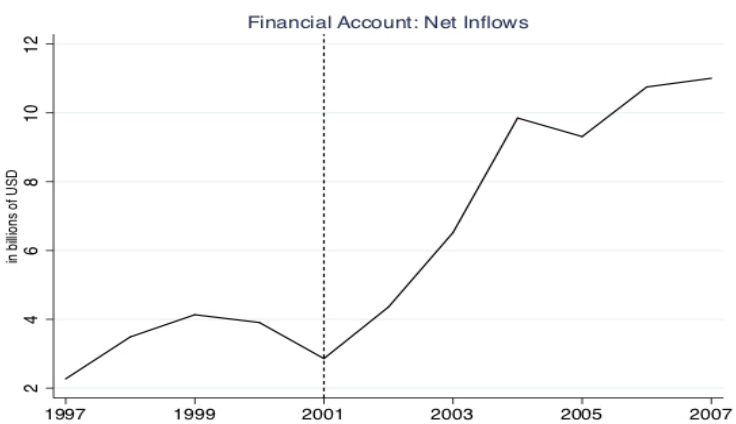
To analyze the effect of capital inflows on the reallocation of resources, we exploit the deregulation of international borrowing in Hungary in 2001. This section presents briefly the capital controls that were in place in Hungary prior to 2001, and describes the deregulation and its aggregate implications.

Capital controls were implemented by the Act XCV of 1995, which employed two main tools to limit international financial flows. The first tool restricted banks' international financial flows by banning all foreign currency instruments -chiefly among them foreign currency swaps and forward contracts. These instruments allow hedging the currency risk and, thus, are critical for banks to raise foreign funds. The second tool required banks' exchange rate spot transactions to be pre-approved by the Central Bank, which made the spot exchange rate market illiquid. As discussed in Varela (2018), these restrictions substantially limited banks' ability to intermediate foreign funds and made them reluctant to borrow internationally. As a result, banks based their credit supply on domestic savings, which led to a low level of credit. In 2000, Hungary's credit-to-GDP ratio (0.27) was three times smaller than the OECD

[3]Our paper also relates to Aghion, Zilibotti, Peters, and Burgess (2019) who use micro data on expenditure shares on India to show that increases in income per capita associates with higher in the employment share in consumer services.

average (0.86).[4]

In 2001, the Act XCIII removed these regulations and allowed banks for intermediate international financial flows freely.[5] The reform had a large impact on capital inflows as shown in Figure 1. In the years after the liberalization (2001-2008), net financial inflows increased by more than three-fold compared to the pre-liberalization period (1995-2000) and rose from 2.5 to 8.2 billions of USD per year. The net foreign asset position of Hungary deteriorated and dropped by 25 percentage points of GDP between 1995-2000 and 2001-2008 (Figure C.2 in Appendix C). Banks started to raise foreign funds and to use intensively financial derivatives. Both cross-border and local derivatives soared and, by 2007, banks' stock of external debt had increased by nine-fold, from 5 billions U.S. dollars to 45 billions U.S. dollars (Figure C.1). These inflows translated into an expansion of the local credit supply and a decrease in the domestic lending rate. The credit-to-GDP ratio doubled (from 25 to 49%) and the domestic lending rate drop from 22% to 10% between 1995-2000 and 2001-2008. While there was already a deceasing trend in the domestic rate in Hungary since the nineties, after controlling from this pre-trend, the lending interest rate dropped by 3 percentage points in the years following the reform (see Section 6.1). Capital inflows associated an increased in consumption, shown by the raise of consumption expenditure over GDP by 3 percentage points within the five years before and after the reform.[6]



	Before 1995-2000	After 2001-2008
	(1)	(2)
Financial account (net)*	2.5	8.2
NFA/GDP	-62	-87
Credit-to-GDP ratio	25	49
Lending interest rate	22	10
Consumption/GDP	74	77

Note: in %. *In billions of USD dollars. Year averages.
Source: NBH, IMF, Lane and Milesi-Ferretti (2018).

Figure 1: Hungary: Net Capital Inflows

3 Data

To analyze the impact of financial liberalization at the micro level, we employ firm-level census data for the period 1992-2008 for Hungary. The dataset – APEH (Nemzeti Adó és Vámhivatal 2011)– contains panel data on balance sheets reported to the National Tax and Customs Authority, for all firms subject to

[4]There were additional regulations that prevented domestically-owned firms from borrowing from abroad, by banning them from holding bank accounts in foreign currency (see Varela 2018 for more details).

[5]This reform was triggered by the accession to the European Union. To join the EU, all candidate countries have to accomplish the Copenhagen Criteria of 1993. One of these criteria is that candidates have to ensure free movement of capital, the only missing requirement in Hungary. The reform completed the deregulation of international financial flows. Importantly, this reform was not associated with an increase in trade (export nor imports) with the EU not with an increase in foreign direct investment, as shown in Figures C.3, C.4 and C.5 and discussed in Section 4.1.

[6]Table C.1 in Appendix C confirms these patterns by splitting the before and after into different these time horizons.

capital taxation in agriculture, manufacture and services activities. It reports information on firms' value added, sales, output, capital, employment, wages, materials and exports that we employ to construct measures of labor productivity (value added per worker), capital intensity (capital per worker), export shares (export over sales). To obtain real values, we use price indexes at four-digit NACE industries for materials, investment, value added and production. When we control for access to credit, we use the credit registry data, which reports information on all corporate loans with financial institutions in Hungary from 2005 (KHR- Credit Registry data, Magyar Nemzeti Bank 2011).

Our database covers the population of Hungarian firms between 1992 and 2008. We exclude firms in education, health and public administration activities, as in Hungary these are mostly public activities. Because small firms are subject to measurement error problems, we keep in our main regressions firms that have three or more employees. To analyze the extensive margin, we consider all firms (including those with less than three employees). Our analysis covers approximately all employment in manufacturing and service activities – 95% and 93% respectively – and more than 98% and 85% of their value added compared to EU-KLEMS data (van Ark and Jäger 2017).[7] To better isolate the impact of the reform, we restrict the analysis to the period 1995-2008.

To identify the input cost and consumption channels, we need to obtain capital and expenditure elasticities. We estimate the capital elasticity at four-digit NACE industries using the Petrin and Levinsohn (2012) and Wooldridge (2009) method to obtain the elasticities of the production function. We compute them for the pre-liberalization period (1992-2000) to avoid endogeneity concerns. For robustness, we estimate the capital elasticity with the Olley and Pakes (1996) methodology and re-estimate our results using these elasticities. We employ the capital and labor elasticities to compute revenue total factor productivity (RTFP). We employ the expenditure elasticities produced by Bils, Klenow, and Malin (2013) who estimate product-level elasticities from the U.S. Consumer Expenditure Survey for 70 categories between 1982-2010. Importantly, Bils, Klenow, and Malin (2013) map the expenditure elasticities estimated for consumers to producers using input-output tables and EU-KLEMS data. We employ this map to assign to each two-digit sector an expenditure elasticity. Table C.2 in Appendix C reports these elasticities. For robustness, we use the expenditure elasticities estimated by Comin, Lashkari, and Mestieri (2021), who use data for 39 developed and developing economies since 1947 to estimate these elasticities for ten sectors (Table C.3 in Appendix C).

Table C.4 in Appendix C presents the summary statistics of the capital and expenditure elasticities. The mean capital and expenditure elasticities are 0.22 and 1.01, which correspond to printing activities and water transport, respectively. The sector with the highest capital elasticity is manufacture of general purpose machine (0.43) and with the lowest is farming of animals (0.05). The sector with the highest expenditure elasticity is real estate with an elasticity of 2.02, and the lowest is food, beverage and tobacco with an elasticity of 0.4. Importantly, although capital and expenditure elasticities are negatively correlated, this correlation is small and only reaches 2.5% (see Figure C.8 in Appendix C). This small correlation indicates that these elasticities are not collinear and there is enough variation among them to

[7] Although the database accounts for almost all employment in the agricultural sector (98%), its share of agricultural value added reaches 54%. This smaller representativeness on agricultural value added does not significantly affect our results as the these activities accounted only for 5% of GDP according to EU KLEMS data. Note that mis-reporting is not uncommon in agricultural activities, see for example Herrendorf and Schoellman (2015).

identify separately the input-cost and consumption channels. To visualize how capital and expenditure elasticities vary across broadly-defined sectors – agriculture, manufacturing and services–, we plot in Figure C.9 in Appendix C these elasticities by sectors. The blue circles show that agriculture activities have the lowest expenditure elasticities, and service activities the highest. Sectors with high capital elasticity tend to be in manufacturing, but there are spread out across the three sectors.

Firms' size varies according with sectors' capital and expenditure elasticities. As we show in Table C.5 in Appendix C, firms in sectors with higher capital elasticity were –on average– larger (value added, capital, employment), older and more productive prior to the reform (1995-2000). Inversely, firms in sectors with higher expenditure elasticity tend to be smaller, younger and less productive.[8]

4 Empirics

4.1 Identification Strategy

To illustrate our empirical analysis, we start by sketching key features of our model. We then present our identification strategy for our firm-level analysis and discuss possible concerns, such as the parallel trend assumption, sample selection and reverse causality.

-Sketch of a Model

We identify the consumption and relative input-cost channels during capital inflows through the lens of a heterogeneous firm-dynamics model with multiple sectors where the consumer has non-homothetic preferences. We present the full model in Section 5 but, to illustrate our empirical analysis, we describe below the main relationships that drive our identification strategy. Think of a small economy that produces a final good – C – which is composed by multiple sectors j that differ in e_j, the parameter that determines the expenditure elasticity.[9] The representative household maximizes its inter-temporal utility and has non-homothetic preferences à la Comin, Lashkari, and Mestieri (2021), with the following functional form $1 = \left[\sum_j \theta_j^{\frac{1}{\eta}} C_t^{\frac{e_j-\eta}{\eta}} C_{j,t}^{\frac{\eta-1}{\eta}}\right]$, where η is the elasticity of substitution between sectors and θ_j is constant weight parameter. Within each sector j, there are monopolistically competitive firms that produce an infinite number of differentiated varieties with an elasticity of substitution across varieties σ. These intermediate firms are heterogeneous in productivity à la Melitz (2003) and produce using a Cobb-Douglas technology based on capital and labor, $q_{(\varphi)t} = \varphi\, k_t^{\alpha_j} l_t^{\beta_j}$, where φ is a firm's productivity and the elasticities of capital and labor – α_j and β_j – are heterogenous across sectors. As in Melitz (2003), firms' optimal price is a constant markup over their marginal costs, e.g. $\frac{\phi_{j,t}}{\varphi\rho}$, where $\phi_{j,t} \equiv \left(\frac{r_t^k}{\alpha_j}\right)^{\alpha_j}\left(\frac{w_t}{\beta_j}\right)^{\beta_j}$ is the input-cost bundle and $1/\rho$ is the markup. In equilibrium, the optimal production of each firm –

[8] Table C.6 in Appendix C presents descriptive statistics for agriculture, manufacturing and services, and shows that these difference in firms' size is present across these broadly defined sectors. Additionally, Table C.7 shows that the difference in means is statistically significant among them.

[9] The expenditure elasticity of sector j is given by $\eta + (1-\eta)\frac{e_j-\eta}{\bar{e}-\eta}$. $\bar{e}$ is weighted average of e_j, where the weight is the expenditure share of sector j. For expositional simplicity, sometimes we loose call e_j the expenditure elasticity of sector j.

$q_{jt}(\varphi)$ – is given by

$$q_{jt}(\varphi) = \left[\left(\frac{\phi_j}{\varphi \rho} \right)^{-\sigma} \theta_j C_t^{e_j} P_{j,t}^{\sigma-\eta} P_t^{\eta} \right]. \quad (1)$$

Replacing the sectoral price level P_{jt} and applying logs, we can write a firm's optimal production as[10]

$$\log(q_{jt}(\varphi)) = -\alpha_j \eta \log(r_t^k/w_t) + e_j \log(C_t) + (\sigma - \eta)\tilde{\varphi}_{jt} - (\alpha_j + \beta_j)\eta \log(w_t) + \eta \log(P_t) + D_{\varphi j}, \quad (2)$$

where $\tilde{\varphi}_{jt} \equiv \frac{1}{\sigma-1} \log \left[\int_{\varphi^*_{jt}} \varphi^{\sigma-1} \mu(\varphi) d\varphi \right]$ reflects the weighted average of firms' productivity levels in each sector j, and $D_{\varphi j}$ is a constant term with sector and firm level parameters.

Equation (2) illustrates how the relative input-cost and consumption channels impact a firm's production. Intuitively, other things equal, a decrease in the relative price of capital (r^k and, thus, $\phi_{j,t}$) lowers the input-cost bundle and encourages production, especially in sectors with higher capital elasticity (higher α_j). Similarly, an increase in the final good consumption (C) promotes the production of firms in sectors with high expenditure elasticity (higher e_j). Formally, the partial effects are given by $\frac{\partial log(q_{jt}(\varphi))}{\partial log(r_t^k/w_t)} = -\alpha_j \eta < 0$ and $\frac{\partial log(q_{jt}(\varphi))}{\partial log(C_t)} = e_j > 0$. Hence, these two structural parameters of the model – α_j and e_j – allow us to identify the relative input-cost and consumption channels on firms' production. In the rest of the paper, we exploit differences in these two structural parameters to identify the impact of capital inflows across sectors.

-Identification Strategy

The identification strategy of the effect of the deregulation of capital flows in Hungary in 2001 is based on three sources of variation: the reform as a source of time variation and the differences in capital and expenditure elasticities across sectors as sources of cross-sectional variation. We evaluate the relative input-cost and consumption channels in three steps. First, we assess the relative input-cost channel by estimating the differential impact of the reform across sectors with different capital elasticity, and assess whether firms in more capital intensive sectors expand differentially upon the reform. Second, we study the consumption channel by exploiting variations in terms of sector's expenditure elasticity and testing whether firms grow differentially according to the implied expenditure elasticity in the sector. Third, we study both the capital and expenditure elasticities to assess whether the relative input cost or consumption channel dominates.

We estimate our main regressions in first differences, so that all constant firm and industry characteristics are differenced out. Following equation (2), we include the weighted average of firms' productivity levels at four-digit sectors to control for a sector time-variant trend. Alternatively, as a robustness, we control for the four-digit sector price index (instead of the weighted average sectoral productivity $\tilde{\varphi}_{jt}$). To show that our results are not an artifact of first differencing, we estimate panel regressions at the firm level and show that our results remain valid under this specification in which firm fixed effects are included.

A critical assumption of the empirical strategy is that firms across capital and expenditure elasticities

[10] Appendix B presents a full derivation of this equation. Note that the log of the sector price level is given by $\log(P_{jt}) = \frac{1}{1-\sigma} \log \left[\int_{\varphi^*_{jt}} p_{jt(\varphi)}^{1-\sigma} \mu(\varphi) d\varphi \right]$, which can be re-written as $\log(P_{jt}) = \log \phi_{jt} + \log\left(\frac{1}{\rho}\right) - \tilde{\varphi}_{jt}$.

shared similar growth trends before the reform. To assess the parallel trend assumption, we compute firms' yearly growth rates in the main variables analyzed –value added, capital and employment– during the pre-liberalization period (1995-2000) and regress them on the capital and expenditure elasticities. We include sector-fixed effects – defined at two-digit and one-digit levels for capital and expenditure elasticities, respectively – to control for sector-time invariant characteristics. Table C.9 in Appendix C shows that neither the capital or expenditure elasticity correlates with higher growth before the reform. As an additional test, in our empirical analysis, we estimate a dynamic difference-in-difference to capture the effect by year and show that, while firms were not growing differentially before the reform, after it they grow more according with their capital and expenditure elasticities (Figure C.10).

A critical hypothesis is that the sample is not subject to selection issues. If the survival probability differed across sectors over time, the estimated coefficients would only be assessed with respect to the surviving firms (see Heckman 1974 and Heckman 1979). To assess whether this missing data problem challenges our estimations, we check whether there are differences in the probability of firms being observed across sectors. In particular, we define a surviving firm if it existed the year before the reform (2000) and did not exit by 2008. Next, we compute the survival ratio and regress it on sectors' capital and expenditure elasticities. Results show no statistically significant difference between the survival probability of firms across sectors with different capital elasticities (Table C.10 in Appendix C). Interesting, in sectors with high expenditure elasticity, the survival probability decreases. This result is not surprising in light with our findings pointing to a differential increase in entry upon the liberalization (Section 4.3). It would not be surprising that entrants increase competitive pressure on existing firms and trigger some exit. Our results on expenditure elasticity should then be considered as an upper bound conditional on survival.

The reform was driven by the accession of transition economies to the EU. The requirements to join the EU were predetermined by the Copenhagen Criteria in 1993 and have been equal for all accessing countries since then. In this sense, the content of the reform was exogenous to the country's political choice. As the agenda was jointly determined by the European Council and the candidate countries, it is unlikely to have been driven by political pressure from Hungarian firms.[11] The economy was growing at a steady pace during the years prior to the liberalization. Notably, real external flows –as trade and foreign direct investment– remained constant.[12] Second, major reforms had already taken place during the early 1990s, such as privatization of public companies, bank deregulation, and competition laws.[13] Finally, the Hungarian economy was already deeply integrated with the EU: exports to the EU already accounted for 80% of total exports in 2001 (Figures C.3 and C.4). It is worth mentioning that

[11] It is worth mentioning that, given the speed of the reform, it is unlikely that firms anticipated it and undertook investment in advance. In December 2000, the European Council defined the timing for the accession vote and the last requirements to be met by each candidate. The reform had to take place before the accession vote in December 2002. Soon after the European Council meeting, in March 2001, Hungary deregulated the remaining controls on financial flows.

[12] During the years preceding and following the reform, FDI remained constant and even showed a small slowdown following the deregulation (see Figure C.5). Moreover, Hungarian external trade did not seem to have particularly suffered from the world recession in 2001. The volume of exports and imports continued to grow during that period (Figure C.6).

[13] Major privatization programs occurred in the early 1990s and, by 1997, the share of public companies in manufacturing value added was only 2%. The banking sector had already achieved a major transformation by 1997, and neither banking concentration nor its efficiency changed around the liberalization. In particular, according to data from Beck, Demirguc-Kunt, and Levine (2010), there were no changes in banks' concentration index, interest rate margin, overhead costs-to-assets ratio, nor cost-income ratio (Varela 2018). Furthermore, the number of credit institutions did not change (Table C.8).

the patterns of capital inflows observed in Hungary cannot be attributed to the joining of the EU, as the timing does not coincide with the accession, and other similar candidates with already deregulated financial accounts do not show the pattern of capital inflows observed in Hungary (Figure C.7). Notice that Hungary did not join the Euro zone and, hence, did not have to fulfill any monetary or fiscal criteria.

4.2 *Firm-Level Analysis: Relative Input-Cost and Consumption Channels*

In this section, we assess the relative input-cost and consumption channels implied in international financial integration. We use our theoretical framework to guide our empirical analysis and identify the effect of the financial liberalization through the structural parameters of the model. In particular, we test whether upon the financial liberalization in Hungary, firms expanded differentially according with their capital and expenditure elasticities.

Consider equation (2) that indicates a firm's optimal production. We can write this equation in a difference-in-difference estimator as follows

$$\log(q_{ijt}) = \gamma_0 \mathrm{FL}_t + \gamma_1(\alpha_j \times \mathrm{FL}_t) + \gamma_2(e_m \times \mathrm{FL}_t) + \gamma_3\tilde{\varphi}_{jt} + \gamma_4((\alpha_j + \beta_j) \times \mathrm{FL}_t) + \mu_i + \varepsilon_{it}, \qquad (3)$$

where i, j, t denote firm, four-digit industry and time. FL_t is a dummy variable equal to one for the post-reform period ($\mathrm{FL}_t = 1$ if year ≥ 2001, 0 otherwise). We denote the expenditure elasticity with the subscript m to highlight that this elasticity varies at two-digit industry level. μ_i are firm-fixed effects that absorb all firm and industry time-invariant characteristics.[14]

Each term of regression (3) has a direct mapping in equation (2). γ_0 captures time-varying trends that affect all sectors equally and absorbs the evolution of the aggregate price level $\eta \log(P_t)$. γ_1 captures the input-cost channel expressed in the term $\eta \log(r_t^k/w_t)$. γ_2 captures the effect of expenditure channel given by the evolution of aggregate consumption, $\log(C_t)$. γ_3 absorbs changes in the sectoral average productivity. γ_4 controls for the heterogeneous evolution according to the returns to scale of the sector, given by $\eta \log(w_t)$. The firm-fixed effects μ_i capture the constant parameters of the term $D_{\varphi j}$.

A potential concern about regression (3), estimated with yearly firm-level data, is that residuals could be serially correlated - across time within firms and across firms within sectors for a given year. Serial correlation in the error term might understate the OLS standard errors and induce a type II error, i.e. rejecting the null hypothesis when this is true. To account for this source of bias of the OLS standard errors, we use one of the solutions proposed by Bertrand, Duflo, and Mullainathan (2004) and remove the time series dimension of the data. More precisely, we aggregate the data into pre- and post-reform periods and compute growth rates as the average value of these periods. That is,

$$\Delta q_{ij} = \log\left(\frac{1}{8}\sum_{2001}^{2008} q_{ijt}\right) - \log\left(\frac{1}{6}\sum_{1995}^{2000} q_{ijt}\right).$$

Equation (3) in first differences becomes:

[14] The term $(\alpha_j + \beta_j)$ is multiplied by the financial liberalization dummy because it includes the effect of the instrument α_j. The term $\tilde{\varphi}_{jt}$ is not multiplied by this dummy because the instrument is not involved in the expression.

$$\Delta q_{ij} = \gamma_0 + \gamma_1 \alpha_j + \gamma_2 e_m + \gamma_3 \Delta \tilde{\varphi}_j + \gamma_4 (\alpha_j + \beta_j) + \Delta \varepsilon_i, \tag{4}$$

where γ_1 and γ_2 capture the effect of financial liberalization across sectors with different capital and expenditure elasticities, respectively. Given that the financial liberalization decreased the relative price of capital and increased consumption, we expect both to be positive, e.g. $\gamma_1, \gamma_2 > 0$. We cluster the OLS standard errors at the four-digit industry level to take into account the correlation across firms within sectors. Similarly, we express firms' capital and labor demands as a function of the structural parameters of the model, and obtain an equivalent expression to equation (4) (see Appendix B).

4.2.1 Empirical Results

The estimated coefficients of equation (3) are presented in Table 1. Panel A reports the results on the relative input cost channel, Panel B presents the results on the consumption channel and Panel C presents the results of both channels together.

Columns 1-3 in Panel A show the results on the cross-section of capital elasticities on firms' value added. Columns add the covariates sequentially: column 1 includes only the capital elasticity as a regressor, column 2 adds the change in the sectoral average productivity and column 3 controls the returns to scale of the sector. The estimated coefficients are positive and statistically significant in all specifications, and indicate that sectors with higher capital elasticity increase their value added relatively more after the financial liberalization. After the inclusion of all controls in column 3, the coefficient implies that one standard deviation increase in the capital elasticity (0.045) associates with 3% higher expansion in value added. This result implies that a sector in the p75 of capital elasticity – as machinery and equipment – has a 3.5% higher increase in value added than a sector in the p25 of capital elasticity – such as retail trade. Columns 4-6 reports the results on capital and show that all the estimated coefficients are positive and highly statistically significant. After including all controls, the coefficient in column 6 indicates that one standard deviation increase in the capital elasticity leads to 4.7% expansion in capital, and that a sector in the p75 of the capital elasticity has 5.4% higher growth than a sector in p25. Columns 7-9 shows that firms do not increase their employment in accordance with the capital elasticity of the sector.

Panel B reports the estimated coefficients for the consumption channel and shows that sectors with higher expenditure elasticity experience a differential expansion in their value added. After including all controls in column 3, the coefficient implies that a one standard deviation increase in the expenditure elasticity (0.42) raises firms' value added by 4.3%. This coefficient implies that, for example, a sector as other business activities (p75) experiences a 5.1% higher increase in value added than retail trade (p25). Firms in high expenditure elasticity elasticity sectors differentially increase their employment, as shown in columns 7-9. After including all controls, the coefficient implies that a one standard deviation increase in the expenditure elasticity raises firms' employment by 5.1%, and that firms in the p75 of the expenditure elasticity increase their employment 6.2% more than firms in the p25. Firms do not change their capital stock in accordance with the expenditure elasticity (columns 4-6).

Panel C presents the results of equation (4) where both capital and expenditure elasticities are included as regressors. Importantly, the estimated coefficients for both elasticities on value added are

Table 1: Relative Input Cost and Consumption Effects of Financial Liberalization

	Δ Value Added			Δ Capital			Δ Employment		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
					Panel A. Capital Elasticity				
Capital elasticity	0.728**	0.701**	0.656*	1.048***	1.026***	1.030***	0.492	0.429	0.410
	(0.351)	(0.343)	(0.342)	(0.340)	(0.343)	(0.331)	(0.349)	(0.347)	(0.322)
Average sectoral productivity		0.025	0.022		0.021	0.021		0.061***	0.059***
		(0.037)	(0.038)		(0.022)	(0.025)		(0.018)	(0.021)
Returns to scale			-0.122			0.011			-0.050
			(0.142)			(0.162)			(0.140)
R^2	0.001	0.001	0.001	0.001	0.002	0.002	0.001	0.003	0.003
					Panel B. Expenditure Elasticity				
Expenditure elasticity	0.094*	0.091*	0.102**	-0.086	-0.088	-0.088	0.117***	0.112***	0.123***
	(0.051)	(0.052)	(0.051)	(0.070)	(0.070)	(0.069)	(0.042)	(0.041)	(0.037)
Average sectoral productivity		0.034	0.026		0.028	0.028		0.060***	0.055***
		(0.036)	(0.039)		(0.019)	(0.022)		(0.014)	(0.017)
Returns to scale			-0.242			0.004			-0.153
			(0.148)			(0.152)			(0.121)
R^2	0.001	0.001	0.002	0.001	0.001	0.001	0.003	0.005	0.005
					Panel C. Capital and Expenditure Elasticities				
Capital elasticity	0.752**	0.725**	0.687*	1.033***	1.008***	1.030***	0.516	0.456	0.408
	(0.361)	(0.354)	(0.353)	(0.364)	(0.369)	(0.354)	(0.317)	(0.315)	(0.295)
Expenditure elasticity	0.079*	0.077*	0.079*	-0.083	-0.085	-0.088	0.119***	0.114***	0.123***
	(0.044)	(0.045)	(0.042)	(0.064)	(0.064)	(0.061)	(0.040)	(0.038)	(0.035)
Average sectoral productivity		0.025	-0.008		0.023	0.024		0.058***	0.054***
		(0.034)	(0.020)		(0.019)	(0.023)		(0.015)	(0.018)
Returns to scale			-0.185			0.058			-0.130
			(0.141)			(0.151)			(0.112)
R^2	0.002	0.002	0.002	0.002	0.002	0.002	0.004	0.006	0.006
N	56,525	56,525	56,525	53,987	53,987	53,987	54,251	54,251	54,251

Notes: *, **, *** significant at 10, 5, and 1 percent. Std. errors are clustered at four-digit NACE industries. The capital elasticity is estimated using the Petrin and Levinsohn (2012) and Wooldridge (2009) methods used at four-digit NACE industries, and the expenditure elasticity comes from Bils, Klenow, and Malin (2013), reported at two-digit NACE industries. Source: APEH.

statistically significant and similar in size to the regressions estimated separately in Panels A and B. This suggests that, following the financial liberalization, firms increase their value added in accordance with their capital and expenditure elasticities. In particular, after including all controls in column 3, the estimated coefficient implies that firms' value added expands by 3.1% and 3.3% following a one standard deviation increase in the capital and expenditure elasticities, respectively. As above, the coefficients in column 6 and 9 indicates that firms increase their capital according with their capital elasticity and their employment with their expenditure elasticity.

The estimated coefficients in Table 1 suggest that the expansion in firms' value added is larger in sectors with high expenditure elasticity than in sectors with high capital elasticity. To assess this comparison econometrically, we estimate the standardized beta coefficients of columns 3, 6 and 9 of Panel C and report them in Table C.11 in Appendix C. This analysis confirms that firms expanded 0.2% more in accordance with their expenditure elasticity than with their capital elasticity. As we discuss over the next sections, this result provides support to our aggregate analysis that indicates that the consumption channel dominates and resources reallocate relatively more towards sectors with high expenditure elasticity.

4.2.2 Robustness Tests

We next conduct two set of exercises to evaluate the validity of our results. In a first set of exercises, we study whether our results could be affected by a relaxation of financial frictions upon the financial liberalization. In a second set of exercises, we conduct a full set of robustness tests that include estimating panel regressions and the effect of the liberalization by year, controlling for exporters and foreign firms, and using different methodologies to estimate the capital and expenditure elasticities.

-Financial frictions. Research has linked capital inflows to a relaxation of financial frictions (Reis 2013 and Gopinath, Kalemli-Ozcan, Karabarbounis, and Villegas-Sanchez 2017). If the ease of financial frictions was correlated with the capital or expenditure elasticities, it could create omitted variable bias and challenge our results.[15] In particular, the estimated coefficients could be confounding the relative input-cost and consumption channels with a relaxation of the financial constraints after the financial liberalization. To assess this possibility, we conduct exercises based on different measures of industry dependence on external finance, and on firms' debt obligations around the time of the reform.

(i) Industry measures. Previous studies have shown that industries differ in characteristics that could imply heterogeneous needs for external finance and, hence, exposure to financial frictions. To measure them, studies created proxies that capture needs for external finance arising from heterogeneous requirement for investment or liquidity across sectors. Focusing on investment needs, Rajan and Zingales (1998) create an index on dependence on external finance that measures the amount of investment that cannot be financed through internal cash flows. Centering on liquidity needs, Raddatz (2006) builds two alternative proxies to measure dependence on external finance: inventories to sales – that captures the fraction of inventory investment that can be financed with sales – and cash conversion cycle – that estimates the length in days between the moment a firm pays for its raw materials and the moment it obtain the receivables from its sales. To assess whether our results could be capturing the effect of a relaxation of financial frictions instead of the input-cost and consumption channels, we employ these three measures as proxies for sectors' *technological* needs for external finance.[16] More

[15]It is important to remark that any variable not correlated with the capital or expenditure elasticities would not bias the estimated coefficients. Econometrically, for the coefficient to be biased, the covariance between the omitted variable and the corresponding elasticity needs to be different than zero.

[16]We follow the literature and estimate these three indexes at four-digit NACE industries for the U.S. using Compustat data. As in the literature, we use the U.S. as a benchmark because capital markets are largely advanced in the U.S. and listed firms are less likely to be credit constrained and, hence, these indexes could be considered to capture the *technical* needs for external finance in a sector. Furthermore, using indexes estimated for U.S. firms avoids endogeneity concerns that could arise from financial frictions in Hungary. The Rajan and Zingales (1998) index is constructed as the median ratio of capital expenditure minus sales over capital expenditure in each four-digit NACE industry. The inventories to sales ratio is the median ratio of total inventories to annual sales in each industry. The cash conversion cycle is defined as the median inventories *365/cost of goods sold + account receivables *365/ total sales- account payables *365/cost goods sold, in each industry. Note that, for the three measures, the higher the index, the higher the industry's reliance on external finance. The correlation of the Rajan and Zingales (1998) index and the capital elasticity is positive but small reaching 8%, and it is -5.7% with the expenditure elasticity. The correlation of the inventories to sales is 7.9% and -49% with the capital and expenditure elasticities, respectively. The correlation of the cash conversion cycle is 11% and -13%

precisely, we re-estimate equation (4) and add these three measures as controls. If the expansion observed after the liberalization was driven by a relaxation of credit constraints instead of the input-cost and consumption channels, the coefficients for the capital and expenditure elasticities would be smaller and could potentially become insignificant. We report the results of these exercises in Table C.12 in Appendix C. Columns 1-3 present the results for value added, capital and employment where the Rajan and Zingales (1998) index is included as a control. The estimated coefficient of this index for value added is positive and statistically significant, but it does not offset the relative input-cost and consumption channels (column 1). The coefficients for both capital and expenditure elasticities remain statistically significant and similar in size than in our main specification. The results on employment and capital remain unchanged when we control for the Rajan and Zingales (1998) (columns 2 and 3). Columns 4-6 report the results for the inventories to sales index and columns 7-9 for the cash conversion cycle. As shown in these columns, both indexes reflecting liquidity needs are not statistically significant, but – most importantly – they do not affect the size or significance of the capital and expenditure elasticities.

These results show that the standard measures used in the literature to control for industry dependence on external finance do not affect our estimates for the capital and expenditure elasticities. Yet it could be argued that these measures might not be reflecting all the extend of financial frictions and could be omitting some firm/sector characteristics that imply heterogeneous access to external finance across sectors. For example, smaller firms might not require large amount of investment or might have a short cash conversion cycle, but they could still be subject to other type of financial constraints, as for example earning-based collateral constraints.[17] If smaller firms were distributed in sectors that correlated with our elasticities, our estimated coefficients could be biased. Section 3 has shown that firms in high expenditure elasticity sectors are indeed smaller and, thus, could be more affected by this type of financial frictions. Hence, other type of unobserved financial frictions could be affecting the identification of the consumption channel. To assess that the observed effect on sectors with high expenditure elasticity corresponds to the consumption channel and is not driven by an ease of financial frictions to smaller firms, we then conduct another set of exercises based on firms' debt.

(ii) Firms' debt obligations. To test that our estimates on the expenditure elasticity are capturing the consumption channel and not other type of financial frictions, we conduct a full set of additional exercises. In these exercises, we employ credit registry and balance sheet data to remove from our sample firms that have any type of obligations with financial institutions in Hungary, trade credit or debt with owners at any point in time over the period 1995-2008. In this way, our estimates for the expenditure elasticity are based on firms that do not ever report any type of credit and, hence, cannot be attributed to an ease of financial frictions after the financial liberalization. We conduct seven empirical exercises that we report in Table C.13 in Appendix C.

In our first exercise, we employ credit registry data that provides information on each loan agreement (on a monthly basis) with financial institutions in Hungary since 2005.[18] We use this data to remove

with the capital and expenditure elasticities.

[17]See for example Lian and Ma (2020), Ivashina, Laeven, and Moral-Benito (2020), Baskaya, di Giovanni, Kalemli-Ozcan, and Ulu (2017), Drechsel (2020), among others.

[18]This data reports information on loans with banks, investment firms, banks' subsidiaries, bank cooperatives and other

firms that report any type of loan since 2005 and re-estimate equation (4) only for firms without this type of credit. Column 1 in Panel A reports the results for value added and shows that the estimated coefficient for the expenditure elasticity remains positive and statistically significant after we remove firms reporting credit with financial institutions.

An important caveat of this exercise is that firms might take debt obligations with agents other than financial institutions. For example, firms can borrow from suppliers or owners, and this information would not be reported in the credit registry data. Hence, if credit conditions improved after the financial liberalization for suppliers/owners and they provide more credit to firms in high expenditure elasticity sectors, one could be confounding the consumption channel with this ease of financing conditions. To assess this possibility, we employ firms' balance sheet statements to tax authorities. This balance sheet data contains information on all type of financial obligations to any agent in the economy and, thus, it provides a comprehensive picture of firms' financial obligations. Furthermore, this data is reported for all the period 1995-2008 and we use it to remove firms that have obligations at any point in time over these years. We analyse this data sequentially by type of obligation and maturity. In column 2, we focus on firms that do not report long-term obligations in their balance sheets and show that the coefficient for the expenditure elasticity remains positive and statistically significant.[19] Columns 3-6 focus on short-term obligations. Column 3 removes firms that report debt with owners, column 4 removes firms that have trade credit, column 5 removes firms that report short-term loans with banks, and column 6 removes firms that have any type of these short-term obligations. All across specifications in columns 3-6, the coefficient for the expenditure elasticity remains positive and statistically significant. Finally, in column 7, we combine these exercises and remove firms that do not report any type of loan contract in the credit registry data and/or any short/long term obligation in their balance sheet. Importantly, the coefficient on the expenditure elasticity remains positive and is highly statistically significant. In Panel C, we report the estimates for employment and show that the coefficients are positive and statistically significant all across the different specifications in columns 1-7.[20]

In sum, we have conducted highly demanding exercises – by restricting our analysis to firms that do not report any type of financial obligations in their balance sheet statements or banks in any year – and show that firms in high expenditure elasticity sectors expand their value added and employment, even in the absence of credit with banks, owners or trade credit.[21]

The exercises presented in this section provide support for the input-cost and consumption chan-

financial firms. Unfortunately, the credit registry data only exists since 2005. Nevertheless, it worth remarking that firms that access to credit tend to keep it during the period (i.e. there is not much turn over in the access to credit within firms from one year to another).

[19]Unfortunately, long-term obligations are not disaggregated by type of counterparty (owners, trade credit, banks) and are only reported on aggregate basis.

[20]These results are in line with the recent paper of Cingano and Hassan (2020), who using firm-bank matched data show that, following an capital inflows, banks do not increase their credit supply to services firms.

[21]In Table C.13, we also present results for the estimated coefficient on the capital elasticity. The effects on value-added and on capital continue to be largely positive, although few coefficients are statistically significant. However, these weaker coefficient estimates should not be interpreted as evidence against the input-cost channel. Within the set of financially unconstrained firms, as long as they are more likely to borrow the higher the capital elasticity, then removing such firms from the analysis will necessarily weaken our results for the input-cost channel. Firms with higher capital elasticity will have a greater increase in demand for capital for a given reduction in the cost of capital, all else equal, so the increased likelihood of borrowing is plausible.

nels and argue for a theory in which these channels operate after the financial liberalization. It is worth remarking that these exercises do not suggest that financial frictions do not matter. Indeed, the literature has demonstrated the important role of financial frictions (Reis 2013 and Gopinath, Kalemli-Ozcan, Karabarbounis, and Villegas-Sanchez 2017). Instead, our empirical analysis indicates that other forces are also at play upon capital inflows. Our empirical analysis has shown that these forces are not perfectly correlated with financial frictions and, hence, even when we undertake highly demanding exercises to control for financial frictions, the input-cost and consumption channels remain valid in the data.

