Profits, 'Superstar' Firms and Capital Flows

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Abstract

In this paper, I study financial liberalization between economies that differ in their aggregate profit share. I first show that if firms compete oligopolistically, then a high aggregate profit share is a feature of an economy which generates more very large — 'superstar' — firms. Embedding this setup in a two-country model with heterogeneous agents and non-homothetic saving behaviour, I show that if the domestic economy features a higher aggregate profit share than the foreign, then (1) its autarkic interest rate is lower; (2) it will experience capital outflows during an episode of financial liberalization. I calibrate the quantitative version of the model to eight European economies, and show that the profit share gap can explain 29% of variation in the current account imbalances incurred between 1998 and 2019. I conclude by discussing structural reforms widely advocated for current account rebalancing.

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1 Introduction

Starting in the late 1990s, Europe saw the emergence of large and persistent current account imbalances, with capital flowing from the European North to South. At the time, this development was viewed as a natural consequence of the opening of financial accounts between richer and poorer regions, with latter facing a spell of catch-up growth and, consequently, higher interest rates (Blanchard and Giavazzi 2002). However, the condition for "convergence flows" – faster total factor productivity growth in the catching-up region – never materialized (Giavazzi and Spaventa 2011). What, then, caused the imbalances? In this paper, I develop a novel theoretical perspective, calling attention to cross-country heterogeneity in aggregate profit shares, and argue that lower profit shares in Southern economies help explain higher returns in the region before financial liberalization, and capital inflows in its wake.

Pure profits affect asset markets from both the asset demand and asset supply sides. On one hand, firms that earn rents "restrict" their production. This, in turn, implies a reduced demand for inputs, and for capital in particular. At an aggregate level, this means that less capital is available as a store of value, relative to GDP, contracting the asset supply. On the other hand, pure profits constitute a source of income. If profits accrue to agents with higher marginal propensity to save, then higher profit share also implies a higher demand for assets. A higher demand and a lower supply of assets together act to suppress the autarkic interest rate, and lead to capital outflows upon financial liberalization.

This paper makes three contributions. First, I build a stylised model in which economies with more extreme firm productivity distributions generate higher aggregate profit shares and experience capital outflows during an episode of financial liberalization. I show that these predictions are in line with firm-level performance and capital flows in the data. Second, I build a quantitative version of the model and calibrate it to match sectoral- and firm level moments of eight European economies. Calibrated to the data, the model shows that the theoretical mechanisms developed in this paper can provide a significant contribution to our understanding of current account imbalances in Europe: financial liberalization in the quantitative model gives rise to net foreign asset positions in the North and South which correspond to about a third of the imbalances accumulated between 1998 and 2019.

Finally, I use the model to re-assess structural reforms widely recommended to Southern economies in order to curb the imbalances. I show that two of the most popular proposals – an increase in Southern productivities and increased competition between Southern firms – would have been either ineffective, or would have led to further widening of the current account imbalances.

I begin by outlining my argument in a stylised setting. I model economic profit as arising due to oligopolistic competition. Two economies trade a non-overlapping set of varieties and compete à la Cournot. In this setup, firm-level profit shares increase in relative productivity. The relationship of the *aggregate* profit shares and firm-level productivities, on the other hand, is non-linear. I show that if the most productive domestic firm becomes even more productive – home's aggregate profit share increases. If the least productive firm becomes more productive – the aggregate profit share declines. In other words, having more extreme draws for the most productive – 'superstar' – firms results in a higher aggregate profit share. Next, I turn to asset markets. In the stylised model, the only asset is capital. Asset demand comes from households, who are divided into workers and capitalists, the latter being the recipients of the profits in the economy. Under the assumption that demand for assets is non-homothetic, with richer capitalist households seeking to hold disproportionally more assets. I derive two results. First, autarkic interest rate is lower in the country that generates a higher aggregate profit share. Second, in the wake of financial liberalization, this country experiences capital outflows.

Turning to data, I show that patterns of firm-level performance and capital flows in Europe between 1998 and 2019 are consistent with the model. In particular, drawing on firm-level data from Orbis, Northern economies had higher aggregate profit shares, and were relatively more likely to generate 'superstar firms' in an average industry, compared to their Southern counterparts. Moreover, both the aggregate profit shares and the prevalence of 'superstar' firms were associated with higher current account surpluses.

To gauge the importance of the mechanism, I construct a quantitative version of the model. The model features multiple sectors and costly trade. Moreover, claims to future profit streams are transferable, giving rise to a second type of asset – firm stocks – in addition to capital. Firm productivity draws follow a Pareto distribution. Finally, I model the household side following Straub (2018). Non-homothetic asset demand now arises endogenously, as richer households both value bequests more and prefer to postpone their spending until later in life.

I calibrate the model to match firm- and sector-level moments of five Northern economies – Belgium, Germany, Finland, France and Sweden, and three Southern economies – Italy, Portugal and Spain, at a two-digit level of disaggregation. Once the model is calibrated, I carry out a series of exercises. First, I model an episode of financial liberalization. In the new steady state, the model generates positive net foreign asset positions for Finland, Sweden and Germany, and net foreign debt for Belgium, France, Portugal, Spain and Italy, in line with the data. Quantitatively, the model explains 29% of the current account imbalances the countries incurred during the period between 1998 and 2019. The model also generates higher profit shares in the North and lower profit shares in the South, in line with the data. Thus, I argue that the gap in profit shares contributed to driving the European imbalances.

Next, I study the drivers of capital flows in the model. I find that practically all of the variation in capital flows in the model is driven by heterogeneous shape parameters in firm productivity distributions. Since this parameter determines the prevalence of firms with extreme productivity draws, I argue that the prevalence of such 'superstar' firms is the key driver of capital flows in the model.

Finally, I discuss a set of structural reforms that have been suggested as means to counter the buildup of current account imbalances, focusing on three interventions in particular: (i) a proportional increase in productivity of Southern firms, (ii) a decrease in Southern wages, and (iii) an increase in the number of Southern firms. I discuss each of these in turn, and show that a proportional increase in firms' productivity in the South leaves capital flows intact, lower wages act to attenuate, and the increased competition among Southern firms acts to amplify the North-South capital flows. Thus, I argue that without a theory of the origin of imbalances, a call for structural reforms is premature.

This paper forms part of a literature on 'global imbalances': a pattern of large and persistent current account deficits in some countries, and current account surpluses in other. In much of the literature, the imbalances are understood as arising from asset market asymmetries in different parts of the world. For example, Caballero, Farhi, and Gourinchas (2008) focus on lower supply of assets in the surplus economies due to the lack of a developed financial system. Mendoza, Quadrini, and Rios-Rull (2009) and Ferrero (2010), instead, explain the imbalances as caused by differences in asset demand, e.g. due to the amount of idiosyncratic risk faced by households or demographic pressures. The majority of papers in the literature on global imbalances address the 'allocation puzzle': the observation that, globally, capital tends to flow from emerging economies to advanced countries. Therefore, the focus tends to be on the experience of Asia and the United States – the economic regions responsible for the majority of the global capital flows. My paper differs from this existing literature by studying the experiences of countries within Europe, which can be considered advanced. In order to generate capital flows in economies with similar levels of financial development and demographics, I introduce a new source of asset market asymmetry: the share of the economy that is constituted by pure profits.

A closely related strand of literature charts 'secular stagnation': a global decline in natural interest rates. Whereas the global imbalances literature focuses on differences between asset markets across countries, the secular stagnation literature focuses on how global asset markets change over time. A number of recent contributions have linked the declining capital share and interest rate with a trend of rising market power (De Loecker, Eeckhout, and Unger (2020), Liu, Mian, and Sufi (2019)). The mechanism in my paper, whereby higher profit shares suppress asset supply, functions similarly. Mian, Straub, and Sufi (2020), instead, link declining interest rates to growing inequality. The mechanism in their paper relies on heterogeneities in saving behaviour of different population groups. In my paper a similar mechanism links profit shares, through the higher propensity to save by the recipients, to higher asset demand. In my paper, the two mechanisms are brought into motion through trade in imperfectly competitive markets and are the driver of cross-border capital flows.

The central element of my model is heterogeneous profit shares which arise due to oligopolistic competition. Recently, there has been a resurgence in the use of oligopolistic competition models to study the behaviour of markups in both macroeconomics (Edmond, Midrigan, and Xu (2018), Burstein, Carvalho, and Grassi (2020)) and the trade literature (Bernard et al. (2003), Atkeson and Burstein (2008), Gaubert and Itskhoki (2018)). That the aggregate profit share is shaped by the heterogeneous markups at a firm level is a standard result in this literature. In this paper, I sharpen this result, arguing that it is the prevalence of extremely productive 'superstar' firms that determines the level of aggregate profits. A closely related point is made in Gaubert, Itskhoki, and Vogler (2021), who argue that industrial policy targeted at the largest firms in the economy can boost the domestic welfare at the expense of its trading partners. This result relies on the resultant increase in the aggregate profit shares, which acts to cannibalize the consumer surplus abroad.

Finally, a number of papers have focused on the nexus of capital flows, trade and TFP. Reis (2013) and Gopinath et al. (2017) argue that capital inflows can lead to declines in TFP as they increase the misallocation of capital. Notably, both papers make Europe their case study. Inasmuch as each of these papers take capital flows as given, the present paper can be viewed as taking one step back and asking what can explain the direction of these flows. The closest paper to mine is by Ferra (2021), which too focuses on North-South capital flows in Europe. In it, capital flows are instigated by implicit subsidies to holdings of assets generated in Southern economies. The mechanism proposed in this paper is distinct, so the two contributions can be viewed as complementary.

The organization of this paper is as follows. Section 2 presents a two-country stylized model where oligopolistic competition between firms gives rise to capital flows, and maps the predictions of the model to the empirical patterns in Europe between 1998 and 2019. In Section 3, I present the fully fledged quantitative trade model with asset markets and discuss calibration. Section 4 presents the results of the quantitative model and studies how the profit share gaps shaped capital flows within Europe. Section 5 discusses the policies frequently recommended for rebalancing, and Section 6 concludes.

2 Stylized model

In this section, I first outline the setup of the two-country model where firms compete oligopolistically and discuss the determinants of the aggregate profit share. I then proceed by characterizing the steady state of the model under financial autarky and financial integration, and discuss the transition between the two following an episode of financial liberalization.