-Additional robustness tests. We now turn to conduct a five additional robustness tests for Table 1. First, our regression in first differences implicitly estimated the impact of the reform for firms present before and after the liberalization. To show that our results are robust to an unbalanced panel of firms, we estimate a panel regression of equation (3) for all firms in the sample. Table C.14 in Appendix C confirms our previous findings and shows that, after the reform, firms increase their value added as a function of their capital and expenditure elasticities. Additionally, our results are robust to considering continuing firms only, which we define as firms existing all along the period 1995 to 2008 (Table C.15).[22]

Second, to assess whether the estimates are capturing the effect of the financial liberalization and not something else, we test whether the timing coincides with the deregulation. To this end, we interact the capital and expenditure elasticities with year dummies and estimate equation (3) in a panel regression. Figure C.10 in Appendix C plots the estimated coefficients for value added and shows that, while the estimated coefficients do not change significantly before the reform, they increase in accordance with sectors' capital and expenditure elasticities after it.[23]

Third, to check that the our results are not driven by exporters or foreign-owned firms, we exclude them from the analysis. Columns 1-3 in Table C.17 in Appendix C present the results for non-exporters and show that the estimated coefficients for value added are larger for both capital and expenditures elasticities. We then assess whether results are robust to excluding foreign-owned companies. Columns 4-6 confirm that the coefficients remain statistically significant. Together these results indicate that the expansion upon the financial liberalization is mainly driven by non-exporters and domestic firms.[24]

Fourth, we show that our results are robust to estimating the capital and expenditure elasticities using different methodologies. Columns 1-3 in Table C.19 in Appendix C report our results for the capital elasticities estimated using Olley and Pakes (1996) method. Columns 6-9 present the results for the expenditure elasticities estimated by Comin, Lashkari, and Mestieri (2021).

Finally, equation (4) could also be estimated using the sectoral price index instead of the average

[22] These results argue against a theory of "involuntary entrepreneurs" in which laid-off workers would become entrepreneurs in high expenditure elasticity sectors. As shown in Table C.15, the estimated coefficients for both capital and expenditure elasticities remain significant and similar in size to the main specification.

[23] As an additional test of the parallel trend assumption, we conduct a second exercise, in which we create dummies for high/low capital and expenditure elasticities (below/above median) and interact them with yearly dummies. In particular, we regress for the capital elasticity: $\log q_{ijt} = \sum_{t=1995}^{2007} \gamma_{1t}\ \text{year}_t + \sum_{t=1995}^{2007} \gamma_{2t}\ (\text{High}_j \times \text{year}_t) + \tilde{\mu}_{jt} + \mu_i + \varepsilon_{ijt}$, where $\tilde{\mu}_{jt}$ is sector time-varying controls. The coefficient γ_{1t} captures the yearly evolution of sectors with low elasticity, and γ_{2t} captures the differential effect of sectors with high elasticity. As shown in column 1 of Table C.16 in Appendix C, before the financial liberalization, the value added was evolving at a similar pace in sectors with high and low capital elasticity but, after the reform, it started growing much faster in sectors with high capital elasticity. We conduct a similar analysis for the expenditure elasticity and confirm the differential pattern of growth for sectors with high elasticity after the reform.

[24] Table C.18 shows that our results are robust to controlling for firms' imports.

productivity of the sector. In Table C.20 in Appendix C, we report the results of this exercise and show that the estimated coefficients remain unaltered when using the sectoral price index.

4.3 Industry-Level Analysis and Extensive Margin

Last section studied the impact of the liberalization within firms across sectors with different capital and expenditure elasticities. We now assess its impact at the industry level and on the extensive margin.

To evaluate the impact of the reform at the industry level, we analyze the data at four-digit NACE industries and estimate the following regression:

$$\Delta y_j = \gamma_0 + \gamma_1 \alpha_j + \gamma_2 e_m + \Delta \varepsilon_j, \tag{5}$$

where $y_j = \{\text{net entrants, entrants, firm size, industry RTFP, producer price index}\}$, where *net entrants* and *entrant* is the number of net entry (entry-exit) and entrants within each four-digit industry, *firm size* is the average value added per firm in the industry, *industry RTFP* is the total RTFP of the industry, and *producer price index* is the industry producer price index.[25] We cluster the standard errors at four-digit NACE industries.

Table 2 presents the results. Column 1 shows that the financial liberalization in Hungary associates with an increase in net entry in sectors with high expenditure elasticity. The estimated coefficient is not only statistically, but it also economically significant. It implies that a one standard deviation increase in the expenditure elasticity correlates with a 17% increase in the number of net entrants. In other terms, a sector in the p75 of the expenditure elasticity would experience 20% higher net entry than a sector in the p25. Column 2 shows that this expansion in net entry is mainly explained by an increase in entrants. Consistent with this expansion in the extensive margin, column 3 shows that the average size of firms drops and column 4 reports a decrease in RTFP in industries with high expenditure elasticity. As a result, the producer price index increases in these industries (column 5). To evaluate the characteristics of new entrants, we restrict our analysis to entrant firms and test whether – upon the financial liberalization – they differ in observable characteristics, such as RTFP and value added. Columns 6 and 7 in Table 2 show that, in sectors with high expenditure elasticity, entrants were less productive and smaller.

Interestingly, industries with high capital elasticity tend to show the oppposite image of these patterns. Column 2 shows that entrants decrease in an industry's capital elasticity, and columns 6 and 7 indicate that entrants tend to be larger and more productive after the reform.

To illustrate the expansion of entry as a function of the industry's expenditure elasticity, we compute the number of net entrants and entrants per year in each industry before and after the reform. In particular, we estimate a regression: $y_{m,t} = \gamma_1(e_m \text{ x } \text{FL}_t) + \gamma_2 e_m + \gamma_3(\alpha_m \text{ x } \text{FL}_t) + \gamma_4 \alpha_m + \varepsilon_{m,t}$, where $y_{m,t}$ is net entry or entry, and plot the predicted values for these variables before and after

[25]Sectoral RTFP is computed as the sum of firms' individual productivities weighted by their respective value added share in the sector. See for example Foster, Haltiwanger, and Syverson (2008) and Baqaee and Farhi (2017) for a similar measure of RTFP.

Table 2: Industry-Level Analysis and Extensive Margin

	Industry-Level Analysis					Entrants	
	Δ Net Entrants	Δ Entrants	Δ Firm Size (VA x firm)	Δ Industry RTFP	Δ Producer Price Index	Log RTFP	Log VA
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Capital and Expenditure Elasticities						
Capital elasticity	-0.984	-1.481**	0.645	0.552	-0.149		
	(0.724)	(0.593)	(0.570)	(0.518)	(0.098)		
Expenditure elasticity	0.420***	0.325***	-0.138*	-0.144*	0.048***		
	(0.112)	(0.117)	(0.076)	(0.079)	(0.012)		
FL * Capital Elasticity						1.327***	0.404**
						(0.323)	(0.205)
FL * Expenditure Elasticity						-0.090**	-0.038*
						(0.040)	(0.023)
Year FE						Yes	Yes
Sector FE						Yes	Yes
R^2	0.042	0.039	0.015	0.014	0.040	0.096	0.127
N	348	348	348	348	348	95,576	185,609

Notes: *, **, *** significant at 10, 5, and 1 percent. Standard errors are clustered at four-digit industries in columns 1-5, and at time and four-digit industries in columns 6 and 7. The capital elasticity is estimated using the Petrin and Levinsohn (2012) and Wooldridge (2009) methods used at four-digit NACE industries, and the expenditure elasticity comes from Bils, Klenow, and Malin (2013), reported at two-digit NACE industries. Source: APEH.

the reform.[26] These values capture the relationship between entrants and expenditure elasticity, once capital elasticity is controlled for. Figure 2 shows that the number of net entrants and entrants is highly and positively related with sector's expenditure elasticity after the financial liberalization. The contrast with the pre-liberalization period is stunning. Before the reform, the relationship between entry and expenditure elasticity is almost flat. After the reform, an industry with an expenditure elasticity of 1.8 –as restaurants and bars– had on average more than 1,500 new firms created per year, which is 1,200 more firms than an industry with low expenditure elasticity (such as agriculture).

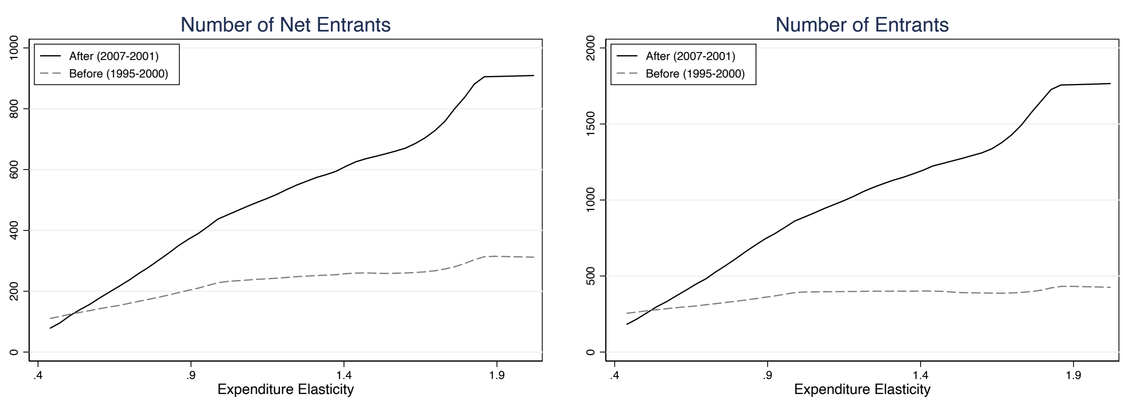


Figure 2: Net Entrants

[26] FL_t is a dummy variable that equals to 1 for the post-reform period ($\text{FL}_t \geq 2001$) and 0 otherwise. Therefore, the coefficient γ_1 captures the relationship in the post-liberalization period, and γ_2 captures the relationship in the pre-liberalization period (i.e. when $\text{FL}_t = 0$). For robustness, Figure C.11 in Appendix C presents these relationships constructed as simple difference in means (i.e. without regression analysis).

This figure confirms that the financial liberalization in Hungary associates with higher entry in those sectors that high expenditure elasticity and, hence, that experienced the highest increase in demand. We now go one step further and show in Table 3 the top fifteen sectors defined at four-digit NACE industries that experienced the highest number of net entrants in the post-liberalization period.

Table 3: Top 15 Industries in Net Entry (2001-2007)

Broad Sector	Sector (II digits)	Industry (IV digits)	Description	Expenditure elasticity	Net entry per year	Number of employees	Share agg. employment (in %)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Service	Real estate activities	7012	Buying and selling of own real estate	2.02	982	2	0.08
Service	Construction	4521	General construction of buildings and civil engineering works	0.89	505	3	0.21
Service	Hotels and restaurants	5530	Restaurants	1.80	480	3	0.13
Service	Other business activities	7414	Business and management consultancy activities	1.35	446	2	0.08
Service	Other business activities	7487	Other business activities n.e.c.	1.35	439	3	0.10
Service	Retail trade	5248	Other retail sale in specialized stores	0.83	420	2	0.06
Service	Land transport	6024	Freight transport by road	2.02	404	3	0.08
Service	Other business activities	7420	Architectural and engineering activities and consultancy	1.35	363	2	0.06
Service	Real estate activities	7020	Letting of own property	2.02	297	4	0.03
Service	Retail trade	5211	Non-specialized stores with food, beverages or tobacco	0.83	271	4	0.11
Service	Repair of motor vehicles	5010	Sale, maintenance and and repair of motor vehicles	0.85	250	2	0.06
Service	Hotels and restaurants	5540	Bars	1.80	248	2	0.04
Service	Retail trade	5263	Other non-store retail sale	0.83	229	2	0.02
Service	Construction	4531	Installation of electrical wiring and fittings	0.89	212	3	0.05
Service	Other business activities	7411	Legal activities	1.35	211	2	0.04
Total					5,757		1.15

Note: this table presents the yearly number of entrants in the post-liberalization period per four-digit NACE industries. Source: APEH.

Column 1 shows that all these sectors are in services and are dominated by real estate, construction, restaurants and bars, retail trade, transport and business activities. The industries that saw more net entrants are: buying and selling own real state, construction, restaurants, consultancy and other business activities, which are sectors that have high expenditure elasticity (columns 4-6). Importantly, entering firms are small and do not exceed four employees on average (column 7). The importance of new entrants in aggregate employment is not negligible, as the 15 sectors with higher entry accounted for 1.15% of aggregate employment in the year of entry.[27]

4.4 Aggregate Analysis

The previous sections reported that, upon the financial liberalization, firms expanded more their value added and employment as a function of sectors' expenditure elasticity and that there was an increase in the extensive margin in those sectors. These changes suggest the presence of reallocation forces across sectors and, in particular, towards sectors with high expenditure elasticity.

To assess this, we define sectors below and above the median of the expenditure elasticity across industries and check whether there is reallocation towards them. More precisely, we sum the value added, employment and mass of firms of sectors with above median expenditure elasticity and compute the share of high expenditure elasticity sectors on the economy. We then regress these shares on a time

[27]Table C.21 in Appendix C presents the top 30 sectors in net entry. By 2008, firms that entry after the reform accounted for more than 15 percentage points of the share of value added and employment in services (Figure C.12).

trend and dummy variables for the years following the financial liberalization, as follows

$$\text{share}_t = \sum_{t=2001}^{2008} \beta_t D_t + \text{Time}_t + \varepsilon_t, \tag{6}$$

where $D_t = 1$ if year $= t$ and 0 otherwise. The β_t coefficients capture whether the share of sectors with high expenditure elasticities increases differentially than the time trend following the financial liberalization in 2001. Figure C.14 plots the estimated coefficients for each year and shows that upon the liberalization, the share of value added, employment and mass of firms in sectors with high expenditure elasticity increases and is statistically different from the pre-liberalization trend.

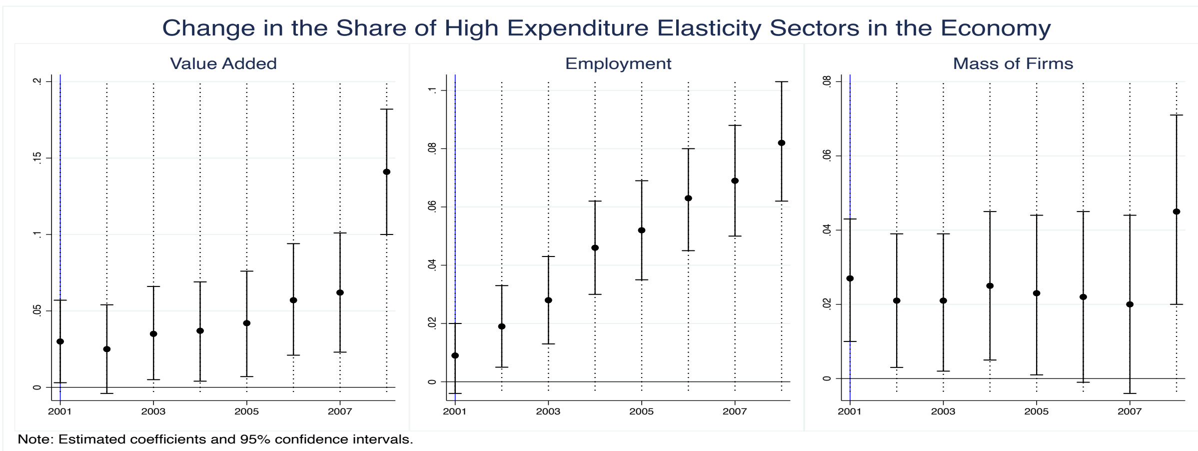


Figure 3: Reallocation across sectors: High Expenditure Elasticities

As an additional test, we then divide sectors into four groups high/low expenditure elasticity and high/low capital elasticity and re-estimate regression (6) for each group. Figure C.13 and Table C.22 in Appendix C present the estimated coefficients and show that, to the same exposure to capital elasticity, sectors with high expenditure elasticity grew more after the financial liberalization. These exercises suggest that – on the aggregate – the consumption channel dominates and that, after the liberalization, resources reallocated towards sectors with expenditure elasticity.[28]

Taking Stock and External Validity

Results presented above assessed the relative input-cost and consumption channels implied in financial liberalization. We showed that, accordingly with the relative input-cost channel, firms in industries with high capital elasticity differentially increased their value added and capital. Additionally, we provided evidence for the consumption channel, as firms in high expenditure elasticity industries increased their

[28]In an additional exercise, we analyze the aggregate implication of these forces for broadly-defined sectors. As discussed in Section 3, our estimations for capital and expenditure elasticities imply that the manufacturing sector is capital intensive and has lower expenditure elasticity, while the service sector is labor intensive and has high expenditure elasticity. We re-estimate equation (6) for the share of services and show in Figure C.14 that upon the liberalization, the share of services in value added, employment and mass of firms increases and is statistically different from the pre-liberalization trend.

value added relatively more. Our results also point to large reallocation of resources within sectors. They suggest that the productivity threshold to operate decreases as a function of sectors' expenditure elasticity. The increase in the extensive margin and the decrease in firms' size point to this direction. On the aggregate, our results suggest that the consumption channel dominates and resources shift toward sectors with high expenditure elasticities, which –as discussed above– are typically in services.

A final question about the external validity of our results remains. The Hungarian financial liberalization illustrates that within the few years after this reform resources shifted towards services. Is this fact valid for the cross-section of countries? We assess this question by checking whether financial liberalization episodes correlate with increases in the share of value added in services across countries. For expositional purposes, we present the details of this analysis in Appendix A and focus here on the main results. Using the Chinn and Ito (2008) index of capital account openness and World Bank data for 163 countries over the period 1970 to 2015, we show that that financial liberalization episodes associate with reallocation of resources towards services.[29] In the next section, we build a heterogeneous firm dynamics model that rationalizes these findings and assess the short- and long-term implications of the financial liberalization.

5 Model

This section develops a small economy model to study the macroeconomic and microeconomic impact of capital account liberalization. In the model, there are two sectors –manufacturing and services– each of which consists of heterogeneous firms à la Melitz (2003). Firms use capital and labor as factors of production. The manufacturing good can be traded internationally and services are non-traded across borders. Capital controls might prevent local households from perfectly accessing international funds. We model a financial liberalization as an unexpected elimination of capital controls during the economy's transition to its steady state. We employ the model to study the impact of a financial liberalization on consumption and saving patterns, current account imbalances, the reallocation of resources within and across sectors, and the long-run effects of the policy. For exposition simplicity, in this section, we present only the main relationships of the model; all derivations are in Appendix G and Appendix H.

5.1 Representative Household

The domestic household has the following intertemporal preferences:

$$U = \sum_{t=0}^{\infty} \beta^t \frac{(C_t^{1-\gamma} - 1)}{1-\gamma}, \tag{7}$$

where $\beta \in (0, 1)$ is the discount factor and γ determines the elasticity of intertemporal substitution. C_t represents the consumption basket or aggregate consumption, which is composed by manufacturing

[29] These results are close to Benigno, Converse, and Fornaro (2015) who identify episodes of large capital inflows for 70 middle- and high-income countries and show that large inflows associate with increases in the value added share of services.

C_{Mt} and services C_{St} goods, defined implicitly by the following function:

$$1 = \left[\theta_M^{\frac{1}{\eta}} C_t^{\frac{e_M - \eta}{\eta}} C_{Mt}^{\frac{\eta-1}{\eta}} + \theta_S^{\frac{1}{\eta}} C_t^{\frac{e_S - \eta}{\eta}} C_{St}^{\frac{\eta-1}{\eta}} \right], \tag{8}$$

where $\eta \in (0,1)$ is the elasticity of substitution between manufacturing and services goods, and θ_j with $j = \{M, S\}$ are constant weight parameters. e_j determines the (constant) aggregate consumption elasticity of demand for sectoral good C_{jt}. The above preferences draw from Comin, Lashkari, and Mestieri (2021), and are a non-homothetic generalization of the CES aggregator. Equation (8) implies that, when aggregate consumption C_t increases keeping sectoral prices fixed, sectoral consumption C_{jt} grows more than proportionately if $e_j > 1$, and less than proportionately if $e_j < 1$. The usual homothetic CES preferences are a special case of the above when $e_j = 1$.

The manufacturing good C_{Mt} is, in turn, a CES aggregate of domestically produced C_{Mt}^D and foreign imported goods C_{Mt}^F according to:

$$C_{Mt} = \left[(\theta_D)^{\frac{1}{\eta_M}} \left(C_{Mt}^D \right)^{\frac{\eta_M - 1}{\eta_M}} + (\theta_F)^{\frac{1}{\eta_M}} \left(C_{Mt}^F \right)^{\frac{\eta_M - 1}{\eta_M}} \right]^{\frac{\eta_M}{\eta_M - 1}}, \tag{9}$$

where $\eta_M \in (0,1)$ is the elasticity of substitution between C_{Mt}^D and C_{Mt}^F, and θ_D and θ_F control the home bias in manufacturing. Finally, C_{St} and C_{Mt}^D are each a CES aggregate of a continuum of differentiated varieties:

$$C_{St} = \left[\int_{\omega \in \Omega_t} q_{St}^d(\omega)^{\frac{\sigma-1}{\sigma}} \right]^{\frac{\sigma}{\sigma-1}} \quad \text{and} \quad C_{Mt}^D = \left[\int_{\omega \in \Omega_t} q_{Mt}^d(\omega)^{\frac{\sigma-1}{\sigma}} \right]^{\frac{\sigma}{\sigma-1}} \tag{10}$$

where Ω_t is the (endogenous) time-varying set of individual varieties sold in the domestic market and $\sigma > 1$ is the elasticity of substitution across varieties which, for simplicity, is the same in both sectors. Manufacturing varieties can be traded internationally, but services are non-tradable.

The representative household accumulates capital over time (K_t) by importing investment goods (I_t). K_t is rented to domestic manufacturing and services firms. The price of imported goods (including C_{Mt}^F and I_t) is the numéraire of the economy ($P_{Mt}^F = 1$). The household can issue foreign bonds (B_t) that are traded internationally and priced at the domestic interest rate (r_t), where $B_t < 0$ implies foreign debt. Importantly, the domestic interest rate includes capital controls that impose a tax τ per unit of foreign bond borrowing. This tax then is redistributed lump-sum to households via T_t.

The household maximizes her utility in equation (7) subject to the following budget constraint:

$$P_{Mt}^D C_{Mt}^D + C_{Mt}^F + P_{St} C_{St} + K_{t+1} - (1 - \delta^k) K_t + B_{t+1} = w_t L + r_t^k K_t + (1 + r_t) B_t + \Pi_t + T_t, \tag{11}$$

where w_t and r_t^k are the wage and rental rate of capital, L denotes the country's labor endowment, which is supplied inelastically, and Π_t are economy-wide profits redistributed to households. The domestic interest rate r_t is endogenously determined and depends on the foreign interest rate (r^*), and the level of capital controls:

$$r_t = r^* + \tau \{B_t < 0\} - \tau \{B_t > 0\}. \tag{12}$$

Note that, there is a level of capital control $\bar{\tau} > 0$ such that when $\tau \geq \bar{\tau}$, the economy is in financial autarky along the transition, i.e. $B_t = 0$ and trade must be balanced. We impose symmetric discounting between national and foreigners, i.e., $r^* = \frac{1}{\beta} - 1$.[30] Thus, a non-zero level of capital control τ, could trigger financial flows –current account and trade imbalances– during the transition to the long-run steady state, but only $\tau = 0$ can support long-run debt and trade imbalances. Consistently with Gourinchas and Jeanne (2006), we focus on the case in which a capital scarce economy fully eliminates financial-autarky levels of capital controls ($\bar{\tau}$) receiving capital inflows $B_t < 0$ and accumulating long-run debt. We will also explore how the degree of capital scarcity at the moment of this liberalization impact the short- and long-run effects of the policy.

The household's optimal demand for manufacturing and service goods are:

$$C_{S,t} = \left(\frac{P_{S,t}}{P_t}\right)^{-\eta} \theta_S C_t^{e_S} \qquad \text{and} \qquad C_{M,t} = \left(\frac{P_{M,t}}{P_t}\right)^{-\eta} \theta_M C_t^{e_M}, \tag{13}$$

$$C_{M,t}^D = \left(\frac{P_{M,t}^D}{P_{Mt}}\right)^{-\eta_M} \theta_D C_{Mt} \qquad \text{and} \qquad C_{M,t}^F = \left(\frac{1}{P_{Mt}}\right)^{-\eta_M} \theta_F C_{Mt}, \tag{14}$$

and the demands for individual varieties are given by:

$$q_{St}^d(\omega) = C_{St}\left(\frac{p_{St}(\omega)}{P_{St}}\right)^{-\sigma} \qquad \text{and} \qquad q_{Mt}^d(\omega) = C_{Mt}^D\left(\frac{p_{Mt}(\omega)}{P_{Mt}^D}\right)^{-\sigma}, \tag{15}$$

where P_t, P_{jt}, and $p_{jt}(\omega)$ $\omega \in \Omega_{jt}$ are the price of the aggregate consumption bundle, the sectoral consumption bundles, and the prices of individual varieties.[31] The household's maximization problem gives the following Euler equations:

$$1 = \Lambda_{t,t+1}(1 - \delta^k + r_{t+1}^k) \qquad \text{and} \qquad 1 = \Lambda_{t,t+1}\left(1 + r_{t+1}\right). \tag{16}$$

where the discount factor is given by $\Lambda_{t,t+1} = \beta\frac{\lambda_{t+1}}{\lambda_t}$.

5.2 Production

There is a continuum of firms in each sector $j \in \{S, M\}$. Firms are monopolistically competitive, so that each variety ω is produced by a single firm. Firms are heterogeneous in productivity (φ), which is drawn from a sector-specific distribution $G_j(\varphi)$ after paying a one-time sunk entry cost f_{jt}^e. In order to keep operating, firms must pay a fixed operational cost ($f_j^d > 0$) every period. Operating firms combine labor (l) and capital (k) in a Cobb-Douglas production function. The production function in sector $j \in \{S, M\}$ is given by $q_{jt}(\varphi) = \varphi k_{jt}(\varphi)^{\alpha_j} l_{jt}(\varphi)^{1-\alpha_j}$.

Manufacturing firms can also choose to export subject to paying an additional fixed exporting cost (f_M^x), in which case they face the following foreign demand: $q_{Mt}^x(\varphi) = A p_{Mt}(\varphi)^{-\sigma}$, where A is a constant reflecting that, in this small open economy, the scale of foreign demand is not affected by

[30] The specific level of $\bar{\tau}$ depends on the capital stock at each point in time. As capital increases, $\bar{\tau}$ decreases.

[31] Where $P_t = \left[\theta_M P_{Mt}^{1-\eta} C_t^{e_M - 1} + \theta_S P_{St}^{1-\eta} C_t^{e_S - 1}\right]^{\frac{1}{1-\eta}}$, $P_{Mt} = \left[\theta_D (P_{Mt}^D)^{1-\eta_M} + \theta_F\right]^{\frac{1}{1-\eta_M}}$, $P_{St} = \left[\int_{\omega\in\Omega_t} p_{St}(\omega)^{1-\sigma} d\omega\right]^{\frac{1}{1-\sigma}}$, and $P_{Mt}^D = \left[\int_{\omega\in\Omega_t} p_{Mt}(\omega)^{1-\sigma} d\omega\right]^{\frac{1}{1-\sigma}}$.

Hungary's liberalization. For simplicity, we assume that foreign consumers have the same price elasticity as domestic consumers. Note that this elasticity being finite implies that export price decreases with the quantity exported. This price elasticity will play a key role in our long-run analysis.

All fixed and variable costs are valued in units of the (*sectoral*) composite price derived from the optimal input demands for production: $\phi_{jt} \equiv \left(\frac{r_t^k}{\alpha_j}\right)^{\alpha_j}\left(\frac{w_t}{1-\alpha_j}\right)^{1-\alpha_j}$. Firms choose their optimal price given the household demands in (15) and the production technology. A firm in sector j charges a constant markup $(1/\rho)$ over its marginal costs $p_{jt}(\varphi) = \frac{\phi_{jt}}{\rho\varphi}$.

5.3 Value Functions, Entry and Exit

The value functions of type-φ firms operating in services and in manufacturing are respectively:

$$V_{St}(\varphi) = \max\Big\{0, \pi_{St}^d(\varphi) + (1-\delta)\Lambda_{t,t+1}V_{S,t+1}(\varphi)\Big\} \quad \text{and} \quad V_{Mt}(\varphi) = \max\Big\{V_{Mt}^d(\varphi), V_{Mt}^x(\varphi)\Big\}, \tag{17}$$

where $V_{Mt}^d(\varphi) = \max\Big\{0, \pi_{Mt}^d(\varphi) + (1-\delta)\Lambda_{t,t+1}V_{M,t+1}(\varphi)\Big\}$ and $V_{Mt}^x(\varphi) = \max\Big\{0, \pi_{Mt}^d(\varphi) + \pi_{Mt}^x(\varphi) + (1-\delta)\Lambda_{t,t+1}V_{M,t+1}(\varphi)\Big\}$. Domestic profits are defined by $\pi_{jt}^d(\varphi) = \Big[p_{jt}(\varphi) - c_{jt}(\varphi)\Big]q_{jt}^d(\varphi) - \phi_{jt}f_j^d$ for $j \in \{S, M\}$. Exporting profits for manufacturing firms are defined by $\pi_{Mt}^x(\varphi) = \Big[p_{Mt}(\varphi) - c_{Mt}(\varphi)\Big]q_{Mt}^x(\varphi) - \phi_{Mt}f_M^x$. Therefore, total profits for manufacturing firms are $\pi_{Mt}(\varphi) = \pi_{Mt}^d(\varphi) + \pi_{Mt}^x(\varphi)$. δ is the exogenous exit rate. The continuation value for service and manufacturing firms takes into account endogenous exit decisions:

$$V_{S,t+1}(\varphi) = \begin{cases} V_{S,t+1} & \text{if} \quad \varphi > \varphi_{S,t+1}^d \\ 0 & \text{otherwise,} \end{cases} \qquad V_{M,t+1}(\varphi) = \begin{cases} V_{M,t+1}^d & \text{if} \quad \varphi_{M,t+1}^d \le \varphi < \varphi_{M,t+1}^x \\ V_{M,t+1}^x & \text{if} \quad \varphi \ge \varphi_{M,t+1}^x \\ 0 & \text{otherwise.} \end{cases}$$

The operational productivity cut-offs φ_{St}^d, φ_{Mt}^d, and φ_{Mt}^x are defined implicitly by the following marginal conditions: $V_{St}(\varphi_{St}^d) = 0$, $V_{Mt}^d(\varphi_{Mt}^d) = 0$, and $\pi_{Mt}^x(\varphi_{Mt}^x) = 0$.

In each period, there is a mass of potential entrants that draw their productivity from a cumulative distribution $G_j(\varphi)$ and a probability density function $g_j(\varphi)$. Denote M_{jt}^e as the mass of potential entrants that pays a sector-specific entry cost to observe their permanent individual productivity. This entry cost is composed of a fixed cost and a variable cost that depends on the current mass of potential entrant firms in the sector.[32] In particular, in sector j, the entry cost is given by $f_{jt}^e = f_j^e + \xi\Big(\exp(M_{jt}^e - \overline{M}_j^e) - 1\Big)$, where f_{ej} is the fixed entry cost and ξ is a constant governing the size of the variable cost. The parameters $\overline{M}_j^e$ are set to the long-run open economy ($\tau = 0$) steady state sector value of potential

[32] The variable entry cost is common in the firm dynamics literature and captures the congestion externalities or competition for a fixed resource at entry, see Fattal Jaef and Lopez (2014) and Benguria, Saffie, and Urzua (2018). Importantly, it does not affect the model's qualitative results and helps avoiding corner solutions and excess volatility in the entry margin.

entry to eliminate the variable cost component in the long-run. The free-entry condition implies that the expected value of a firm in sector j should equal the sunk cost of entry in the sector $\int_{\varphi_{jt}^d}^{\infty} V_{jt}(\varphi)g_j(\varphi)d\varphi = \phi_{jt}\left[f_j^e + \xi\left(e^{M_{jt}^e - \overline{M}_j^e} - 1\right)\right]$ for $j \in \{S, M\}$. The time-varying distribution of producers in each sector depends on the mass of surviving producers ($M_{j,t}$) and the mass of potential entrants. In particular,

$$M_{j,t+1}\mu_{j,t+1}(\varphi) = \begin{cases} (1-\delta)M_{jt}\mu_{jt}(\varphi) + M_{j,t+1}^e g_j(\varphi) & \text{if} \quad \varphi \geq \varphi_{j,t+1}^d \\ 0 & \text{otherwise} \end{cases} \qquad j \in \{S, M\} \tag{18}$$

The law of motion that characterizes the mass of producers in sector j and time $t+1$ is $M_{j,t+1} = (1-\delta)M_{jt}\int_{\varphi_{j,t+1}^d}^{\infty} \mu_{jt}(\varphi)d\varphi + M_{j,t+1}^e \int_{\varphi_{j,t+1}^d}^{\infty} g_j(\varphi)d\varphi$ for $j \in \{S, M\}$.

5.4 Equilibrium Conditions

Labor and Capital market. The inelastic household supply of labor L equals labor demand for production and entry costs used in both sectors. That is, $\overline{L} = L_{St} + L_{Mt}$, where $L_{jt} = L_{jt}^{prod} + L_{jt}^{entry}$ and $j \in \{S, M\}$. Similarly, the equilibrium condition in the capital market is given by $K_t = K_{St} + K_{Mt}$, where $K_{jt} = K_{jt}^{prod} + K_{jt}^{entry}$ and $j \in \{S, M\}$, where the capital supply is time-varying and predetermined by the household's investment decision in the previous period.

Goods markets. Using the ideal price indexes, we can write the market-clearing conditions for services and manufacturing as $P_{St}C_{St} = M_{St}\int_{\varphi_{St}^d}^{\infty} p_{St}(\varphi)q_{St}^d(\varphi)\mu_{St}(\varphi)d\varphi$ and
$P_{Mt}^D C_{Mt}^D = M_{Mt}\int_{\varphi_{Mt}^d}^{\infty} p_{Mt}(\varphi)q_{Mt}^d(\varphi)\mu_{Mt}(\varphi)d\varphi$.

Balance of Payments. The small open economy's net foreign assets position evolves according to:[33]

$$B_{t+1} = (1 + r_t - \tau)B_t + TB_t, \tag{19}$$

where the trade balance (TB_t) can be written as manufacturing exports (X_{Mt}) minus imports of final consumption goods (C_{Mt}^F) minus imports of new capital goods:

$$TB_t = X_{Mt} - C_{Mt}^F - (K_{t+1} - (1-\delta^k)K_t). \tag{20}$$

6 Quantitative Analysis

This section employs our quantitative model to study how the relative input-cost and consumption channels shape the macro dynamics of financial liberalization. Sections 6.1 and 6.2 present the calibration and check whether the model's non-targeted moments are consistent with the short-term patterns observed in Hungary after the reform. In Section 6.3, we present the short-term dynamics of capital flows and discuss their reallocation forces within and across sectors. Additionally, we conduct two

[33] Assuming $B_t \leq 0$ for all t.

counterfactual exercises to assess the contribution of the input-cost and consumption channels to the short-term dynamics of capital flows. In Section 6.4, we study the long-term impact of capital inflows and how the size of capital flows affects the open economy steady state. In Section 6.5, we study the welfare implications of capital flows and welfare improving policy. We present a novel trade-off between the speed of convergence to the open economy steady state and the steady state level of capital, and assess the how policy can balance this trade-off.

6.1 Calibration

We calibrate the model at an annual frequency to Hungarian micro and macro data, and to standard parameters from the literature. We assume that Hungary reaches a financially open steady state characterized by $\tau = 0$ in the year 2008, and solve the model targeting that equilibrium. The model has 31 parameters that we divide into two groups.

Table 4 lists the first group of 17 parameters that are set directly to match the Hungarian data or to standard values from the literature. We set the international interest rate ($r^* = \frac{1}{\beta} - 1$) to 4%. We choose standard values for the parameters governing risk aversion, substitution between varieties, and depreciation of capital ($\gamma, \eta, \eta_M, \sigma$, and δ^k). The exogenous exit rates of each sector (δ_S, δ_M) are set to the firm-level sectoral exit rate observed in our micro data. We set the capital intensity of each sector (α_S, α_M) to the average elasticity estimated at the industry level.[34] We set the fixed entry costs parameters in each sector (f_S^e, f_M^e) to unity, so that the operation cost is a ratio relative to the entry cost. We set the average log-productivity for the services productivity distribution (μ_S) to 0, so that μ_M captures relative differences in average size between sectors. For simplicity, the foreign demand scale of each variety (A) is set to unity.[35] We set the parameter governing the variable entry cost (ξ) to 2 in order to avoid corner solutions (without significant impact on the dynamics).[36] Consistent with a fully open economy calibration, we set the capital controls (τ) to zero.

A second group of 14 parameters is internally calibrated, i.e., the parameters are chosen so that the model matches particular moments or targets. Table 5 presents the results of the calibration. Although every moment is affected by every parameter, we can point to some strong economic relationships between particular moments and particular parameters. The consumption share of services disciplines the weight of services in the aggregate basket ($\theta_S = 1 - \theta_M$), and the share of domestic manufacturing consumption is related to the weight of domestic manufacturing on the manufacturing basket ($\theta_D = 1 - \theta_F$).[37] The mean of the log-productivity entry distribution in the manufacturing sector determines the relative mass of firms between sectors. Intuitively, on average, manufacturing firms are larger and more productive; hence, few firms can produce a large share of production. The fixed operating

[34] We compute the capital elasticities for manufacturing and services, as the weighted average of the elasticities estimated at four-digit level, where weights are given by the value added in the industry. The mean and median capital elasticities are close to the values reported in Table 4, specifically 0.36 and 0.36 in manufacturing, and 0.33 and 0.31 in services. Note that, because the model implies constant returns to scale, we normalize the capital and labor elasticities to sum one.

[35] Because we target the fraction of exporters, other values for A just change the level of entry cost into exporting.

[36] The absolute value of the steady state mass of firms is low (see Table 5), so 2 is in fact a small fraction of the entry cost relative to $f_j^e = 1$.

[37] Because there are 8 times more services firms than manufacturing firms, a small θ_S generates a large share of consumption by services.

Table 4: Externally-Calibrated Parameters

Parameter	Description	Value	Source
r^*	World interest rate	0.04	Macro Data
β	Discount Rate	0.96	$\frac{1}{1+r^*}$
γ	Risk aversion	2	Corsetti, Dedola, and Leduc (2008)
η	Substitution C_M-C_S	0.50	Comin, Lashkari, and Mestieri (2021)
η_M	Substitution C_M^D-C_M^F	0.85	Corsetti, Dedola, and Leduc (2008)
σ	Substitution M varieties	3.8	Ghironi and Melitz (2005)
δ^k	Depreciation of capital	0.12	Macro Data
δ_S	Exogenous exit rate M	0.11	Micro data
δ_M	Exogenous exit rate S	0.08	Micro data
α_S	Capital Share S Sector	0.30	Micro data
α_M	Capital Share M Sector	0.36	Micro data
f_S^e	Fixed entry cost S	1	normalization
f_M^e	Fixed entry cost M	1	normalization
ξ	Variable entry cost	2	small
μ_S	Mean prod dist S	0	normalization
A	Foreign demand for M	1	normalization
τ	Capital control tax	0	na

costs (f_M^d, f_S^d) along with the standard deviations of the log-productivity entry distribution (Σ_M, Σ_S) determine the distribution of value-added within and across sectors. In particular, we target inter-quantile ranges and relative moments of this distribution. The fixed exporting cost in manufacturing (f_x) is used to discipline the fraction of exporters in the manufacturing sector. The parameters governing the non-homotheticity of the preferences (ϵ_S, ϵ_M) are used to target the average expenditure elasticity for services and manufacturing estimated by Bils, Klenow, and Malin (2013) for U.S. sectors.[38] The timing of the liberalization–the level of K_0 at which the capital controls are eliminated– is pinned down by the decrease in the interest rate in the five years that follow the liberalization.[39] Labor supply $(\bar{L})$ is set so that nominal GDP equals unity in the steady state. The centrality parameters of the congestion externality in the entry cost $(\overline{M}_S^e, \overline{M}_M^e)$ are set internally to the open economy entry levels so that there are no congestion externalities in the long-run absent any capital controls.