2.1 Model setup

The model features two countries, home and foreign. Foreign variables are marked by asterisks. There are N firms in each economy producing non-overlapping, heterogeneous varieties, and a final good producer that combines the varieties into a final good. There are two types of households in each economy: workers and capitalists. Home and foreign are symmetric, with the exception of firm productivities. I derive the optimality conditions for the domestic firms and households, suppressing the corresponding conditions for the foreign for ease of exposition. I then characterize the equilibrium of the model. The model is kept intentionally simple to aid tractability, several extensions are added in Section 3.

Firms in the common market. Domestic firms are indexed by $n \in N$. They are heterogeneous in their productivity z_n and produce using a Cobb-Douglas production function, taking capital and labor as inputs:

$$q_n = z_n k_n^{\alpha} l_n^{1-\alpha}, \quad \alpha \in [0, 1).$$

Intermediate goods can be traded costlessly. The intermediate goods are combined into a final good by the final good producer using CES technology:

$$Q = \left[\sum_{n \in M} q_n^{\frac{\sigma-1}{\sigma}} + \sum_{n^* \in M^*} q_{n^*}^{\frac{\sigma-1}{\sigma}} \right]^{\frac{\sigma}{\sigma-1}}, \quad \text{where } \sigma > 1$$

is the elasticity of substitution, and where M, M^* are the subsets of firms that operate in equilibrium. The final good market is perfectly competitive. The final good is non-tradable.

The finite number of firms results in oligopolistic competition structure in the intermediate goods market. I assume that firms compete on quantity, à la Cournot. Atkeson and Burstein (2008) show that in this case, firm prices and market shares are jointly determined by the firm profit maximization conditions and the final good producer demand for intermediate goods, such that firm n's price P_n is

$$P_n = \frac{\sigma}{\sigma - 1} \frac{c_n}{1 - s_n}, \quad \text{where} \quad c_n = \left(\frac{w}{1-\alpha} \right)^{1-\alpha} \left(\frac{r}{\alpha} \right)^{\alpha} \frac{1}{z_n}, \tag{1}$$

w is the wage, r is the rental cost of capital, c_n is the marginal cost of production of firm n, and s_n is firm n's sales share in the common market:

$$s_n = \frac{y_n}{\sum_{n\in M} y_n + \sum_{n^*\in M^*} y_{n^*}} = \frac{P_n^{1-\sigma}}{\sum_{n\in M} P_n^{1-\sigma} + \sum_{n^*\in M^*} P_{n^*}^{1-\sigma}}. \tag{2}$$

I assume that there are no fixed costs of operation. This means that all N firms at home and abroad operate: $M = M^* = N$. Variety output, y_i, is its share of the global output:

$$y_n = s_n \left(Y + Y^*\right), \tag{3}$$

where Y and Y^* are revenues of home and foreign final goods producers respectively. Firm profit share, i.e. the share of profits in its revenue, is linear in firm's market share:

$$\pi_n = \frac{\Pi_n}{y_n} = \frac{y_n - c_n q_n}{y_n} = 1 - \frac{c_n}{P_n} = \frac{1}{\sigma} + \frac{\sigma - 1}{\sigma} s_n. \tag{4}$$

Firm-level factor demand comes from their optimality conditions:

$$rk_n = \alpha c_n q_n = \alpha(1 - \pi_n) y_n,$$

$$wl_n = (1-\alpha) c_n q_n = (1-\alpha)(1-\pi_n) y_n.$$

Foreign firms operate symmetrically, yielding optimal $\{s_n^*, \pi_n^*, k_n^*, l_n^*\}$ for each firm.

Households. There are two types of households in the economy: workers and capitalists, of measures $(1-\mu)L$ and μL. Workers supply labor inelastically and earn wages w. Capitalists also work and earn wages, but, in addition, they are the recipients of the firm profits. Firm ownership is pooled across the capitalist households, so each receives $\frac{\sum_n \pi_n y_n}{\mu L}$.[1]

Household utility increases in consumption of the final good.[2] The budget constraint

1. I assume that firm ownership is not transferable. This would be the case if the claims to future profits are not contractible. I make this stringent assumption to match qualitatively the relatively low market capitalization in Europe, and relax it in the quantitative version of the model.

2. This ensures that household budget constraints hold with equality.

for workers and capitalists is as follows:

$$C^w + s^w = ra^w + w,$$
$$C^c + s^c = ra^c + w + \frac{\sum_n \pi_n y_n}{\mu L},$$

where C^i is per-capita consumption by each of the household types, s^i is the period savings, and a^i are the assets held by each household. Capital does not depreciate, so the rental rate of capital and the return on asset holdings is the same, r. I focus on the steady state, so time subscripts are suppressed and $s^i = 0$ for both household types.

For the purposes of the stylized model, I characterize households by an asset demand that is proportional to their per-capita, non-financial income by a factor ζ^i:

$$a^w = \zeta^w w, \quad a^c = \zeta^c \left(w + \frac{\sum_n \pi_n y_n}{\mu L} \right),$$

where a^w and a^c are assets held by each household in the worker and capitalist segments of the population. I assume that $\zeta^c > \zeta^w$. Per-capita asset holdings in foreign are symmetric and are denoted by a^*_w, a^*_c. This setup, in a reduced form, captures the idea that asset demand is non-homothetic: the richer, in per-capita terms, capitalist households demand more assets as a share of their non-financial income.[3] Since non-homothetic asset demand does not typically give rise to closed form policy functions, I defer the specification with endogenous asset demand to the quantitative model of Section 3.

Markets clearing. The model is closed by pricing the factors of production: capital and labor. Aggregating across firms, home capital demand satisfies:

$$rK = \sum_{n \in N} \alpha(1 - \pi_n) y_n = \alpha(1 - \pi) Y, \quad \text{where } \pi = \frac{\sum_{n \in N} \pi_n y_n}{\sum_{n \in N} y_n} \tag{5}$$

is the aggregate profit share in the economy.

3. This idea has a long history in economics, dating back to Fisher (1930), and has been supported empirically (Dynan, Skinner, and Zeldes 2004; Straub 2018; Fagereng et al. 2019). There are many possible reasons for the asset demand to feature non-homotheticity. De Nardi (2004) models it as arising due to the households treating bequests as a luxury good, while Straub (2018) finds that each of non-linear social security system, non-homothetic preferences for bequests and non-homothetic preferences for the distribution of consumption across periods play a role in explaining the disproportionate asset holdings of the rich.

Asset demand A can be obtained by summing up individual asset demands of domestic workers and capitalists:

$$A = \mu L a_c + (1-\mu) L a_w = \mu L \zeta_c \left(w + \frac{\sum_n \pi_n y_n}{\mu L}\right) + (1-\mu) L \zeta_w w. \tag{6}$$

If the two economies are in financial autarky, then capital markets clear domestically (Case (a)). If instead capital can flow freely across borders, then capital markets clear globally (Case (b)) and the interest rates are equalized at home and abroad at some global level r^G:

$$K = A, \tag{7a}$$

$$K + K^* = A + A^*, \quad r = r^* = r^G. \tag{7b}$$

Wage ensures that the labor supplied by the households satisfies the labor demand:

$$wL = \sum_{n \in N} (1-\alpha) c_n q_n = (1-\alpha)(1-\pi) Y. \tag{8}$$

Home output is the sum of the sales of domestic firms:

$$Y = \sum_{n \in N} y_n. \tag{9}$$

The foreign is symmetric and yields a set of $\{K^*, A^*, r^*, w^*, Y^*\}$. Finally, I normalize the global expenditure to 1:

$$Y + Y^* = 1. \tag{10}$$

Definition 1: **(Steady state equilibrium)** An equilibrium is a sequence of $\{s_i, y_i, \pi_i\}_N$, $\{s_i^*, y_i^*, \pi_i^*\}_{N^*}, r, r^*, w, w^*, Y, Y^*$ such that (i) firm's market share, output, and profit share satisfy the firm's optimal pricing conditions and the final good producer's demand, (1)–(4), (ii) the interest rates equalize the aggregate capital demand given in (5) and asset demand given in (6) subject to the capital market clearing condition (7a) in the case of autarky and (7b) in the case of financial liberalization, (iii) wages satisfy the respective labour market clearing conditions (8), (iv) aggregate outputs satisfy (9), and (v) normalization holds (10).

2.2 Aggregate profit share and 'superstar' firms

From firm-level to country-level profit share. In the simple model of oligopolistic competition presented above, the source of higher profit share of a firm, π_i, is its cost advantage in the form of a relatively low unit production cost c_n. This means that the firm is able to offer a lower price than that of the competitors, attracting a larger share of the market s_n. Moreover, the two are linearly related as per equation (4):

$$\pi_i = \frac{1}{\sigma} + \frac{\sigma - 1}{\sigma} s_i.$$

Consider now the aggregate counterparts to firm-level profit share and the market share:

$$\pi = \sum_{n \in N} d_i \pi_i, \quad s = \sum_{n \in N} d_i s_i,$$

where $d_i = y_i / \sum_{n \in N} y_i$ is the domestic sales share of firm i, π is the aggregate profit share, and s is the weighted average share of domestic firms in the common market. As before,

$$\pi = \frac{1}{\sigma} + \frac{\sigma - 1}{\sigma} s.$$

In other words, economies with bigger firms also feature higher aggregate profit shares. Finally, note that the average market share s can be rewritten as follows:

$$s = \frac{\sum_{n \in N} s_i^2}{\eta}, \quad \text{where} \quad \eta = \frac{Y}{Y + Y*}.$$

This alternative presentation aids the economic interpretation of the average share of domestic firms in the common market, s. An economy with a small population will necessarily have a limited presence in the world markets. However, it may still be an important player internationally. Thus, an alternative interpretation of a high s is that this is an economy that produces many 'superstar' firms (firms with $s_i^2 \gg 0$), given its size η.

Fundamental determinants of the aggregate profit share. Both the average share in the common market and the aggregate profit share are endogenous objects in the model. Meanwhile, the fundamental source of heterogeneity among countries in the model is the differing productivities of their firms. Thus, in order to understand what, at a fundamental level, makes for a high aggregate profit share economy, one needs to understand how it is affected by the firm-level productivities.