We solve for a baseline transition with a zero current account and balanced trade in every period. With this financial autarky baseline, we then study an unexpected financial liberalization, in which capital controls are removed completely and permanently – decreasing τ from $\bar{\tau}$ to 0. This allows the economy to smooth consumption by supporting trade imbalances and borrowing in the long-run.

[38]The expenditure elasticity of sector i is given by $\eta + (1-\eta)\frac{e_i - \eta}{\bar{e} - \eta}$. $\bar{e}$ is defined by $\omega_S \cdot e_S + \omega_M \cdot e_M$ where ω_j denotes the consumption share of the sector j good. Note that in the model, the sum of expenditure elasticities weighted by the sectoral consumption shares is one. As a result, we apply a transformation to the estimated sectoral elasticities from the data such that this is satisfied and the ratio in the two elasticities is preserved. In particular, the median income elasticities estimated from the data are 1.2 and 1.57 for manufacturing and services respectively. Conditional on the service consumption share of 0.59, the transformed expenditure elasticities are 0.85 and 1.10 for manufacturing and services respectively.

[39]We estimate the decrease in the lending interest rate following the liberalization by estimating the regression: $IR_t = \alpha \text{FL}_t + T_t + \varepsilon_t$, where $\text{FL}_t = 1$ if year ≥ 2001 and 0 otherwise. This regression allows us to control from any pre-existing trend in the interest rate.

Table 5: Internally-Calibrated Parameters

Parameter	Description	Value	Target	Data	Model
θ_S	Share C_S in C	0.31	$(P_S \cdot C_S)/(P \cdot C)$	0.59	0.56
θ_D	Share C_M^D in C_M	0.62	$(P_M^D \cdot C_M^D)/(P_M \cdot C_M)$	0.64	0.63
μ_M	Mean Prod. dist. M	1.46	M_S/M_M	8.10	8.04
f_S^d	Fixed operating cost M	0.02	$\log(VA_S^{p75}) - \log(VA_S^{p50})$	1.10	1.06
f_M^d	Fixed operating cost S	0.08	$\log(VA_M^{p75}) - \log(VA_M^{p50})$	1.35	1.31
Σ_S	Std. Prod. dist. S	0.78	$\log(VA_M^{p50}) - \log(VA_S^{p50})$	1.13	1.09
Σ_M	Std. Prod. dist. M	1.72	$\log(VA_M^{p25}) - \log(VA_S^{p25})$	1.02	1.00
f_M^x	Fixed exporting cost M	7.00	$\frac{1-G(\varphi_M^x)}{1-G(\varphi_M^d)}$	0.13	0.12
e_S	Expenditure Elasticity S	2.6	Bils, Klenow, and Malin (2013)	1.11	1.14
e_M	Expenditure Elasticity M	1.41	Bils, Klenow, and Malin (2013)	0.85	0.82
K_0	Initial Condition K	$0.55 \times K_{SS}$	r^k decrease during liberalization	-0.035	-0.035
$\overline{L}$	Labor supply	2.9e-4	Nominal GDP Y	1	1
$\overline{M}_S^e$	Convex entry cost S	3.5e-4	Open SS Value	na	na
$\overline{M}_M^e$	Convex entry cost M	5.8e-4	Open SS Value	na	na

6.2 Model Validation

In order to validate the calibrated model, we compare the model's predictions with the Hungarian post-financial liberalization experience (2001-2008). For the Hungarian data, we estimate differences with respect to the trend by regressing the variable on a time trend and a dummy for the reform period, i.e., $y_t = \alpha \mathrm{FL}_t + T_t + \varepsilon_t$, where $\mathrm{FL}_t = 1$ if year $\geq$ 2001 and 0 otherwise, and T is a time trend. In the model, we calculate the average difference between the liberalization path and the financial autarky path in the seven periods following liberalization. Recall that the calibration only targets the interest rate decrease during the liberalization, and no other information from the Hungarian economy along its transition path. Table 6 compares the model and data along five non-targeted dimensions.

Table 6: Non-Targeted Moments

	Model	Data
	(1)	(2)
Capital (log diff)	0.215	0.064*
		(0.034)
Share of consumption in services	0.013	0.009*
		(0.004)
Share value added in services	0.030	0.038*
		(0.021)
Relative entry rate (S/M)	0.069	0.153**
		(0.063)
Relative price index (S/M) (log diff)	0.018	0.047***
		(0.013)

Note: *, **, *** significant at 10, 5, and 1 percent. Std. errors in parenthesis. Coefficients in column 2 are computed in a regression of the variable on a time trend and a dummy for the reform period: $y_t = \alpha \mathrm{FL}_t + T_t + \varepsilon_t$, where $\mathrm{FL}_t = 1$ if year $\geq$ 2001 and 0 otherwise. Consumption data comes from OECD expenditure of households data.

Table 6 shows that model correctly captures the main qualitative features of the reallocation of resources at the onset of the transition. It replicates well the increase in the share of services in value added and consumption, and captures the increase in the relative price of services. Due to the lack of adjustment frictions, the aggregate capital stock increases faster in the model.[40] The next section assess the micro and macro dynamics that a financial liberalization can trigger.

6.3 Macro and Micro Dynamics in the Short-Term

This section describes the short-term dynamics of capital flows on the aggregate economy and its effects on the reallocation of resources within and across sectors. We additionally present two counterfactual exercises to assess the importance of the input-cost and consumption channels in the short term.

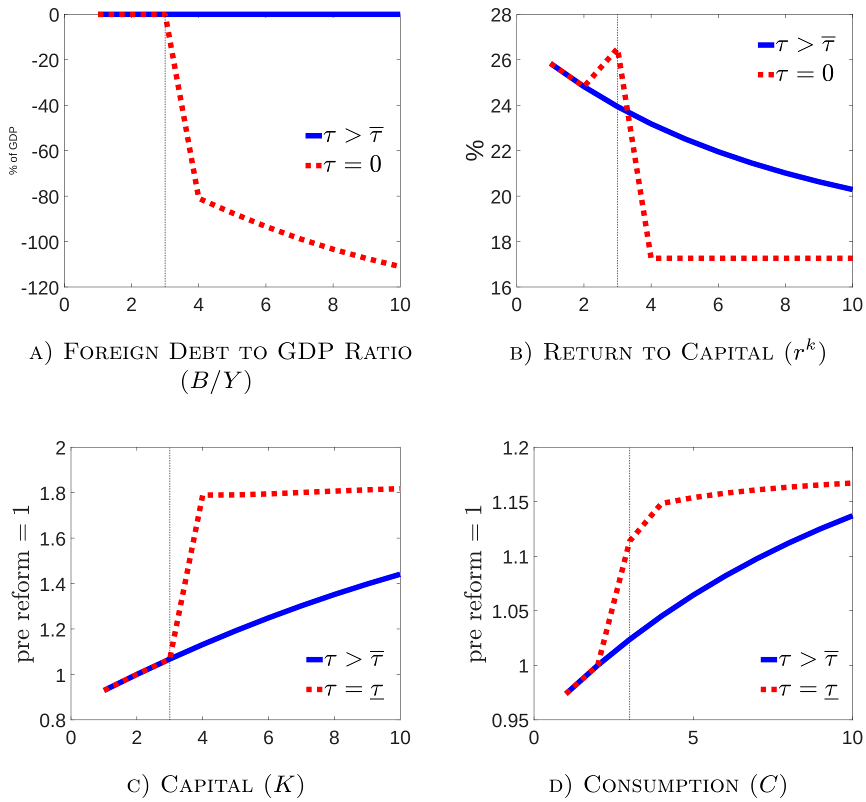
We start with an economy in financial autarky that is transitioning to its steady state. The economy then implements an unexpected and permanent elimination of capital controls that lowers the tax on foreign borrowing to zero. At the macro-level, the reduction in capital controls promotes investment and consumption growth. Investment increases because the reduction in the tax for foreign borrowing lowers the domestic interest rate, which – becoming lower than the autarky rental rate – encourages the household to borrow internationally to invest in physical capital and promotes capital accumulation. Consumption increases for two reasons. First, the increased rate of capital accumulation raises the permanent income of the economy. Second, the lower interest rate encourages an intertemporal shift of consumption to the present. These two forces also lead to higher international borrowing, in part because current income does not rise as much as permanent income. Hence, both higher capital accumulation and higher consumption lead to increased international borrowing.

These dynamics are plotted in Figure 4 for an economy that starts on the autarky transition path and, in the third year, implements a financial liberalization.[41] The economy in financial autarky is depicted by the solid blue line, which shows that – as the economy transitions and accumulates more capital – the capital return decreases and consumption increases. The dashed red line shows the dynamic of the economy hit by the liberalization. Panel A shows that the liberalization triggers international borrowing, and a deterioration of the net foreign asset position of the country (foreign debt as a share of GDP). The return of capital (r_k) increases on impact as the capital stock is fixed in the period of the liberalization and desired capital increases due to the lower interest rate. After the investment boom, the return of capital decreases permanently to a level consistent with r^*, accompanied by a higher capital accumulation and consumption (Panels B, C and D).

The relative input-cost and consumption channels imply intricate dynamics at the micro level, and trigger reallocation effects across sectors. The removal of capital controls lowers the relative input cost of manufacturing goods, ϕ_M/ϕ_S (Panel A in Figure 5). This reduction stems from the lower rental rate of capital and higher wages owing to higher capital accumulation. Hence, the relative input-cost channel favors the manufacturing capital-intensive sector. In parallel, increased aggregate consumption raises demand relatively more for goods with a high expenditure elasticity, encouraging production of service goods. These two forces – relative input-cost and (non-homothetic) consumption forces – compete with one another and can shift resources to manufacturing or services depending on which force dominates.

[40] An alternative calibration of the capital stock at the moment of the liberalization ($K_0 = 0.85$) can deliver an increase in capital stock of the empirical magnitude. This will be used as an example of a *small* financial liberalization.

[41] There is an initial burning period for the autarky transition to allow for a stable path independent of the initial distribution of firms.



A) Foreign Debt to GDP Ratio (B/Y)

B) Return to Capital (r^k)

C) Capital (K)

D) Consumption (C)

Figure 4: Relative Input-Cost and Consumption Channels in the short term

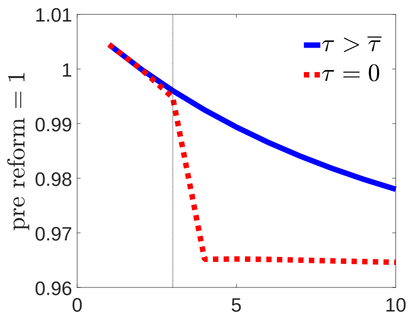
Note: This figure shows the dynamics of the domestic return of capital (top left), the net foreign asset position over GDP (top right), the consumption level (left bottom), and the capital level (right bottom). The blue and solid line corresponds to an economy in financial autarky and the red and dashed line corresponds to a financially open economy.

As Figure 5 shows, in the short-term, the consumption channel dominates and resources reallocate towards services. Upon the liberalization, the consumption and production share of services increases (Panels B and C). This higher consumption of services raises the relative price of services and the ideal price index (Panel D), which induces a real exchange rate appreciation.

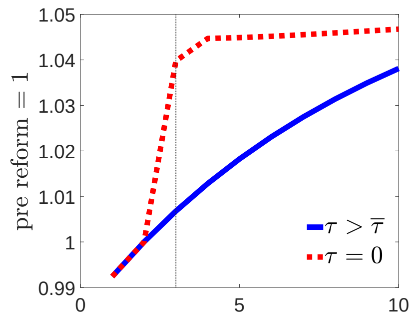
There are also reallocation effects within sectors. Higher consumption of services increases expected profits and expands the extensive margin. As Panels A and B in Figure 6 show, there is a decrease in the relative cut-off for producing $(\frac{\varphi_s^d}{\varphi_M^d})$ and an increase in the relative entry rates in services. Conversely, in manufacturing, resources shift to large and productive firms. Among manufacturing firms, resources shifts towards domestic production. Because foreign demand is constant in this small open economy, but domestic demand has increased, manufacturing firms shift their production towards the domestic market. As Panel C in Figure 6 shows, there is an increase in the cut-off for exporting in the short term. This shift in production away from exports is the flip side of the real exchange rate appreciation.

In sum, capital inflows lead to a short-term boost in capital accumulation and consumption. Because the consumption channel dominates, resources reallocation towards services. There is also reallocation within sectors, as entry in services expands and manufacturing production shifts away from exports.

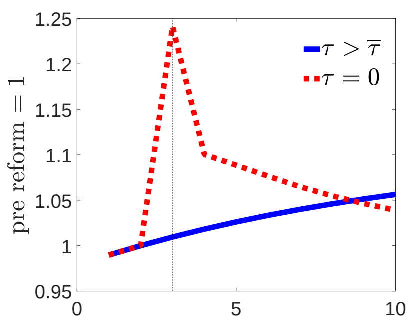
To assess the importance of heterogeneous expenditure and capital elasticities in the short-run term,



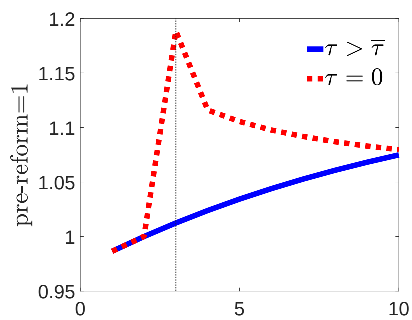
A) Relative Cost Ratio $\left(\frac{\phi_M}{\phi_S}\right)$



B) Consumption share of Services $\left(\frac{P^S \times C^S}{P \times C}\right)$



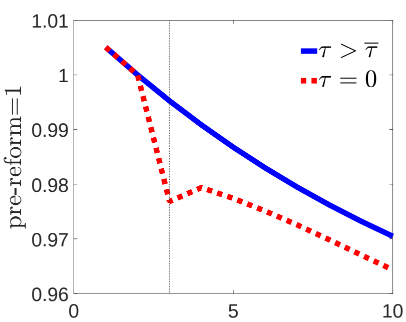
C) Production share of Services $\left(\frac{P^S \times C^S}{P^S \times C^S + P^M_D \times C^D_M + XM}\right)$



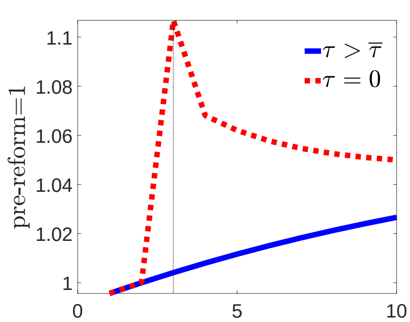
C) Ideal Price Index (P)

Figure 5: Reallocation across Sectors in the short term

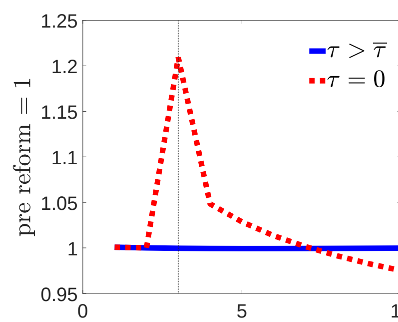
Note: This figure shows the dynamics of the relative cost ratio (left), the consumption share of services (middle) and the production share of services (right). The blue and solid line corresponds to an economy in financial autarky and the red and dashed line corresponds to a financially open economy.



A) Relative Domestic Production Cut-off $\left(\frac{\varphi^d_S}{\varphi^d_M}\right)$



B) Relative Entry Rate $\left(\frac{S}{M}\right)$



C) Relative Cut-offs within Manufacturing $\left(\frac{\varphi^x_M}{\varphi^d_M}\right)$

Figure 6: Reallocation Within Sectors in the Short Term

Note: This figure shows the dynamics of the relative domestic production cut-offs (left), the relative entry rate (middle), the relative cut-offs in the manufacturing sector (right). The blue and solid line corresponds to an economy in financial autarky and the red and dashed line corresponds to a financially open economy.

we conduct two counterfactual exercises: i) an economy where preferences are homothetic ($\epsilon_M = \epsilon_S = 1$), and ii) a version of the non-homothetic economy without heterogeneous technologies ($\alpha_S = \alpha_M = 0.33$).[42] Figure E.2 in Appendix F displays the short-run percentage difference of liberalized economy with respect to their autarky transition for the consumption and production share of services, the relative entry rate of services and the overall price index. In all these outcomes, the non-homothetic economy exhibits the largest deviations from the baseline economy. Thus, heterogeneous expenditure elasticities are key in the short-run dynamics of sector resource allocation and relative prices.

6.4 Permanent Effects of Financial Liberalization

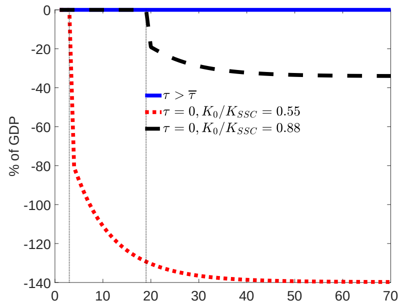
In this section, we study the permanents effects of the financial liberalization in two steps. We first provide an overview of the permanent effects of the financial liberalization on macroeconomic aggregates, show that these effects depend on the level of capital stock at the moment of the liberalization and study their implications for resource allocation. Second, we conduct quantitative exercises to decompose the forces driving the permanent effects of capital inflows.

(i) Long-Term Impact of Financial Liberalization on Macroeconomic Aggregates

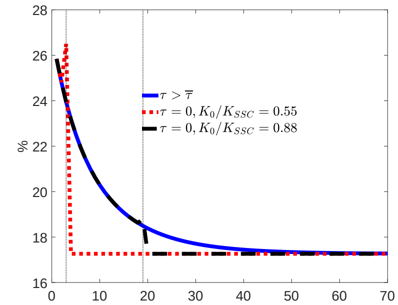
We now turn to study the permanent effects of a financial liberalization. Note first that the non-arbitrage condition between capital and bonds implies that in the long-run, an economy will be characterized by the same return on capital ($r_k^{ss} = r^* + \delta$). In a one-good representative-firm economy with a traditional Ramsey-Cass-Koopmans structure (as in Gourinchas and Jeanne 2006), a unique r_k implies a common long-run level of capital that is independent of the magnitude of capital inflows ($r_k = \frac{\partial F(K,L)}{\partial K}$). Larger capital inflows have to be sustained by trade surpluses that decrease the level of long-run consumption without affecting any other aspect of the long-run allocation. When exports face an elastic demand, trade imbalances change the relative price of goods affecting the mapping between the unique capital return and the level of capital in the long run. In fact, the level of capital is determined by $\frac{r_k}{P}$ where P is the long-run price level of the domestic good in units of the imported capital good. Therefore, if larger capital inflows affect long-run prices, the size of capital inflows also determines the long-run level of physical capital in the economy. Appendix Appendix D provides analytic characterization of this result in a simple representative firm model. The same logic carries to our two-sector heterogeneous firm model with monopolistic competition. Moreover, because only one sector can be exported, the long-run trade imbalance required to serve the debt also affects permanently the exchange rate and the allocation of resources between the two sectors. Permanent changes in the exchange rate level trigger permanent reallocation of resources within sectors, especially between exporter and non-exporter firms in the manufacturing sector.

Figure 7 illustrates the medium- and long-term effect of capital inflows on the foreign debt-to-GDP ratio, return to capital, price level and capital stock. To assess how these effects depend on the timing of the liberalization, we study two alternative financial liberalizations: i) a liberalization entailing large

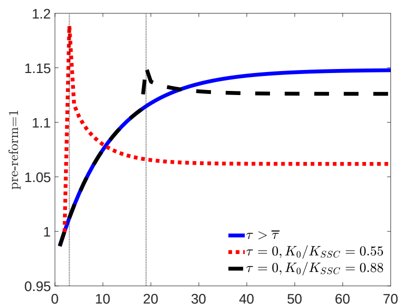
[42] In both counterfactual exercises, we adjust the supply of labor such that, in the long-run autarky steady state, these economies have the same level of output than the baseline economy ($Y = 1$) and we adjust the preference levels (θ_j) such that the three economies also feature the same consumption share across sectors in the autarky steady state. All other parameters are common between the economies.



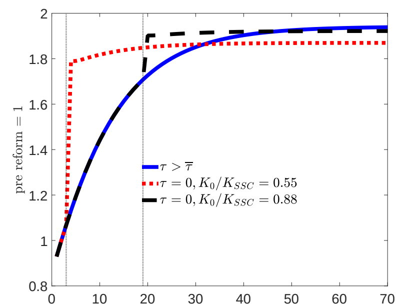
A) Foreign Debt to GDP (B/Y)



B) Return to Capital (r^k)



C) Price level



D) Capital

Figure 7: Medium and Long-Term Adjustments of Macroeconomic Aggregates

Note: This figure shows the long-term dynamics of the net foreign asset position over GDP (top left), the return to capital (top right), the price level (bottom left), and aggregate capital (bottom right). The solid blue corresponds to an economy in financial autarky; The dashed black line corresponds to and economy with lower capital inflows, and the dotted red line corresponds to the baseline economy.

capital inflows corresponding to a capital scarce economy (with capital at 55% of its autarky long-run level, similar to our benchmark economy), and ii) a liberalization entailing moderate capital inflows corresponding to an economy with more capital (with capital at 85% of its autarky long-run level). Panel A shows that the larger capital inflows (dotted red line) entail larger long-run debt. Larger repayment obligations are met with lower levels of long-run consumption, which – in turn– lowers the price level (Panel C). Panel D shows that the larger liberalization implies 2.76% less long-run capital than the smaller liberalization. In the long-run, the repayment obligations depress domestic absorption relative to the financial autarky steady state and the increase in exports decrease the terms of trade, the implied decrease in domestic prices relative to financial autarky increases the required return of capital in both sectors and, therefore, the long-run level of capital and real output in the economy. Because the external demand is independent of domestic conditions, the demand for the manufacturing sector contracts less than the demand for services. Therefore, the manufacturing price level decreases less than the services price level in the long-run, triggering a depreciation of the exchange rate and a reallocation of resources towards manufacturing, and within manufacturing, towards exporter firms.

To further explore the between and within sector reallocation, we compare long-run steady states of economies that liberalize at different moments in their financial autarky transition paths. This heterogeneous timing implies that economies receive different amount of capital inflows following the liberalization, where more capital scarce economies receive larger capital inflows. The results are shown in Figure 8. As stated above, to sustain long-run borrowing, economies with larger inflows (lower K_0) exhibit a larger long-run trade imbalance (Figure 8a) and lower long-run consumption (Figure 8b). The lower expenditure elasticity in manufacturing, coupled with the slight decrease in long-run consumption, implies a modest shift of the consumption basket towards manufacturing goods (Figure 8c). Because only manufacturing output is tradable and the higher long-run debt is serviced by exporting, production is shifted further towards manufacturing (Figure 8d). Consequentially, an economy with larger debt holding must also have more firms in the manufacturing sector (Figure 8e). Importantly, the lower domestic demand reduces the ideal consumption price, inducing a real exchange depreciation (Figure 8f). A smaller service sector implies a higher relative price of services and, thus, its operational cutoff to produce (relative to manufacturing) decrease. (Figure 8g). Along with the reallocation towards manufacturing goods, there is reallocation within this sector towards exporter firms. The reduction in the domestic demand relative to the foreign demand and the real exchange depreciation lead that the cutoff to export decreases. More manufacturing firms export, and existing exporting firms expand (Figure 8h). Both of these reallocation effects imply economy-wide long-run productivity gains (Figure 8i). These gains can be sizable. An economy that liberalizes with 70% of the long-run autarky capital level ends with 6% higher aggregate productivity in the long run when compared to an economy with no long-run borrowing.[43]

(ii) Decomposing the Permanent Effect on Capital of a Financial Liberalization

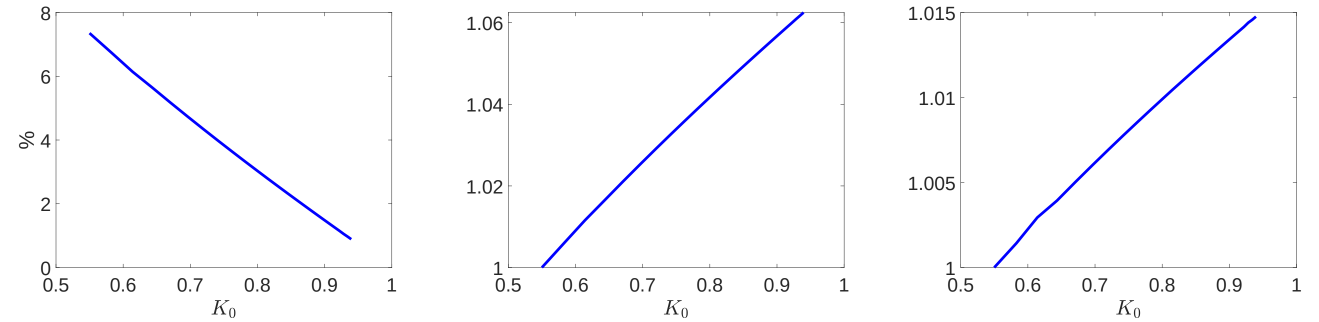
To understand how the baseline economy links capital inflows to permanent effects on the level of long-run physical capital, we develop and calibrate a set of twelve alternative economies (including our baseline economy).[44] Appendix E shows a detailed description of each model.[45] In our first exercise, we shut down firm-heterogeneity and endogenous pricing of the tradable-manufacturing good and assess an economy with a representative firm. That is, we consider a small economy with two sectors – manufacturing and services – and only one firm in each sector. Importantly, we let the price of the manufacturing good to be exogenously determined. In a second exercise, we study the same two-sector economy, but we let the price of the tradable good be endogenously determined and given a global demand with a strictly negative slope. In a third exercise, we consider a heterogeneous firm model with two sectors and endogenous pricing of tradable goods as in Melitz (2003).[46] Then, for each of the three models (representative firms with exogenous and endogenous pricing of the tradable good

[43] Appendix I shows that the main short- and long-run dynamics of the model are not affected when including a risk premium as in Schmitt-Grohe and Uribe (2003) allowing for a less patient ($\beta < \frac{1}{1+r^*}$) domestic economy.

[44] Additionally, in Appendix D, we develop a one-sector representative firm version of our model with endogenous pricing of exports and show analytically how capital inflows can affect long-run physical capital. In particular, we show that, when the price elasticity of the export demand is relatively elastic, a lower level of capital at the onset of the liberalization implies a higher long-term level of external debt, which, in turn, is associated with lower long-term export prices and, through them, a lower capital stock in the long-run.

[45] Appendix E also discusses the calibration procedure and shows that it delivers a long-run autarky equilibrium consistent with the baseline economy.

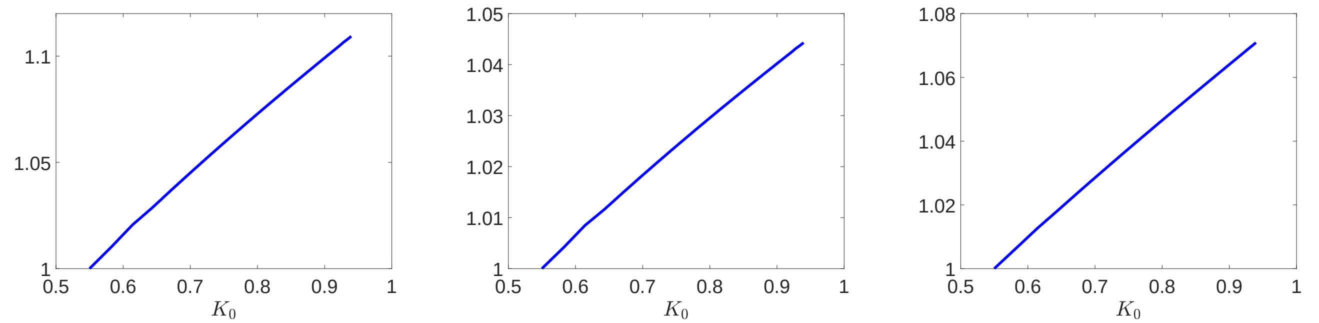
[46] When the tradable price is exogenous and there is long-run factor mobility between sectors, the non-tradable price also becomes exogenous and thus independent from the long-run level of debt (see Appendix E).



A) TRADE BALANCE TO GDP RATIO (TB/Y)

B) CONSUMPTION (C)

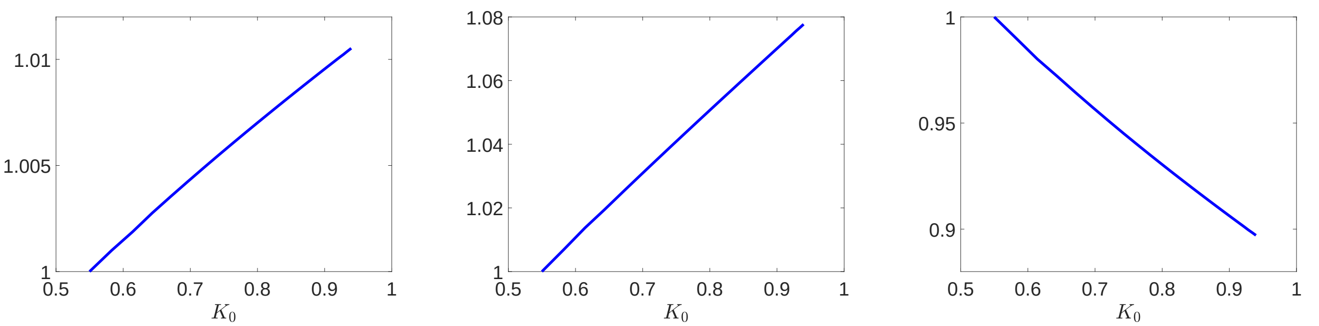
C) CONSUMPTION SHARE OF SERVICES $\left(\frac{P_S \cdot C_S}{P_S \cdot C_S + P_M^D \cdot C_M^D}\right)$



D) PRODUCTION SHARE OF SERVICES $\left(\frac{P_S \cdot C_S}{Y}\right)$

E) RELATIVE SECTORAL FIRM MASS (M_S/M_M)

F) AGGREGATE PRICE INDEX (P)



G) RELATIVE SECTORAL OPERATING CUTOFFS $(\bar{\varphi}_S/\bar{\varphi}_M^d)$

H) MANUFACTURING RELATIVE CUTOFFS $(\bar{\varphi}_M^x/\bar{\varphi}_M^d)$

I) AGGREGATE TFP

Figure 8: COMPARISON OF LONG-RUN STEADY STATES

NOTE: In figures (b)-(i), the values in the open steady state with the lowest capital at the moment of the liberalization are normalized to 1.

and our baseline economy), we consider four configurations where we explore different combinations of expenditure and capital elasticity heterogeneity: (i) same capital and expenditure elasticities across sectors; (ii) same capital and heterogeneous expenditure elasticities across sectors; (iii) heterogeneous capital and same expenditure elasticities across sectors; and (iv) heterogeneous capital and expenditure elasticities across sectors.

Table 7 shows the long-run capital of the liberalized path relative to the long-run level of capital under financial autarky for each economy ($\frac{K_0}{K_{SSC}}$). Column 1 presents the economy with representative firms and exogenous pricing of the manufacturing good. Column 2 reports the economy with representative firms and endogenous pricing. Column 3 presents the heterogeneous firms model with endogenous pricing of the manufacturing good as in Melitz (2003). The rows present the different combination of parameters for capital and expenditure elasticities. Our baseline economy is reported in row (iv) and column 3. As documented before, this economy converges to a level of capital equivalent to 96.3% than an identical economy that chooses to never to remove capital controls.

Table 7: Terminal Capital

	Representative Firms with Exogenous Pricing of Manufacturing Good	Representative Firms with Endogenous Pricing of Manufacturing Good	Heterogeneous Firms with Endogenous Pricing of Manufacturing Good
	(1)	(2)	(3)
(i) Same α and e	1.000	0.911	0.956
(ii) Same α and Het. e	1.000	0.913	0.956
(iii) Same e and Het. α	1.007	0.914	0.965
(iv) Het. α and Het. e	1.009	0.913	0.963

Note: For each economy we report long-run capital of the liberalization (baseline capital scarcity of 55%) as a fraction of their long-run autarky level. The first column represents a model with two representative firms and an exogenous tradable price, the second column allows for an endogenous tradable price, and the third column has heterogeneous firms in both sectors. The first row features the same production and expenditure elaticities (homothetic CES preferences) for both sectors, while the second row allows for heterogeneous expenditure elasticities, the third row only features heterogeneity in production elasticties, while the last row has heterogeneity on both elasticity margins.

Four observations stand out from the analysis of Table 7. First, the main long-run differences take place between columns and not within. Therefore, allowing for endogenous manufacturing prices and firm heterogeneity affects the long-run level of capital of an economy, whereas expenditure and production elasticity play a more muted role in the long-run. Second, exogenous prices and homogeneous capital elasticity are key to generate an invariant long-run level of capital (column 1, rows (i) and (ii)). In line with Gourinchas and Jeanne (2006), when the tradable price is exogenous and both sectors use the same production function, the liberalized economy has the same level of long-run capital than the one that slowly converges in financial autarky. Instead, when manufacturing production is allowed to be more capital intensive, the long-run shift of the economy towards manufacturing in order to serve the debt by exporting, materialized in a slightly higher capital stock (column 1, rows (iii) and (iv)). This is consistent with the classical theorem by Rybczynski (1955). Third, column 2 shows that the endogenous pricing of the manufacturing good affects significantly the long-term level of capital of the open economy. In the case where α and e are identical across sectors (row (i)), the long-run level of capital in the open economy is about 9% lower than the level of capital in autarky. This is purely a price effect as lower long-run prices push up the marginal product of capital in both sectors. A small Rybczynski effect is present when factor intensities differ across industries, but this force is clearly dominated by the endogenous price effect. Finally, in the baseline heterogeneous firm model, the long-run capital stock is larger than in the representative case with endogenous prices (Columns 3 vs 2). The differences between the heterogeneous firm model and the representative firm model with endogenous prices highlight the contribution of firm heterogeneity in shaping the permanent effects of liberalization. Heterogeneity triggers selection within sectors, lower demand for both sectors shifts the firm distribution towards more productive firms, alleviating part of the price effect and allowing for a higher level of long-run capital. In fact, comparing the last two columns of Table 7, firm heterogeneity decreases the long-run capital loss from 9% to 4.4%. This more muted response of the long-term level of capital comes from the love for variety implied in the heterogeneous firm model. Lower consumption decreases the mass of firms producing in the long-term, which lowers the number of varieties available and – in turn– reduces the drop in the domestic price. Therefore, although the lower consumption reduces the long-term aggregate price, this reduction is lower because the decreases in the number of varieties tends to rise the price level.

In sum, endogenous pricing of the manufacturing good lowers the long-term level of capital in an open economy and, hence, induces a loss. Interestingly, the heterogeneous firm model reduces this loss by reallocating resources towards the most productive firms in the economy. A natural question follows suit: what are the welfare implications of these models?

6.5 Welfare and Policy

As discussed in the previous section, because endogenous price responses decrease the long-run level of capital and, thus, the long-run production capacity of the economy, capital account openness can introduce a trade-off between the speed of convergence and the long-run equilibrium of the economy. This section studies the welfare consequences of a financial liberalization and shows that the long-run cost can dominate the short-run gains, which opens policy opportunities for pacing the financial liberalization. Because welfare analysis is not appropriate across models with different preferences, we focus our discussion on the welfare effects of a financial liberalization on the three models in the last row of Table 7 (row (iv) columns 1-3).

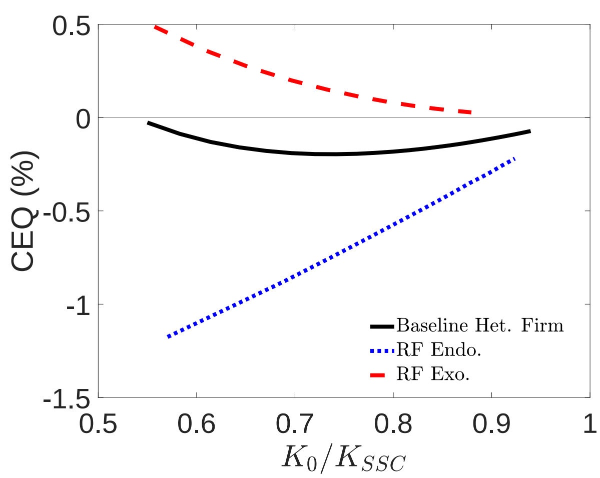


Figure 9: CEQ Welfare from Liberalization

Note: This figure shows the consumption-equivalent welfare gains for different initial capital conditions across the three models: baseline heterogeneous firm (solid), representative firm with endogenous prices (dotted), and representative firm with exogenous prices (dashed).

We measure welfare within each model as the consumption equivalent variation (CEQ) over the transition path and the steady-state that would leave the representative household indifferent between experiencing the liberalization or remaining in financial autarky. A positive number implies the household prefers the liberalization.[47] Figure 11 displays the CEQ gains under the three models. The red-dashed line plots welfare of the representative firm model with exogenous pricing of the domestic manufactured good. The blue dotted line plots welfare of the representative firm model with endogenous pricing of the domestic manufactured good, and the black line gives plots welfare from our benchmark model with heterogeneous firms. The figure shows that for both the representative firm model with endogenous prices and our benchmark model, there are welfare losses from liberalization (relative to financial autarky). In addition, the welfare effects from our benchmark model are lower than in the representative firm model with exogenous prices, and higher than in the representative firm model with endogenous prices.

To understand this result, first consider the representative firm model with exogenous prices. With the exception of having two sectors instead of one, and having non-homothetic preferences instead of homothetic preferences, this model is essentially the same as that of Gourinchas and Jeanne (2006). In particularly, upon liberalization, the economy immediately borrows so that it reaches its steady-state capital stock in one period. Moreover, this steady-state capital stock is independent of the initial level of capital.[48] Hence, there is an unambiguous gain in welfare and the welfare gain is larger the lower the initial capital stock. The latter is because the quicker the economy can reach its steady-state, the larger the gains.

Now consider the representative firm model with endogenous prices. Following the initial period of liberalization, households recognize that in order to service the long-run debt, consumption demand must decline (relative to GDP less investment). Alternatively, there must be a sufficiently large net export surplus in the manufacturing sector. From the consumption perspective, the lower long-run demand leads to a lower aggregate price level (relative to autarky), as well as lower sectoral prices. The lower long-run sectoral prices imply a lower long-run capital stock (as discussed previously in the context of the benchmark model). From the net export perspective, in order to run a large net export surplus in manufacturing, output in the sector must rise – indeed, capital used for manufacturing exports rises, even as total capital in manufacturing declines. The price effect – the lower long-run sectoral prices – leads to a lower terms of trade. Putting together these two perspectives, compared to the exogenous price model, liberalization in the representative firm model with endogenous prices implies a smaller short-run consumption gain, and a larger long-run consumption decline (relative to financial autarky).

Finally, let us turn to the welfare effects of the baseline model. This model has qualitatively the same force driving welfare relative to autarky as in the representative firm model with endogenous prices – namely, lower demand in the long-run, thus leading to a lower price level, and, ultimately, a lower

[47] The consumption equivalent compensation (CEQ) welfare gain is the difference between the welfare gain of an economy exposed to the liberalization (W_{lib}) versus that of one that remains in financial autarky (W_0), that is

$$\text{Consumption-Equivalent Welfare Gain} = \left(\frac{W_{\text{lib}}}{W_0}\right)^{\frac{1}{1-\gamma}} - 1.$$

We compute the CEQ over the entire time horizon, including the transition path and steady-state, starting from the date of the liberalization.

[48] Because of heterogeneous capital intensities across sectors there is a small Rybczynski effect discussed in Appendix E that makes capital slightly higher.

long-run capital stock. However, as figure 11 shows, the welfare losses relative to autarky are smaller in our baseline model. There are two reasons for this. The first reason involves the short-run consumption response following the liberalization. The liberalization allows households to borrow to finance more capital, and to finance the creation of new firms via expenditures on sunk costs. Hence, relative to autarky, in which the transition to the steady-state is slowed by the need to finance the creation of new firms, consumption rises strongly. This consumption response is greater than in the representative firm model with endogenous prices in which the liberalization simply speeds up capital accumulation.

The second reason for the smaller welfare losses involves the evolution of prices over time. In the long-run, the price level in our baseline model under liberalization is only slightly lower than it is under financial autarky. This translates to a slightly smaller capital stock relative to autarky. By contrast, the representative firm model with endogenous prices has a larger fall in the price level, and a correspondingly smaller capital stock, relative to autarky. Why is the long-run price decline relatively small in our baseline model? In fact, heterogeneous firms and selection imply a love for variety effect that counteracts part of the price decrease. In our baseline model there are fewer firms under liberalization compared to autarky. Fewer varieties, all else equal, implies a higher price level. Hence, the fall in prices relative to financial autarky is smaller (compared to the representative firm model with endogenous prices). Appendix Appendix E provides a detailed discussion of the forces behind the welfare effects of the model.

-Welfare-Improving Capital Controls

An important result from the preceding discussion is the decline in the terms of trade that occurs while the economy generates a large enough manufacturing net export surplus to service the long-run debt. This decline is the key reason why welfare is lower following the liberalization. Importantly, the representative household does not take into account that long-run prices respond to her borrowing patterns in the onset of the liberalization. Therefore, allowing for endogenous prices introduces a novel trade-off between the speed of convergence and the final steady state level of consumption. This trade-off can generate welfare losses even in a fully efficient model. The existence of these losses suggests avenues for welfare improving policies. Because the long-run steady state is affected by the level of long-run debt, a natural policy to consider is a gradual financial liberalization that reduces the long-run level of debt and, therefore, trades some convergence speed for a higher long-run capital stock. In particular, we study how a gradual reduction in the borrowing tax τ may contribute to welfare gains relative to the benchmark case where τ is reduced to zero upon liberalization. We use the following functional form for the borrowing tax schedule:

$$\tau_t = \max\left\{\left(1 - \left(\frac{2t}{T}\right)^{\phi}\right) \cdot \bar{\tau}, 0\right\}, \tag{21}$$

where T is the length of the transition to the new steady state, $\bar{\tau}$ is the value of τ that makes households just indifferent between borrowing and not borrowing in the first period. The parameter $\phi \in [0, \infty)$ controls the shape of the borrowing tax schedule.

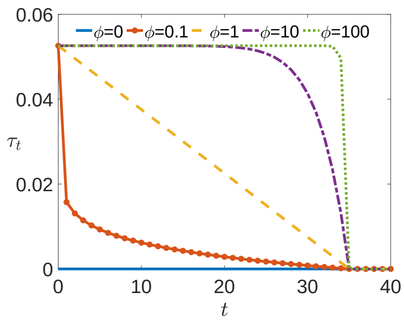
Figure 10 presents our exercises and illustrates how this policy allows us to balance the speed-level trade-off of a financial liberalization. Figure 10a shows how ϕ governs the speed of the decrease in capital controls. When $\phi = 0$, the borrowing tax is reduced to zero immediately, which coincides with our baseline analysis. When $\phi < 1$, the liberalization reform is front-loaded in the sense that the borrowing tax decreases quickly at first and then gradually approaches zero. With $\phi = 1$, the tax decreases linearly whereas $\phi > 1$ corresponds to a concave schedule where the tax remains high for a number of periods and decreases at an increasing rate. In the limiting case as $\phi \to \infty$, the reform occurs in the period $\frac{T}{2} + 1$. Panel 10b shows how ϕ affects welfare. The hump shape pattern of the welfare gain as a function of ϕ shows the nature of the speed-level trade-off between consumption smoothing and lower long-term level of capital. We illustrate this trade-off in Panels 10c and 10d. Panel 10c shows that the final level of capital is increasing in ϕ. This pattern reflects that front-loaded financial liberalizations imply high long-run levels of debt and higher losses of long-run capital due to price effects. Panel 10d shows that the number of periods needed to reach half of the consumption transition increases in ϕ. The higher the speed of the liberalization, the faster the economy reaches half of the consumption level at the steady state level. For the calibrated baseline model, the best policy is given by $\phi = 0.15$. This implies that, if Hungary would have implemented this staggered financial liberalization, it would have secured welfare gains of 0.21% (instead of experiencing welfare loses of 0.03%).[49]

7 Conclusion

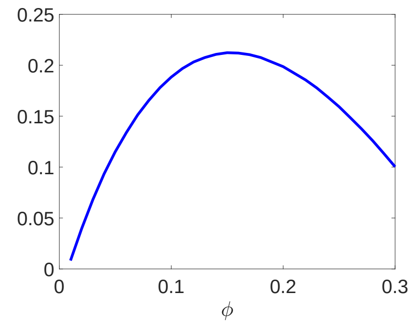
In our paper, we demonstrate that services play an integral role in the short-run adjustment of an economy following the capital inflows that accompany a financial liberalization. Services tend to have higher expenditure elasticities, lower capital elasticities, and less tradability, than manufactured goods. Using the census of firms in Hungary, we show that a key part of the adjustment following Hungary's financial liberalization in 2001 arises from two channels: the consumption channel, which stems from different expenditure elasticities, and the input cost channel which stems from different capital elasticities. Our results indicate that the consumption channel dominates and the short-term dynamics is characterized by increases in the share of employment, value added and mass or firms towards services.

Our calibrated model delivers the above short and medium-term firm and sector-level dynamics, even as it also implies at the macroeconomic level that the domestic interest rate falls, the net foreign asset position becomes negative, and consumption and capital accumulation increase. We examine our model's implications for the long-run, as well. Large capital inflows are associated with large long-run levels of debt that have to be served by exporting. This long-run trade surplus implies another set of dynamics, which, reverses much of the short and medium-term dynamics. In the long-run, the trade surplus must occur in manufacturing and, hence, there is reallocation to manufacturing and to exporters in particular. In turn, higher exports decreases terms of trade and the long-term level of capital. This lower capital stock entails welfare loses that can dominate the welfare gains arising from the faster speed of convergence to the steady state. Notably, our paper shows that there is room for welfare-improving capital controls, as countries face a trade-off between speed of convergence and long-run capital stock.

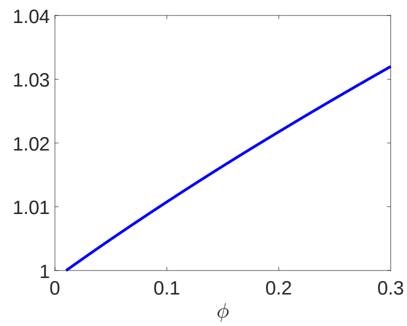
[49] Appendix F.2 shows the dynamic path of several macro variables associated to the best policy and compares it to policies characterized by faster and slower liberalizations.



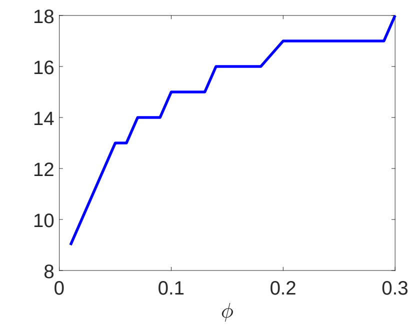
A) Borrowing Tax Schedule



B) CEQ Welfare



C) Long-Run Capital Level



D) Half-Life C Convergence

Figure 10: Borrowing Tax Policy and Welfare

Note: The first panel (top left) plots the borrowing tax schedule for a transition with length $T = 70$ and various values of ϕ. The second panel (top right) displays CEQ welfare gains as a function of ϕ. The third panel (bottom left) displays the final level of capital associated to each ϕ .The fourth panel (bottom right) shows the number of period needed for consumption to reach half of its final steady state level as a function of ϕ.

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Online Appendices

Empirical Appendices

Appendix A Cross-Country Analysis

In this section we assess whether international financial integration associates with sectoral allocation across countries in the short-term. In particular, we test if financial liberalization episodes –measured with the Chinn and Ito (2008) index of capital account openness– associates with changes in the share of value added in agriculture, manufacturing and services, using World Bank Data for 163 countries over 1970 to 2015.[50]

A first glance at the data suggests that financial liberalization episodes correlate with reallocation of resources towards services to the expense of agriculture and manufacturing. Figure A1 shows that, within the three years before and after a capital account liberalization, there is an increase share of value added share of services activities (blue line on the right axis), and with a parallel decrease in the value added share in agriculture activities (green-dashed line, left axis) and, to a lesser extent, a drop in manufacturing (red-dotted line, left axis).

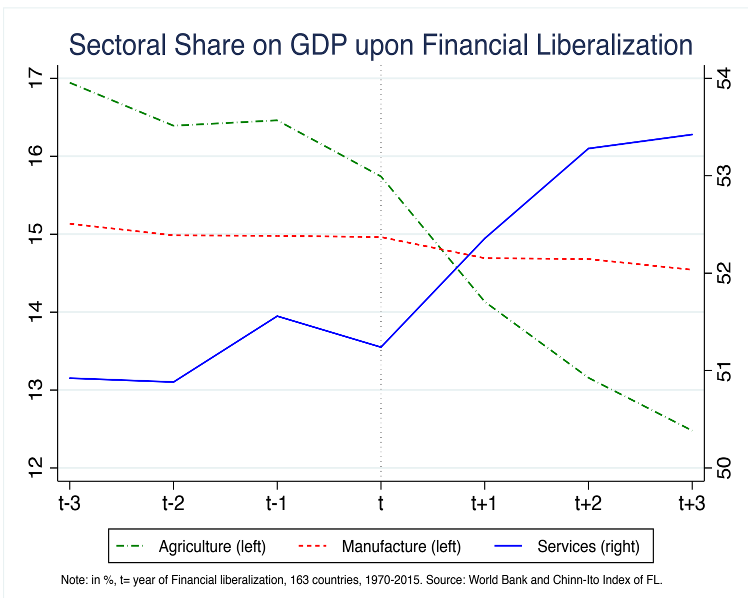


Figure A1: Financial Liberalization: A Cross-Country Analysis

Yet this correlation could be omitting other factors and mislead the real effect of financial liberalization. As extensively discussed in the international economics literature, capital account openness often associates with other reforms, such as trade liberalizations or banking deregulations (see Henry 2007, Bonfiglioli 2008 and Varela 2018 for example). To account for these factors, one could estimate this

[50]The Chinn and Ito index uses the Annual Report on Exchange Arrangements and Exchange Restrictions produced by the International Monetary Fund to create a measure accounting for restrictions on capital account and current account transactions. This measure goes from -1.9 to 2.35 –with a standard deviation of 1.52– for closed to fully open economies.

relationship econometrically by regressing:

$$\log s_{jit} = \alpha \log s_{ijt-1} + \beta FL_{it} + \gamma X_{it} + \varepsilon_{ijt}, \tag{A.1}$$

where j, i, t represent sector (agriculture, manufacturing, services), country and year, respectively; s is the value added share in the sector, FL is the measure of financial liberalization; and X_{it} is a vector of controls including trade openness (export+ import/ GDP), government size (government expenditure/ GDP), financial depth (private credit/GDP) and a dummy for financial crisis. Our control data comes from the World Development Indicators of the World Bank and the indicator for financial crisis from Reinhart and Rogoff (2014). The variable $\log s_{ijt-1}$ is the sector's previous year value added share that controls for the sector's specific trend. The variable of interest is β, which captures the effect of financial liberalization on the value added share of each sector.

Estimating equation (A.1) with OLS poses two econometric concerns: simultaneity bias –if sectoral reallocation induces countries to deregulate their capital accounts– and inconsistent estimators due to the presence of lagged dependent variable. To address these issues, we follow the literature on capital account openness (Bekaert, Harvey, and Lundblad 2005 and Bekaert, Harvey, and Lundblad 2011, and Bonfiglioli 2008) and estimate a GMM dynamic panel (Arellano and Bond 1991 and Blundell and Bond 1998), where we employ five years past information of endogenous variables as instrument for current variables. We employ five years non-overlapping panel data to avoid endogeneity issues. The identification assumption is that the five year lags of the sectoral shares are valid instruments for the lagged dependent variable and the financial liberalization measure. In particular, we estimate the following system:

$$d \log s_{jit} = \alpha \; d \log s_{ijt-5} + \beta \; dFL_{it} + \gamma \; dX_{it} + d\iota_t + d\varepsilon_{ijt}, \tag{A.2}$$

$$\log s_{jit} = \alpha \; \log s_{ijt-5} + \beta FL_{it-5,t} + \gamma \; dX_{it-5,t} + \mu_i + \iota_t + \varepsilon_{ijt}, \tag{A.3}$$

where $d \log s_{ijt-5}$ is the log difference between t and $t-5$, variables indexed by $(t-5, t)$ are averages over the period $t-5$ and t, and μ_i and ι_t are country and year fixed effects. The identification strategy is to estimate differences of the endogenous and the pre-determine variables in equation (A.2) with lagged levels, and levels in equation (A.3) with differenced variables. We estimate the system by the two-step Generalized Method of Moments with moments conditions $E[\log s_{jit-5s}(\varepsilon_{it} - \varepsilon_{it-5})] = 0$ and $E[\log z_{it-5s}(\varepsilon_{ijt} - \varepsilon_{ijt-5})] = 0$ for $s \geq 2$ on the predetermined variables z for equation (A.2); and $E[d \log s_{ijt-5}\varepsilon_{ijt}] = 0$ and $E[dz_{it-5}\varepsilon_{ijt}] = 0$ for equation (A.3). We treat both the financial liberalization measure and controls as pre-determined. Instruments would be valid whenever the residuals from equation (A.2) are not second order serially correlated. Then, the coefficients are efficient and consistent where both the moment conditions and the no-serial correlation are satisfied. In order to test for no-serial correlation of the residuals, we employ the Sargan test of over-identifying restrictions. To ensure the consistency of results, we keep countries that report at least ten years of consecutive data.

Table A1 presents the results. Column 1 shows the OLS coefficient of equation (A.1) for the agricultural sector. The estimated coefficient is negative and highly statistically significant, suggesting that financial liberalization associates with a decrease in the value added share of agriculture activities. Columns 2 and 3 confirm this correlation when estimating the dynamic panel. After the inclusion of all

Table A1: Financial Liberalization: A Cross-Country Analysis

	Log share in value added								
	Agriculture			Manufacturing			Services		
	OLS	GMM		OLS	GMM		OLS	GMM	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
FL Index	-0.020***	-0.028*	-0.026***	0.007	0.032**	-0.000	0.010**	0.007**	0.014***
	(0.007)	(0.015)	(0.008)	(0.008)	(0.015)	(0.017)	(0.004)	(0.003)	(0.005)
Trade Openness			-0.363**			-0.136			0.100***
			(0.143)			(0.315)			(0.022)
Government Size			0.337***			0.132			-0.109***
			(0.127)			(0.264)			(0.019)
Financial Depth			-0.041*			-0.017			0.032***
			(0.021)			(0.062)			(0.006)
Financial Crisis			0.034**			-0.103**			0.033***
			(0.015)			(0.051)			(0.006)
Lag Dep. Var.	1.006***	0.983***	1.004***	0.877***	0.827***	0.709***	0.817***	0.807***	0.704***
	(0.009)	(0.040)	(0.027)	(0.027)	(0.047)	(0.132)	(0.037)	(0.028)	(0.023)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	914	914	342	914	914	342	914	914	342
Countries	163	163	62	163	163	62	163	163	62
Sargan (pvalue)		0.410	0.821		0.313	0.220		0.208	0.265

Notes: *, **, *** significant at 10, 5, and 1 percent. All regressions include a constant term. Period 1970-2015. Chinn and Ito (2016) index of Financial Liberalization. Source: World Bank, IMF, Chinn and Ito (2016).

controls in column 3, the coefficient implies that one standard deviation increase in the index of financial liberalization (1.52) associates with a 3.9% decrease in the value added share in agriculture activities. This result implies that, upon the financial liberalization, the value share in agriculture decreases 0.7 percentage points in the average country. Columns 4-6 present the results for the manufacturing sector. Interestingly, the estimated coefficient of the dynamic panel is close to zero and non-statistically significant after the inclusion of all controls in column 6. This insignificant effect is not surprising given that the value added share in manufacturing usually displays a hump shape on country's income per capita (Buera and Kaboski 2009; Jorgenson and Timmer 2011; Herrendorf, Rogerson, and Valentinyi 2014, among others). Lastly, columns 7-9 confirm the increase in services following financial liberalization episodes. In particular, a one standard deviation increase in the level of international financial integration associates with a 2.1% increase in the share of service activities. This expansion implies an increase of 1.1 percentage points for the average country.

We present below several robustness tests and extensions. First, we show in Table A2 that the expansion in value added share of services remains significant in a shorter horizons using a GMM of 3 non-overlapping year panel (columns 1-3). Second, in columns 4-6, we use data from Abiad, Detragiache, and Tressel (2010) who construct a narrowly defined measure of financial openness by focusing on restrictions on capital flows and show that the increase in the share of services change remains true when using this measure.[51] Third, to assess whether the effect of financial integration for manufacturing varies according with the country's level of economic development, in Table A3, we split countries by

[51] In particular, Abiad, Detragiache, and Tressel (2010) create an index indicating: whether the exchange rate system is unified, whether banks are allowed to borrow from abroad, and whether capital outflows are allowed to flow freely.

below and above the median income per capita and re-estimate column 6. For less developed economies, the coefficient is positive and statistically significant suggesting that financial liberalization enhances the manufacturing sector in countries with a low income per capita (column 1). The effect is non-significant in developed economies (column 2). Finally, Table A3 uses the employment shares as dependent variables and confirms the increase in the share of services following financial openness. Columns 3 and 5 report the decrease in the employment share in agriculture and the increase in this share in services.[52]

Table A2: Financial Liberalization: A Cross-Country Analysis-Robustness

	Log VA Share (3 years)			IMF- Index of FL		
	Agriculture	Manufacturing	Services	Agriculture	Manufacturing	Services
	(1)	(2)	(3)	(4)	(5)	(6)
FL Index	-0.018	0.013	0.007*	-0.111***	0.000	0.014***
	(0.015)	(0.015)	(0.004)	(0.022)	(0.014)	(0.005)
Trade Openness	-0.232	-0.021	-0.015	0.478***	0.049	-0.153**
	(0.171)	(0.238)	(0.054)	(0.143)	(0.223)	(0.074)
Government Size	0.228	0.036	0.007	-0.388***	-0.052	0.112*
	(0.176)	(0.211)	(0.052)	(0.086)	(0.204)	(0.064)
Financial Depth	-0.039	0.024	0.018*	-0.002	-0.001	0.038***
	(0.031)	(0.049)	(0.011)	(0.015)	(0.029)	(0.009)
Financial Crisis	0.03	-0.003	0.003	0.028	0.001	0.014*
	(0.031)	(0.030)	(0.007)	(0.036)	(0.054)	(0.007)
Lag Dependent Variable	0.926***	0.842***	0.747***	0.991***	0.751***	0.795***
	(0.042)	(0.127)	(0.060)	(0.013)	(0.098)	(0.052)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes	Yes
N	602	602	602	229	229	229
Countries	62	62	62	48	48	48
Sargan (pvalue)	0.638	0.796	0.898	0.318	0.116	0.147

Notes: *, **, *** significant at 10, 5, and 1 percent. All regressions include a constant term. Period 1970-2015. Source: World Bank, IMF, Chinn and Ito (2008) and Abiad, Detragiache, and Tressel (2010).

[52]Note that sectors have a slightly different classification in the employment data of World Bank. In particular, the World Bank uses data from International Labour Organization, ILOSTAT database, which defines industry (instead of manufacturing) as manufacturing, construction and utilities (electricity, gas and water). In consequence, the service data excludes construction and utilities.

Table A3: Financial Liberalization: A Cross-Country Analysis-Extensions

	Log share in value added		Log share in employment		
	Manufacturing		Agriculture	Industry	Services
	(1)	(2)	(3)	(4)	(5)
FL Index	0.041*	0.003	-0.009*	-0.015	0.003*
	(0.022)	(0.064)	(0.005)	(0.014)	(0.002)
Trade Openness	-0.613	-0.936***	0.348***	-0.256	-0.086***
	(0.950)	(0.313)	(0.085)	(0.195)	(0.029)
Government Size	0.735	0.862***	-0.292***	0.256	0.028
	(1.018)	(0.328)	(0.087)	(0.169)	(0.026)
Financial Depth	0.018	0.015	-0.214***	0.043	0.026***
	(0.077)	(0.075)	(0.010)	(0.029)	(0.006)
Financial Crisis	-0.033	-0.023	0.024**	-0.047	0.022***
	(0.054)	(0.048)	(0.010)	(0.043)	(0.003)
Lag Dep. Var.	0.613**	0.792***	0.872***	0.732***	0.840***
	(0.278)	(0.216)	(0.007)	(0.057)	(0.015)
Year FE	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes
N	209	127	187	187.000	187
Countries	31	27	63	63	63
Sargan (pvalue)	0.314	0.648	0.236	0.110	0.100

Notes: *, **, *** significant at 10, 5, and 1 percent. All regressions include a constant term. Period 1970-2015. Chinn and Ito (2016) index of Financial Liberalization. Industry: includes construction and utilities (electricity, gas and water) as reported in the WDI. Source: World Bank, IMF and Chinn and Ito (2008) .

Appendix B Empirical Design

-*Value Added.* To assess the impact of the financial liberalization on firms' value added, we consider the production function $q_{ijt} = \varphi\, k_{ijt}^{\alpha_j} l_{ijt}^{\beta_j}$ and use the optimal capital and labor demand employed in domestic production. In particular, the optimal capital and labor demands for variable domestic costs are

$$k_{dj,t}(\varphi) = \frac{\alpha_j}{r_t^k}\phi_{j,t}\left[\left(\frac{p_{j,t}(\varphi)}{P_{j,t}}\right)^{-\sigma}\left(\frac{P_{j,t}}{P_t}\right)^{-\eta}\frac{\theta_j C_t^{e_j}}{\varphi}\right] \quad \text{and} \quad l_{dj,t}(\varphi) = \frac{\beta_j}{w_t}\phi_{j,t}\left[\left(\frac{p_{j,t}(\varphi)}{P_{j,t}}\right)^{-\sigma}\left(\frac{P_{j,t}}{P_t}\right)^{-\eta}\frac{\theta_j C_t^{e_j}}{\varphi}\right].$$

Replacing these equations into the production function, we obtain

$$q_{jt}(\varphi) = \left[\left(\frac{p_{j,t}(\varphi)}{P_{j,t}}\right)^{-\sigma}\left(\frac{P_{j,t}}{P_t}\right)^{-\eta}\theta_j C_t^{e_j}\right].$$

Re-arranging terms and applying logs, the optimal production of each firm $q_{jt}(\varphi)$ becomes:

$$\begin{aligned}\log(q_{jt}(\varphi)) = \quad & -\alpha_j\sigma\log(r_t^k/w_t) + e_m\log(C_t) + (\sigma-\eta)\log(P_{jt}) \\ & -(\alpha_j+\beta_j)\sigma\log(w_t) + \eta\log(P_t) + \log(\theta_m) + \alpha_j\sigma\log(\alpha_j) + \beta_j\sigma\log(\beta_j) + \sigma\log(\varphi\rho),\end{aligned} \tag{B.1}$$

We can solve for the sectoral price level P_{jt} and replace it into equation (B.1). Recall that the price level is given by

$$\log(P_{jt}) = \frac{1}{1-\sigma}\log\left[\int_{\varphi_{jt}^*} p_{jt(\varphi)}^{1-\sigma}\mu(\varphi)d\varphi\right].$$

After re-arranging terms, sector j's price level becomes

$$\log(P_{jt}) = \log\phi_{jt} + \log\left(\frac{1}{\rho}\right) - \underbrace{\frac{1}{\sigma-1}\log\left[\int_{\varphi_{jt}^*}\left(\frac{1}{\varphi}\right)^{1-\sigma}\mu(\varphi)d\varphi\right]}_{\equiv\tilde{\varphi}_{jt}} \tag{B.2}$$

Replacing equation (B.2) on (B.1), we obtain

$$\begin{aligned}\log(q_{jt}(\varphi)) = \quad & -\alpha_j\eta\log(r_t^k/w_t) + e_m\log(C_t) + (\sigma-\eta)\tilde{\varphi}_{jt} \\ & \underbrace{-(\alpha_j+\beta_j)\eta\log(w_t)}_{\tilde{A}_{jt}\text{:sector time-varying}} + \underbrace{\eta\log(P_t)}_{\tilde{B}_t\text{:agg time-varying}} + \underbrace{\log(\theta_m) - \alpha_j\eta\log(\alpha_j) - \beta_j\eta\log(\beta_j)}_{\tilde{C}_j\text{:sector time-invariant}} + \underbrace{\sigma\log(\varphi) - \eta\log(\rho).}_{\tilde{D}_i\text{:firm time-invariant}}\end{aligned} \tag{B.3}$$

From equation (B.3), it is straightforward to see the effect of the input-cost and consumption channels on firm's production. Taking derivatives with respect to the input cost ratio, we obtain $\frac{\partial\log(q_{jt}(\varphi))}{\partial\log(r_t^k/w_t)} = -\alpha_j\eta < 0$, which indicates that a decrease in the relative price of capital leads to an increase in firms' production, particularly in sectors with higher capital elasticity. Similarly, $\frac{\partial\log(q_{jt}(\varphi))}{\partial\log(C_t)} = e_m > 0$, indicating that an increase in aggregate consumption leads to a higher increase in firms' production for sectors with higher expenditure elasticity.

We can express equation (B.3) in a difference-in-difference estimator. Define FL_t a dummy variable equal one for the post-reform period, and 0 otherwise. The effect of the policy could be estimated as

$$\log(q_{ijt}) = \gamma_0 \text{FL}_t + \gamma_1(\alpha_j \times \text{FL}_t) + \gamma_2(e_m \times \text{FL}_t) + \gamma_3\tilde{\varphi}_{jt} + \gamma_4((\alpha_j + \beta_j) \times \text{FL}_t) + \mu_i + \varepsilon_{it}, \tag{B.4}$$

where γ_0 captures time-varying general trends of the economy that affect all sectors homogeneously and, in particular, the term $\tilde{B}_t$ of equation (B.3). γ_1 captures the effect of the input-cost channel, that is, how $-\eta\log(r_t^k/w_t)$ affects sectors differentially according to their capital elasticity. γ_2 captures the effect of expenditure channel and how aggregate consumption – $\log(C_t)$ – affects sector heterogeneously according with their expenditure elasticity e_m. γ_3 captures changes in the sectoral average productivity by $(\sigma-\eta)\tilde{\varphi}_{jt}$. γ_4 controls for how aggregate trends affect sectors differently according to their returns to scale of the sector, which are driven by the term $\tilde{A}_{jt}$. μ_i captures firms' and sectors' time-invariant characteristics given by $\tilde{C}_j$ and $\tilde{D}_i$ in equation (B.3).

To obtain a first-difference estimator, consider that in period $t = 1$, the effect of the financial liberalization would be

$$\log(q_{ij1}) = \gamma_0 \text{FL}_1 + \gamma_1(\alpha_j \times \text{FL}_1) + \gamma_2(e_m \times \text{FL}_1) + \gamma_3\tilde{\varphi}_{j1} + \gamma_4((\alpha_j + \beta_j) \times \text{FL}_1) + \mu_i + \varepsilon_{i1}. \tag{B.5}$$

In $t = 0$ when $\text{FL}_t = 0$, equation (B.4) becomes

$$\log(q_{j0}(\varphi)) = \gamma_3\tilde{\varphi}_{j0} + \mu_i + \varepsilon_{i0} \tag{B.6}$$

Subtracting equation (B.6) to (B.5), we obtain the difference-in-difference estimator

$$\Delta q_j(\varphi) = \gamma_0 \text{FL}_1 + \gamma_1(\alpha_j \times \text{FL}_1) + \gamma_2(e_m \times \text{FL}_1) + \gamma_3\Delta\tilde{\varphi}_j + \gamma_4((\alpha_j + \beta_j) \times \text{FL}_1) + \Delta\varepsilon_i,$$

which is equivalent to write

$$\Delta q_j(\varphi) = \gamma_0 + \gamma_1\alpha_j + \gamma_2 e_m + \gamma_3\Delta\tilde{\varphi}_j + \gamma_4(\alpha_j + \beta_j) + \Delta\varepsilon_i. \tag{B.7}$$

-Capital. A firm's optimal capital demand for local variable production is given by $k_{jt}(\varphi) = \alpha_j \frac{\phi_{jt}}{r_t^k}\frac{q_{jt}(\varphi)}{\varphi}$. Applying logs we obtain

$$\log(k_{jt}(\varphi)) = \log(\alpha_j) + \log(\phi_{jt}) - \log(r_t^k) + \log(q_{jt}(\varphi)) - \log(\varphi). \tag{B.8}$$

Replacing equation (B.3) and considering that $\log(\phi_{jt}) = \alpha_j\log(r_t^k/w_t) + (\alpha_j+\beta_j)\log(w_t) - \alpha_j\log(\alpha_j) + \beta_j\log(\beta_j)$, we can rewrite equation (B.8) as

$$\log(k_{ijt}) = -\alpha_j(\eta-1)\log(r_t^k/w_t) + e_m\log(C_t) + (\sigma-\eta)\tilde{\varphi}_{jt} + (\alpha_j+\beta_j)\log(w_t) + \tilde{B}'_t + \tilde{C}'_j + \tilde{D}'_i, \tag{B.9}$$

where $\tilde{B}'_t$, $\tilde{C}'_j$, and $\tilde{D}'_i$ absorb aggregate time-varying, sectoral time-invariant, and firm time-invariant trends.

We can take partial derivatives in equation (B.9) to assess the effect of the input-cost and consumption channels on firm's capital. Formally, $\frac{\partial \log(k_{ijt})}{\partial \log(r_t^k/w_t)} = -\alpha_j(\eta - 1) < 0$, which (if $\eta > 1$) indicates that a decrease in the relative price of capital leads to an increase in firms' capital demand, particularly in sectors with higher capital elasticity. Similarly, $\frac{\partial \log(k_{ijt})}{\partial \log(C_t)} = e_m > 0$, indicating that an increase in aggregate consumption leads to a higher increase in firms' capital demand for sectors with higher expenditure elasticity.

In a difference-in-difference estimator, equation (B.9) becomes

$$\Delta k_j(\varphi) = \gamma_0 + \gamma_1\alpha_j + \gamma_2 e_m + \gamma_3\Delta\tilde{\varphi}_j + \gamma_4(\alpha_j + \beta_j) + \Delta\varepsilon_i, \tag{B.10}$$

-Labor. A firm's optimal labor demand for local variable production is given by $l_{jt}(\varphi) = \beta_j \frac{\phi_{jt}}{w_t}\frac{q_{jt}(\varphi)}{\varphi}$. Applying logs we obtain

$$\log(l_{jt}(\varphi)) = \log(\beta_j) + \log(\phi_{jt}) - \log(w_t) + \log(q_{jt}(\varphi)) - \log(\varphi). \tag{B.11}$$

Replacing equation (B.3) and $\log(\phi_{jt})$, we can rewrite equation (B.11) as

$$\log(l_{ijt}) = -\alpha_j(\eta - 1)\log(r_t^k/w_t) + e_m\log(C_t) + (\sigma - \eta)\tilde{\varphi}_{jt} + (\alpha_j + \beta_j)\log(w_t) + \tilde{B}_t'' + \tilde{C}_j'' + \tilde{D}_i', \tag{B.12}$$

where $\tilde{B}_t''$, $\tilde{C}_j''$, and $\tilde{D}_i'$ absorb aggregate time-varying, sectoral time-invariant, and firm time-invariant trends.

Taking partial derivatives in equation (B.12), we obtain $\frac{\partial \log(l_{ijt})}{\partial \log(r_t^k/w_t)} = -\alpha_j(\eta-1) < 0$, which indicates that a decrease in the relative price of capital leads to an increase in firms' labor demand, particularly in sectors with higher capital elasticity. Similarly, $\frac{\partial \log(l_{ijt})}{\partial \log(C_t)} = e_m > 0$, indicating that an increase in aggregate consumption leads to a higher increase in firms' labor demand for sectors with higher expenditure elasticity.