Let firms be indexed such that the productivities of domestic firms decline in n: $z_1 \geq z_2 \geq ... \geq z_N$. The derivative of the aggregate profit share with respect to the firm i's productivity is proportional to the difference between the elasticities of wage and output per worker, $y = Y/L$, both with respect to the firm i's productivity:

$$\frac{d\pi}{dz_i} = \frac{z_i}{1-\alpha}\left(\frac{dy/y}{dz_i/z_i} - \frac{dw/w}{dz_i/z_i}\right).$$

Moreover, both elasticities are positive: a higher productivity of firm i simultaneously increases output per worker and pushes up the workers' wage. Thus, the effect of firm i's productivity on the aggregate profit share is ambiguous: higher productivity of any one firm does not necessarily make an economy more profitable. In Appendix B, I show that the sign of the derivative depends on the firm's ranking in the domestic economy.

Proposition 1: An increase in productivity of the *most productive* firm increases the aggregate profit share:

$$\frac{dw/w}{dz_1/z_1} \leq \frac{dy/y}{dz_1/z_1}, \quad \text{and thus} \quad \frac{d\pi}{dz_1} > 0.$$

If $2s_z \leq s$, i.e. if the firm productivity distribution is sufficiently dispersed, then an increase in productivity of the *least productive* firm decreases the aggregate profit share:

$$\frac{dw/w}{dz_N/z_N} \geq \frac{dy/y}{dz_N/z_N}, \quad \text{and thus} \quad \frac{d\pi}{dz_N} \leq 0.$$

In other words, having more extreme draws for the most productive – 'superstar' – firms results in a higher aggregate profit share compared to an economy with an identical firm productivity distribution. Note that this relationship relies crucially on oligopolistic competition where largest firms earn higher rents. The most productive firm in the economy has the largest market share among the domestic firms. The most productive firm in the economy also hires the most labour. However, under oligopolistic competition, the sales share of the largest firm is larger than its labour share: $d_1 > l_1$. Not only are firms restricting their supply (and therefore inputs) to earn rents, but the most productive firms do so more. As a result, a 'superstar' firm that expands does not lift the wages much. The oligopolistic behaviour of such firms makes for relatively low wages given the country's productivity, thereby increasing the aggregate profit share.

2.3 Aggregate profit share and capital flows

I now turn to discussing how the aggregate profit share interacts with the asset markets.

Steady state under financial autarky. Consider the case of autarky first. The autarkic interest rate r_a clears the domestic asset market:

$$K = \frac{\alpha}{r_a} Y(1-\pi) = \zeta_c(\mu(1-\alpha)(1-\pi)+\pi)Y + \zeta_w(1-\mu)(1-\alpha)(1-\pi)Y = A,$$

where the right-hand side has the per-capita income of the workers and capitalists expressed as a share of GDP. Note that both the capital demand (thus, asset supply) and household savings (thus, asset demand) depend on the aggregate profit share. Consider each in turn.

Aggregate demand for capital as a share of GDP declines in the aggregate profit share:

$$\frac{K}{Y} = \frac{\alpha}{r_a}(1-\pi), \quad \frac{d\frac{K}{Y}}{d\pi} < 0.$$

This result is closely linked to discussion in Subsection 2.2: firms that compete oligopolistically restrict their supply to earn rents, which in turn means that fewer inputs are used, in relation to sales. Another way to think about it is to note that firms that command large market power will have a larger share of their revenue construed by rents, as opposed to value added. A lower value added share, for a given interest rate, will require less inputs as a share of sales. At an aggregate level, the more market power the domestic firms hold – the lower will be the aggregate demand for capital as a share of GDP.

Aggregate asset holdings as a share of GDP increase in the aggregate profit share:

$$\frac{A}{Y} = \zeta_c(\mu(1-\alpha)(1-\pi)+\pi) + \zeta_w(1-\mu)(1-\alpha)(1-\pi), \quad \frac{d\frac{A}{Y}}{d\pi} > 0. \tag{11}$$

Aggregate asset holdings are proportional to the average asset holdings in the economy. A higher profit share redistributes the income in the economy towards the capitalists and, therefore, towards the demographic with a higher demand for assets, raising the aggregate.

Higher aggregate profit share simultaneously suppresses the asset supply and increases the asset demand, both as a share of GDP. The two effect a decline in the autarkic interest rate:

$$r_a = \frac{\alpha(1-\pi)}{\zeta_c(\mu(1-\alpha)(1-\pi)+\pi)+\zeta_w(1-\mu)(1-\alpha)(1-\pi)}, \quad \frac{dr_a}{d\pi} < 0. \tag{12}$$

Since all the parameters other than firm productivities are symmetric between home and foreign, the following proposition holds. See Appendix B for the proof.

Proposition 2: **(Steady state under financial autarky)** If home features a higher aggregate profit share than foreign, then in the steady state under financial autarky home's autarkic interest rate is lower than in foreign.

Steady state under financial integration. If capital is allowed to flow freely, the home and foreign interest rates will be equalized at some global level r^G and the global capital market will clear subject to (7b). The global interest rate will be as follows:

$$r^G = \frac{\alpha(1-\pi^G)}{\zeta_c(\mu(1-\alpha)(1-\pi^G)+\pi^G)+\zeta_w(1-\mu)(1-\alpha)(1-\pi^G)}, \tag{13}$$

where $\pi^G = \eta\pi + (1-\eta)\pi^*$ is a weighted average of the home and foreign profit shares.

Under financial integration, home asset demand need not be satisfied by domestic assets. Countries can both lend and borrow, taking up positive and negative net foreign asset positions. In Appendix B I show that home net foreign assets as a share of GDP will be a function of the aggregate profit share differential at home and abroad:

$$\frac{NFA}{Y} = \frac{A-K}{Y} = \zeta_c(1-\eta)\frac{(\pi-\pi^*)}{1-\pi^G}. \tag{14}$$

Proposition 3: **(Steady state under financial integration)** If home features a higher aggregate profit share than foreign, home's net foreign asset position is positive in the steady state under financial integration.

Transition between autarky and financial integration. Suppose the two economies start in autarky and then suddenly undergo full financial liberalization at the time period t. Since in this simple setup there are no adjustment costs and households do no consumption smoothing, the adjustment takes exactly one period, after which the economies reach the financial liberalization steady state. During the transition, the economies run current account imbalances of the size necessary to reach the new steady state.

Proposition 4: **(Financial liberalization with no trade costs)** If home features a higher aggregate profit share than foreign and the two economies undergo financial liberalization at t, home runs a current account surplus at $t+1$:

$$ca = \frac{CA}{Y} = \frac{NFA}{Y} = \frac{A-K}{Y} = \zeta_c(1-\eta)\frac{(\pi-\pi^*)}{1-\pi^G}.$$

Foreign runs current account deficits. Current account imbalances are zero thereafter.

The one period transition to the new steady state is due to costless trade. At $t+1$, cross-country patterns of spending are away from the steady state, as capital is dismantled at home and built in foreign. However, this leads to no changes in production: the loss in domestic demand for domestically produced varieties is fully offset by the higher demand for exports to foreign:

$$y_i = s_i(Y + CA + Y^* - CA) = s_i Y^G = s_i.$$

Thus, no equilibrium objects depend on the current account, and the factor prices, output and sales shares reach the new steady state at time $t+1$. Therefore, $ca_{t+2} = ca^*_{t+2} = 0$.

2.4 Evidence from Europe

In this section, I discuss capital flows in Europe between years 1995 and 2019,[4] alongside the evidence on the performance of European firms, and link it to the predictions of the model.

Financial integration in European Union. In the late 1990s Europe underwent a period of financial liberalization, involving wide ranging legal and regulatory harmonization in the

4. I end my analysis in 2019 as COVID-19 pandemic introduced a major but transitory shock to both net foreign assets and GDP.

financial markets and, ultimately, adoption of the Euro by twelve economies in 1999-2001 (see Kalemli-Ozcan, Papaioannou, and Peydró (2010) for a detailed discussion). The increased financial integration between the European states has led to a significant increase in intra-European cross-border financial linkages. The same period witnessed the opening of large current account imbalances among the member states.

Panel (a) in Figure 1 shows that between 1995 and 2019, current account dynamics followed a clear geographic pattern: Northern economies (Sweden, Netherlands, Germany, Austria, Finland, Belgium, Denmark and France) have been running current account surpluses, whereas Southern economies (Greece, Italy, Spain and Portugal) have for much of the period been running large current account deficits. Both series peaked just prior to the onset of the Global Financial Crisis in 2008, at 4.4% of the GDP in the North, and −9.5% of GDP in the South. In the consecutive years, both groups saw some correction of the imbalances, with the Southern group reaching a small surplus in the latter years of the sample. Persistent current account imbalances, in turn, contributed towards the development of sizeable net foreign assets positions, reflected in Panel (b) of Figure 1. Starting from an essentially identical position, the net foreign assets of the two groups diverged sharply in 1998 and continued doing so for much of the period, reaching 30% of GDP for the Northern and -86% of GDP for the Southern group. Finally, private and public net saving contributed roughly equally to this divergence, with Northern group exhibiting, on average, 3.1% higher net private saving and 3.5% higher net public saving, compared to the Southern group.[5]

Firms in Europe. To compare the performance of firms in different European economies, I use Orbis Historical by Bureau van Dijk Electronic Publishing: the best publicly available database for comparing firm panels across countries (Kalemli-Ozcan et al. (2015)). The dataset covers millions of firms in Europe and, crucially, covers both private and public firms. The dataset is not exhaustive; however, Bajgar et al. (2020) cross-check the representativeness against country-level censuses and recommend a set of countries and years where the coverage is high, stable over time, and where the moments of firm distribution align closely with those in the population. I restrict my analysis to their 'preferred sample', which com-

5. In national accounting, current account balance is equal to the sum of financial account (net acquisition of financial assets) and capital account (net acquisition of physical assets). Since the latter is typically small, $CA \approx FA$. In turn, net acquisition of financial assets can be broken down into public and private net saving.