In a difference-in-difference estimator, equation (B.12) becomes

$$\Delta l_{ij} = \gamma_0 + \gamma_1\alpha_j + \gamma_2 e_m + \gamma_3\Delta\tilde{\varphi}_j + \gamma_4(\alpha_j + \beta_j) + \Delta\varepsilon_i, \tag{B.13}$$

Appendix C Additional Figures and Tables

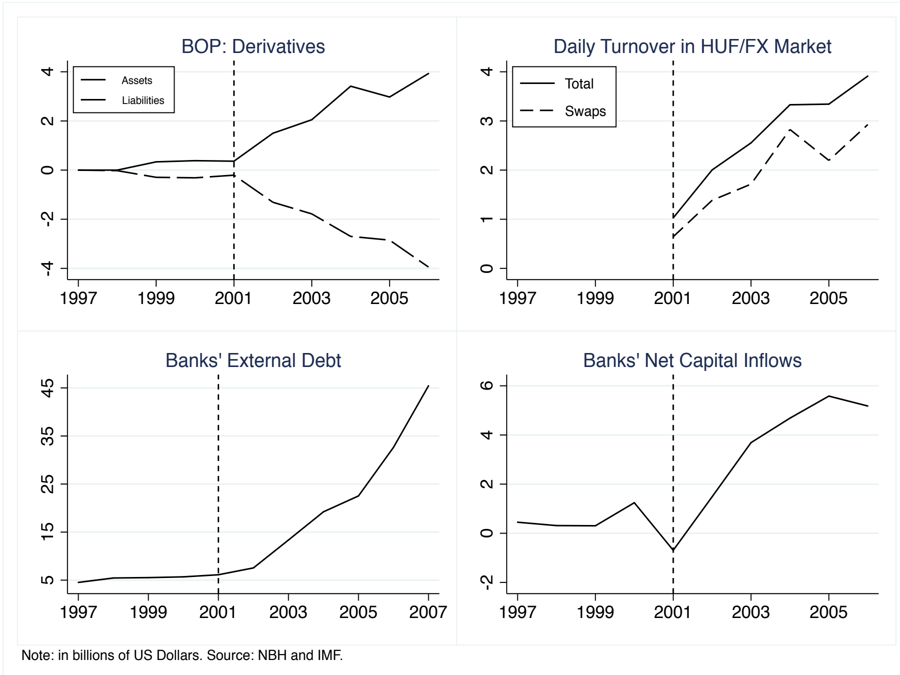


Figure C.1: Capital Flows and Financial Liberalization in Hungary

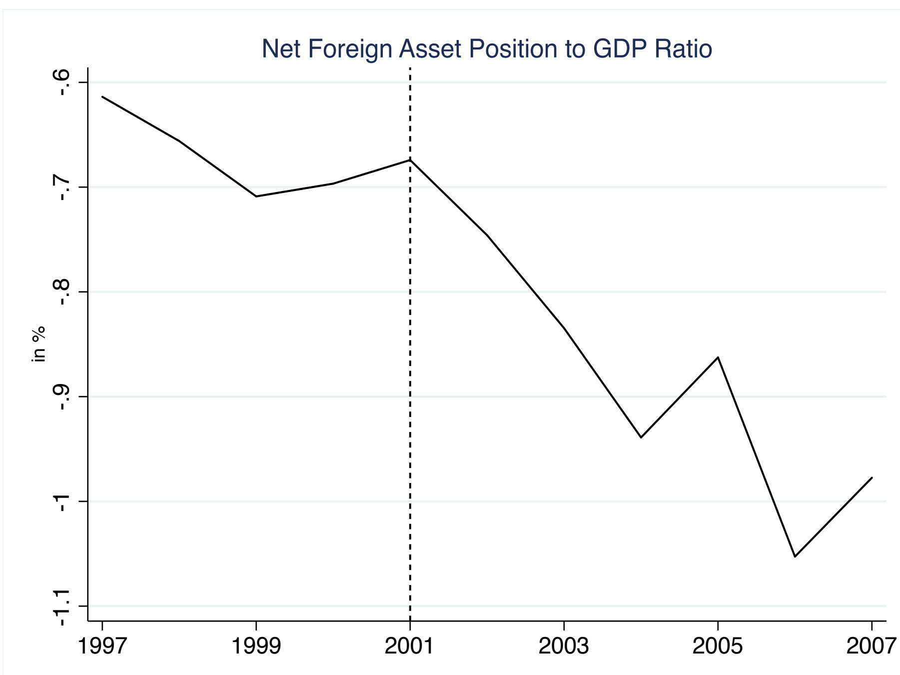


Figure C.2: Hungary: Evolution of Net Foreign Asset Position over GDP

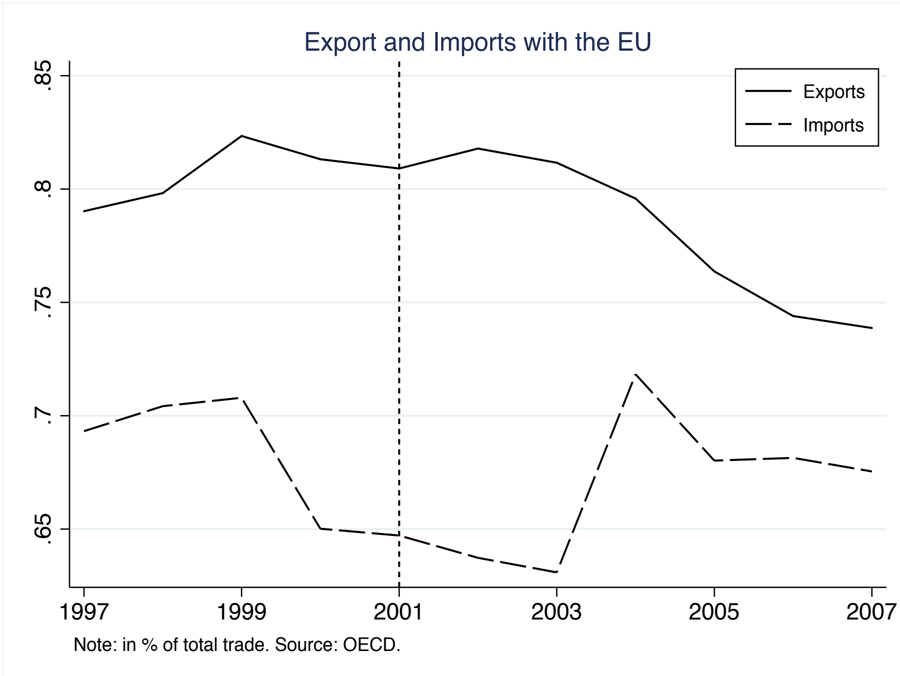


Figure C.3: Hungary: Total Exports and Imports with the EU

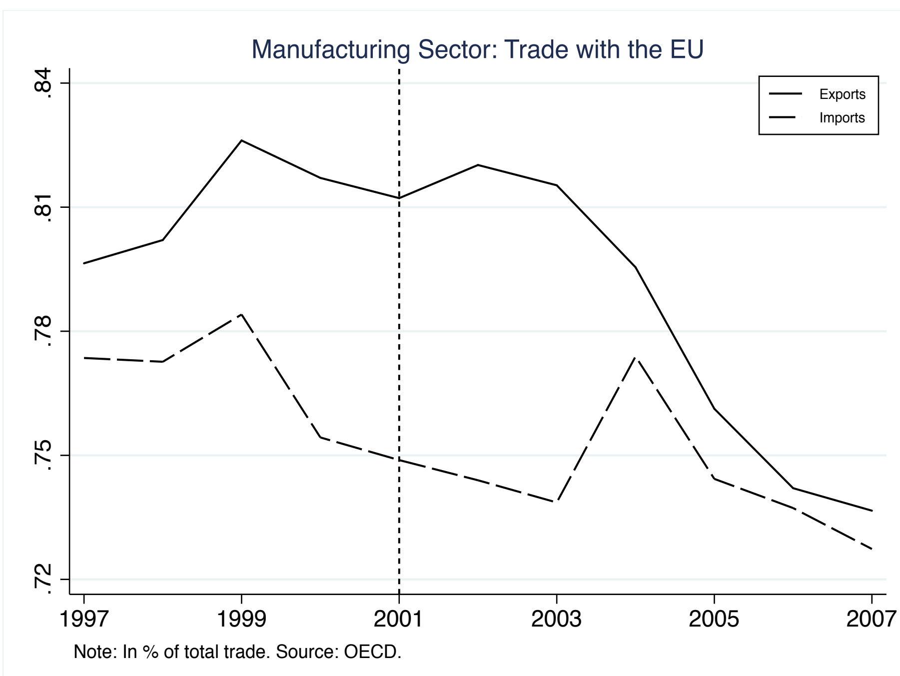


Figure C.4: Hungary: Manufacturing Trade and Exports with the EU

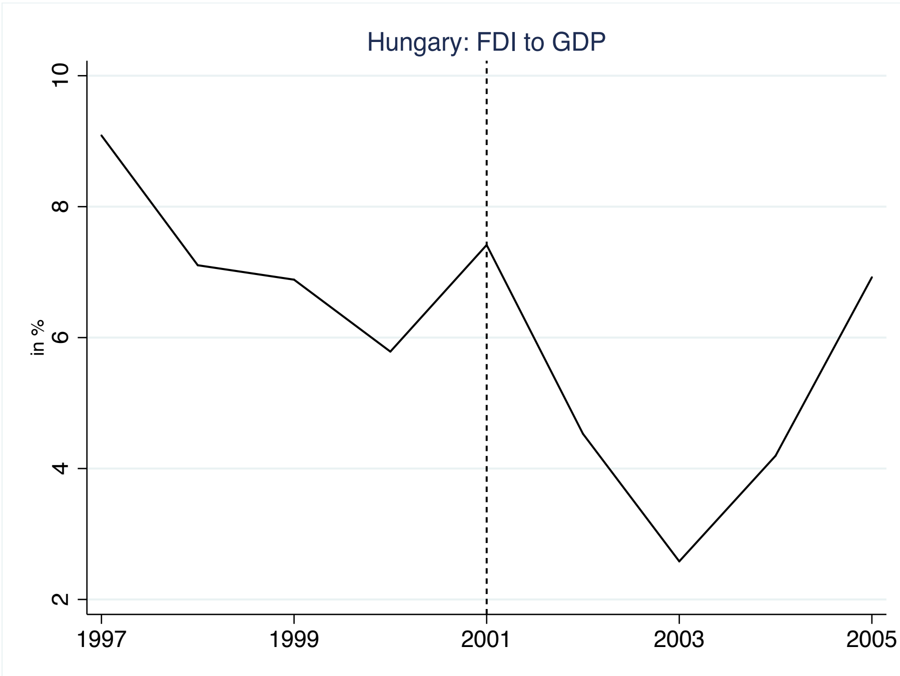


Figure C.5: Hungary: Evolution of Foreign Direct Investment

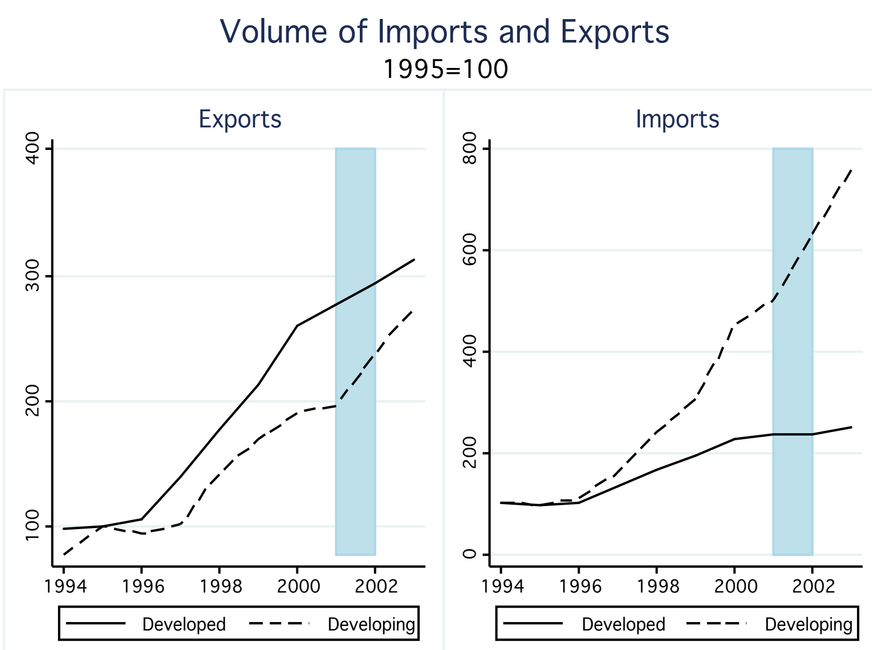


Figure C.6: Hungary: Volume of Trade

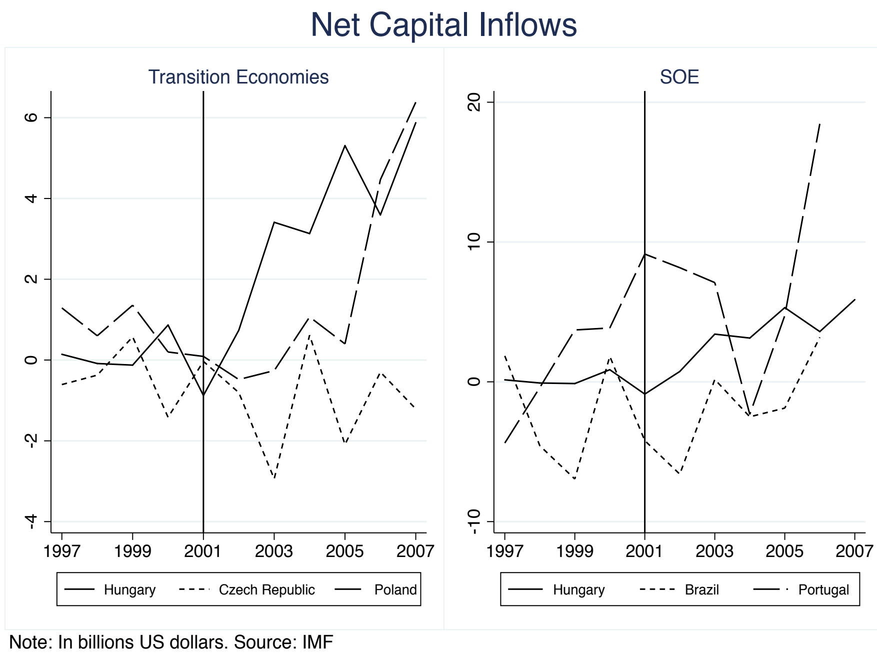


Figure C.7: Net Capital Inflows to Transition and Small Open Economies

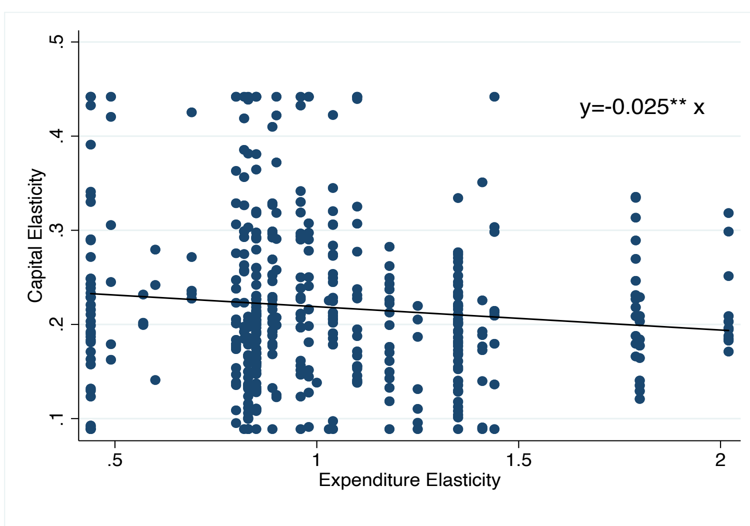


Figure C.8: Correlation between Capital and Expenditure Elasticities

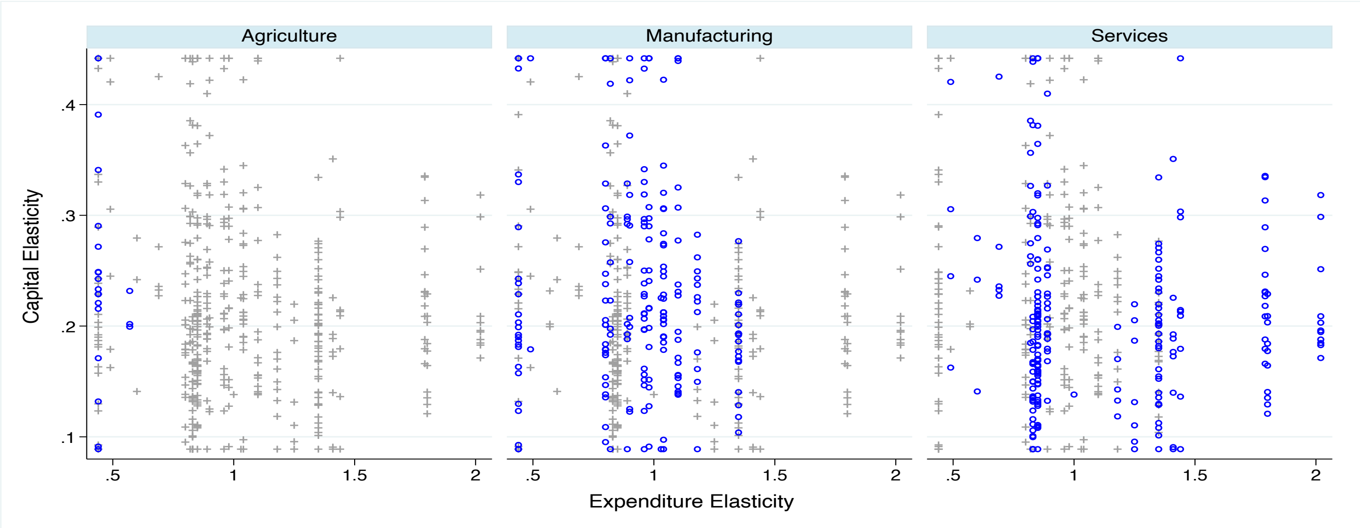


Figure C.9: Capital and Expenditure Elasticities across broadly-defined sectors

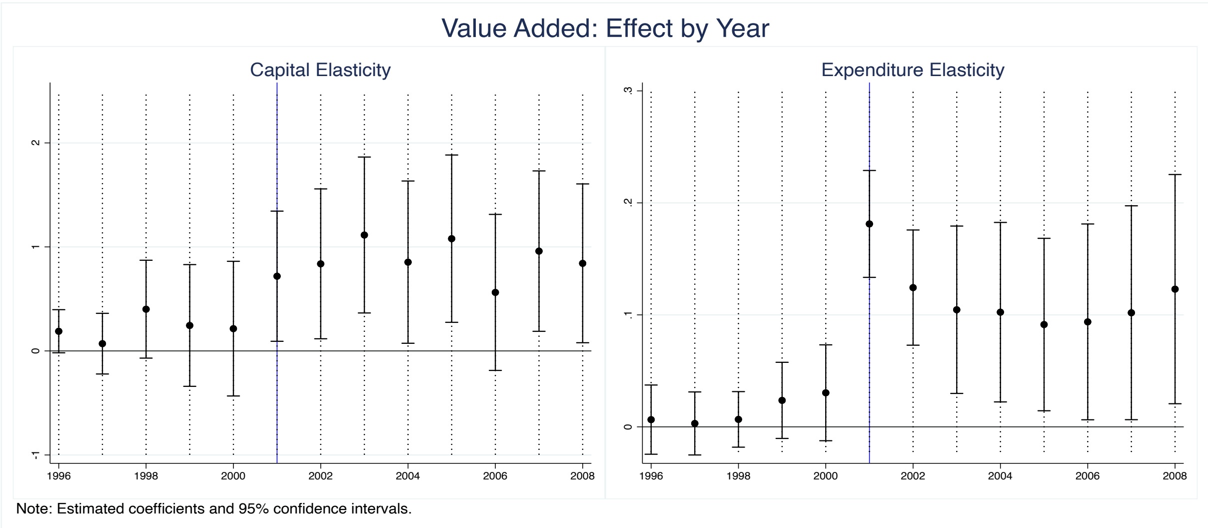


Figure C.10: Value Added: Effect by Year

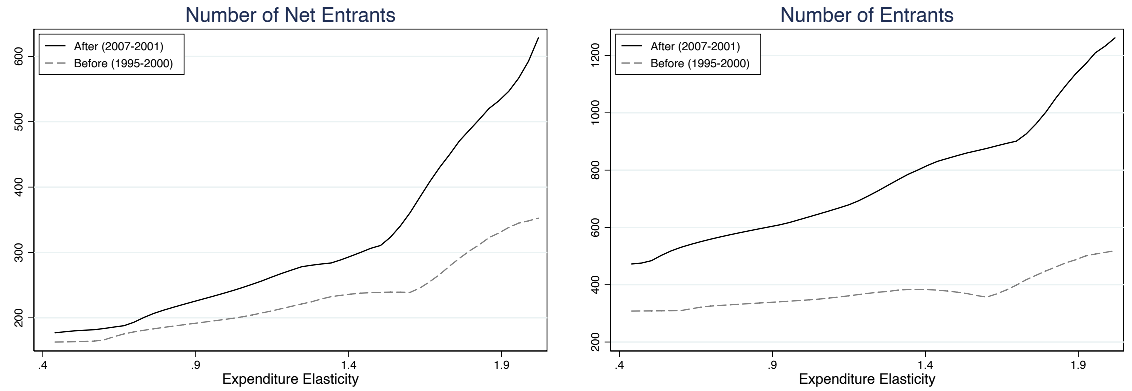


Figure C.11: Net Entrants

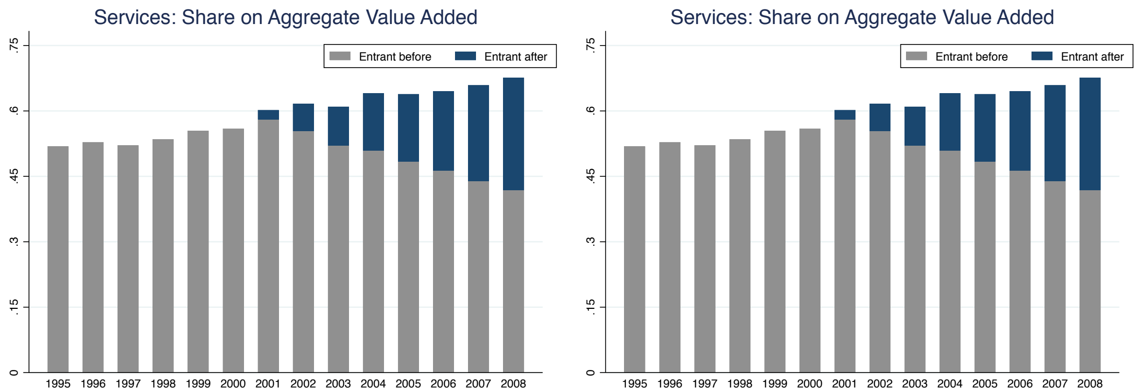


Figure C.12: Entrants Before and After the Financial Liberalization

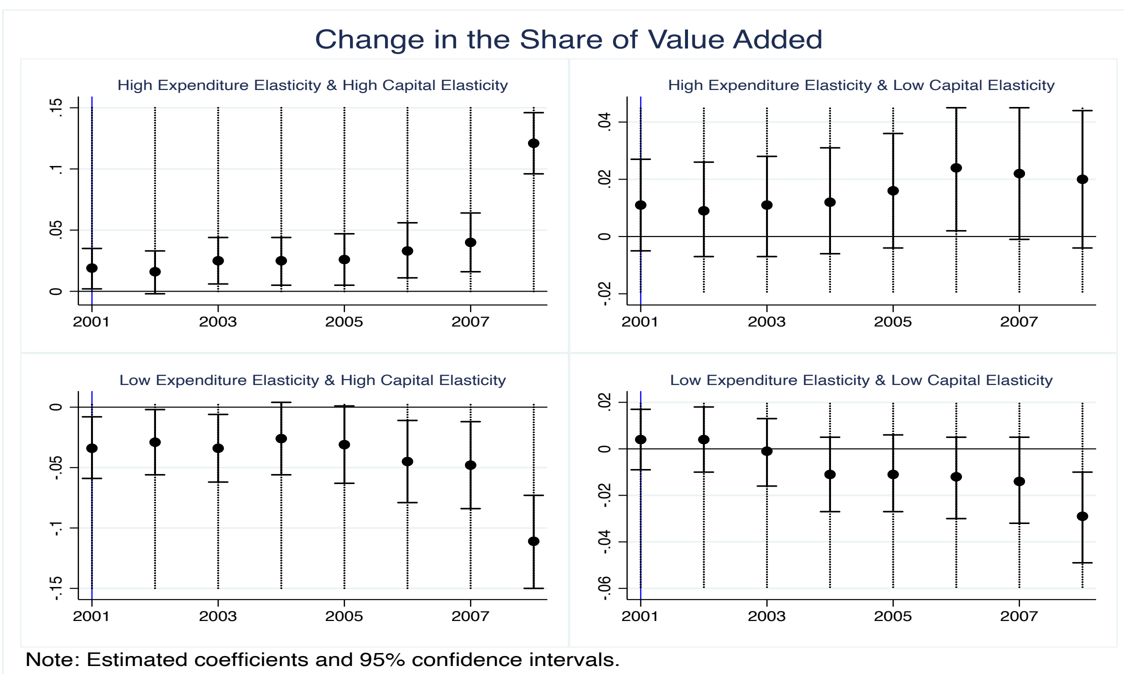


Figure C.13: Reallocation across sectors: Capital and Expenditure Elasticities

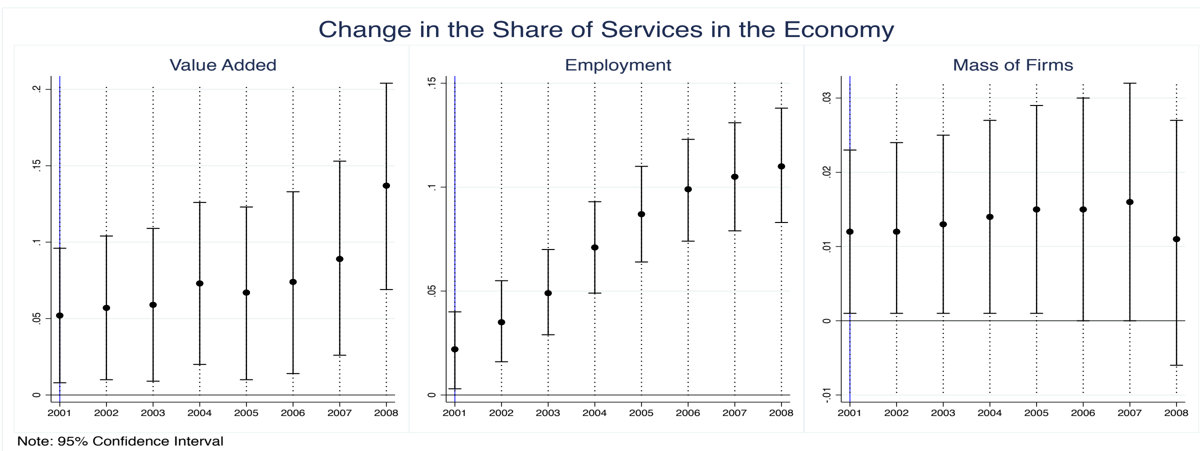


Figure C.14: Reallocation across sectors: Services

Table C.1: Financial Liberalization and Net capital Inflows

	Before 1995-2000	**After 2001-2008**	Before 1995-1998	Before 1998-2000	After 2001-2004	After 2005-2008
	(1)	(2)	(3)	(4)	(5)	(6)
Financial account (net)*	2.5	8.2	1.2	3.8	6.1	10.4
NFA/GDP	-62	-87	-57	-67	-79	-95
Credit-to-GDP ratio	25	49	23	27	39	59
Lending interest rate	22	10	27	16	11	9
Consumption/GDP	74	77	74	74	77	76

Note: in %. *In billions of USD dollars. Before is 2000 and after is 2004. Source: NBH, IMF, Lane and Milesi-Ferretti (2018).

Table C.2: Expenditure Elasticity (Bils, Klenow, and Malin 2013)

Sector	Description	Expenditure elasticity
1	Agriculture, hunting and related services	0.44
2	Forestry, logging and related services	0.44
10	Mining of coal and lignite; extraction of peat	0.57
11	Extraction of crude petroleum and natural gas	0.57
12	Mining of uranium and thorium ores	0.57
13	Mining of metal ores	0.57
14	Other mining and quarrying	0.57
15	Manufacture of food products and beverages	0.44
16	Manufacture of tobacco products	0.44
17	Manufacture of textiles	1.1
18	Manufacture of wearing apparel; dressing and dyeing of fur	1.1
19	Tanning & dressing of leather; manufacture of luggage, handbags, saddlery, harness and footwear	1.1
20	Manufacture of wood & wood products & cork and straw & plaiting materials	0.82
21	Manufacture of pulp, paper and paper products	1.35
22	Publishing, printing and reproduction of recorded media	1.35
23	Manufacture of coke, refined petroleum and nuclear fuel	0.66
24	Manufacture of chemicals, and chemical products	0.9
25	Manufacture of rubber and plastic products	0.8
26	Manufacture of other non-metallic mineral products	0.8
27	Manufacture of basic metals	1.04
28	Manufacture of fabricated metal product, except machinery and equipment	1.04
29	Manufacture of machinery and equipment n.e.c	0.96
30	Manufacture of office machinery and computers	1.03
31	Manufacture of electrical machinery and apparatus n.e.c	0.98
32	Manufacture of radio, television and communication equipment and apparatus	0.98
33	Manufacture of medical, precision and optical instruments, watches and clocks	0.98
34	Manufacture of motor vehicles, trailers	0.89
35	Manufacture of other transport equipment	0.89
36	Manufacture of furniture; manufacturing n.e.c	1.18
37	Recycling	0.49
40	Electricity, gas, steam and hot water supply	0.49
41	Collection, purification and distribution of water	0.49
45	Construction	0.89
50	Sale, maintenance & repair of motor vehicles; retail sale of automotive fuel	0.85
51	Wholesale trade & commission trade, except of motor vehicles & motorcycles	0.85
52	Retail trade, except of motor vehicles and motorcycles; repair of personal & household goods	0.83
55	Hotels and restaurants	1.8
60	Land transport; transport via pipelines	2.02
61	Water transport	1
62	Air transport	1.41
63	Supporting & auxiliary transport activities; activities of travel agencies	1.41
64	Post and telecommunications	0.6
65	Financial intermediation, except insurance and pension funding	1.44
66	Insurance and pension funding, except compulsory social security	1.44
67	Activities auxiliary to financial intermediation	1.44
70	Real estate activities	2.02
71	Renting of machinery & equipment without operator & of personal & household	0.82
72	Computer and related activities	1.35
73	Research and development	1.35
74	Other business activities	1.35
85	Health and social work	1.25
90	Sewage and refuse disposal, sanitation and similar activities	0.69
91	Activities of membership organization n.e.c.	1.79
92	Recreational, cultural and sporting activities	1.79
93	Other services activities	1.18

Notes: expenditure elasticity from Bils, Klenow, and Malin (2013).

Table C.3: Expenditure Elasticity (Comin, Lashkari, and Mestieri 2021)

	Expenditure Elasticity
Agriculture	0.32
Mining	0.41
Public Utilities	1.59
Construction	1.03
Wholesale and Retail	1.62
Transport, storage, communications	1.44
Finance, insurance, real estate	2.17
Community, social and personal services	1.18

Notes: sectoral elasticities computed relative to manufacturing, which is normalized to 1. Sample: 39 developed and developing economies since 1947. Source: Comin, Lashkari, and Mestieri (2021).

Table C.4: Summary Statistics Capital and Expenditure Elasticities

	Capital elasticity (1)	Expenditure Elasticity (2)
Mean	0.22	1.01
Median	0.20	0.90
Standard Deviation	0.09	0.36
p25	0.16	0.83
p75	0.26	1.18

Notes: capital elasticity was estimated at four-digit NACE industries following Wooldridge (2009) and Petrin and Levinsohn (2012) methodology. Expenditure elasticity comes from Bils, Klenow, and Malin (2013).

Table C.5: Firms' Characteristics across Sectors

	Mean	Capital Elasticity	Expenditure Elasticity
	(1)	(2)	(3)
Log value added	7.238	4.692***	-0.429***
		(0.151)	(0.018)
Log capital	7.188	4.915***	-0.284***
		(0.165)	(0.019)
Log employment	1.414	1.211***	-0.395***
		(0.095)	(0.012)
Log RTFP	5.139	-2.448***	-0.125***
		(0.103)	(0.013)
Log age	1.335	1.106***	-0.129***
		(0.046)	(0.005)
Log export share	0.036	0.244***	-0.007***
		(0.010)	(0.001)
Number of firms	255,008	255,008	255,008

Notes: *, **, *** significant at 10, 5, and 1 percent. This table reports the estimated coefficients from a regression of the log of each variable on the capital and expenditure elasticities for the pre-reform period (1995-2000). The capital elasticity is estimated using the Petrin and Levinsohn (2012) and Wooldridge (2009) methods and the expenditure elasticity is obtained from Bils, Klenow, and Malin (2013). Source: APEH.

Table C.6: Firms' Characteristics across Sectors

	Agriculture	Manufacture	Services
	(1)	(2)	(3)
Value Added*	2,058	3,029	1,008
Capital*	5,200	2,140	1,038
Capital Intensity*	1,150	386	358
Employment	5	6	3
Log RTFP	5.40	5.53	5.10
Age	5	5	4
Export Share**	0.19	0.31	0.19
Number of firms	6,925	23,231	115,949

Notes: *in thousands of Forints. ** Conditional on Exporting/Importing. Median values. Average over 1995-2000. Source: APEH.

Table C.7: Firms' Characteristics across Sectors: Difference in Means

	Agriculture	Manufacturing	Services
Log value added	7.618	8.057	6.933
F-stat	177.69		4541.20
pvalue	0.00		0.00
Log capital	8.361	7.624	6.805
F-stat	471.15		2054.66
pvalue	0.00		0.00
Log capital Intensity	6.821	5.775	5.685
F-stat	1212.91		34.19
pvalue	0.00		0.00
Log employment	1.889	1.979	1.180
F-stat	19.50		5867.70
pvalue	0.00		0.00
Log TFP	5.209	5.498	5.060
F-stat	154.60		1452.39
pvalue	0.00		0.00
Log age	1.345	1.305	1.197
F-stat	17.21		446.86
pvalue	0.00		0.00
Log export share	0.025	0.082	0.029
F-stat	872.38		2608.26
pvalue	0.00		0.00
Log import share	0.023	0.098	0.042
F-stat	773.73		1424.46
pvalue	0.00		0.00

Notes: estimated coefficients of a regression of each variable on sectoral dummies in the pre-reform period (1995-2000). In particular, $y = \beta_1$Agriculture + β_2Manufacturing + β_3Services. F-statistics and p-value come from the test of equality of coefficients with respect to manufacturing firms. Source: APEH.

Table C.8: Number of Banks in Hungary

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Number of banks	43	43	43	45	45	45	45	44	44	44	44

Source: National Bank of Hungary.

Table C.9: Growth Rate in the Pre-Reform Period

	Capital Elasticity			Expenditure Elasticity		
	Value Added Growth	Capital Growth	Employment Growth	Value Added Growth	Capital Growth	Employment Growth
	(1)	(2)	(3)	(4)	(5)	(6)
Capital Elasticity	-0.125	0.135	-0.080			
	(0.148)	(0.114)	(0.078)			
Expenditure Elasticity				0.003	-0.022	-0.007
				(0.014)	(0.041)	(0.005)
R^2	0.002	0.001	0.002	0.001	0.000	0.001
N	274,591	256,947	242,221	274,591	256,947	242,221
Sector FE	Yes	Yes	Yes	Yes	Yes	Yes
N	313,512	313,512	335,895	335,895	335,895	335,895

Notes: *, **, *** significant at 10, 5, and 1 percent. This table reports the estimated coefficients from a regression of the growth rate of each variable on the capital and expenditure elasticities for the pre-reform period (1995-2000). The capital elasticity is estimated using the Petrin and Levinsohn (2012) and Wooldridge (2009) methods, and the expenditure elasticity is obtained from Bils, Klenow, and Malin (2013). Source: APEH.

Table C.10: Identification Strategy: Survival Ratio

	Capital Elasticity	Expenditure Elasticity
	(1)	(2)
Survival Ratio	0.036	-0.064***
	(0.033)	(0.007)
N	103,555	103,555

Notes: *, **, *** significant at 10, 5, and 1 percent. This table reports the estimated coefficients from a regression of the survival rate between 2000 and 2007 on the capital and expenditure elasticities. The capital elasticity is estimated using the Petrin and Levinsohn (2012) and Wooldridge (2009) methods used at four-digit NACE industries, and the expenditure elasticity comes from Bils, Klenow, and Malin (2013). All regressions include a constant term. Source: APEH.

Table C.11: Robustness: Standardized Beta Coefficient

	Δ Value Added	Δ Capital	Δ Employment
	(1)	(2)	(3)
Capital elasticity	0.029*	0.035***	0.022
	(0.015)	(0.012)	(0.016)
Expenditure elasticity	0.031*	-0.027	0.060***
	(0.016)	(0.019)	(0.017)
Average sectoral productivity	-0.007	0.013	0.043***
	(0.017)	(0.012)	(0.014)
Returns to scale	-0.023	0.006	-0.020
	(0.017)	(0.015)	(0.017)
R^2	0.002	0.002	0.006
N	56,525	53,987	54,251

Notes: *, **, *** significant at 10, 5, and 1 percent. Std. errors are clustered at four-digit NACE industries. The capital elasticity is estimated using the Petrin and Levinsohn (2012) and Wooldridge (2009) methods used at four-digit NACE industries, and the expenditure elasticity comes from Bils, Klenow, and Malin (2013), reported at two-digit NACE industries. Source: APEH.

Table C.12: Robustness: Financial Dependence

	Rajan and Zingales			Inventories to Sales			Cash Conversion Cycle		
	Δ Value Added	Δ Capital	Δ Employment	Δ Value Added	Δ Capital	Δ Employment	Δ Value Added	Δ Capital	Δ Employment
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Capital elasticity	0.701*	1.322***	0.666**	0.729**	1.205***	0.580**	0.681*	1.245***	0.589**
	(0.361)	(0.394)	(0.285)	(0.366)	(0.360)	(0.284)	(0.391)	(0.356)	(0.283)
Expenditure elasticity	0.077*	-0.096	0.105***	0.114*	-0.120	0.071*	0.106*	-0.103	0.103***
	(0.041)	(0.074)	(0.039)	(0.064)	(0.074)	(0.042)	(0.062)	(0.072)	(0.039)
Financial Dependence	0.011**	-0.008	-0.003	0.136	-0.255	-0.334**	0.025	-0.022	-0.005
	(0.005)	(0.007)	(0.005)	(0.201)	(0.177)	(0.155)	(0.028)	(0.021)	(0.003)
Average sectoral productivity	0.073	0.018	0.036	0.084	0.027	0.043	0.087	0.023	0.038
	(0.056)	(0.044)	(0.037)	(0.056)	(0.045)	(0.032)	(0.059)	(0.042)	(0.035)
Returns to scale	-0.444**	0.185	-0.134	-0.411**	0.090	-0.207	-0.411**	0.113	-0.172
	(0.172)	(0.223)	(0.165)	(0.182)	(0.185)	(0.131)	(0.176)	(0.180)	(0.134)
R^2	0.005	0.003	0.005	0.005	0.003	0.005	0.006	0.003	0.004
N	47,549	45,723	46,163	46,723	44,652	45,020	46,831	44,754	45,127

Notes: *, **, *** significant at 10, 5, and 1 percent. Std. errors are clustered at four-digit NACE industries. The capital elasticity is estimated using the Petrin and Levinsohn (2012) and Wooldridge (2009) methods and the expenditure elasticity comes from Bils, Klenow, and Malin (2013). Columns 1-3 include as a control the Rajan and Zingales (1998) index. Columns 4-6 controls for the inventories to sales index and columns 7-9 controls for the cash conversion cycle, both estimated as in Raddatz (2006). The three financial dependence measures are estimated at four-digit NACE industries. Source: APEH.

Table C.13: Robustness: Firms without Debt

	Credit Registry	Balance Sheet Data					Credit Registry + BS Data
	No ST or LT	No LT	ST Obligations				No Credit or LT/ST
	Credit	Obligations	w/ Owners	Trade Credit	w/ Banks	All	Obligation
						=(3)+(4)+(5)	=(1)+(2)+(6)
	Panel A- Value Added						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Capital elasticity	0.126	-0.193	0.416	0.107	0.064	-0.209	-0.854
	(0.397)	(0.508)	(0.509)	(0.754)	(0.492)	(1.151)	(1.400)
Expenditure elasticity	0.152**	0.232**	0.232**	0.350**	0.186*	0.608***	0.737***
	(0.063)	(0.103)	(0.091)	(0.141)	(0.100)	(0.193)	(0.217)
Average sectoral productivity	0.039	0.029	0.022	-0.027	0.017	-0.093	-0.073
	(0.036)	(0.037)	(0.046)	(0.039)	(0.040)	(0.057)	(0.060)
Returns to scale	-0.144	-0.371	-0.358	-0.943**	-0.426*	-1.364**	-1.326*
	(0.181)	(0.249)	(0.260)	(0.467)	(0.249)	(0.633)	(0.705)
R^2	0.003	0.007	0.008	0.024	0.006	0.066	0.081
N	27,790	23,358	20,989	8,420	22,583	4,410	2,508
	Panel B- Capital						
Capital elasticity	0.419	0.387	1.107**	-0.364	0.543**	0.013	0.209
	(0.304)	(0.303)	(0.520)	(0.377)	(0.233)	(0.469)	(0.636)
Expenditure elasticity	-0.003	-0.113***	-0.080	-0.024	-0.096	-0.046	0.021
	(0.037)	(0.041)	(0.077)	(0.057)	(0.061)	(0.060)	(0.065)
Average sectoral productivity	0.028**	0.050***	-0.005	0.002	0.021	-0.010	-0.088*
	(0.013)	(0.016)	(0.036)	(0.029)	(0.016)	(0.045)	(0.050)
Returns to scale	0.118	0.161	-0.004	-0.048	0.132	0.025	-0.040
	(0.119)	(0.134)	(0.227)	(0.205)	(0.193)	(0.236)	(0.234)
R^2	0.001	0.002	0.002	0.000	0.001	0.000	0.002
N	25,712	21,369	19,405	7,127	20,739	3,391	1,736
	Panel C- Employment						
Capital elasticity	-0.125	0.067	0.181	-0.299	0.344	-0.636	-0.794
	(0.328)	(0.276)	(0.401)	(0.319)	(0.261)	(0.395)	(0.527)
Expenditure elasticity	0.157***	0.081**	0.150***	0.109***	0.094**	0.097**	0.158***
	(0.042)	(0.041)	(0.045)	(0.033)	(0.041)	(0.047)	(0.058)
Average sectoral productivity	0.067***	0.069***	0.060**	0.060***	0.044***	0.027	0.039
	(0.017)	(0.016)	(0.026)	(0.022)	(0.014)	(0.029)	(0.030)
Returns to scale	-0.039	-0.085	-0.101	-0.191	-0.135	-0.114	0.062
	(0.118)	(0.115)	(0.159)	(0.138)	(0.099)	(0.174)	(0.211)
R^2	0.007	0.005	0.007	0.006	0.004	0.004	0.008
N	25,578	21,188	19,532	6,557	20,531	3,175	1,535

Notes: *, **, *** significant at 10, 5, and 1 percent. Std. errors are clustered at four-digit NACE industries. Column 1 excludes firms reporting short term (ST) and/or long term (LT) credit in the credit registry data. Columns 2 to 6 consider liabilities obligations reported in balance sheet data. Column 2 excludes firms reporting long-term obligations. Column 3 excludes firms reporting short-term loans with owners, column 4 excludes firms reporting short-term trade credit, column 5 excludes firms reporting short-term credit with financial institutions, and column 6 excludes firms reporting all short-term obligations. Column 7 excludes firms reporting any type of short or long term obligation or credit reported either in the credit registry or balance sheet data. Source: APEH and credit registry.