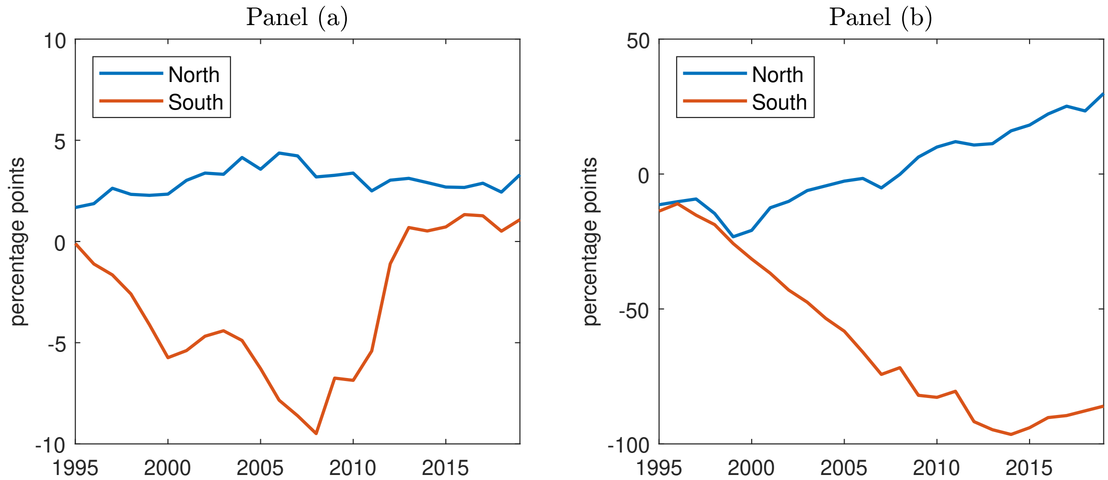

Figure 1: Current Account Imbalances and Net Foreign Assets in Europe

Notes: Panel (a): average current account balances as a share of GDP. Panel (b): average net foreign assets as a share of GDP. North: Germany, Netherlands, Sweden, Denmark, Belgium, Finland, Austria, France. South: Italy, Spain, Portugal, Greece. Sources: OECD and External Wealth of Nations Database (EWN).

prises a non-balanced panel featuring Belgium, Germany, Finland, France, Italy, Portugal, Spain and Sweden over years 2002 to 2015. See Appendix A.1 for description of the dataset.

First, I argue that Northern firms enjoyed higher aggregate profit shares, compared with their Southern counterparts. To do so, I begin by obtaining profit shares at a firm level by dividing the 'Profit (Loss) for Period' variable by the 'Operating Revenue / Turnover' and multiplying through by 100. Second, I aggregate these up to a two-digit industry level using firm-level revenues as weights. To ensure that different years of coverage do not affect my series, I regress the resultant set of country-sector-year profit shares on a set of country-sector and year dummy variables, and use these to obtain country-sector profit shares in an average year. Finally, I use these to construct the aggregate profit share in the non-financial corporate sector using sectoral sales shares from the national accounts as weights.

Results can be seen in Figure 2. Panel (a) shows that Northern economies saw higher aggregate profit shares compared to their Southern counterparts. In Panel (b), I repeat the exercise but now focus on the tradable sectors only.[6] Results show that the aggregate profit share gap is even higher in the tradable sectors, with Northern firms enjoying profit shares almost double that in the South.

Second, Northern economies also produced disproportionately more 'superstar' firms.

6. I classify sectors in Sections A, B and C (agriculture, mining and manufacturing) as tradable.

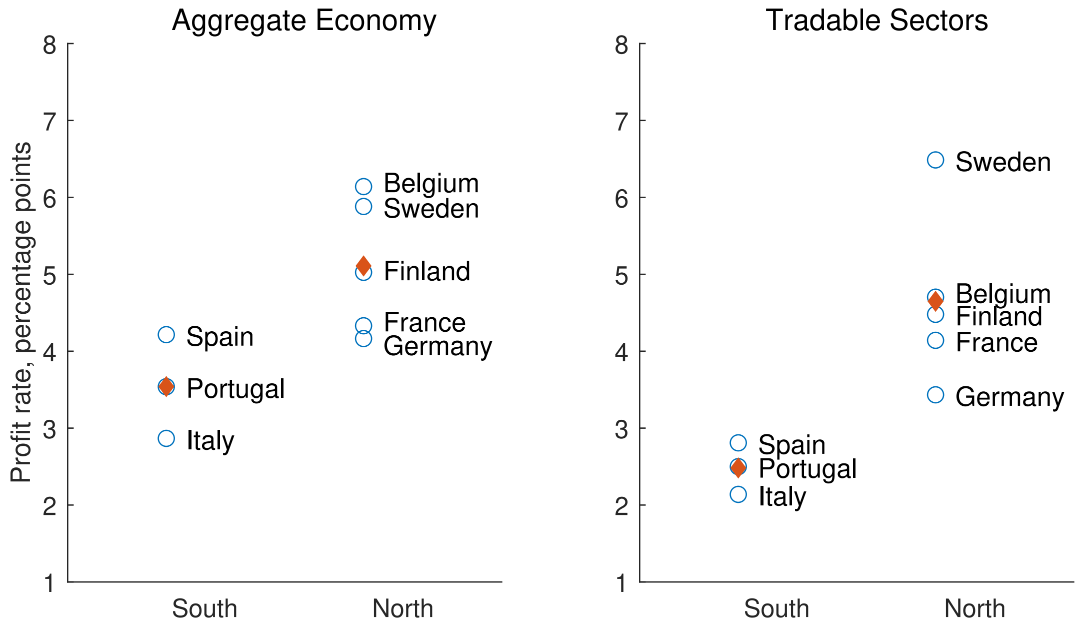

Figure 2: Aggregate profit shares

Notes: Panel (a): aggregate profit shares in the non-financial corporate sector. Panel (b): aggregate profit shares in the tradable sector. Computed using the Orbis firm-level profit shares aggregated using revenue weights at the firm- and sectoral levels. Average across 2002-2015. Red diamonds mark the group average.

To make this case, I first define 'superstar' firms as Top-x firms with highest revenue in a given market. In turn, a market is comprised of all firms across the eight economies in a given tradable 4-digit industry.[7] The first column of Table 1 reports the share of sales in my Orbis sample that is represented by firms from each of the economies. The following columns, in turn, report the share of sales by firms that are among the Top-x in any one industry, by origin. The shares of Finnish, German, French, Swedish and Belgian firms increase as the definition of 'superstar' firms narrows. The opposite is true for Spanish, Italian and Portuguese firms. To see this more clearly, in Figure 3 I plot the results from the table, normalizing each country's share to one in the full sample. What emerges from the exercise is that Finnish firms were around 50%, German firms were around a quarter, and French, Swedish and Belgian firms 10% as likely to be amongst the top ten firms, whereas firms from Italy, Spain and Portugal were around half less likely to be among the

7. This definition of a market is stylised: if trade is costly, markets become geographically segmented and the list of top firms will differ by destination. However, since Orbis does not provide market-specific firm-level sales, I conduct analysis using total revenue instead. To keep the definition of the market consistent across years, I restrict my attention to the balanced panel sub-sample covering years 2006 to 2012.

top firms, relative to what their size would suggest. In other words, Northern economies disproportionally produced 'superstar' firms across industries, while as Southern firms were noticeably underrepresented.

	Sample	Top-100	Top-50	Top-10
Belgium	5.8	6.5	6.6	6.2
Germany	25.5	28.4	29.1	32.3
Spain	9.1	8.4	7.9	5.6
Finland	4.1	4.9	5.0	6.0
France	28.3	27.8	28.4	31.1
Italy	18.8	15.5	14.5	10.8
Portugal	1.9	1.4	1.3	0.9
Sweden	6.5	7.1	7.3	7.1

Table 1: 'Superstar' Firms Firms by Country of Origin

Notes: Entries in each column are shares of the (column) total, in percentage points. The columns contain the share of sales in the given slice of the sample (where 'Sample' stands for the full Orbis sample, and 'Top-x' is the sub-sample with only Top-x largest firms in any one tradable 4-digit industry retained) by firms that are domiciled in a given country. Average across 2006-2012.

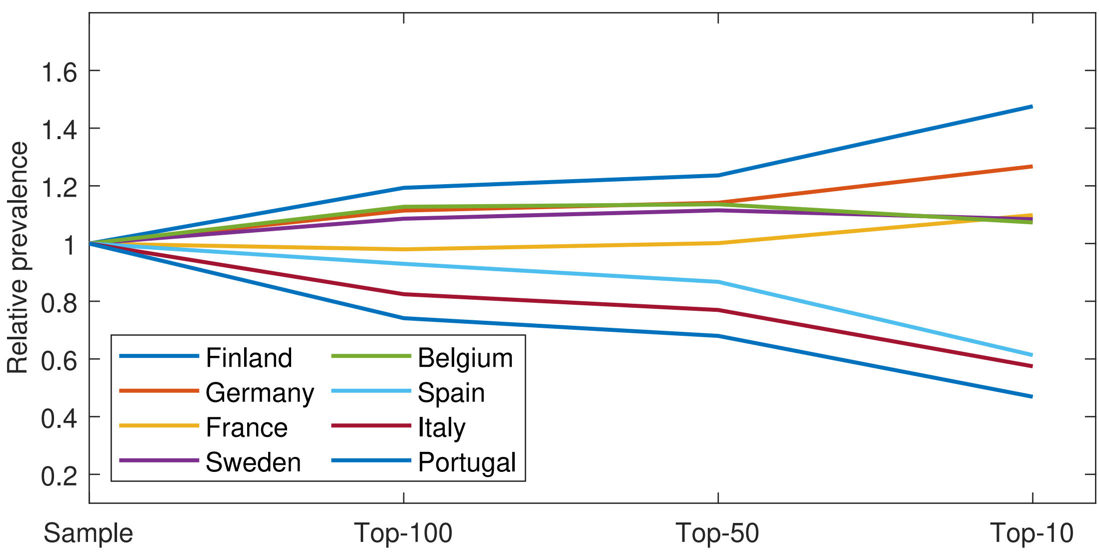

Figure 3: 'Superstar' Firms Firms by Country of Origin

Notes: On the y-axis is the share of sales in the given slice of the sample (where 'Sample' stands for the full Orbis sample, and 'Top-x' is the sub-sample with only Top-x largest firms in any one tradable 4-digit industry retained) by firms that are domiciled in a given country, normalized by the share of the sales represented by firms from that country in the full sample. Average across 2006-2012.

Finally, in Figure 4 I show that both the aggregate profit shares and the relative prevalence among the ‘superstar’ firms correlate with the net foreign assets accumulated by year 2019. Note that according to Proposition 4, such correlation should obtain during a period of financial liberalization. In other words, qualitatively, the data is consistent with the model.

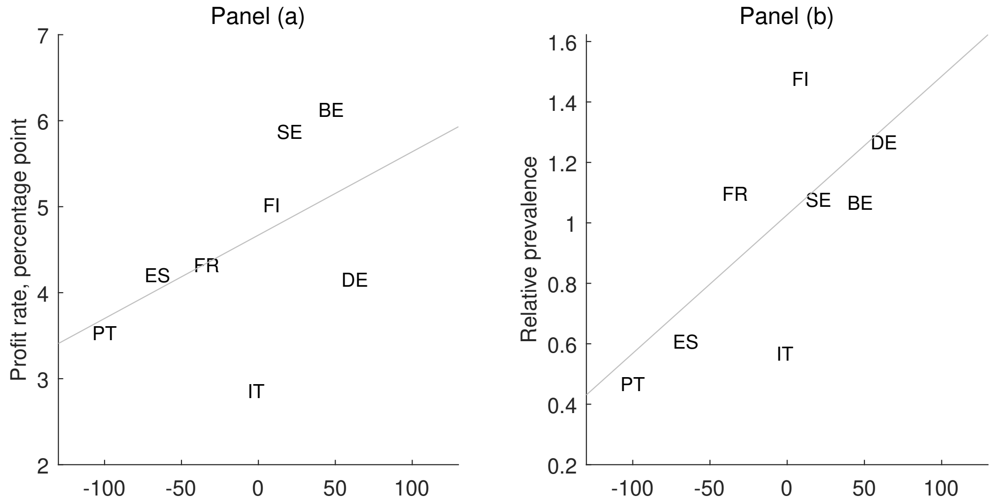

Figure 4: Profitability Gap and Current Account Imbalances

Notes: The x-axis plots the net foreign assets as a share of GDP in 2019 in each of the panels. On the y-axis, Panel (a): aggregate profit shares in the non-financial corporate sector; Panel (b): prevalence among the Top-10 largest firms in an average tradable 4-digit industry.

3 Quantitative Model

In this section I extend the stylized model to map more readily to the data and discuss how it is calibrated.

3.1 From Stylized to Quantitative Model

Fully fledged model differs from the stylized model as follows. First, I allow for $I \geq 2$ countries and $K \geq 1$ sectors. Introducing multiple countries is straightforward: the only difference with the stylized model is that the final goods producers buy intermediate varieties from all trading partners, not just home and foreign. Multiple sectors, in turn, enter through a higher level aggregation in the final goods production function, which now becomes Cobb-

Douglas in the sectoral goods with weights γ_{ik}, nested with CES at a variety level:

$$Q_i = \prod_K Q_{ik}^{\gamma_{ik}}, \quad \text{where} \quad Q_k = \left[\sum_{n \in M} q_{kn}^{\frac{\sigma-1}{\sigma}} + \sum_{n^* \in M^*} q_{n^*}^{\frac{\sigma-1}{\sigma}} \right]^{\frac{\sigma}{\sigma-1}}, \quad \sum_K \gamma_{ik} = 1.$$

Second, I allow for costly trade. This extension is important as trade costs protect domestic firms from competition, and thus have a first order effect on aggregate profits. While costless trade yields one common market for each sector, costly trade means that there are as many (sector-level) markets as there are economies. Firms may choose how much to export in any given market, and what markup to charge on their exports, independently of their domestic sales considerations. Thus, firm sales shares and profit rates are now determined for each of the markets the firm serves, with index j marking the market: s_{jikn}, π_{jikn}. I introduce trade costs as iceberg costs, applying as a percentage over the marginal costs. Thus, costs of production are now market specific:

$$c_{jikn} = \begin{cases} \left(\frac{w_i}{1-\alpha}\right)^{1-\alpha} \left(\frac{r_i}{\alpha}\right)^{\alpha} \frac{1}{z_{in}} & \text{if sold domestically,} \\ \\ \left(\frac{w_i}{1-\alpha}\right)^{1-\alpha} \left(\frac{r_i}{\alpha}\right)^{\alpha} \frac{d_{jik}}{z_{in}} & \text{if sold in } j, \quad d_{jik} \geq 1. \end{cases}$$

Third, I specify a parametric distribution from which firms make their productivity draws. I assume firms draw productivities from a Pareto distribution, with CDF

$$G_{ik}(z) = 1 - \left(\frac{\underline{z}_{ik}}{z}\right)^{\theta_{ik}},$$

where $\underline{z}_{ik}$ and θ_{ik} are country-sector scale and shape parameters of Pareto distribution.

In the stylised model I assumed that firm ownership is non-transferable, that is the future profit streams can not be capitalized into traded financial claims. For the quantitative version of the model, I relax this assumption. Instead, I introduce limited pledgeability of such flows, parameterized by parameter λ (I follow Caballero, Farhi, and Gourinchas (2008), who model $\lambda < 1$ since agents can dilute and divert part of the profits). Limited pledgeability is important to match quantitatively the relatively low stock market capitalization in Europe.

This assumption changes the asset supply in the model, which now is a sum of domestically held capital K_i and the tradable share of the value of firms in the economy, λF, where $F = \sum_t^{\infty}(1+r)^{-t}\Pi_t$. Furthermore, the stream of profits from the non-tradable portion of the firms that accrue to the capitalists is now reduced, at $(1-\lambda)\Pi$.

Finally, I now introduce a fully-fledged asset demand for the two types of households. I borrow the setup from Straub (2018), stripping away the individual income- and date-of-death uncertainty to aid computation. Households are born and live for t_3 periods in an overlapping generations manner. The birth rate is $1/t_3$, so the size of the population remains constant. The two groups of population, workers and capitalists, represent dynasties with no mobility between the types: workers give birth to workers and capitalists to capitalists. Within each dynasty, three generations co-exist, with each agent giving birth to one child at the age of $(t_3+1)/3$. Agents are economically inactive until the age of $t_1 = (t_3+1)/3$, at which point they enter the labour force. At age t_2 agents leave the workforce and stay retired until the age of death t_3. Labour is taxed at τ^{lab}, with the tax receipts paid out as pension transfers T^{soc} to the concurrently living retired. The only difference in the income stream between the workers and capitalists is that capitalists own the non-tradable share of firms in the economy, and thus, as a group, receive share $1-\lambda$ of the aggregate profits. I take no stance regarding the distribution of profits across age, and simply assume that each cohort receives an equal share.[8] Upon death, the stake in the firms is passed to the youngest economically active agent in the dynasty. In short, the non-financial income of the two types of households is as follows:

$$y_s^w = \begin{cases} (1-\tau^{lab})w & \text{if } t_1 \leq s \leq t_2, \\ T^{soc}w & \text{if } t_2 < s \leq t_3, \end{cases} \qquad y_s^c = \begin{cases} (1-\tau^{lab})w + \dfrac{\Pi(1-\lambda)}{\mu L(t_3-t_1)} & \text{if } t_1 \leq s \leq t_2, \\ T^{soc}w + \dfrac{\Pi(1-\lambda)}{\mu L(t_3-t_1)} & \text{if } t_2 < s \leq t_3. \end{cases}$$

The social security budget is balanced, so $(t_3-t_2)T^{soc} = (t_2-t_1)\tau^{lab}w$. The budget constraint is standard:

$$c_t^i + a_t^i = y_t^i + (1+r_t)a_{t-1}^i, \quad \text{where} \quad i \in \{w, c\}.$$

Agents receive inheritance from their grandparent at $(t_3+1)/3$, so the asset holdings at the

8. This ensures that these profit streams do not generate a smoothing motive of their own.

start of economic life are the assets held at the date of death by their grandparent, $a_0^i = a_T^i$.

Each agent has a utility function that depends on per-period consumption and on the bequest left at the time of death:

$$U = \sum_{s=t_3/3}^{t_3} \beta^s u_s(c_s^i) + U_a(a_T^i).$$

Following Straub (2018), I pick

$$u_s(c) = \frac{(c/o)^{1-\nu_s}}{1-\nu_s}, \quad \text{where} \quad \nu_s > 0,\ o > 0,$$

where ν_s is an age-dependent parameter that governs the income elasticity of consumption over the life-cycle, and

$$U_a(a) = k\frac{((a+\underline{a})/o)^{1-\nu_T}}{1-\nu_T}, \quad \text{where} \quad \sigma > 0,\ k > 0,\ \underline{a} > 0.$$

This setup generates two sources of non-homotheticity in asset holdings. First, the intercept in the bequest part of the utility function ensures that bequeathing is a luxury: richer agents will be saving more to leave a larger inheritance for their grandchild. There is extensive evidence that bequests as a share of income do indeed increase as individuals get richer (Carroll 1998; Dynan, Skinner, and Zeldes 2004). Second, I follow Straub (2018) in parameterizing ν_s to decline in age, with $\nu_{s+1}/\nu_s = \sigma^{slope} < 1$. This generates a higher late-life expenditure amongst the richer agents in the economy, thus encouraging them to accumulate assets for late-life consumption. Such late-life expenditures can be thought of as covering, e.g., college fees, expensive medical procedures or vacations during retirement, all of which are more prevalent among the higher-income households. The rest of the model remains unchanged.[9]

The endogenous variables in the quantitative model are $\{s_{jikn}, P_{jikn}, w_i, r_i, Y_i\}$ for each country $i \in I$, trade partner $j \in I$, sector $k \in K$ and firm $n \in N$, and a vector of consumption

9. I retain the assumption of no fixed costs of entry, as non-zero costs of entry have no quantitatively meaningful effect on aggregate profits. In particular, introducing fixed costs of entry which halve the number of operating firms changes the aggregate profits by at most 0.02 percentage points, or 0.0002. This is due to the fat-tailed firm productivity distribution, where smallest firms that would exit in presence of entry costs contribute negligibly to the aggregate.

and asset holdings for each type of agent and each age: $\{c_s^w, c_s^c, a_s^w, a_s^c\}$ for $s \in \{t_1, ..., t_3\}$. The parameters of the model are $\{\alpha, \delta, \sigma, \gamma_{ik}, d_{jik}, \underline{z}_{ik}, \theta_{ik}, N, t_1, t_2, t_3, \mu, T^{soc}, \lambda, \beta, \nu_{med}, \nu_{slope}, \kappa, o, \underline{a}\}$ for countries $i, j \in I$ and sectors $k \in K$. The full description of the quantitative model and the definition of the steady state equilibrium can be found in Appendix D.1.