Table C.14: Robustness: Panel Regression

	Log Value Added (1)	Log Capital (2)	Log Employment (3)
FL * Capital Elasticity	0.534*	1.068**	0.573*
	(0.316)	(0.392)	(0.304)
FL * Expenditure Elasticity	0.066*	-0.072	0.098**
	(0.039)	(0.065)	(0.039)
Average sectoral productivity	0.027***	0.016*	0.020**
	(0.008)	(0.008)	(0.008)
FL * Returns to scale	-0.158	0.130	-0.099
	(0.130)	(0.144)	(0.109)
Firm FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
R^2	0.802	0.865	0.781
N	905,630	846,162	791,981

Notes: *, **, *** significant at 10, 5, and 1 percent. Std. errors are clustered at year and four-digit NACE industries. The capital elasticity is estimated using the Petrin and Levinsohn (2012) and Wooldridge (2009) methods used at four-digit NACE industries, and the expenditure elasticity comes from Bils, Klenow, and Malin (2013), reported at two-digit NACE industries. Source: APEH.

Table C.15: Robustness: Continuing Firms

	Δ Value Added (1)	Δ Capital (2)	Δ Employment (3)
Capital elasticity	0.665*	1.121***	0.376
	(0.368)	(0.375)	(0.353)
Expenditure elasticity	0.094*	-0.037	0.107***
	(0.048)	(0.052)	(0.038)
Average sectoral productivity	0.024	0.027	0.060***
	(0.028)	(0.023)	(0.021)
Returns to scale	-0.287*	-0.024	-0.097
	(0.159)	(0.155)	(0.133)
R^2	0.004	0.003	0.006
N	20,936	20,936	20,936

Notes: *, **, *** significant at 10, 5, and 1 percent. Std. errors are clustered at four-digit sector level. These regressions only consider firms existing all over the period 1995-2008. The capital elasticity is estimated using the Petrin and Levinsohn (2012) and Wooldridge (2009) methods used at four-digit NACE industries, and the expenditure elasticity comes from Bils, Klenow, and Malin (2013), reported at two-digit NACE industries. Source: APEH.

Table C.16: Effect by Year

	Log Value Added	
	Capital Elasticity	Expenditure Elasticity
	(1)	(2)
y1995 × High Elasticity	-0.035	-0.055
	(0.028)	(0.044)
y1996 × High Elasticity	-0.002	-0.019
	(0.027)	(0.048)
y1997 × High Elasticity	-0.014	0.054
	(0.021)	(0.047)
y1998 × High Elasticity	-0.013	0.078
	(0.025)	(0.051)
y1999 × High Elasticity	-0.021	0.074
	(0.024)	(0.048)
y2000 × High Elasticity	0.015	0.056
	(0.017)	(0.043)
y2001 × High Elasticity	0.055***	0.121***
	(0.013)	(0.025)
y2002 × High Elasticity	0.050***	0.073***
	(0.011)	(0.018)
y2003 × High Elasticity	0.032**	0.059**
	(0.015)	(0.026)
y2004 × High Elasticity	0.061***	0.042**
	(0.007)	(0.019)
y2005 × High Elasticity	0.040***	0.046***
	(0.011)	(0.013)
y2006 × High Elasticity	0.029**	0.019
	(0.012)	(0.011)
y2007 × High Elasticity	0.016*	0.049***
	(0.009)	(0.008)
y1995	-0.925***	-1.592***
	(0.203)	(0.180)
y1996	-0.935***	-1.490***
	(0.160)	(0.151)
y1997	-0.854***	-1.356***
	(0.120)	(0.125)
y1998	-0.731***	-1.195***
	(0.106)	(0.111)
y1999	-0.654***	-1.056***
	(0.089)	(0.100)
y2000	-0.592***	-0.906***
	(0.074)	(0.090)
y2001	-0.499***	-0.762***
	(0.067)	(0.079)
y2002	-0.455***	-0.669***
	(0.055)	(0.066)
y2003	-0.411***	-0.579***
	(0.043)	(0.058)
y2004	-0.300***	-0.445***
	(0.038)	(0.047)
y2005	-0.345***	-0.445***
	(0.030)	(0.037)
y2006	-0.177***	-0.235***
	(0.021)	(0.021)
y2007	-0.068***	-0.113***
	(0.008)	(0.008)
Firm Fixed-Effects	Yes	Yes
Sectoral controls	Yes	Yes
R^2	0.802	0.793
N	905,635	905,635

Notes: *, **, *** significant at 10, 5, and 1 percent. Std. errors are clustered at four-digit NACE industries. The capital elasticity is estimated using the Petrin and Levinsohn (2012) and Wooldridge (2009) methods used at four-digit NACE industries, and the expenditure elasticity comes from Bils, Klenow, and Malin (2013), reported at two-digit NACE industries. Source: APEH.

Table C.17: Robustness: Non-Exporters and Domestically-Owned Firms

	Non-Exporters			Domestically-Owned Firms		
	Δ Value Added	Δ Capital	Δ Employment	Δ Value Added	Δ Capital	Δ Employment
	(1)	(2)	(3)	(4)	(5)	(6)
Capital elasticity	0.887**	1.274***	0.546*	0.653*	1.030***	0.408
	(0.399)	(0.387)	(0.327)	(0.368)	(0.354)	(0.295)
Expenditure elasticity	0.087*	-0.100	0.125***	0.103**	-0.088	0.123***
	(0.052)	(0.065)	(0.040)	(0.048)	(0.061)	(0.035)
Average sectoral productivity	0.042	0.035	0.061***	0.024	0.024	0.054***
	(0.036)	(0.028)	(0.019)	(0.038)	(0.023)	(0.018)
Returns to scale	-0.268*	0.022	-0.171	-0.210	0.058	-0.130
	(0.162)	(0.168)	(0.123)	(0.153)	(0.151)	(0.112)
R^2	0.004	0.003	0.007	0.003	0.002	0.006
N	49,102	46,636	46,805	56,525	53,987	54,251

Notes: *, **, *** significant at 10, 5, and 1 percent. Std. errors are clustered at four-digit NACE industries. Columns 1-3 exclude exporters. Columns 4-6 exclude multinational firms (where MNC are firms with 10% foreign ownership). The capital elasticity is estimated using the Petrin and Levinsohn (2012) and Wooldridge (2009) methods used at four-digit NACE industries, and the expenditure elasticity comes from Bils, Klenow, and Malin (2013), reported at two-digit NACE industries. Source: APEH.

Table C.18: Robustness: Controlling for Imports

	Δ Value Added	Δ Capital	Δ Employment
	(1)	(2)	(3)
Capital elasticity	0.564*	1.005***	0.352
	(0.339)	(0.365)	(0.283)
Expenditure elasticity	0.082**	-0.087	0.122***
	(0.041)	(0.063)	(0.034)
Imports	0.011***	0.004	0.016***
	(0.003)	(0.003)	(0.002)
Average sectoral productivity	0.012	0.022	0.048***
	(0.036)	(0.022)	(0.018)
Returns to scale	-0.113	0.065	-0.035
	(0.139)	(0.156)	(0.112)
R^2	0.004	0.002	0.011
N	55,928	53,535	53,278

Notes: *, **, *** significant at 10, 5, and 1 percent. Std. errors are clustered at four-digit NACE industries. The capital elasticity is estimated using the Petrin and Levinsohn (2012) and Wooldridge (2009) methods used at four-digit NACE industries, and the expenditure elasticity comes from Bils, Klenow, and Malin (2013), reported at two-digit NACE industries. Source: APEH.

Table C.19: Robustness: Capital and Expenditure Elasticities

	Capital Elasticity Olley and Pakes (1996)			Expenditure Elasticity Comin, Lashkari, and Mestieri (2021)		
	Δ Value Added	Δ Capital	Δ Employment	Δ Value Added	Δ Capital	Δ Employment
	(1)	(2)	(3)	(4)	(5)	(6)
Capital elasticity	0.800**	0.888***	0.887***	0.873**	1.211***	1.073***
	(0.321)	(0.244)	(0.201)	(0.431)	(0.358)	(0.255)
Expenditure elasticity	0.081*	-0.109*	0.102***	0.083*	0.076	0.288***
	(0.042)	(0.058)	(0.027)	(0.050)	(0.069)	(0.036)
Average sectoral productivity	0.015	0.017	0.043**	0.001	0.013	0.027
	(0.041)	(0.021)	(0.017)	(0.027)	(0.027)	(0.017)
Returns to scale	-0.232	0.015	-0.139	-0.210	-0.013	-0.162*
	(0.145)	(0.143)	(0.115)	(0.156)	(0.173)	(0.087)
R^2	0.004	0.002	0.009	0.002	0.002	0.015
N	56,485	53,978	54,242	47,579	53,950	54,212

Notes: *, **, *** significant at 10, 5, and 1 percent. Std. errors are clustered at four-digit NACE industries. Columns 1-3 employ capital elasticities computed with Olley and Pakes (1996) method and expenditure elasticity from Bils, Klenow, and Malin (2013). Columns 4-6 employ capital elasticity estimated using the Petrin and Levinsohn (2012) and Wooldridge (2009) methods and expenditure elasticity from Comin, Lashkari, and Mestieri (2021). Source: APEH.

Table C.20: Robustness: Price Index

	Δ Value Added	Δ Capital	Δ Employment
	(1)	(2)	(3)
Capital elasticity	0.671*	1.135***	0.603**
	(0.365)	(0.350)	(0.280)
Expenditure elasticity	0.080*	-0.103	0.101***
	(0.047)	(0.063)	(0.034)
Sectoral price index	-0.024	0.182***	0.315***
	(0.312)	(0.069)	(0.069)
Returns to scale	-0.175	0.007	-0.226**
	(0.137)	(0.135)	(0.096)
R^2	0.002	0.003	0.008
N	56,525	53,987	54,251

Notes: *, **, *** significant at 10, 5, and 1 percent. Std. errors are clustered at four-digit sector level. The capital elasticity is estimated using the Petrin and Levinsohn (2012) and Wooldridge (2009) methods used at four-digit NACE industries, and the expenditure elasticity comes from Bils, Klenow, and Malin (2013), reported at two-digit NACE industries. Source: APEH.

Table C.21: Top 30 Sectors: Net Entry (2001-2007)

Activity	Broad sector (II digits)	Sector (IV digits)	Description	Expenditure elasticity	Net entry per year	Number of employees	Share agg. employment (in %)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Service	Real estate activities	7012	Buying and selling of own real estate	2.02	982	2	0.08
Service	Construction	4521	General construction of buildings and civil engineering works	0.89	505	3	0.21
Service	Hotels and restaurants	5530	Restaurants	1.80	480	3	0.13
Service	Other business activities	7414	Business and management consultancy activities	1.35	446	2	0.08
Service	Other business activities	7487	Other business activities n.e.c.	1.35	439	3	0.10
Service	Retail trade	5248	Other retail sale in specialized stores	0.83	420	2	0.06
Service	Land transport	6024	Freight transport by road	2.02	404	3	0.08
Service	Other business activities	7420	Architectural and engineering activities and related technical consultancy	1.35	363	2	0.06
Service	Real estate activities	7020	Letting of own property	2.02	297	4	0.03
Service	Retail trade	5211	Retail sale in non-specialized stores with food, beverages or tobacco predominating	0.83	271	4	0.11
Service	Sale, maintenance and repair of motor vehicles	5010	Sale of motor vehicles	0.85	250	2	0.06
Service	Hotels and restaurants	5540	Bars	1.80	248	2	0.04
Service	Retail trade	5263	Other non-store retail sale	0.83	229	2	0.02
Service	Construction	4531	Installation of electrical wiring and fittings	0.89	212	3	0.05
Service	Other business activities	7411	Legal activities	1.35	211	2	0.04
Service	Retail trade	5242	Retail sale of clothing	0.83	201	2	0.06
Service	Computer and related activities	7222	Other software consultancy and supply	1.35	199	2	0.04
Service	Construction	4533	Plumbing	0.89	197	3	0.04
Service	Sale, maintenance and repair of motor vehicles	5020	Maintenance and repair of motor vehicles	0.85	189	2	0.03
Service	Activities auxiliary to financial inter	6720	Activities auxiliary to insurance and pension funding	1.44	182	1	0.02
Service	Real estate activities	7011	Development and selling of real estate	2.02	176	2	0.01
Service	Other business activities	7460	Investigation and security activities	1.35	170	6	0.11
Service	Other services activities	9302	Hairdressing and other beauty treatment	1.18	151	2	0.02
Service	Retail trade	5246	Retail sale of hardware, paints and glass	0.83	143	2	0.03
Service	Other business activities	7440	Advertising	1.35	141	2	0.03
Service	Recreational, cultural and sporting activities	9262	Other sporting activities	1.79	131	2	0.01
Service	Activities auxiliary to financial inter	6713	Activities auxiliary to financial intermediation n.e.c.	1.44	123	2	0.01
Service	Computer and related activities	7220	Software consultancy and supply	1.35	121	2	0.03
Service	Other business activities	7470	Industrial cleaning	1.35	121	7	0.08
Service	Construction	4544	Painting and glazing	0.89	112	2	0.03
Total					8109		1.68

Table C.22: Aggregate Trends

	High Expenditure Elasticity & High Capital Elasticity			High Expenditure Elasticity & Low Capital Elasticity			Low Expenditure Elasticity & High Capital Elasticity			Low Expenditure Elasticity & Low Capital Elasticity		
	Value Added (1)	Empl. (2)	Number of Firms (3)	Value Added (4)	Empl. (5)	Number of Firms (6)	Value Added (7)	Empl. (8)	Number of Firms (9)	Value Added (10)	Empl. (11)	Number of Firms (12)
2001	0.019**	0.011**	0.013***	0.011	-0.002	0.013**	-0.034**	0.004	-0.017**	0.004	-0.013**	-0.009***
	(0.007)	(0.003)	(0.003)	(0.007)	(0.004)	(0.005)	(0.011)	(0.006)	(0.007)	(0.006)	(0.005)	(0.002)
2002	0.016*	0.019***	0.010**	0.009	-0.001	0.010	-0.029**	0.002	-0.010	0.004	-0.021***	-0.010***
	(0.007)	(0.004)	(0.003)	(0.007)	(0.005)	(0.006)	(0.011)	(0.006)	(0.007)	(0.006)	(0.005)	(0.002)
2003	0.025**	0.025***	0.010**	0.011	0.003	0.011	-0.034**	0.005	-0.004	-0.001	-0.033***	-0.017***
	(0.008)	(0.004)	(0.003)	(0.008)	(0.005)	(0.006)	(0.012)	(0.007)	(0.007)	(0.006)	(0.006)	(0.002)
2004	0.025**	0.031***	0.000	0.012	0.015**	0.025***	-0.026*	-0.005	-0.020**	-0.011	-0.041***	-0.005*
	(0.008)	(0.004)	(0.004)	(0.008)	(0.005)	(0.006)	(0.013)	(0.007)	(0.008)	(0.007)	(0.006)	(0.002)
2005	0.026**	0.039***	0.001	0.016	0.013**	0.022**	-0.031*	0.001	-0.013	-0.011	-0.053***	-0.010***
	(0.009)	(0.004)	(0.004)	(0.009)	(0.005)	(0.007)	(0.014)	(0.008)	(0.008)	(0.007)	(0.007)	(0.002)
2006	0.033***	0.046***	0.008*	0.024**	0.016**	0.019**	-0.045**	0.005	-0.004	-0.012	-0.067***	-0.024***
	(0.009)	(0.005)	(0.004)	(0.009)	(0.006)	(0.007)	(0.014)	(0.008)	(0.009)	(0.007)	(0.007)	(0.002)
2007	0.040***	0.051***	0.003	0.022*	0.018**	0.017*	-0.048**	0.011	0.004	-0.014	-0.080***	-0.024***
	(0.010)	(0.005)	(0.004)	(0.010)	(0.006)	(0.007)	(0.015)	(0.009)	(0.009)	(0.008)	(0.007)	(0.003)
2008	0.121***	0.071***	0.067***	0.020*	0.011	-0.022**	-0.111***	0.013	0.009	-0.029**	-0.096***	-0.054***
	(0.011)	(0.005)	(0.005)	(0.010)	(0.006)	(0.008)	(0.016)	(0.009)	(0.010)	(0.008)	(0.008)	(0.003)
Time trend	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.980	0.973	0.995	0.983	0.997	0.997	0.985	0.997	0.998	0.819	0.987	0.991
N	17	17	17	17	17	17	17	17	17	17	17	17

Notes: *, **, *** significant at 10, 5, and 1 percent. The capital elasticity is estimated using the Petrin and Levinsohn (2012) and Wooldridge (2009) methods used at four-digit NACE industries, and the expenditure elasticity comes from Bils, Klenow, and Malin (2013), reported at two-digit NACE industries. Source: APEH.

Table C.23: Characteristics of Entrants Before and After the Financial Liberalization

	RTFP		Labor Productivity (VA per worker)		Value Added	
	(1)	(2)	(3)	(4)	(5)	(6)
FL	-0.151***	-0.077***	-0.221***	-0.138***	-0.784***	-0.619***
	(0.029)	(0.019)	(0.028)	(0.023)	(0.044)	(0.021)
Sector FE		Yes		Yes		Yes
R^2	0.003	0.095	0.005	0.096	0.035	0.134
N	95,689	95,687	143,427	143,314	211,241	211,163

Notes: *, **, *** significant at 10, 5, and 1 percent. Std. errors are clustered at four-digit NACE industries. Sector fixed effects are estimated at four-digit NACE industries. Period: 1995-2008. Source: APEH.

Theory Appendices

Appendix D Long-Term Effects of Financial Liberalization in a Simple Model

In this section, we develop a simple model to describe the relationship between the foreign debt, the price level and the capital stock in the steady state, as well as how these variables are affected by the initial capital stock.

Appendix D.1 Setup

Consider a capital-scarce economy that is converging to the financial autarky steady state. The representative household has utility given by $U(C_t)$ with $U' > 0$ and $U'' < 0$, where C_t is the domestic consumption of the final good. The consumption good is produced according to $Y_t = F(K_t)$ with $F' > 0$ and $F'' < 0$, where K_t is the stock of capital. Capital is imported and depreciates at a rate δ. The final good can be consumed domestically or exported. Exports face an exogenous foreign demand with slope: $C_t^x = D(P)$ with $D' < 0$, and the price elasticity of demand is η. In financial autarky, trade is balanced and exports are equal to imports. In the financially open economy, there can be trade imbalances and the representative household can issue a foreign bond – B_{t+1} – at an exogenous international rate R^*, where borrowing implies $B_{t+1} < 0$.

Appendix D.2 The Economy in Financial Autarky

The representative household maximizes its lifetime utility:

$$\max_{\{C_t, K_{t+1}\}_{t=0}^{\infty}} \beta^t U(C_t),$$

subject to the following budget constraint:

$$C_t = F(K_t) + \frac{(1-\delta)K_t - K_{t+1}}{P_t}.$$

The first order condition with respect to K_{t+1} is:

$$\frac{U'(C_t)}{P_t} = \beta U'(C_{t+1}) \left[F'(K_{t+1}) + \frac{1-\delta}{P_{t+1}} \right] \tag{B.14}$$

Under financial autarky, trade is balanced and exports equal imports in each period:

$$K_{t+1} - K_t (1-\delta) = P_t D(P_t).$$

In the financial autarky steady state, the first order condition (B.14) becomes:

$$\frac{1}{\beta} - 1 = P_{css} F'(K_{css}) - \delta, \tag{B.15}$$

where P_{css} and K_{css} denote the price level and the level of capital in the financial autarky steady state. This expression shows that the value of marginal product of capital, net of depreciation, is given by the discount rate. Using the trade balance condition in the steady state, we obtain the following:

$$\delta K_{css} = P_{css} D(P_{css}). \tag{B.16}$$

Let $G(P_{css}) = P_{css} D(P_{css})$ be the value of exports in steady-state. Then, we obtain:

$$P_{css} = \delta G^{-1}(K_{css}). \tag{B.17}$$

Equation (B.17) shows that, in the financial autarky steady state, there is a relationship between the price level and level of capital. Note that the long-term level of capital K_{css} does not depend on the initial conditions; rather, it depends exclusively on the parameters of the model. Therefore, given the production and demand functions, there is a unique K_{css} that is independent of the initial capital level.

We now turn to study the long-term effects of a financial liberalization. We show below that, when the economy opens to international financial flows, the initial level of capital determines the long-run steady state levels of capital and debt, as well as the long-run price level.

Appendix D.3 Financial Liberalization

In the financial liberalized economy, the household has access to one period bonds with interest rate $R^* = \frac{1}{\beta}$. Bonds are denominated in units of the foreign good. The maximization program of the household becomes:

$$\max_{\{B_{t+1}, K_{t+1}\}_{t=0}^{\infty}} \beta^t U(C_t)$$

subject to the budget constraint:

$$C_t \quad = \quad F(K_t) + \frac{(1-\delta)K_t - K_{t+1} - B_{t+1} + R^* B_t}{P_t}$$

The first order conditions for capital and foreign assets are:[53]

$$\begin{aligned}
[K_{t+1}] \quad &: \quad \frac{U'(C_t)}{P_t} = \beta U'(C_{t+1}) \left[F'(K_{t+1}) + \frac{1-\delta}{P_{t+1}} \right] \\
[B_{t+1}] \quad &: \quad \frac{U'(C_t)}{P_t} - \beta R^* \frac{U'(C_{t+1})}{P_{t+1}} \quad \Rightarrow \quad \frac{P_{t+1}}{P_t} = \frac{U'(C_{t+1})}{U'(C_t)}
\end{aligned}$$

Substituting the second equation into the first order condition of capital, we obtain:

$$\frac{1}{\beta} = 1 - \delta + P_{t+1} F'(K_{t+1}) \quad \Rightarrow \quad K_{t+1} = [F']^{-1} \left(\frac{\frac{1}{\beta} - (1-\delta)}{P_{t+1}} \right)$$

[53]Note that these FOC at $t = 0$ both B_0 and K_0 are given.

In the open economy steady state, the long-term level of capital is given by

$$K_{ss} = \left[F'\right]^{-1} \left(\frac{\frac{1}{\beta} - (1-\delta)}{P_{ss}} \right), \tag{B.18}$$

where K_{ss} and P_{ss} denote the capital stock and the price level in the financial liberalized steady state. Also, the expression in parentheses is the argument of the inverse function of F'. Now, we derive three lemmas giving the relationship between K_{ss}, P_{ss}, and B_{ss} in the steady-state, and then we show how they are linked to K_0.

Lemma 1: In the financially liberalized economy, the lower the long-run price level, the lower the level of steady-state capital. *In particular,*

$$\frac{dK_{ss}}{dP_{ss}} > 0$$

Proof. Take derivatives in equation (B.18), we obtain

$$\frac{dK_{ss}}{dP_{ss}} = -([F']^{-1})' \left(\frac{\frac{1}{\beta} - (1-\delta)}{P_{ss}^2} \right) > 0. \tag{B.19}$$

Now, we assess the relationship between the long-run price level, P_{ss}, and the long-run level of foreign assets, B_{ss}, in the open economy steady-state. The following Lemma provides a sufficient condition for the long-run price level to be increasing in the long-run level of foreign assets (or, equivalently, for the long-run price level to be decreasing in the long-run level of foreign debt).

Lemma 2: A sufficient condition for the open economy steady-state price level to be decreasing in the steady-state level of foreign debt $(-B_{ss})$ ***is for the price elasticity of demand to be finite and lower than*** -1***.*** *In particular, the derivative of the price level with respect to foreign assets in the open economy steady state is:*

$$-\infty < \eta < -1 \quad \Rightarrow \quad \frac{dP_{ss}}{dB_{ss}} > 0,$$

where η is the price-elasticity of demand of the export good. This lemma shows that the higher the long-term level of debt, the lower would be the price level in the open economy steady state.

Proof. Recall that, in the long-run, the trade balance equals the interest on the foreign debt:

$$\begin{aligned} P_{ss} D\left(P_{ss}\right) - \delta K_{ss} &= -\left(R^* - 1\right) B_{ss} \\ P_{ss} D\left(P_{ss}\right) &= -\left(R^* - 1\right) B_{ss} + \delta \left[F'\right]^{-1} \left(\frac{\frac{1}{\beta} - (1-\delta)}{P_{ss}} \right). \end{aligned}$$

Taking total derivatives:

$$\left[D\left(P_{ss}\right)+P_{ss}D'\left(P_{ss}\right)\right]dP_{ss}=-\left(R^{*}-1\right)dB_{ss}-\delta\left(\frac{\frac{1}{\beta}-(1-\delta)}{P_{ss}^{2}}\right)\left[\left(\left[F'\right]^{-1}\right)'\left(\frac{\frac{1}{\beta}-(1-\delta)}{P_{ss}}\right)\right]dP_{ss}.$$

Using the Inverse Function Theorem, we get:

$$\left(\left[F'\right]^{-1}\right)'\left(\frac{\frac{1}{\beta}-(1-\delta)}{P_{ss}}\right)=\frac{1}{F''\left[F'\right]^{-1}\left(\frac{\frac{1}{\beta}-(1-\delta)}{P_{ss}}\right)}=\frac{1}{F''(A)}<0 \tag{B.20}$$

where A satisfies $\frac{\frac{1}{\beta}-(1-\delta)}{P_{ss}}=F'(A)$. Therefore, we obtain:

$$\begin{aligned}
&\left[D\left(P_{ss}\right)+P_{ss}D'\left(P_{ss}\right)\right]dP_{ss}=-\left(R^{*}-1\right)dB_{ss}-\delta\left(\frac{\frac{1}{\beta}-(1-\delta)}{P_{ss}^{2}}\right)\frac{1}{F''(A)}dP_{ss}\\
\Rightarrow\quad&\left[D\left(P_{ss}\right)+P_{ss}D'\left(P_{ss}\right)+\delta\left(\frac{\frac{1}{\beta}-(1-\delta)}{P_{ss}^{2}}\right)\frac{1}{F''(A)}\right]dP_{ss}=-\left(R^{*}-1\right)dB_{ss}\\
\Rightarrow\quad&\frac{dP_{ss}}{dB_{ss}}=\frac{-r^{*}}{D\left(P_{ss}\right)+P_{ss}D'\left(P_{ss}\right)+\left(\frac{r^{*}+\delta}{P_{ss}^{2}}\right)\frac{\delta}{F''(A)}}.
\end{aligned}$$

A sufficient condition for this derivative to be positive is:

$$D\left(P_{ss}\right)+P_{ss}D'\left(P_{ss}\right)<0$$

The price elasticity of the demand, η, is defined as:

$$\eta=\frac{d\ln D(P_{ss})}{d\ln P_{ss}}=\frac{dD(P_{ss})}{dP_{ss}}\frac{P_{ss}}{D(P_{ss})}.$$

Hence, the sufficient condition becomes $D\left(P_{ss}\right)+\eta D\left(P_{ss}\right)<0$, or $1+\eta<0$, or $\eta<-1$. Therefore, any elastic good with elasticity higher than unitary would satisfy this condition. Hence, we have:

$$-\infty<\eta<-1\quad\Rightarrow\quad\frac{dP_{ss}}{dB_{ss}}=\frac{-r^{*}}{D(1+\eta)+\left(\frac{r^{*}+\delta}{P_{ss}^{2}}\right)\frac{\delta}{F''(A)}}>0.$$

Note that if the price elasticity of demand is perfectly elastic ($\eta\to-\infty$, as in the standard neoclassical model), $dP_{ss}/dB_{ss}\to 0$ and the long-term level of foreign assets does not affect the price level in the open economy steady state. Moreover, as the elasticity decreases, a given change in B_{ss} has a larger effect on P_{ss}. Household and firm do not internalize this effect, because they take prices as given. Therefore, as long as $-\infty<\eta<-1$, there is a pecuniary externality, because long-term borrowing affects long-run prices, i.e., the terms of trade. Moreover, the externality is larger, the smaller the elasticity.

Lemma 1 showed that, in the open economy steady-state, the lower the long-run price level, the lower the long-run capital stock. Provided the elasticity of demand exceeds one, Lemma 2 showed that the higher the long-run debt, the lower the long-run price level. A natural question to ask is the relationship between the long-run level of foreign debt and the long-run level of capital. The following lemma derives this relationship.

Lemma 3: A sufficient condition for the open economy steady-state capital stock to be decreasing in the steady-state level of foreign debt $(-B_{ss})$ ***is for the price elasticity of demand to be finite and lower than*** -1. *More precisely,*

$$-\infty < \eta < -1 \quad \Rightarrow \quad \frac{dK_{ss}}{dB_{ss}} > 0$$

Proof. Taking derivatives in equation (B.18)

$$\begin{aligned}
\frac{dK_{ss}}{dB_{ss}} &= \frac{dK_{ss}}{dP_{ss}}\frac{dP_{ss}}{dB_{ss}} \\
&= -([F']^{-1})'\left(\frac{\frac{1}{\beta}-(1-\delta)}{P_{ss}^2}\right)\left[\frac{-r^*}{D(1+\eta)+\left(\frac{r^*+\delta}{P_{ss}^2}\right)\frac{\delta}{F''(A)}}\right] \\
&= ([F']^{-1})'\left(\frac{\frac{1}{\beta}-(1-\delta)}{P_{ss}^2}\right)\left[\frac{r^*}{D(1+\eta)+\left(\frac{r^*+\delta}{P_{ss}^2}\right)\frac{\delta}{F''(A)}}\right] \\
&= \frac{1}{F''(A)}\left[\frac{r^*}{D(1+\eta)+\left(\frac{r^*+\delta}{P_{ss}^2}\right)\frac{\delta}{F''(A)}}\right] \\
&= \left[\frac{r^*}{F''(A)D(1+\eta)+\left(\frac{r^*+\delta}{P_{ss}^2}\right)\delta}\right] > 0.
\end{aligned}$$

Under a fully elastic demand, $dK_{ss}/dB_{ss} \to 0$ and the long-term level of foreign assets does not affect the level of capital stock in the open economy steady state, as in Gourinchas and Jeanne (2006).

Lemmas 1, 2 and 3 show that, in the open economy steady-state, the higher the steady state foreign debt, the lower the steady-state price level and steady-state capital stock. The question that follows is: what determines the long-run debt? Lemma 4 shows that the level of foreign debt in the open economy steady-state is determined by the initial capital stock, i.e. the capital stock at the moment of the liberalization.

Lemma 4: A sufficient condition for the open economy steady-state debt $(-B_{ss})$ ***to be decreasing in the initial capital stock*** (K_0) ***is for the price elasticity of demand to be finite and lower than*** -1. *In particular,*

$$-\infty < \eta < -1 \quad \Rightarrow \quad \frac{dB_{ss}}{dK_0} > 0.$$

Proof. At $t = 0$ the level of capital and foreign assets (K_0 and B_0) are given, where $B_0 = 0$ and $0 < K_0 < K_{ss}$. In the next period, $K_1 = K_{ss}$ and $B_1 = B_{ss}$, i.e., these two state variables attain their steady-state values. Hence, in the initial period, we have:

$$P_0C_0 = P_0F(K_0) + (1-\delta)K_0 - K_{ss} - B_{ss}.$$

Note that K_{ss} is a function of P_{ss} and P_{ss} is a function of B_{ss}. Therefore, we can write:

$$P_0C_0 = P_0F(K_0) + (1-\delta)K_0 - K_{ss}\left(B_{ss}\right) - B_{ss}.$$

Moreover, from the goods market clearing condition, we know that:

$$C_0 + D(P_0) = F(K_0).$$

Then

$$B_{ss} + K_{ss}\left(B_{ss}\right) = P_0D(P_0) + (1-\delta)K_0.$$

The former implies that P_0 is also function of B_{ss} given a K_0 level. We build the inter-temporal budget constraint:

$$\begin{aligned}
C_0 &= F(K_0) + \frac{(1-\delta)K_0 - K_1 + R^*B_0}{P_0} - \frac{B_1}{P_0} \\
C_0 &= F(K_0) + \frac{(1-\delta)K_0 - K_1 + R^*B_0}{P_0} + \frac{1}{P_0R^*}\left[P_1\left(F(K_1) - C_1\right) - K_2 + (1-\delta)K_1 - B_2\right] \\
P_0C_0 &= P_0F(K_0) + (1-\delta)K_0 - K_1 + \sum_{t=1}^{\infty}\left[\frac{1}{R^*}\right]^t\left[P_t\left(F(K_t) - C_t\right) - K_{t+1} + (1-\delta)K_t\right] \\
P_0C_0 &= P_0F(K_0) + (1-\delta)K_0 - K_1 + \sum_{t=1}^{\infty}\left[\frac{1}{R^*}\right]^t\left[P_{ss}\left(F(K_{ss}) - C_{ss}\right) - \delta K_{ss}\right] \\
P_0C_0 &= P_0F(K_0) + (1-\delta)K_0 - K_{ss} + \frac{1}{R^*}\left(\frac{1}{1-\frac{1}{R^*}}\right)\left[P_{ss}\left(F(K_{ss}) - C_{ss}\right) - \delta K_{ss}\right]
\end{aligned}$$

From the first order condition, we know that:

$$\begin{aligned}
\frac{P_1}{P_0} &= \frac{U'(C_1)}{U'(C_0)} \\
\frac{P_{ss}}{P_0} &= \frac{U'(C_{ss})}{U'(C_0)}
\end{aligned}$$

Assume, for simplicity, the log utility function, i.e. $U(C) = \ln(C)$[54]:

$$\begin{aligned}
\frac{P_1}{P_0} &= \frac{U'(C_1)}{U'(C_0)} \\
\frac{P_{ss}}{P_0} &= \frac{C_0}{C_{ss}} \Rightarrow P_0 C_0 = P_{ss} C_{ss}
\end{aligned}$$

Using this expression, we can write the level of consumption in the open economy steady state as:

$$\begin{aligned}
P_{ss}C_{ss} &= P_0 F(K_0) + (1-\delta)K_0 - K_{ss} + \frac{1}{R^*}\left(\frac{1}{1-\frac{1}{R^*}}\right)\left[P_{ss}\left(F(K_{ss}) - C_{ss}\right) - \delta K_{ss}\right] \\
P_{ss}C_{ss} &= P_0 F(K_0) + (1-\delta)K_0 - K_{ss} + \frac{1}{R^*-1}\left[P_{ss}F(K_{ss}) - P_{ss}C_{ss} - \delta K_{ss}\right]
\end{aligned}$$

$$\frac{R^*}{R^*-1} P_{ss}C_{ss} = P_0 F(K_0) + (1-\delta)K_0 - K_{ss} + \frac{1}{R^*-1}\left[P_{ss}F(K_{ss}) - \delta K_{ss}\right] \tag{B.21}$$

We want to replace $P_{ss}C_{ss}$ by the foreign assets. We know that $C_{ss} + D(P_{ss}) = F(K_{ss})$ (goods market equilibrium) and $-r^* B_{ss} = P_{ss}D(P_{ss}) - \delta K_{ss}$ (current account balance = 0). Rearranging the latter:

$$D(P_{ss}) = \frac{-r^* B_{ss} + \delta K_{ss}}{P_{ss}}$$

This implies:

$$\begin{aligned}
C_{ss} + \frac{\delta K_{ss} - r^* B_{ss}}{P_{ss}} &= F(K_{ss}) \\
P_{ss}C_{ss} - r^* B_{ss} + \delta K_{ss} &= P_{ss}F(K_{ss}) \\
P_{ss}C_{ss} &= P_{ss}F(K_{ss}) + r^* B_{ss} - \delta K_{ss}
\end{aligned}$$

Substituting the above into equation (B.21):

$$\begin{aligned}
\frac{R^*}{R^*-1}\left[P_{ss}F(K_{ss}) + r^* B_{ss} - \delta K_{ss}\right] &= P_0 F(K_0) + (1-\delta)K_0 - K_{ss} + \frac{1}{R^*-1}\left[P_{ss}F(K_{ss}) - \delta K_{ss}\right] \\
R^* B_{ss} &= P_0 F(K_0) + (1-\delta)K_0 - K_{ss} + \left(\frac{1}{R^*-1} - \frac{R^*}{R^*-1}\right)\left[P_{ss}F(K_{ss}) - \delta K_{ss}\right] \\
R^* B_{ss} &= P_0 F(K_0) + (1-\delta)K_0 - K_{ss} - \left[P_{ss}F(K_{ss}) - \delta K_{ss}\right] \\
R^* B_{ss} &= P_0 F(K_0) + (1-\delta)K_0 - \left[P_{ss}F(K_{ss}) + (1-\delta)K_{ss}\right] \qquad \text{(B.22)} \\
P_0 &= \frac{R^* B_{ss} - (1-\delta)K_0 + P_{ss}F(K_{ss}) + (1-\delta)K_{ss}}{F(K_0)} \equiv P_0\left(K_0, B_{ss}\left(K_0\right)\right)
\end{aligned}$$

Then:

$$\frac{dP_0\left(K_0, B_{ss}\left(K_0\right)\right)}{dK_0} = \frac{\partial P_0}{\partial K_0} + \frac{dP_0}{dB_{ss}}\frac{dB_{ss}}{dK_0}$$

Using Equation (B.22), $\frac{dP_0}{dB_{ss}}$ is given by:

[54] A first order approximation of the Euler equation under a general utility function delivers a similar result.

$$
\begin{aligned}
R^* &= F(K_0)\frac{dP_0}{dB_{ss}} - \left[\frac{dP_{ss}}{dB_{ss}}F(K_{ss}) + P_{ss}F'(K_{ss})\frac{dK_{ss}}{dB_{ss}} + (1-\delta)\frac{dK_{ss}}{dB_{ss}}\right] \\
\frac{dP_0}{dB_{ss}} &= \frac{R^* + F(K_{ss})\frac{dP_{ss}}{dB_{ss}} + \left(P_{ss}F'(K_{ss}) + (1-\delta)\right)\frac{dK_{ss}}{dB_{ss}}}{F(K_0)} > 0
\end{aligned}
$$

Because $K_{ss} > K_0$ we have $F(K_{ss}) > F(K_0)$, and then $\frac{dP_0}{dB_{ss}} > \frac{dP_{ss}}{dB_{ss}}$. Now we can go back to Equation (B.22) and find $\frac{dB_{ss}}{dK_0}$ because we know all the relevant signs. A similar procedure for $\frac{\partial P_0}{\partial K_0}$ delivers:

$$
\frac{\partial P_0}{\partial K_0} = (1-\delta)\,\frac{K_0F'(K_0) - F(K_0)}{\left[F(K_0)\right]^2} < 0
$$

The former stems from the concavity of the production function. Therefore:

$$
\begin{aligned}
\frac{dP_0\left(K_0, B_{ss}\left(K_0\right)\right)}{dK_0} &= (1-\delta)\,\frac{K_0F'(K_0) - F(K_0)}{\left[F(K_0)\right]^2} + \frac{R^* + F(K_{ss})\frac{dP_{ss}}{dB_{ss}} + \left(P_{ss}F'(K_{ss}) + (1-\delta)\right)\frac{dK_{ss}}{dB_{ss}}}{F(K_0)}\frac{dB_{ss}}{dK_0} \\
&\equiv \Gamma_2 + \Gamma_3\frac{dB_{ss}}{dK_0},
\end{aligned}
$$

with $\Gamma_3 > 0$ and $\Gamma_2 < 0$ due to the concavity of the production function. Now we can use all these derivatives on the first period budget constraint:

$$
\begin{aligned}
B_{ss} + K_{ss} &= P_0D(P_0) + (1-\delta)\,K_0 \\
\frac{dB_{ss}}{dK_0} + \frac{dK_{ss}}{dB_{ss}}\frac{dB_{ss}}{dK_0} &= \frac{dP_0}{dK_0}D(P_0) + P_0\frac{\partial D(P_0)}{\partial P_0}\frac{dP_0}{dK_0} + (1-\delta) \\
\frac{dB_{ss}}{dK_0}\left(1 + \frac{dK_{ss}}{dB_{ss}}\right) &= \frac{dP_0}{dK_0}\left(D(P_0) + P_0\frac{\partial D(P_0)}{\partial P_0}\right) + (1-\delta) \\
\frac{dB_{ss}}{dK_0}\left(1 + \frac{dK_{ss}}{dB_{ss}}\right) &= \frac{dP_0}{dK_0}D(P_0)\,(1+\eta) + (1-\delta) \\
\frac{dB_{ss}}{dK_0}\left(1 + \frac{dK_{ss}}{dB_{ss}}\right) &= \left(\Gamma_2 + \Gamma_3\frac{dB_{ss}}{dK_0}\right)D(P_0)\,(1+\eta) + (1-\delta) \\
\frac{dB_{ss}}{dK_0}\left(1 + \frac{dK_{ss}}{dB_{ss}} - \Gamma_3D(P_0)\,(1+\eta)\right) &= \Gamma_2D(P_0)\,(1+\eta) + (1-\delta) \\
\eta < -1 \quad \Rightarrow \quad \frac{dB_{ss}}{dK_0} &= \frac{\Gamma_2D(P_0)\,(1+\eta) + (1-\delta)}{1 + \frac{dK_{ss}}{dB_{ss}} - \Gamma_3D(P_0)\,(1+\eta)} > 0
\end{aligned}
$$

Because $\Gamma_2 < 0$ and $\Gamma_3 > 0$, when $-\infty < \eta < -1$ the numerator and the denominator are positive. Under the same condition the denominator is also positive.