3.2 Calibration

The model with free capital flows can be calibrated in blocks. The first block are the goods markets, where the competing firms determine the country-level income, profit rates, sectoral sales and trade flows. Since the interest rate is equalized across countries and since all firms produce with the same production function, the interest rate drops out from the firm sales share equation and is thus irrelevant for the equilibrium in the goods market. This property allows me to parameterize the firm productivity distributions and trade costs that can rationalize the trade flows and sectoral concentration observed in the data independently of the asset side of the model. Once the production block is calibrated, I use the resultant global profit rate to calibrate the parameters of the household side of the model.

3.2.1 Data Sources

I am calibrating the model to eight economies studied in the empirical section: Belgium, Germany, Finland, France, Italy, Portugal, Spain and Sweden. To calibrate the production side of the economy, I need data on population, sectoral output, bilateral trade flows, current account imbalances and concentration. The first four I obtain from World Input-Output Database (WIOD). To measure sectoral concentration, I rely on Orbis firm-level dataset. Finally, to calibrate the household block of the model I rely on data from the OECD, Penn World Tables, World Bank and Household Finance and Consumption Survey (HFCS) compiled by the ECB. Since I am calibrating the model to the financial liberalization steady state, I pick the latest vintages of WIOD (2014) and HFCS (2017).

3.2.2 Production Block

External Calibration: I set α, the share of capital in production to 0.34, the average value for the eight economies in WIOD. For the sake of conciseness, I abstract from modelling intermediate inputs. However, the data from WIOD features full input-output structure. In order make the model and the data comparable, I use the data to re-compute consumption series such that they reflect direct demand for final consumption and indirect demand for intermediate goods as inputs into production of final goods. The procedure results in sectoral value added that matches the data and equals the sum of adjusted final demand across destinations, in line with the market clearing condition. Since final good production function is Cobb-Douglas, I solve for parameters γ_{ik} as country specific adjusted expenditure shares.

I set N, the number of potential firms in each country and sector to a value of 500. This choice reflects two considerations. First, for low values of N, the market shares in the non-tradable sectors have a lower bound at $1/N$, which in turn results in a lower bound on market concentration indices. At $N = 500$, this lower bound falls well below the HHI indices in the data. Second, for a given elasticity of substitution σ, a higher N results in slightly lower aggregate profits (increasing N from 500 to 4500 – the average number of firms per sector in the data – results in a decline in the average profit rate from 9.5% to 9.15%). However, since I calibrate σ internally, I am able to match the average aggregate profit rate using $N = 500$, with considerable economy in terms of computational time.

WIOD release 2016 features 56 sectors, 23 of which are tradable. However, sector *C19* – manufacture of coke and refined petroleum products – features fewer than 100 firms in most country-year observations, with an average number of firms at 35. While this can be targeted at the expense of introducing sector-specific fixed costs of operation, I opt for bundling sector *C19* with sector B – mining and quarrying. This leaves me with 22 tradable sectors. I aggregate the remaining sectors into one non-tradable sector. Thus, I set $K = 23$.

Internal Calibration: having set the external parameters, I am left with four sets of parameters in the production block to estimate internally: $\sigma, \underline{z}_{ik}, \theta_{ik}, d_{jik}$. I further restrict the shape parameters of the country-sector Pareto distributions to be a product of country- and sector-specific terms: $\theta_{ik} = \theta_i \theta_k$. This reduces the number of parameters to estimate and prevents model over-fitting. I calibrate $\sigma, \underline{z}_{ik}, \theta_i, \theta_k, d_{jik}$ jointly to match the following moments: (i) sector- and country-pair trade shares X_{jik}/X_{jk}, where X_{jik} is the exports of sector k goods from country i to country j and X_{jk} is j's total expenditure on sector k goods, (ii) sector-country real output per worker from WIOD, (iii) the coefficients from a regression of country-sector-year logarithms of Herfindahl–Hirschman Indices, computed using Orbis firm-level data, on a set of sector and country dummy variables, (iv) average aggregate profit rate in my sample – 10.8%.[10] Note that non-zero current account affects trade flows, as well as factor prices and firm-level sales shares. Since my WIOD data features non-zero trade balances, these need to be taken into account when calibrating the underlying technology parameters. To do so, I impose the trade imbalances as observed in the data exogenously when calibrating the trade costs and moments of firm productivity distributions.

Normalization: θ_i and θ_k can not be identified independently, so I set the shape parameter for Germany θ_{DE} to 1. In addition, only the relative costs of production matter for determining sales shares. Thus, productivities in each of the sectors can only be identified up to a constant. I normalize scale parameters for Germany such that the average productivity of German firms is 1 in each sector.

3.2.3 Household Block

The next step is to calibrate the demographics and household preferences. In parameterizing the household side, I choose a common set of parameters for all eight economies that I am modelling. I do this so that the simulated capital flows are driven by the heterogeneity on the firm side and not the household side. For this purpose, I target the average moments across the eight economies.

External Calibration: I set the age of entry to the labor force, t_1, to 27 years – the age at which half the age-cohort is in full-time employment. I set the age of retirement, t_2, to 64 – the average across the eight economies. I set the age of death, t_3, to the average life-expectancy in the sample – 80. I pick T^{soc} to match the average net replacement ratio[11]

10. Since my model does not feature intermediate inputs, the relevant target for the latter is the ratio of profits to value added, which I compute as $\pi^{va} = \dfrac{\pi}{1 - s_m}$, where s_m is the intermediate input share.

11. The ratio of pension entitlement to pre-retirement earnings net of social security contributions.

of 0.7, the average in the data. This gives rise to pension expenditure of 12.2% of GDP, compared to 11.6% in the data. I set the share of capitalists, μ, to 7.6% – following Cagetti and De Nardi (2009), the discount factor to 0.97 following De Nardi (2004), and the income elasticity of consumption at the median age, ν_{med}, to 2.5 as in Straub (2018). I set δ, the rate of capital depreciation, to 0.038, the average in Penn World Tables for the eight economies in years 1998-2019. Finally, I set λ, the parameter governing the pledgeability of profit streams, to 0.34, targeting the average stock market capitalization of 89% in my sample.

Internal Calibration: in Straub (2018), κ an $\underline{a}$ are set as to target bequests as a share of GDP (5% for the US) and a 30% share of households with bequests below 6.25% of average income. I target the value of 6.85% for bequests as a share of GDP in Europe following Alvaredo, Garbinti, and Piketty (2017), who estimate values of 7.2% for France and 6.5% for Germany. Moreover, since I do not model the full distribution of incomes, I chose a different target to calibrate the parameters governing the heterogeneity of the household saving behaviour. I target the share of assets held by the top 7.5% of households, which is 43.2% in my sample.[12] The scale parameter o anchors the strength of the average income elasticity of consumption. A low o shifts up the asset demand of both types of households. I set the value of o as to match the aggregate assets to GDP ratio that, together with the depreciation rate of 3.8% results in a risk-free interest rate of 3.4% – the average in Penn World Tables for the eight economies in years 1998-2019. Finally, I set ν_{slope} to match the ratio of bequests between capitalists and workers. I obtain the ratio from Hurd, Smith, et al. (2001), who report the distribution of bequests left by single decedents. Authors find the 95th and 50th percentiles at 250000$ and 33300$ respectively, giving a ratio of 7.5. See Table 2 for the list of parameters as well as their targets.

I calibrate each block using the simulated method of moments (SMM). Specifically, for a given parameter vector Θ, I simulate the model, compute a list of country-sector moments $M(\Theta)$, and compare these with the corresponding moments in the data $\tilde{M}$. I search for the parameter vector that minimizes the distance between the model and the empirical moments, according to the loss function $L(\Theta) = \left(M(\Theta) - \tilde{M}\right)' W \left(M(\Theta) - \tilde{M}\right)$; where

12. HFCS only records the net wealth held by top-10% and top-5%. 43.2% is the average of these two statistics across Belgium, Germany, Spain, France, Finland, Italy and Portugal.

W is a weighting matrix. The full SMM procedure is described in Appendix C.1.

Parameter	Description	Value	Target/Source
Production			
α	Capital Share	0.34	WIOD
δ	Depreciation	0.038	PWT
σ	Within-sector elasticity of substitution	14.5	Aggregate profit rate, Orbis
γ_{ik}	Cobb-Douglas shares in final production	Vector	Sectoral absorption, WIOD
d_{jik}	Bilateral trade costs	Matrix	Bilateral trade flows, WIOD
Firm distribution			
$\underline{z}_{ik}$	Productivity Pareto scale parameter	Matrix	Real output per worker, WIOD
θ_{ik}	Productivity Pareto shape parameter	Matrix	HHI_{ik}, Orbis
N	Number of firms per sector	500	
Population			
t_1	Age of entry into the labor force	27	OECD
t_2	Age of retirement	64	OECD
t_3	Age of death	80	OECD
μ	Share of capitalists	0.076	Cagetti and De Nardi (2009)
T^{soc}	Net replacement ratio	0.7	OECD
λ	Pledgeability of income	0.34	Market capitalization, World Bank
Preferences			
β	Discount factor	0.97	Cagetti and De Nardi (2009)
ν_{med}	Elasticity of intertemporal substitution	2.5	Straub (2018)
ν_{slope}	Ratio of elasticities ν_{s+1}/ν_s	0.985	Hurd, Smith, et al. (2001)
k	Weight on bequest motive	14.2	Alvaredo, Garbinti, and Piketty (2017)
o	Scale term in utility function	2% of GDP	r = 0.034, PWT
$\underline{a}$	Intercept in bequest utility	0.003	Net wealth of top 7.5%, HFCS

Table 2: Baseline calibration

3.3 Model Fit

Targeted moments – fitting $N \times K$ scale parameters $\underline{z}_{ik}$ and $N \times (N-1) \times K$ trade cost parameters d_{jik} means that I have enough parameters to match the sector- and country-pair trade shares and sector-country real output per worker exactly. In addition to matching the expenditure shares one for one as Cobb-Douglas shares, this means that the simulated model matches the sectoral sales and country-level GDP exactly. In turn, restricting the shape parameters of the firm productivity distribution to be a product of country- and sector-specific terms gives me enough degrees of freedom to match the coefficients from regressing HHI in the data on country- and sector fixed effects. Likewise, on the household side, I have a matching number of moments and parameters, resulting in an exact fit.

Untargeted moments – there are two categories of untargeted moments in the calibration. First, while I target the average aggregate profit rate, the cross-country variance in profit rates is untargeted. My calibration gives rise to the standard deviation of 1.3%, the corresponding number in the data is 2.1%. In other words, the model is unable to generate as much dispersion in aggregate profit rates as there is in the data. Note that in the stylised model the capital flows are proportional to the profit rate gaps. Thus, since my calibration errs on the side of lower variability, my simulations give rise to a conservative estimate of the relationship between the profit rates and current account imbalances.

The second group of untargeted moments concerns the household side of the model. First, while the asset side inequality is used to calibrate the strength of the non-homotheticity in utility function, the income inequality is not targeted. Nevertheless, the ratio of income of the two groups falls close to the the ratio of 95th and 50th percentiles of incomes in the data – at 3.13 and 3.3 respectively. Second, the key statistic in Straub (2018) – the propensity to consume out of permanent income (obtained by regressing consumption on permanent income, controlling for age) – was not targeted. Despite this, my model gives rise to a value of 0.7 – remarkably close to 0.699 reported in Straub (2018). In short, while the households remain stylised, I conclude that the quantitative model is successful at capturing, in very broad strokes, the pattern of household heterogeneity seen in the data.

4 Results

In this section I ask: what was the contribution of the aggregate profit share gap between the North and the South to the buildup of the current account imbalances in Europe?

4.1 Modelling Financial Liberalization

While financial liberalization in Europe occurred gradually over the late 1990s, the average net foreign assets as a share of GDP in the North and the South moved in lockstep until 1999, at which point the two diverged sharply. The divergence coincided with the first roll-out of the euro, and continued over a course of a decade. For both groups, the net foreign asset positions as a share of GDP plateaued between 2009 and 2019. Thus, I assume that by 2019, Europe has reached the new financial liberalization steady state.

To study the drivers of imbalances, I compare the observed net foreign asset positions that the eight economies accumulated over the twenty years between 1999 and 2019, with the net foreign asset positions in the financial liberalization steady state of the quantitative model developed in Section 3. The exercise thus studies the effects of financial liberalization between heterogeneous economies, taking the firm productivity distributions, trade costs and household preference parameters as given.

4.2 Simulating Financial Liberalization

The Table 3 below summarizes the results of the financial liberalization simulation. First, notice that the model is fairly successful in matching the patterns of aggregate profit shares in the eight economies. Finland and Sweden show highest profit shares in the data and rank second and third in the model, meanwhile Portugal, Italy and Spain have the lowest aggregate profit shares in the data and in the model. France is mid-ranking in both model and data. Two countries where the model over-predicts and under-predicts aggregate profits are Germany and Belgium. As such, Germany shows highest profit rate in the model, but ranks relatively low in the data; the reverse is true for Belgium. Nonetheless, the higher profits in the North compared to the South are consistent with the data. Note that the profit shares were not targeted during the calibration, and instead arise endogenously.

Second, note that the model is successful in replicating the North-South split of the current account imbalances during the period. Germany, Finland and Sweden accumulate positive net foreign asset holdings in the model and in the data, while as France, Belgium, Italy, Spain and Portugal accumulate net foreign debt. In short, in all eight economies the direction of asset accumulation is matched exactly. Quantitatively, the model matches 66% of the surplus built up by Germany, a fifth of that in Sweden, and under-predicts the surpluses in Finland. The model can explain around 40% of the deficits accumulated in Spain and Belgium, and a quarter of that in Portugal. Overall, under-prediction of the imbalances is unsurprising, as the model has abstracted from other drivers of capital flows. During the period, Portugal substantially ran up its public debt and Spain experienced a housing bubble, both of which which contributed to the current account deficits in these economies.

	Profit Share		NFA/Y	
	Model	Data	Model	Data
Germany	13.4	9.9	33.7	52.9
Finland	12.5	12.0	19.7	171.4
Sweden	11.8	14.0	9.8	45.9
France	10.7	10.3	-4.6	-40.9
Belgium	10.5	14.6	-6.6	-18.9
Italy	9.8	6.8	-15.6	-0.6
Portugal	9.8	8.4	-16.0	-68.0
Spain	9.7	10.0	-17.1	-43.1

Table 3: Simulation results: Profits and Capital Flows

Note: All variables in percent. The first column presents the aggregate profit shares in the model, the second column presents aggregate profit shares in the data as computed in Section 2.4, the third column presents net foreign assets as a share of GDP in the model, and the fourth column presents the change in the net foreign assets as a share of GDP in the data between years 1999-2019.

To quantify the contribution of the aggregate profit share gap to the current account imbalances in the data, I compute the explained share of squares in my model as follows:

$$\frac{ESS}{TSS} = 1 - \frac{\sum_i (\text{nfa}_i^{data} - \text{nfa}_i^{model})^2}{\sum_i (\text{nfa}_i^{data})^2}, \quad \text{where} \quad \text{nfa}_i = \frac{NFA_i}{Y_i} - \overline{\frac{NFA_i}{Y_i}}.$$

I find that the model is able to explain 29% of the current account imbalances in my sample.

4.3 Fundamental Drivers of Current Account Imbalances

In the model, current account imbalances arise along the transition from autarky to financial openness due to the differences in income between workers and capitalists at home and abroad, which in turn are generated by the heterogeneity in the production side of the economies. But what are the key drivers of these differences? To address this question, I set all but one of the parameters that differ across the economies to a common value equal to the simple average across economies, and compute the variance of net foreign asset positions in the resultant simulation. I consider five types of parameters: firm distribution scale parameters $\bar{z}$, firm distribution shape parameters θ, trade costs d, final consumption expenditure shares γ and the population size L. I measure the share explained by variation in a given parameter as the ratio of the variances in the restricted and fully calibrated models.

The results of the exercise are presented in Table 4. It is striking that the only type of variation that measures up to the magnitude of capital flows that the full model generates is heterogeneity in the shape parameters of the firm productivity distributions, θ_i. Why so?

	Variable	Contribution
Productivity scale	$\bar{z}$	0.00
Productivity shape	θ	1.04
Trade costs	d	0.04
Expenditure shares	γ	0.00
Population	L	0.00

Table 4: Variance Decomposition of Current Account Imbalances

In the model, capital flows from the high profit share to low profit share economies. Low costs of export d or higher scale parameter of firms' productivity distributions $\bar{z}$ confer a cost advantage to all firms in an economy. But this cost advantage is eroded by a wage increase associated with higher demand for domestically produced goods. The two effects effectively cancel out so that the market power of domestic firms remains intact. A fatter right tail of firm productivity draws at home, on the other hand, ensures that, amongst the firm productivity draws, a few will wind up being very productive, leading to the formation of 'superstar' firms. The relatively low labour shares of the 'superstar' firms prevent the wages from rising sufficiently to erode the cost advantage of the extreme draws.

5 Rebalancing Europe

Now that the contribution of the heterogeneity in the firm performance across economies to the pre-crisis capital flows has been quantified and the key dimension of heterogeneity for the operation of the mechanism have been discussed, I proceed to discuss a set of policies for rebalancing. Note that this is not an exercise in deriving an optimal policy: whether rebalancing is desirable is outside the scope of this paper. Instead, I centre my discussion on the policy recommendations that have been made with the view of reducing imbalances in Europe. In short, in this section I assess their effectiveness in attaining their stated goal.

5.1 Structural reforms

A number of policy reports have suggested structural reforms as means to counter the buildup of current account imbalances (Dieppe et al. 2012; Angelini, Ca'Zorzi, and Forster van Aerssen 2016; Rodriguez-Palenzuela and Dees 2016; Zorell 2017). Three interventions in particular have been recommended: (i) an increase in Southern productivity, (ii) a decrease in Southern wages, and (iii) an increase in the intensity of competition between Southern firms. I discuss each of these in turn, adding slight alterations to the model when necessary to accommodate the analysis.

Higher productivity in the deficit economies. I model an increase in productivity by increasing the scale parameters $\bar{z}$ of the Southern economies to match the average sectoral productivity in the North. In column 2 of the Table 5 I show the net foreign assets in this counterfactual scenario. Spain sees its net foreign asset positions improve somewhat. Portugal and Italy, instead, accumulate more foreign debt. The average size of the imbalances in the South, however, is practically unaffected by this intervention. The reason for this is that, as argued in the previous section, aggregate profit shares and therefore the associated capital flow dynamics are largely unaffected by uniform shifts in productivity.

Lower bargaining power of the workers. The policy recommendation to reduce wages implies that, in some sense, the wages in the South are excessive. To model this notion, I introduce ad-hoc bargaining over the pure profits into my model. Suppose bargaining takes a collective form: workers, as a group, have a claim on ω share of the aggregate profits that the firms make. Specifically, each firm gets $1-\omega$ share of its gross profit:

$$\Pi_i^{net} = (1-\omega)(p_n - c_n)q_n,$$

and gives up $\omega(p_n - c_n)q_n$ into the collective pool, which is then split equally between the workers. Firm optimality conditions are as before, so the firms produce exact same quantities as in the model without profit splitting, which in turn means that wages are also unchanged. However, the net income of capitalists is now lower, and that of the workers is higher.

For illustrative purposes, I re-calibrate the model such that in the baseline scenario workers have a claim on 10% of the profits the firms make. I then model a counterfactual episode of financial liberalization with bargaining power of the workers in the Southern economies lowered to 0%. The resultant capital flows can be seen in column 3. The intervention is indeed effective: compared with the new baseline, it nearly halves the deficits in the South, and reduces the surpluses in Germany, Sweden and Finland. Notably, now that the Southern economies are receiving less capital flows from the surplus economies, the two Northern economies that were running small deficits in the baseline scenario – France and Belgium – end up with larger deficits. However, despite the effectiveness of this measure, it ultimately operates through reducing the take-home income of the workers in Southern economies, by 1.3%, 2.3% and 1.7% in Spain, Italy and Portugal respectively. Notice further that increasing the bargaining power in the Northern economies to 20% results in a *bigger* reduction of deficits in the South, a 25% reduction in current account imbalances on average compared to the baseline, and increases the take-home income of workers by 1.9% in the North. The capital flows under this scenario can be seen in column 4.