Theorem: Lemmas 1 to 4 imply that, when -$\infty < \eta < -1$, the lower the capital stock at the moment of a financial liberalization, the lower is the level of capital level in the open economy steady state. *In particular,*

$$-\infty < \eta < -1 \quad \Rightarrow \quad \frac{dK_{ss}}{dK_0} > 0.$$

Note that, when $\eta \to -\infty$, the debt level still strictly decreases on the initial capital.[55] This is consistent with Gourinchas and Jeanne (2006). In their economy lower initial capital also generates more long-run debt, the difference is that debt does not affect long-run prices and thus, it does not distort long-run capital levels.

[55] By L'hôpital's Rule, the limit is $-\frac{\Gamma_2}{\Gamma_3} = \frac{1-\delta}{R^*}\left(1 - \frac{K_0}{F(K_0)}\frac{\partial F(K_0)}{\partial K_0}\right) > 0$.

Appendix E Long-Term Effects of Financial Liberalization on Capital and Sectoral Prices

Appendix E.1 Representative-Firm Models with Different Demand Elasticity of Exporting Good

This appendix presents two simple models with representative firms to illustrate the impact of financial openness on capital and goods' prices. The first model follows the standard neoclassical one-sector model (Gourinchas and Jeanne 2006) extended to two sectors: manufacturing and services. As in the standard model, we let the price of the tradable-manufacturing good to be exogenously determined in the international goods market. The second model relaxes this assumption and lets the tradable good to have a downward slopping demand, inversely related to its price.[56] In both models, the price of the non-tradable service good is endogenously determined in the local economy. For comparison purposes, the household has the same preferences than in the baseline heterogeneous-firm model. In all models, the foreign interest rate is exogenous and constant. We start by succinctly discussing the main forces of both models below and how they affect equilibrium prices and the stock of capital in the financially opened steady state. We then calibrate our models and discuss the transition dynamics after the financial liberalization. To assess the role of firm heterogeneity, we compare these models with our benchmark economy.

1. Representative-Firm Models with Different Demand Elasticity of Exporting Good

Consider an economy with two sectors j: manufacturing and services $j \in \{S, M\}$, where each sector is populated by a representative firm. The representative firm in each sector has the following Cobb-Douglas production function:

$$Y_{j,t} = A_j K_{j,t}^{\alpha_j} L_{j,t}^{1-\alpha_j}.$$

The first order conditions for the representative firms in each sector imply that the marginal product of each factor equates its marginal cost:

$$w_t = P_j \alpha_j A_j K_{j,t}^{\alpha_j - 1} L_{j,t}^{1-\alpha_j} \tag{B.23}$$

$$r_t^k = P_j \left(1 - \alpha_j\right) A_j K_{j,t}^{\alpha_j} L_{j,t}^{-\alpha_j} \tag{B.24}$$

Consistent with the baseline heterogeneous firm model, we assume a constant aggregate labor supply.[57] Because of perfect competition, prices of the sectoral output $Y_{j,t}$ are related to factor prices through the zero profit condition:

$$P_{j,t} = \frac{1}{A_j} \left(\frac{r_t^k}{\alpha_j}\right)^{\alpha_j} \left(\frac{w_t}{1 - \alpha_j}\right)^{1-\alpha_j} \tag{B.25}$$

[56] Trade models typically imply, or assume, foreign demands with "slope". This is true for both Melitz (2003)-type models and Eaton and Kortum (2002)-type models. In this appendix, the representative firm takes the sloped demand as given, thus, the effects do not depend on the use of monopoly power. Allowing for the use of monopoly power does not affect the conclusions of this appendix.

[57] Aggregate labor supply is normalized such that steady state output is equal to 1 in each model.

As discussed above, we analyze two versions of this simple model. First, we consider the price of the manufacturing good be exogenous. Second, we allow the manufacturing price to respond endogenously to the quantity demanded.

(i) Infinite Demand Elasticity of the Exporting Good

The manufacturing firm faces an infinitely elastic demand at a constant price $P^X_{M,t} = P^X_M$. We further assume no price discrimination between the domestic and foreign market, so that $P^D_{M,t} = P^X_M$. All manufacturing production in excess of domestic demand is exported:

$$X_t = P^X_M \left(Y_{M,t} - C^D_{M,t} \right). \tag{B.26}$$

The first period after the financial liberalization, the rental rate of capital drops to the exogenous international interest rate plus the depreciation rate, i.e. $r^k = r^* + \delta^k$, where $r^* = \frac{1}{\beta} - 1$. Given that P^D_M and r^k are exogenous in the financially open economy, the zero profit condition for the manufacturing sector – equation (B.25) – determines the wage in the local economy. In turn, perfect factor mobility across sectors pins down the price of the non-tradable service good. This implies that, under exogenous pricing of the tradable good, the quantities exported and, thus, consumed domestically do not affect the long-run equilibrium wage and price of the non-tradable good.

In particular, equation (B.25), implies:

$$w = (1-\alpha_M) \left(P_M A_M \left(\frac{r^k}{\alpha_M} \right)^{-\alpha_M} \right)^{\frac{1}{1-\alpha_M}}.$$

Replacing this expression into the zero profit condition of the non-tradable sector, we obtain:

$$P_S = \frac{1}{A_S} \left(\frac{r^k}{\alpha_S} \right)^{\alpha_S} \left(\frac{1-\alpha_M}{1-\alpha_S} \right)^{1-\alpha_S} \left(P_M A_M \left(\frac{r^k}{\alpha_M} \right)^{-\alpha_M} \right)^{\frac{1-\alpha_S}{1-\alpha_M}}.$$

Because in the long-run, factor and good prices are independent of the long-run level of debt in both sectors, first order condition (B.24) implies that capital in both sectors is independent of the long-run level of prices. Therefore, when the exporting price of the manufacturing good is exogenous, long-run sectoral prices do not affect the long-run level of capital in the open economy.

(ii) Finite Demand Elasticity of the Exporting Good

In the second model, the manufacturing firm faces a downward sloping export demand schedule:

$$C^X_{M,t} = \zeta_X \left(P^X_{M,t} \right)^{-\eta_M}, \tag{B.27}$$

where η_M is the price-elasticity for local exports and ζ_X is the foreign demand scale which we calibrate to match the export share of output. When the price of the tradable good has a downward slopping demand, the adjustment after the financial openness differs. In this case, the level of exports determines the price of the manufacturing good, which – in turn– affects the equilibrium wage and the price of the non-tradable good. Therefore, good prices and wages are potentially affected by the level of long-run debt, and thus, the long-run stock of capital can depend on the financial liberalization, as seen in equation (B.24). What determines the long-term level of capital in the open economy? In a nutshell and as shown in the previous appendix, the capital stock in the moment prior to the financial liberalization determines the long-term level of foreign debt. The long-run equilibrium between current account and trade balance imply that debt repayment determines how much the economy needs to export, which –in turn– determines equilibrium sectoral prices and wages, hence, the long-term stock of capital.

To illustrate the dynamic adjustment after the financial liberalization and the steady states of the main outcomes in the different models, we calibrate both versions of this simple model and compare them with our benchmark economy with heterogeneous firms. It is worth mentioning that these exercises do not attempt to quantify the models, but to show their qualitative implications.

2. Calibration

The calibration strategy of the representative-firm models is consistent with the calibration of the baseline heterogeneous firm model. Externally calibrated parameters taken from the baseline heterogeneous firm model and summarized in Table D.1.

Table D.1: Externally-Calibrated Parameters

Parameter	Description	Value	Source
r^*	World interest rate	0.05	Macro Data
β	Discount Rate	0.95	$\frac{1}{1+r^*}$
γ	Risk aversion	2	Corsetti, Dedola, and Leduc (2008)
η	Substitution C_M-C_S	0.50	Comin, Lashkari, and Mestieri (2021)
η_M	Substitution C_M^D-C_M^F	0.85	Corsetti, Dedola, and Leduc (2008)
δ^k	Depreciation of capital	0.12	Macro Data
α_S	Capital Share S Sector	0.30	Micro data
α_M	Capital Share M Sector	0.36	Micro data
A_S	Service Sector TFP	1	Normalization
τ	Capital control tax	0	na

We internally calibrate the steady state of the endogenous price version to obtain the remaining parameters. Relative to the baseline heterogeneous-firm model, there are three new parameters to be calibrated, which are the TFP in each sector (A_S, A_M) and the level of the foreign demand ζ_S. We normalize $A_S = 1$ and internally calibrate A_M to match the employment share of the manufacturing sector in the Hungarian data. We use ζ_X to match the export share of GDP in the baseline heterogeneous firm model. All remaining parameters are calibrated to Hungarian data in 2008 using target moments from the baseline model. The internally calibrated parameters and the corresponding moments are reported in Table D.2. In the exogenous price version, we set the tradable price $P_M^D = P_M^X$ equal to its steady state value in the endogenous price model. It is worth noting that to be able to compare the three models, we maintain the same consumption preferences –i.e. non-homothetic preferences– and capital elasticities in the three models. The calibration of our heterogeneous firm model is the same as in the main text.

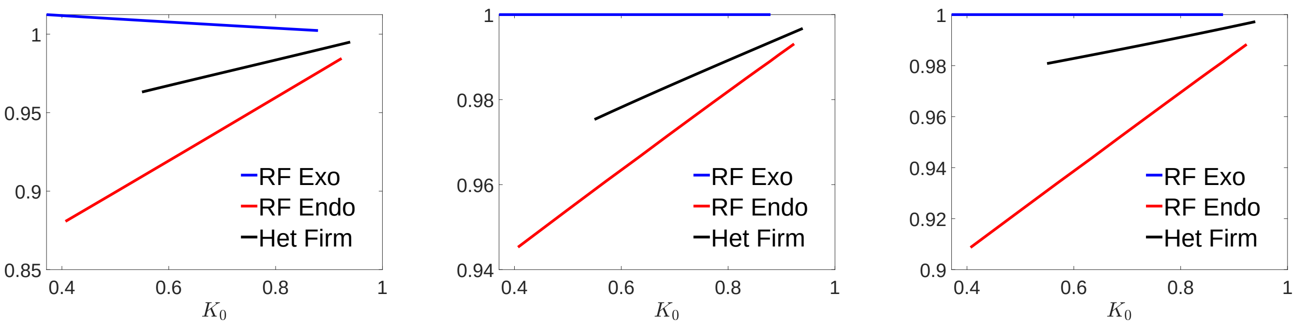
Table D.2: Internally-Calibrated Parameters

Parameter	Description	Value	Target	Data	Model
A_M	Share L_M in L	0.44	$L_M/(L_S+L_M)$	0.53	0.53
θ_S	Share C_S in C	0.31	$(P_S \cdot C_S)/(P \cdot C)$	0.59	0.56
θ_D	Share C_M^D in C_M	0.62	$(P_M^D \cdot C_M^D)/(P_M \cdot C_M)$	0.64	0.63
ζ_X	Foreign Import Demand	0.34	$(P_M^X \cdot C_M^X)/Y$	0.34	0.34
e_S	Expenditure Elasticity S	1.76	Bils, Klenow, and Malin (2013)	1.11	1.11
e_M	Expenditure Elasticity M	1.22	Bils, Klenow, and Malin (2013)	0.85	0.85
$\overline{L}$	Labor supply	0.53	Nominal GDP Y	1	1

3. Open Economy: Steady States in the Three Models

Figure D.1b shows the manufacturing good's price in the open economy steady state for different levels of capital stock at the moment of the liberalization (K_0) in the three models. As discussed above, in the representative-firm model with exogenous pricing of the tradable good (blue line), the price of this good is exogenous and, hence, does not depend on the initial level of capital stock. The zero profit condition in the non-tradable sector pins downs P_s (Panel b), as previously discussed, when the foreign demand for the exporter good is infinitly elastic, the long-run level of P_s is interdependent of the initial capital stock. This is not the case for the models with endogenous pricing of the tradable good. Both in the representative firm model with endogenous pricing of the tradable good (red line) and in the heterogeneous-firm model (black line), the price of the tradable-manufacturing good is set endogenously and depends on the capital stock at the moment of the liberalization. Intuitively, the lower the initial capital stock is, the more the economy borrows externally and the higher debt repayment become sin the long-run. Larger transfers to foreigners imply higher exports, which lower the manufacturing good price. Hence, in models with endogenous pricing of the tradable good, the long-run level of P_M decreases with the initial capital stock. It is worth noting that in the heterogeneous-firm model, the price of the manufacturing good drops by less than in the representative-firm model with endogenous pricing. This lower decline is explained by a love for variety effect. In the heterogeneous-firm model, lowered consumption –triggered by debt repayment– reduces the number of firms and, hence, the number of varieties produced locally. This effect creates upward pressure on the price level such that, even if the price of the manufacturing good drops, it does not drop as much as in the representative-firm case.

As discussed above, changes in final goods prices can affect the long-term level of capital. Formally, the zero profit condition of each sector (equation (B.25)) ensures that the real marginal cost of capital $r^k/P_{j,t}$ is equal to the sectoral marginal product of capital, which –in turn– pins down the level of capital stock in each sector. Figure (D.1a) presents the long-term level of capital in the steady state for the three models. In the representative-firm model with exogenous pricing of the tradable good, the steady-state level of capital in the open economy is close to the financial autarky steady state, albeit it is slightly higher in the former. This slightly higher long-term stock of capital stems from the Rybczynski effect (as discussed in Section 6.4 and shown in Table 7), which increases total capital by leading to a higher expansion of the capital-intensive (tradable) sector. Importantly, if the tradable and non-tradable sectors have the same capital and labor elasticities, the open economy steady state level of capital would be the same as in financial autarky (as in the standard neoclassical model with one sector, Gourinchas and Jeanne 2006). In models with endogenous pricing of the tradable good, the lower sectoral price level increases the required return to capital and lowers the stock of capital in the open economy steady state. Notably, the lower is the capital stock at the moment of the liberalization, the lower is the sectoral price decrease and, thus, lower the capital stock in the open economy steady state (Figure (D.1a)). As sectoral prices drop by less in the heterogeneous-firm model (Figures (D.1b)-(D.1c), the long-term level of capital also drop by less with respect to the representative-firm model with endogenous pricing of the tradable good.



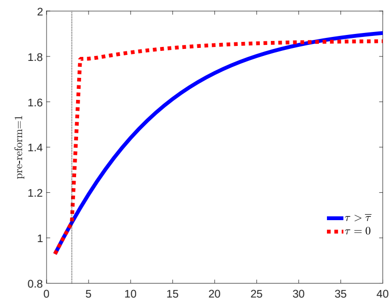
a) Steady State Capital (K) b) Steady State Mfg. Price (P_M) c) Steady State Service Price (P_S)

Figure D.1: Financially Open Steady State Comparison Across Models

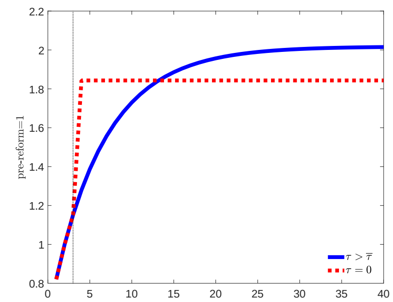
4. Open Economy: Transition Dynamics in the Three Models

How is the transition to the open economy steady state? Figure (D.2) plots the transition dynamics of sectoral prices and capital in the three models for an economy that opens to financial flows when it has 55% of capital with respect to the financial autarky steady state. In the representative-firm model with exogenous price of the traded good, the price of the service good increases in the onset of the reform and reaches fast its steady state level. During the transition, the long-term price of the non-tradable good is higher than in the transition of the financial autarky economy because faster capital accumulation increases the labor demand, which –in turn– raises wages and the price of of the service good (see equation (B.25)). As discussed above, the steady state level of the tradable and non-tradable goods is equal in the financially open and closed economies.

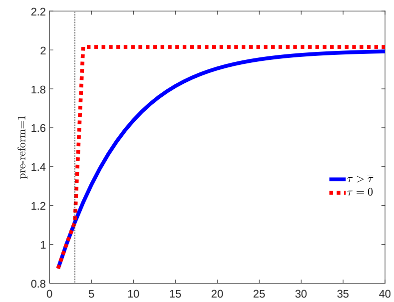
The transition dynamics of the economies with endogenous pricing of the tradable good is different. In these models, both prices of tradable and non-tradable goods jump in the onset of the reform, but they decrease after the policy is implemented and reach a permanently lower long-term level when compared to the financial autarky steady state. The period of the reform, installed capital was determined before the new policy was implemented. Therefore, the increase in demand due to consumption smoothing cannot be accommodated by easily increasing quantities. Therefore, on impact, prices increase as the supply cannot easily respond. The period after the policy is implemented, capital is much higher as it was decided last period with the new ability to borrow, the increase in supply is able to meet demand and triggers a decrease in prices consistent with the lower cost of capital. This results in lower sectoral price levels along the rest of the transition and in the open economy steady state. Note that the transition dynamics of the heterogeneous-firm model is more protracted than in the representative firm model. The reason of this difference is that the baseline economy has heterogeneous firms with endogenous entry, therefore, in order to increase production efficiently, the economy needs to expand the number of firms in both sectors. Because of entry costs and the fact that labor is part of the entry cost and it is in fixed supply, the mass of firms adjust slowly after the initial shock.



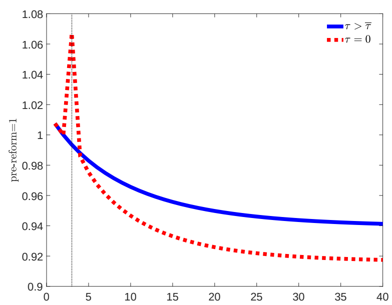
A) Het. Firm: Capital (K)



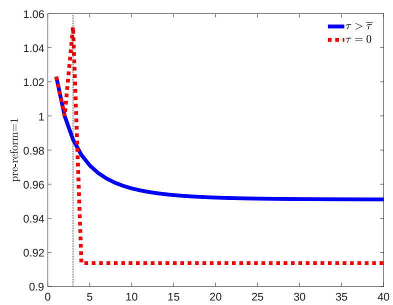
B) RF Endo: Capital (K)



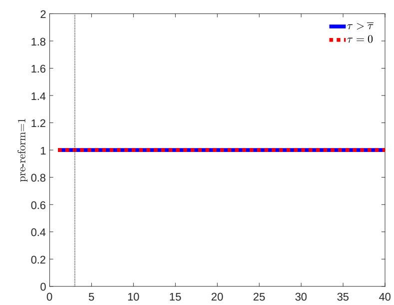
C) RF Exo: Capital (K)



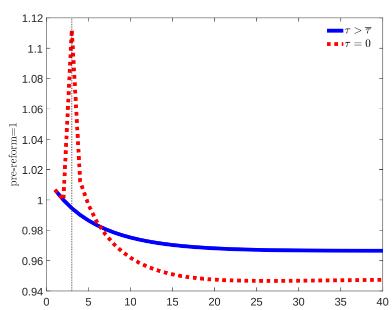
D) Het. Firm: Mfg. Price (P_M)



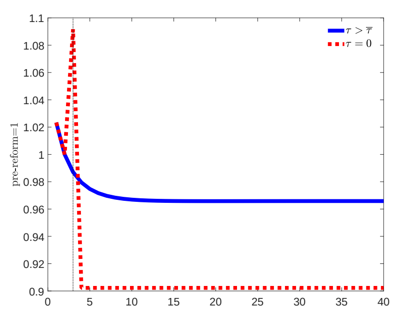
E) RF Endo: Mfg. Price (P_M)



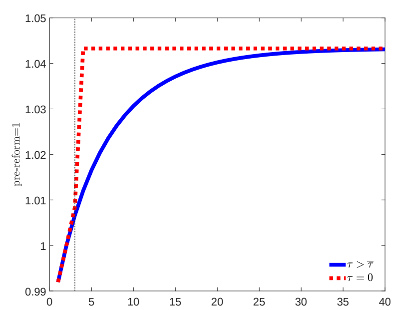
F) RF Exo: Mfg. Price (P_M)



G) Het. Firm: Service Price (P_S)



H) RF Endo: Service Price (P_S)



I) RF Exo: Service Price (P_S)

Figure D.2: Transition Comparisons Across Models

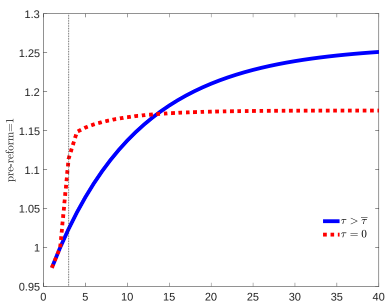
5. Implications for Welfare

The transition dynamics that we just described have implications for welfare. As discussed in Section 6.5, we consider welfare as consumption equivalent variation (CEQ) including the transition path and the new steady-state. Hence, we can assess welfare gains/losses during the transition and in the steady state for each of the three models.

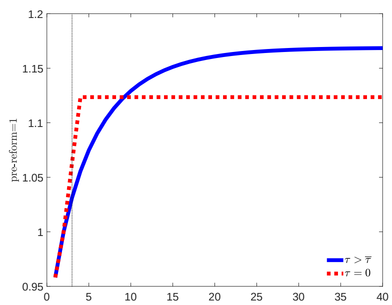
In the representative-firm model with exogenous price of the traded good, there are only welfare gains during the transition. The financial liberalization allows the household to increase consumption and smooth it over time (Figure D.2 below). This is the only source of welfare gains. Because the level of capital in the open economy steady state is equal to that in financial autarky, there are no looses due to lower capital in the liberalized steady state. Therefore, in this model, there are only welfare gains arising from the faster transition to the steady state.

Instead, in the models with endogenous prices of the traded good, a second force can affect welfare. In fact, the lower level of long-term capital due to debt repayment generate downward pressure on welfare. Therefore, whether there are overall welfare gains or losses depends on the strength of the gains from consumption smoothing during the transition and the loss of capital in the long-term. For our calibration, Figure 9 showed that there are welfare losses in these two models and these losses are lower in the heterogeneous-firm model. There are two reasons for the lower welfare losses in this model relatively to the representative-firm model with endogenous price of the traded good. First, as shown in Figures D.1b and D.1c above, the long-term sectoral price level drops less in the heterogeneous-firm model, which implies that the long-term level of capital is higher. This implies that the long-term welfare losses are lower with heterogeneous firms. Second, the welfare gains during the transition are higher because the financial openness increases transitional consumption more than in the representative-firm model relative to their respective financial autarky dynamics. This larger increase in consumption during the transition can be seen from the larger difference between the red and the blue lines in Panels (a) and (b) of Figure D.3 below. Why does consumption increase relatively more in the heterogeneous-firm model? The reason is that, in the transition to the financial autarky steady state, consumption increases more smoothly in this model, as capital is used for both production and creation of new firms. This slows down the consumption path in the financial autarky transition. Financial liberalization triggers foreign borrowing, which can be used for both capital accumulation and the creation of new firms. This accelerates the transition to the open economy steady state and it does so much more than in the representative-firm model with endogenous pricing of the traded good.[58] Therefore, higher gains during the transition and lower losses in the open economy steady state explained lower welfare loses of the heterogeneous-firm model relative to the representative- firm model with endogenous prices of the traded good.

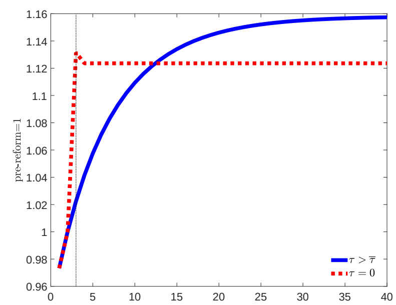
[58]In fact, the autarky transition of the representative firm model is already quite fast, this is the main reason for the rather small welfare gains documented in the literature. Thus, there are little gains t be made from accelerating an already fast transition.



A) Het. Firm: Consumption (C)



B) RF Endo: Consumption (C)



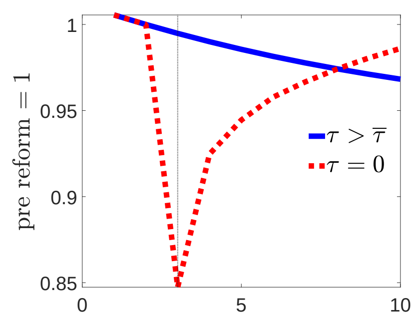
C) RF Exo: Consumption (C)

Figure D.3: Consumption Transition Comparisons Across Models

Appendix F Model: Additional Figures

Appendix F.1 Short-Term Dynamics

1) Aggregate Productivity

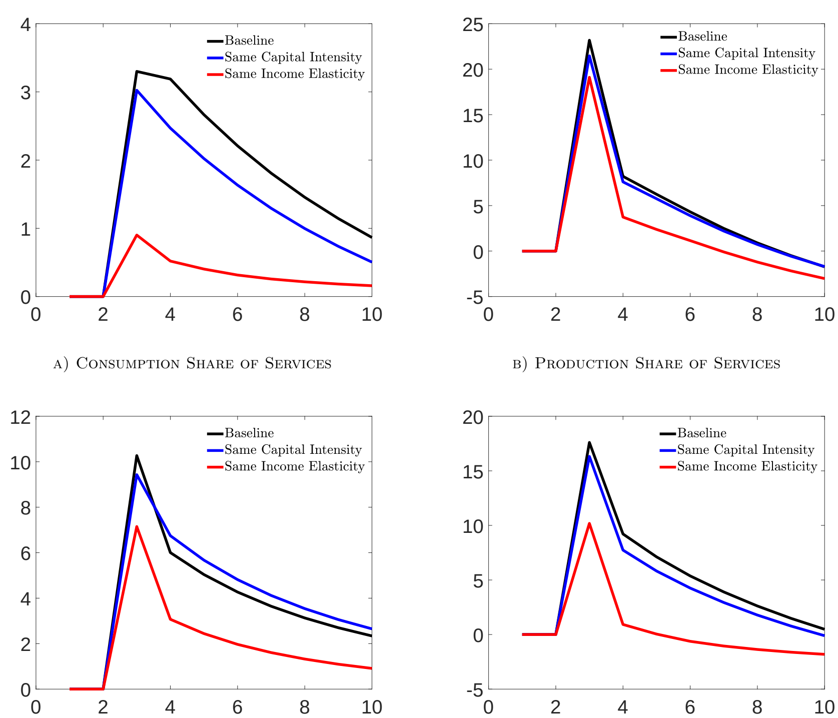


(a) a) Aggregate TFP

Figure E.1: Aggregate TFP

Note: The blue and solid line corresponds to an economy in financial autarky and the red and dashed line corresponds to a financially open economy.

2) Counterfactual Exercises



a) Consumption Share of Services

b) Production Share of Services

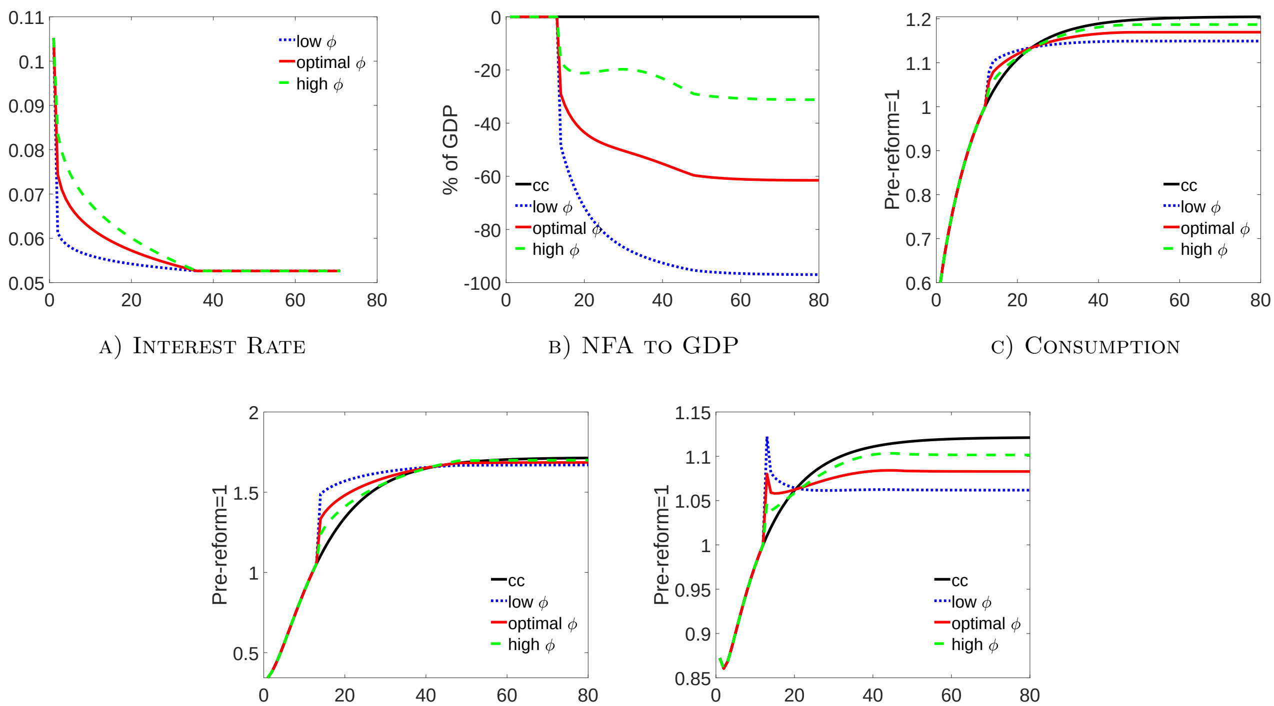
c) Relative Entry Rate (S/M)

d) Price Index (P)

Figure E.2: Counterfactual Economies in the short term

Appendix F.2 Policy for Hungary: Additional Figures

Figure E.3 plots the transition paths of aggregate variables under different levels of ϕ, where ϕ governs the speed of decrease in the borrowing tax. With a larger value of ϕ, the effective interest rate inclusive of the borrowing tax decreases at a slower pace during the transition (Figure E.3a). As such, a larger ϕ reduces the net foreign assets position of the economy. Compared to an immediate removal of capital controls –as studied in the baseline model– that leads to a terminal debt to GDP ratio of 140%, the policy results in a steady state debt to GDP ratio of only 60% (Figure E.3b). With less borrowing along the transition path, the increase in consumption and capital stock upon liberalization is also dampened (Figures E.3c and E.3d). By mediating the spike in consumption upon liberalization, a more gradual reduction in the borrowing tax also smooths the effects of liberalization on the aggregate price index (Figure E.3e).

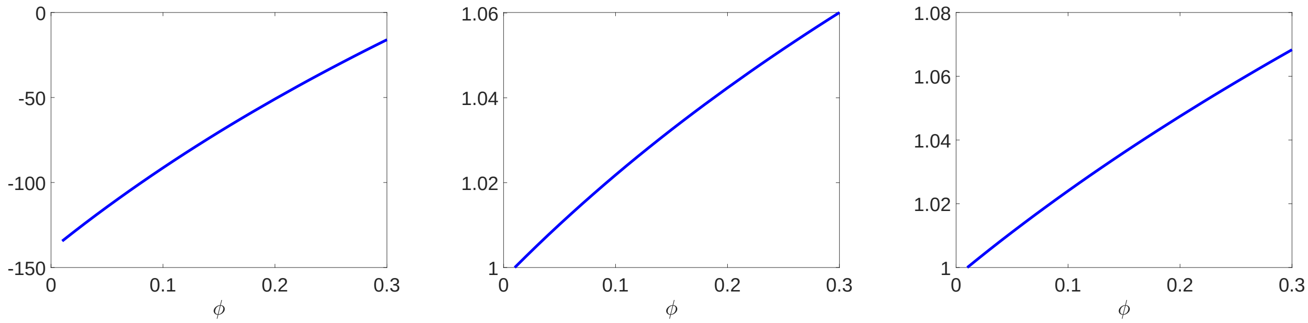


a) Interest Rate b) NFA to GDP c) Consumption

d) Capital e) Price

Figure E.3: Full Transition for different values of ϕ

Figure E.4 plots the terminal level of borrowing, consumption and aggregate price associated with different values of ϕ. A faster liberalization (lower ϕ) results in larger transitional borrowing and, therefore, a larger steady state level of debt to GDP ratio (Figure E.4a). As mentioned above, there is a trade-off between the speed of convergence and the terminal steady state of the open economy. An economy can reach the terminal steady state faster by borrowing more along the transition, but a larger terminal level of debt also reduces the terminal level of consumption and, in turn, the aggregate price level. Figures E.4b and E.4c present these patterns and show that faster reforms (lower ϕ) are consistent with a lower level of consumption and aggregate price level in the open economy steady state.



A) Long Run NFA-to-GDP-ratio ($\frac{B}{Y}$)   B) Long Run Consumption (C)   C) Long Run Price (P)

Figure E.4: Long run aggregates for different values of ϕ

Appendix G Steady State System

$$
\begin{aligned}
Endogenous(39) &= \{P, P_S, P_M, P_M^D, w, r^k, r, \phi_j\} = 8 \\
&= \{C, C_S, C_M, C_M^D, C_M^F, B, TB, K, X_M, Y, TBY\} = 11 \\
&= \{M_j, M_j^e, \varphi_S^d, \varphi_M^d, \varphi_M^x\} = 5 \\
&= \{c_j(\varphi), p_j(\varphi), q_j^d(\varphi), q_M^x(\varphi), \pi_j^d(\varphi), \pi_M^x(\varphi), V_S(\varphi), V_M(\varphi), V_M^d(\varphi), V_M^x(\varphi), \mu_j(\varphi)\} = 11 \\
&= \{k_j^d(\varphi), k_M^x(\varphi), l_j^d(\varphi), l_M^x(\varphi)\} = 4
\end{aligned}
$$

Appendix G.1 Household

$$P_M = \left[\theta_D (P_M^D)^{1-\eta_M} + \theta_F (P_M^F = 1)^{1-\eta_M}\right]^{\frac{1}{1-\eta_M}} \tag{F.1}$$

$$P = \left[\theta_M P_M^{1-\eta} C^{e_M - 1} + \theta_S P_S^{1-\eta} C^{e_S - 1}\right]^{\frac{1}{1-\eta}} \tag{F.2}$$

$$C_S = \left(\frac{P_S}{P}\right)^{-\eta} \theta_S C^{e_S} \tag{F.3}$$

$$C_M = \left(\frac{P_M}{P}\right)^{-\eta} \theta_M C^{e_M} \tag{F.4}$$

$$C_M^D = \left(\frac{P_M^D}{P_M}\right)^{-\eta_M} \theta_D C_M \tag{F.5}$$

$$C_M^F = \left(\frac{P_M^F = 1}{P_M}\right)^{-\eta_M} \theta_F C_M \tag{F.6}$$

$$r^k = \frac{1}{\beta} - 1 + \delta^k \tag{F.7}$$

$$1 = \beta\,(1 + r) \tag{F.8}$$

$$r = r^* + \tau\{B_t < 0\} - \tau\{B_t > 0\} \tag{F.9}$$

Appendix G.2 Production

Appendix G.2.1 Composite price, costs, prices, demands, profits, inputs demands

$$\phi_j = \left(\frac{r^k}{\alpha_j}\right)^{\alpha_j} \left(\frac{w}{1-\alpha_j}\right)^{1-\alpha_j} \qquad j \in \{S, M\} \tag{F.10}$$

$$c_j(\varphi) = \frac{\phi_j}{\varphi} \qquad j \in \{S, M\} \tag{F.11}$$

$$p_j(\varphi) = \frac{1}{\rho} c_j(\varphi) \qquad j \in \{S, M\} \tag{F.12}$$

$$q_S^d(\varphi) = C_S \left(\frac{p_S(\varphi)}{P_S}\right)^{-\sigma} \tag{F.13}$$

$$q_M^d(\varphi) = C_M^D \left(\frac{p_M(\varphi)}{P_M^D}\right)^{-\sigma} \tag{F.14}$$

$$q_M^x(\varphi) = A \left(p_M(\varphi)\right)^{-\sigma} \tag{F.15}$$

$$\pi_j^d(\varphi) = \Big[p_j(\varphi) - c_j(\varphi)\Big] q_j^d(\varphi) - \phi_j f_j^d \qquad j \in \{S, M\} \tag{F.16}$$

$$\pi_M^x(\varphi) = \Big[p_M(\varphi) - c_M(\varphi)\Big] q_M^x(\varphi) - \phi_M f_M^x \tag{F.17}$$

$$k_j^d(\varphi) = \alpha_j \frac{\phi_j}{r^k} \left[\frac{q_j^d(\varphi)}{\varphi} + f_j^d\right] \qquad j \in \{S, M\} \tag{F.18}$$

$$k_M^x(\varphi) = \alpha_M \frac{\phi_M}{r^k} \left[\frac{q_M^x(\varphi)}{\varphi} + f_M^x\right] \tag{F.19}$$

$$l_j^d(\varphi) = (1-\alpha_j) \frac{\phi_j}{w} \left[\frac{q_j^d(\varphi)}{\varphi} + f_j^d\right] \qquad j \in \{S, M\} \tag{F.20}$$

$$l_M^x(\varphi) = (1-\alpha_M) \frac{\phi_M}{w} \left[\frac{q_M^x(\varphi)}{\varphi} + f_M^x\right] \tag{F.21}$$

Appendix G.2.2 Value Functions and Cut-Offs

$$V_S(\varphi) = \max\left\{0, \frac{\pi_S^d(\varphi)}{1-\beta(1-\delta)}\right\} \tag{F.22}$$

$$V_M(\varphi) = \max\left\{V_M^d(\varphi), V_M^x(\varphi)\right\} \tag{F.23}$$

$$V_M^d(\varphi) = \max\left\{0, \frac{\pi_M^d(\varphi)}{1-\beta(1-\delta)}\right\} \tag{F.24}$$

$$V_M^x(\varphi) = \max\left\{0, \frac{\pi_M^d(\varphi) + \pi_M^x(\varphi)}{1-\beta(1-\delta)}\right\} \tag{F.25}$$

$$V_S(\varphi_S^d) = 0 \tag{F.26}$$

$$V_M^d(\varphi_M^d) = 0 \tag{F.27}$$

$$V_M^x(\varphi_M^x) = 0 \quad \Leftrightarrow \quad \pi_M^x(\varphi_M^x) = 0 \tag{F.28}$$

Appendix G.2.3 Stationary distribution, mass of firms, and free-entry condition

$$\mu_j(\varphi) = \begin{cases} \frac{g(\varphi)}{1-G(\varphi_j^d)} & \text{if} \quad \varphi \geq \varphi_j^d \\ 0 & \text{otherwise} \end{cases} \qquad j \in \{S, M\} \tag{F.29}$$

$$\delta M_j = \left[1 - G(\varphi_j^d)\right] M_j^e \qquad j \in \{S, M\} \tag{F.30}$$

$$\int_{\varphi_j^d}^{\infty} V_j(\varphi) g(\varphi) d\varphi = \phi_j \left[f_j^e + \xi\left(\exp\left(\frac{M_j^e - \overline{M}_j^e}{\overline{M}_j^e}\right) - 1\right)\right] \qquad j \in \{S, M\} \tag{F.31}$$

Appendix G.2.4 Aggregation

$$L_S^{prod} = M_S \int_{\varphi_S^d}^{\infty} l_S^d(\varphi)\mu_S(\varphi)d\varphi$$

$$L_M^{prod} = M_M \int_{\varphi_M^d}^{\infty} l_M^d(\varphi)\mu_M(\varphi)d\varphi + M_M \int_{\varphi_M^x}^{\infty} l_M^x(\varphi)\mu_M(\varphi)d\varphi$$

$$L_j^{entry} = M_j^e \cdot \nu(1-\alpha_{1j}) \cdot \frac{\phi_j}{w}\left[f_j^e + \xi\left(\exp\left(\frac{M_j^e - \overline{M}_j^e}{\overline{M}_j^e}\right) - 1\right)\right] \qquad j \in \{S, M\}$$

$$L_j = L_j^{prod} + L_j^{entry} \qquad j \in \{S, M\}$$

$$\overline{L} = L_M + L_S \tag{F.32}$$

$$K_S^{prod} = M_S \in_{\varphi_S^d}^{\infty} k_S^d(\varphi)\mu_S(\varphi)d\varphi$$

$$K_M^{prod} = M_M \int_{\varphi_M^d}^{\infty} k_M^d(\varphi)\mu_M(\varphi)d\varphi + M_M \int_{\varphi_M^x}^{\infty} k_M^x(\varphi)\mu_M(\varphi)d\varphi$$

$$K_j^{entry} = M_j^e \cdot \nu\alpha_{1j} \cdot \frac{\phi_j}{r^k}\left[f_j^e + \xi\left(\exp\left(\frac{M_j^e - \overline{M}_j^e}{\overline{M}_j^e}\right) - 1\right)\right] \qquad j \in \{S, M\}$$

$$K_j = K_j^{prod} + K_j^{entry} \qquad j \in \{S, M\}$$

$$K = K_M + K_S \tag{F.33}$$

Appendix G.3 Markets Clear

$$P_S C_S = M_S \int_{\varphi_S^d}^{\infty} p_S(\varphi) q_S^d(\varphi) \mu_S(\varphi) d\varphi \tag{F.34}$$

$$P_M^D C_M^D = M_M \int_{\varphi_M^d}^{\infty} p_M(\varphi) q_M^d(\varphi) \mu_M(\varphi) d\varphi \tag{F.35}$$

$$X_M = M_M \int_{\varphi_M^x}^{\infty} p_M(\varphi) q_M^x(\varphi) \mu_M(\varphi) d\varphi \tag{F.36}$$

$$B = -\frac{TB}{(r - \tau)} \tag{F.37}$$

$$TB = X_M - C_M^F - \delta^k K \tag{F.38}$$

$$TBY \equiv TB/Y \tag{F.39}$$

$$Y \equiv PC + \delta K + TB = P_S C_S + P_M^D C_M^D + X_M \tag{F.40}$$

Appendix H Dynamic System

$$
\begin{aligned}
Endogenous(42) &= \{P, P_S, P_M, P_M^D, w, r^k, r, \Lambda, \lambda, \phi_j\} = 10 \\
&= \{C, C_S, C_M, C_M^D, C_M^F, B, TB, K, X_M, Y, TBY\} = 11 \\
&= \{M_j, M_j^e, \varphi_S^d, \varphi_M^d, \varphi_M^x\} = 5 \\
&= \{c_j(\varphi), p_j(\varphi), q_S^d(\varphi), q_M^d(\varphi), q_M^x(\varphi), \pi_j^d(\varphi), \pi_M^x(\varphi), V_S(\varphi), V_M(\varphi), V_M^d(\varphi), V_M^x(\varphi), \mu_j(\varphi)\} = 12 \\
&= \{k_j^d(\varphi), k_M^x(\varphi), l_j^d(\varphi), l_M^x(\varphi)\} = 4
\end{aligned}
$$

Appendix H.1 Household

$$P_{Mt} = \left[\theta_D (P_{Mt}^D)^{1-\eta_M} + \theta_F (P_{Mt}^F = 1)^{1-\eta_M}\right]^{\frac{1}{1-\eta_M}} \tag{G.1}$$

$$P_t = \left[\theta_M P_{Mt}^{1-\eta} C_t^{e_M - 1} + \theta_S P_{St}^{1-\eta} C_t^{e_S - 1}\right]^{\frac{1}{1-\eta}} \tag{G.2}$$

$$C_{St} = \left(\frac{P_{St}}{P_t}\right)^{-\eta} \theta_S C_t^{e_S} \tag{G.3}$$

$$C_{Mt} = \left(\frac{P_{Mt}}{P_t}\right)^{-\eta} \theta_M C_t^{e_M} \tag{G.4}$$

$$C_{Mt}^D = \left(\frac{P_{Mt}^D}{P_{Mt}}\right)^{-\eta_M} \theta_D C_{Mt} \tag{G.5}$$

$$C_{Mt}^F = \left(\frac{P_{Mt}^F = 1}{P_{Mt}}\right)^{-\eta_M} \theta_F C_{Mt} \tag{G.6}$$

$$\lambda_t = \frac{C_t^{-\gamma}}{P_t}\left[\frac{1-\eta}{\epsilon_M \theta_M^{\frac{1}{\eta}} C_t^{\frac{\epsilon_M - \eta}{\eta}} C_{Mt}^{\frac{\eta-1}{\eta}} + \epsilon_S \theta_S^{\frac{1}{\eta}} C_t^{\frac{\epsilon_S - \eta}{\eta}} C_{St}^{\frac{\eta-1}{\eta}} - \eta}\right] \tag{G.7}$$

$$\Lambda_{t,t+1} = \beta \frac{\lambda_{t+1}}{\lambda_t} \tag{G.8}$$

$$1 = \Lambda_{t,t+1}(1 - \delta^k + r_{t+1}^k) \tag{G.9}$$

$$1 = \Lambda_{t,t+1}\left(1 + r_{t+1}\right) \tag{G.10}$$

$$r_{t+1} = r^* + \tau \tag{G.11}$$

Appendix H.2 Production

Appendix H.2.1 Composite price, costs, prices, demands, profits, inputs demands

$$\phi_{jt} = \left(\frac{r_t^k}{\alpha_j}\right)^{\alpha_j} \left(\frac{w_t}{1-\alpha_j}\right)^{(1-\alpha_j)} \qquad j \in \{S, M\} \tag{G.12}$$

$$c_{jt}(\varphi) = \frac{\phi_{jt}}{\varphi} \qquad j \in \{S, M\} \tag{G.13}$$

$$p_{jt}(\varphi) = \frac{1}{\rho} c_{jt}(\varphi) \qquad j \in \{S, M\} \tag{G.14}$$

$$q_{St}^d(\varphi) = C_{St} \left(\frac{p_{St}(\varphi)}{P_{St}}\right)^{-\sigma} \tag{G.15}$$

$$q_{Mt}^d(\varphi) = C_{Mt}^D \left(\frac{p_{Mt}(\varphi)}{P_{Mt}^D}\right)^{-\sigma} \tag{G.16}$$

$$q_{Mt}^x(\varphi) = A \left(p_{Mt}(\varphi)\right)^{-\sigma} \tag{G.17}$$

$$\pi_{jt}^d(\varphi) = \Big[p_{jt}(\varphi) - c_{jt}(\varphi)\Big] q_{jt}^d(\varphi) - \phi_{jt} f_j^d \qquad j \in \{S, M\} \tag{G.18}$$

$$\pi_{Mt}^x(\varphi) = \Big[p_{Mt}(\varphi) - c_{Mt}(\varphi)\Big] q_{Mt}^x(\varphi) - \phi_{Mt} f_M^x \tag{G.19}$$

$$k_{jt}^d(\varphi) = \alpha_j \frac{\phi_{jt}}{r_t^k} \left[\frac{q_{jt}^d(\varphi)}{\varphi} + f_j^d\right] \qquad j \in \{S, M\} \tag{G.20}$$

$$k_{Mt}^x(\varphi) = \alpha_M \frac{\phi_{Mt}}{r_t^k} \left[\frac{q_{Mt}^x(\varphi)}{\varphi} + f_M^x\right] \tag{G.21}$$

$$l_{jt}^d(\varphi) = (1-\alpha_j) \frac{\phi_{jt}}{w_t} \left[\frac{q_{jt}^d(\varphi)}{\varphi} + f_j^d\right] \qquad j \in \{S, M\} \tag{G.22}$$

$$l_{Mt}^x(\varphi) = (1-\alpha_M) \frac{\phi_{Mt}}{w_t} \left[\frac{q_{Mt}^x(\varphi)}{\varphi} + f_M^x\right] \tag{G.23}$$

Appendix H.2.2 Value Functions and Cut-Offs

$$V_{St}(\varphi) = \max\Big\{0, \pi_{St}^d(\varphi) + (1-\delta)\Lambda_{t,t+1} V_{S,t+1}(\varphi)\Big\} \tag{G.24}$$

$$V_{Mt}(\varphi) = \max\Big\{V_{Mt}^d(\varphi), V_{Mt}^x(\varphi)\Big\} \tag{G.25}$$

$$V_{Mt}^d(\varphi) = \max\Big\{0, \pi_{Mt}^d(\varphi) + (1-\delta)\Lambda_{t,t+1} V_{M,t+1}(\varphi)\Big\} \tag{G.26}$$

$$V^x_{Mt}(\varphi) = \max\left\{0, \pi^d_{Mt}(\varphi) + \pi^x_{Mt}(\varphi) + (1-\delta)\Lambda_{t,t+1}V_{M,t+1}(\varphi)\right\} \tag{G.27}$$

$$V_{St}(\varphi^d_{St}) = 0 \tag{G.28}$$

$$V^d_{Mt}(\varphi^d_{Mt}) = 0 \tag{G.29}$$

$$V^x_{Mt}(\varphi^x_{Mt}) = 0 \quad \Leftrightarrow \quad \pi^x_{Mt}(\varphi^x_{Mt}) = 0 \tag{G.30}$$

Appendix H.2.3 Stationary distribution, mass of firms, and free-entry condition

$$M_{j,t+1}\mu_{j,t+1}(\varphi) = \begin{cases} (1-\delta)M_{jt}\mu_{jt}(\varphi) + M^e_{j,t+1}g(\varphi) & \text{if} \quad \varphi \geq \varphi^d_{j,t+1} \\ 0 & \text{otherwise} \end{cases} \qquad j \in \{S, M\} \tag{G.31}$$

$$M_{j,t+1} = (1-\delta)M_{jt}\int_{\varphi^d_{j,t+1}}^{\infty} \mu_{jt}(\varphi)d\varphi + M^e_{j,t+1}\int_{\varphi^d_{j,t+1}}^{\infty} g(\varphi)d\varphi \qquad j \in \{S, M\} \tag{G.32}$$

$$\int_{\varphi^d_{jt}}^{\infty} V_{jt}(\varphi)g(\varphi)d\varphi = \phi_{jt}\left[f^e_j + \xi\left(\exp\left(\frac{M^e_{jt} - \overline{M}^e_j}{\overline{M}^e_j}\right) - 1\right)\right] \qquad j \in \{S, M\} \tag{G.33}$$

Appendix H.2.4 Aggregation

$$L^{prod}_{St} = M_{St}\int_{\varphi^d_{St}}^{\infty} l^d_{St}(\varphi)\mu_{St}(\varphi)d\varphi$$

$$L^{prod}_{Mt} = M_{Mt}\int_{\varphi^d_{Mt}}^{\infty} l^d_{Mt}(\varphi)\mu_{Mt}(\varphi)d\varphi + M_{Mt}\int_{\varphi^x_{Mt}}^{\infty} l^x_{Mt}(\varphi)\mu_{Mt}(\varphi)d\varphi$$

$$L^{entry}_{jt} = M^e_{jt}\cdot(1-\alpha_j)\cdot\frac{\phi_{jt}}{w_t}\left[f^e_j + \xi\left(\exp\left(\frac{M^e_{jt} - \overline{M}^e_j}{\overline{M}^e_j}\right) - 1\right)\right] \qquad j \in \{S, M\}$$

$$L_{jt} = L^{prod}_{jt} + L^{entry}_{jt} \qquad j \in \{S, M\}$$

$$\overline{L} = L_{Mt} + L_{St} \tag{G.34}$$

$$K^{prod}_{St} = M_{St}\int_{\varphi^d_{St}}^{\infty} k^d_{St}(\varphi)\mu_{St}(\varphi)d\varphi$$

$$K^{prod}_{Mt} = M_{Mt}\int_{\varphi^d_{Mt}}^{\infty} k^d_{Mt}(\varphi)\mu_{Mt}(\varphi)d\varphi + M_{Mt}\int_{\varphi^x_{Mt}}^{\infty} k^x_{Mt}(\varphi)\mu_{Mt}(\varphi)d\varphi$$

$$K_{jt}^{entry} = M_{jt}^e \cdot \alpha_j \cdot \frac{\phi_{jt}}{r_t^k}\left[f_j^e + \xi\left(\exp\left(\frac{M_{jt}^e - \overline{M}_j^e}{\overline{M}_j^e}\right) - 1\right)\right] \qquad j \in \{S, M\}$$

$$K_{jt} = K_{jt}^{prod} + K_{jt}^{entry} \qquad j \in \{S, M\}$$

$$K_t = K_{Mt} + K_{St} \tag{G.35}$$

Appendix H.3 Markets Clear

$$P_{St}C_{St} = M_{St}\int_{\varphi_{St}^d}^{\infty} p_{St}(\varphi)q_{St}^d(\varphi)\mu_{St}(\varphi)d\varphi \tag{G.36}$$

$$P_{Mt}^D C_{Mt}^D = M_{Mt}\int_{\varphi_{Mt}^d}^{\infty} p_{Mt}(\varphi)q_{Mt}^d(\varphi)\mu_{Mt}(\varphi)d\varphi \tag{G.37}$$

$$X_{Mt} = M_{Mt}\int_{\varphi_{Mt}^x}^{\infty} p_{Mt}(\varphi)q_{Mt}^x(\varphi)\mu_{Mt}(\varphi)d\varphi \tag{G.38}$$

$$B_{t+1} = (1 + r_t - \tau)B_t + TB_t \tag{G.39}$$

$$TB_t = X_{Mt} - C_{Mt}^F - (K_{t+1} - (1-\delta^k)K_t) \tag{G.40}$$

$$TBY_t \equiv TB_t / Y_t \tag{G.41}$$

$$Y_t \equiv P_t C_t + (K_{t+1} - (1-\delta^k)K_t) + TB_t = P_{St}C_{St} + P_{Mt}^D C_{Mt}^D + X_{Mt} \tag{G.42}$$

Appendix I Risk Premium

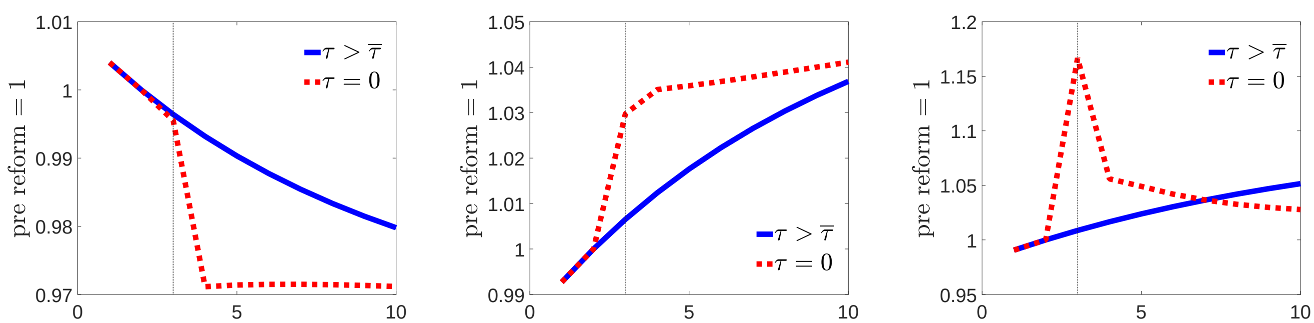
Economies are typically subject to risk premiums as higher debt levels increase their borrowing costs. We study the robustness of our results in the context of a risk premium consistent with Schmitt-Grohe and Uribe (2003). In particular, the domestic interest rate r_t is endogenously determined and depends on the foreign interest rate (r^*), the level of capital controls, and the local risk premium:

$$r_t = r^* + \tau\{B_t < 0\} - \tau\{B_t > 0\} + \psi(\exp(-B_t) - 1). \tag{H.1}$$

We use the same calibration but set a slightly lower $\beta = 0.95 < \frac{1}{1+r^*}$ to allow for different long-run levels of debt depending on the magnitude of capital controls. In fact, under a risk-premium set-up, the long-run of the economy is independent of the initial condition (K_0), therefore, the timing of the reform is immaterial for the long-run. Nevertheless, the long-run does depend on the level of capital controls (τ) as long as $\beta =< \frac{1}{1+r^*}$.

Short-run Dynamics

Figures H.1 and H.2 shows that the main short-run dynamics of the baseline economy are robust to this alternative model.



a) Relative Cost Ratio ($\frac{\phi_M}{\phi_S}$) b) Consumption share of Services $\left(\frac{P^S \times C^S}{P \times C}\right)$ c) Production share of Services $\left(\frac{P^S \times C^S}{P^S \times C^S + P_D^M \times C_M^D + XM}\right)$

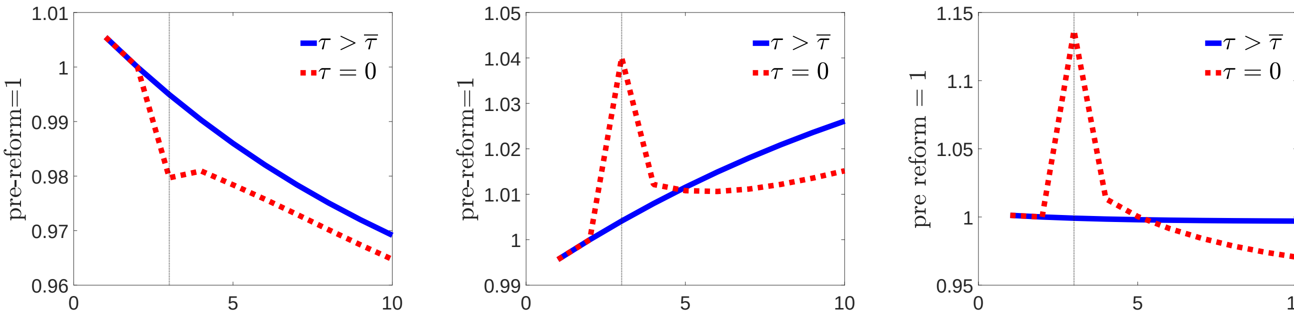
Figure H.1: Reallocation across Sectors in the short term

Note: This figure shows the dynamics of the relative cost ratio (left), the consumption share of services (middle) and the production share of services (right). The blue and solid line corresponds to an economy in financial autarky and the red and dashed line corresponds to a financially open economy.

Long-run Effects

The size of the reduction of capital controls has implications for the characterization of the transition path, as well as of the long-run steady state. A modest liberalization episode would induce an economy to accumulate foreign debt along the transition, but the economy will return to financial autarky in the long-run. However, a larger liberalization can result in long term foreign debt in the new steady-state.

To understand this point, consider an economy that has a tax on foreign financial transactions high



A) Relative Domestic Production Cut-off $\left(\frac{\varphi_S^d}{\varphi_M^d}\right)$

B) Relative Entry Rate $\left(\frac{S}{M}\right)$

C) Relative Cut-offs within Manufacturing $\left(\frac{\varphi_M^x}{\varphi_M^d}\right)$

Figure H.2: Reallocation Within Sectors in the short term

Note: This figure shows the dynamics of the relative domestic production cut-offs (left), the relative entry rate (middle), the relative cut-offs in the manufacturing sector (right). The blue and solid line corresponds to an economy in financial autarky and the red and dashed line corresponds to a financially open economy.

enough such that the rental rate of capital net of depreciation is lower than the domestic interest rate at $t = 0$, i.e. $r_0^k - \delta < r = r^* + \tau$. Therefore, the cost of borrowing from abroad is higher than the return of capital; the optimal decision for the household is not to issue foreign debt. Because the household accumulates capital along the transition path, $r_0^k > r_t^k$, $\forall t > 0$. Thus, this economy follows a path of financial autarky and balanced trade until it reaches its steady state.

Now, consider two alternative levels of capital controls. First, define $\bar{\tau}$ to be the tax rate that makes the household marginally indifferent from issuing foreign bonds at $t = 0$ when $B_0 = 0$: $\bar{\tau} = r_0^k - \delta - r^*$. Note that the long-run return to capital in any long-run steady state has to satisfy $r_{ss}^k - \delta = \frac{1}{\beta} - 1$. Second, define $\underline{\tau}$ as the tax rate that makes the household marginally indifferent about holding debt in the long run; that is: $\underline{\tau} = \frac{1}{\beta} - 1 - r^* \leq \bar{\tau}$. Then, for any initial condition characterized by $r_0^k\,(K_0, M_{j0}, \mu_{j0}, B_0 = 0)$, we can define three potential types of transition paths:

1. **Financial Autarky**: $\forall \tau, \tau \geq \bar{\tau}$ the economy is closed to international financial markets. In this case, $\forall t > 0$, foreign bond holdings are $B_t = 0$.

2. **Transitional Debt (long-run financial autarky)**: $\forall \tau, \underline{\tau} \leq \tau < \bar{\tau}$ the economy is closed to international financial markets in the long-run. In this case, $\forall t$, $T > t > 0$, foreign bond holdings are $B_t < 0$, and $B_t = 0$ for $t \geq T$, with T being the final period of the transition.

3. **Long-Run Debt (full financial openness)** $\forall \tau, 0 \leq \tau < \underline{\tau}$ the economy is open to international financial markets. In this case, $\forall t > 0$, foreign borrowing B_{t+1} adjusts to eliminate arbitrage opportunities. Hence, foreign borrowing is implicitly defined by:

$$1 + r_{t+1}^k - \delta^k = \left(1 + r^* + \tau + \psi \cdot (e^{-B_{t+1}} - 1) - \psi B_{t+1} \cdot e^{-B_{t+1}}\right) \tag{H.2}$$

In particular, in the long-run bond holdings B_{ss} are given implicitly by:

$$\frac{1}{\beta} = \left(1 + r^* + \tau + \psi \cdot (e^{-B_{ss}} - 1) - \psi B_{ss} \cdot e^{-B_{ss}}\right) \tag{H.3}$$

When $B_{ss} < 0$, trade is not balanced in the long-run steady-state, and the economy must run a trade surplus of $-r_{ss}B_{ss}$.

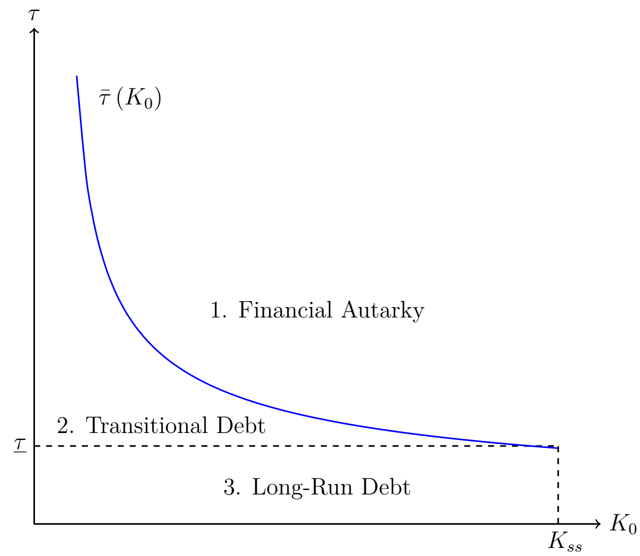
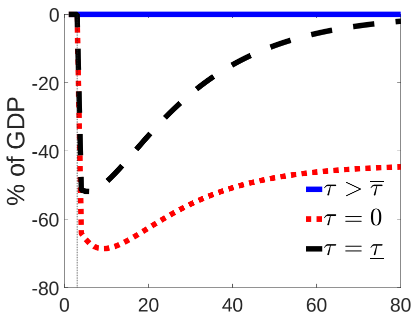


Figure H.3: Initial Endowment, Capital Controls, and Borrowing
Note: This figure illustrates the function $\bar{\tau}(K_0)$ fixing the other initial states. It also depicts the level of capital control $\underline{\tau}$ below wish long-term borrowing is supported. These curves are used to show three regions: 1) financial autarky, 2) Transitional Debt, and 3) Long-run Debt.

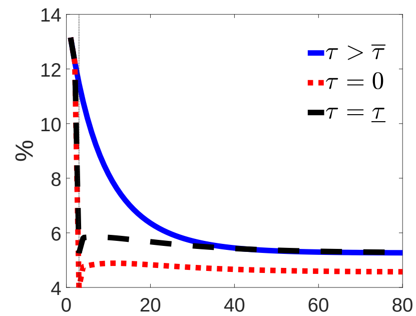
Figure H.3 illustrates the three regions in $(\tau - K_0)$ space for given initial firm distributions and no initial debt holding. The function $\bar{\tau}(K_0)$ maps the location of the level of capital control that leaves an economy with initial capital K_0 marginally indifferent between borrowing or not at the beginning of the transition. The figure also shows the level $\underline{\tau}$, independent of the initial conditions, above which no long-run debt can be supported. Note that as the initial capital approaches its steady state level, $\bar{\tau}(K_0)$ converges to $\underline{\tau}$. In addition, as capital approaches 0, $\bar{\tau}(K_0)$ increases to infinity and any level of capital control can support transitional debt.

To illustrate how these different regions imply heterogeneous transition paths and long-run equilibria, we study the macroeconomic dynamics for two types of unexpected financial reforms. First, we study a moderate financial liberalization that decreases capital control from $\tau > \bar{\tau}$ to $\tau = \underline{\tau}$. This reform maximizes transitional borrowing dynamics without sustaining borrowing in the long-run. Second, we study a large financial liberalization that sets $\tau = 0 < \underline{\tau}$. This last reform generates transitional and long-run borrowing dynamics, and results in a new steady state of the economy. The short-run consequences of this reform was what we studied in the previous sub-section.

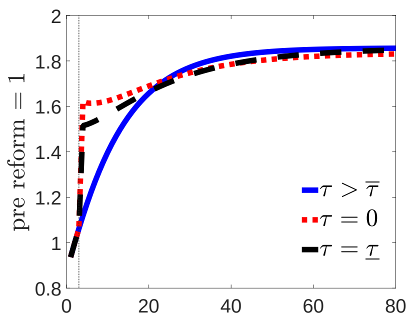
Figure H.4 shows the net foreign asset to GDP ratio, the domestic interest rate, physical capital, and the consumption paths for these two alternative reforms and compares them with a transition under financial autarky (the solid blue line). Consistent with Figure H.3, the moderate liberalization



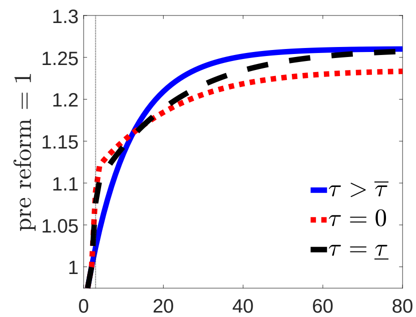
A) Foreign Debt to GDP (B/Y)



B) Domestic Interest Rate (r)



C) Capital (K)



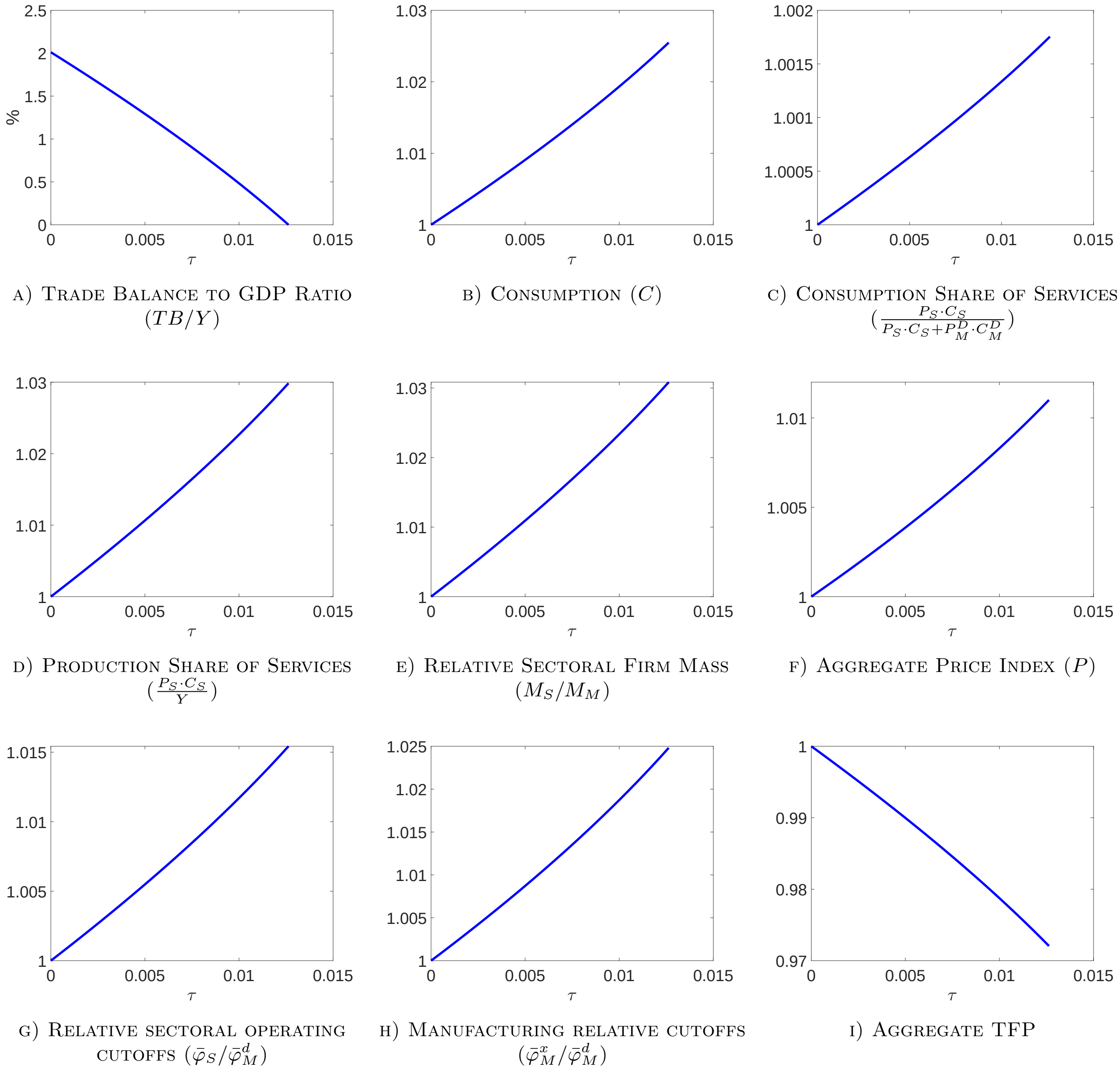
D) Consumption (C)

Figure H.4: Medium and Long-Term Adjustments of Macroeconomic Aggregates

Note: This figure shows the long-term dynamics of the domestic interest rate (top left), the net foreign asset position over GDP (top right), the consumption level (left bottom), and the capital level (right bottom). The solid blue corresponds to an economy in financial autarky; The dashed black line corresponds to the moderate liberalization economy, and the dotted red line corresponds to the large liberalization economy.

– the dashed black dashed line – does not support long-run borrowing (Panel A). Therefore, this economy reaches exactly the same steady state as the financially closed economy. The moderate financial liberalization only accelerates the transition and allows for consumption to tilt towards the initial periods. Panel A also shows that the large liberalization (dotted red line) entails a new steady-state characterized by a sustainable level of debt. After the sharp increase in borrowing that finances capital and consumption growth, the debt level stabilizes at a new long-run level. At this new steady-state, the economy must transfer resources to the rest of the world, i.e., run a trade surplus; hence, consumption, in particular, and also capital, are lower than in the financial autarky steady state (Panels C and D).

The large liberalization (dotted red line) case above is the maximum liberalization that can occur ($\tau = 0$). More broadly, any reform that brings capital controls below $\underline{\tau}$ will lead to long-run debt. The lower the level of the post-liberalization capital control tax τ, the higher the long-run debt, as given by Equation (H.3). Servicing the long-run debt requires, of course, a positive trade balance in the long-run. Because exporting is only possible in the manufacturing sector, this implies that the manufacturing sector is larger in the long-run relative to that in an economy with no long-run debt (and balanced trade). In addition to this between-sector reallocation, long-run debt also has consequences for within-sector reallocation between firms. In particular, long-run debt reallocates resources towards exporters within manufacturing.



A) Trade Balance to GDP Ratio (TB/Y)

B) Consumption (C)

C) Consumption Share of Services ($\frac{P_S \cdot C_S}{P_S \cdot C_S + P_M^D \cdot C_M^D}$)

D) Production Share of Services ($\frac{P_S \cdot C_S}{Y}$)

E) Relative Sectoral Firm Mass (M_S/M_M)

F) Aggregate Price Index (P)

G) Relative sectoral operating cutoffs ($\bar{\varphi}_S/\bar{\varphi}_M^d$)

H) Manufacturing relative cutoffs ($\bar{\varphi}_M^x/\bar{\varphi}_M^d$)

I) Aggregate TFP

Figure H.5: Comparison of Long-Run Steady States

Note: In figures (b)-(i), the values in the open steady state with no capital control tax are normalized to 1.

To further explore the between-sector and within-sector reallocation, we compare long-run steady states with different sizes of capital control tax τ. The results are shown in Figure H.5. As stated above, to sustain long-run borrowing, economies with larger reforms (lower τ) exhibit a larger long-run trade balance (Figure H.5a) and lower long-run consumption (Figure H.5b). The lower expenditure elasticity in manufacturing, coupled with the slight decrease in long-run consumption, implies a modest shift of the consumption basket towards manufacturing goods (Figure H.5c). Because only manufacturing output is tradable and the higher long-run debt is serviced by exporting, production is shifted further towards manufacturing (Figure H.5d). Consequentially, an economy with larger debt holding must also have more firms in the manufacturing sector (Figure H.5e). Importantly, the lower domestic demand reduces the ideal consumption price, inducing a real exchange depreciation (Figure H.5f). Smaller services sectors in more open economies imply a larger services price index relative to manufacturing, which in turn implies the services cutoff shifts left (relative to manufacturing) (Figure H.5g). Along with the reallocation towards manufacturing goods, there is reallocation within this sector towards exports. The reduction in the domestic demand relative to the foreign demand, and the real exchange depreciation, imply the export cutoff shifts left. More manufacturing firms export, and existing exporting firms expand. (Figure H.5h). Both of these reallocation exporting effects imply economy-wide long-run productivity gains (Figure H.5i). These gains can be sizable, as the fully open economy ends has 3% higher aggregate productivity in the long run when compared to an economy with no long-run borrowing.