Increased intensity of competition among Southern firms. The third type of structural reform mentioned in policy reports is a call for increased competition among the Southern producers. I model this intervention by increasing the number of firms operating in Italy, Spain, and Portugal by a factor of two. Since, as I argue in Section 2, it matters *where* these new firms fit in the firm productivity distribution, I conduct an experiment by doubling the mass of firms in the South across the distribution, essentially creating a double for each of the existing Southern firm. I keep all other parameters in the model at their baseline level. The results of this exercise can be seen in column 5: it acts to increase surpluses in Germany, Finland, and Sweden, and to increase deficits in Italy, Spain, and Portugal. Thus, the policy acts to amplify the capital flows. As competition between the Southern firms increases, this puts a squeeze on their profit shares. Indeed, the aggregate profit shares decline by 0.7 percentage points in Portugal, and by 0.6 percentage points in Spain and Italy. As profits shrink, the domestic savings experience a decline. This acts to push up the autarkic interest rate and invites in the savings from abroad.

Taking stock. In this section, I have argued that some of the structural reforms that have been suggested as means to counter the buildup of current account imbalances in the South are ineffective, while others still are in fact counterproductive. In other words, policy

	Baseline	$\bar{z}_S = \bar{z}_N$	$\omega_S = 0$	$\omega_N = 0.2$	$N_S = 1000$
	(1)	(2)	(3)	(4)	(5)
Germany	33.7	37.5	31.7	26.7	37.1
Finland	19.6	20.3	16.3	13.8	22.4
Sweden	9.7	10.9	5.5	4.7	11.8
France	-4.6	-2.9	-10.0	-8.3	-2.1
Belgium	-6.9	-3.6	-12.4	-10.4	-2.7
Italy	-15.5	-19.1	-9.3	-6.9	-19.3
Portugal	-16.2	-18.0	-10.2	-7.6	-20.6
Spain	-17.0	-14.9	-11.3	-8.6	-20.6

Table 5: Policies for Rebalancing

Note: All variables in percent. Entries in the columns report the net foreign assets as a share of GDP in the financial liberalization steady state. Column 1: baseline calibration of the model. Column 2: scale parameter of the firm productivity distributions of the Southern economies set to match the average sectoral productivity in the Northern economies. Column 3: bargaining power of the workers in the Southern economies set to 0. Column 4: bargaining power of the workers in the Northern economies set to 0.2. Column 5: double the number of firms in the Southern economies.

proposals that do not build on an explicit model of the origins of current account imbalances may fail under their own terms.

6 Conclusion

In this paper I have argued that capital flows from the European North to South, in years 1999-2019, have been in part driven by the differential aggregate profit share of the Northern and Southern firms. Higher profit shares in the Northern firms generated income without an associated increase in asset supply, and were themselves in a need of an investment opportunity. The two effects caused capital outflows from the North and into the South.

There is renewed recognition that 'fickle' capital flows can be damaging to recipient economies (Caballero and Simsek 2020). In the world increasingly characterized by 'superstar' firm dynamics (Autor et al. 2020), some economies may find themselves locked in in a double-trap of lacking the scale to compete effectively on international markets, and on the receiving end of fickle capital flows that expose them to excess volatility. Thus, a better understanding of how the firm performance and capital flows relate to each other is important to assuring equitable growth.

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A Data Appendix

A.1 Description of the Dataset

Orbis: data selection. I collect my firm-level dataset using Orbis Historical. I select countries following Bajgar et al. (2020), who study the coverage and representativeness of Orbis against the industry-level and firm population data benchmarks. They offer a 'preferred' sample of countries and years where a) Orbis data covers a significant amount of aggregate sales, b) coverage is stable over time, c) correlation of Orbis- and population-derived moments is high. I work with the seven economies in the 'preferred' sample, and add Spain, which was not a part of the representativeness analysis for lack of a benchmark, but nonetheless offers high coverage. The final sample features Belgium (2002-2014), Germany (2005-2013), Spain (2006-2012), France (2002-2015), Finland (2002-2013), Italy (2002-2015), Portugal (2006-2012) and Sweden (2002-2012). I focus on non-financial corporate sector. Thus, I drop all firms in NACE Rev. 2 Sections D (Electricity, gas, steam and air conditioning supply), E (Water supply; sewerage, waste management and remediation activities), K64 (Financial service activities, except insurance and pension funding), O (Public administration and defence; compulsory social security), P (Education), Q (Human health and social work activities), R (Arts, entertainment and recreation), S (Other service activities), T (Activities of households as employers; undifferentiated goods- and services-producing activities of households for own use) and U (Activities of extraterritorial organisations and bodies). Additionally, I drop all observations with NACE Rev. 2 4-digit industry classification ending in '00' or '000', as these are over-represented, compared to non-round industries, potentially indicating imprecise classification. Whenever the same firm features consolidated and unconsolidated accounts, I retain the unconsolidated accounts.

Orbis: data cleaning. I follow Kalemli-Ozcan et al. (2015) abstract A.5.3 steps 3 to 10 when cleaning the data. This involves (3) dropping all observations with missing information on total assets and operating revenue and sales and employment (simultaneously), (4) dropping the entire company (all years) if total assets is negative in any year, (5) dropping the entire company if employment (in persons) is negative in any year and companies with employment larger than that of Walmart (2 million) in any year, (6) dropping the entire company if sales are negative in any year, (7) dropping the entire company when reporting in any year a value of employment per million of total assets larger than the 99.9 percentile of the distribution, (8) dropping the entire company when reporting in any year a value of employment per million of sales larger than the 99.9 percentile of the distribution, (9) dropping the entire company when reporting in any year a value of sales to total assets larger than the 99.9 percentile of the distribution, (10) dropping the entire company if Tangible Fixed Assets (such as buildings, machinery, etc.)is negative in any year. If the firm ID appears more than once in my sample, I pick the observation with the latest account date. For calculation of aggregate profit rates, I discard observations with profit rates above 300% and below -100%.

B Proofs

B.1 Proof of Proposition 1

Begin with the derivative of unit labour costs with respect to a shock in firm i productivity:

$$\frac{d\pi}{dz_i} = \frac{\sigma-1}{\sigma}\frac{\sum_i s_i^2}{\sum_i s_i}\sum_i \left(2h_i - d_i\right)\frac{ds_i}{dz_i}\frac{1}{s_i},$$

where $h_i = s_i^2/\sum_j s_j^2$ and $d_i = s_i/\sum_j s_j$. Sales shares respond to the change directly, but also to the changes in the relative factor costs $\omega = \left(\frac{w}{w^*}\right)^{(1-\alpha)}\left(\frac{r}{r^*}\right)^{\alpha}$:

$$\begin{aligned}
\frac{ds_i}{dz_i}\frac{1}{s_i} &= \left(\frac{1}{z_i} - \frac{s_i v(s_i)}{v^G}\frac{1}{z_i} - \frac{v^*}{v^G}\frac{d\omega}{dz_i}\frac{1}{\omega}\right)v(s_i),\\
\frac{ds_j}{dz_i}\frac{1}{s_j} &= -\left(\frac{s_i v(s_i)}{v^G}\frac{1}{z_i} + \frac{v^*}{v^G}\frac{d\omega}{dz_i}\frac{1}{\omega}\right)v(s_j),\\
\frac{ds_j^*}{dz_i}\frac{1}{s_j^*} &= -\left(\frac{s_i v(s_i)}{v^G}\frac{1}{z_i} - \frac{v}{v^G}\frac{d\omega}{dz_i}\frac{1}{\omega}\right)v(s_j^*),\ \text{where}\\
v(s_i) = \left((\sigma-1)^{-1} + \frac{s_i}{1-s_i}\right)^{-1}, &\quad v^* = \sum_i s_i v(s_i), \quad v^* = \sum_i s_i^* v(s_i^*), \quad v^G = v + v^*.
\end{aligned}$$

Plugging in,

$$\frac{d\pi}{dz_i} = \frac{\sigma-1}{\sigma}\frac{\sum_i s_i^2}{\sum_i s_i}\left[\left(2h_i - d_i\right)v(s_i)\frac{1}{z_i} - \sum_j \left(2h_j - d_j\right)v(s_j)\left(\frac{s_i v(s_i)}{v^G}\frac{1}{z_i} + \frac{v^*}{v^G}\frac{d\omega}{dz_i}\frac{1}{\omega}\right)\right].$$

Suppose the economies are in financial autarky. In this case, the relative factor costs are as follows:

$$\omega = \frac{(1-\pi)Y}{(1-\pi^*)Y^*}, \quad \text{and} \quad \frac{d\omega}{dz_i} = \omega\left(-\frac{d\pi}{dz_i}\frac{1}{1-\pi} + \frac{d\pi^*}{dz_i}\frac{1}{1-\pi^*} + \frac{dY/Y^*}{dz_i}\frac{1}{Y/Y^*}\right),$$

where

$$\frac{d\pi}{dz_i} = \frac{\sigma-1}{\sigma}\frac{\sum_i s_i^2}{\sum_i s_i}\sum_i \left(2h_i - d_i\right)\frac{ds_i}{dz_i}\frac{1}{s_i},$$

$$\begin{aligned}
\frac{d\pi^*}{dz_i} &= \frac{\sigma-1}{\sigma}\frac{\sum_i s_i^{*2}}{\sum_i s_i^*}\sum_i \left(2h_i^* - d_i^*\right)\frac{ds_i^*}{dz_i}\frac{1}{s_i^*},\\
\frac{dY/Y^*}{dz_i}\frac{1}{Y/Y^*} &= \sum_i d_i\frac{ds_i}{dz_i}\frac{1}{s_i} - \sum_i d_i^*\frac{ds_i^*}{dz_i}\frac{1}{s_i^*}.
\end{aligned}$$

Plugging in and combining with the sales share derivative equations,

$$\frac{d\omega}{dz_i}\frac{1}{\omega} = b_i\frac{1}{z_i} - b\left(\frac{s_i v(s_i)}{v^G}\frac{1}{z_i} + \frac{v^*}{v^G}\frac{d\omega}{dz_i}\frac{1}{\omega}\right) + b^*\left(\frac{s_i v(s_i)}{v^G}\frac{1}{z_i} - \frac{v}{v^G}\frac{d\omega}{dz_i}\frac{1}{\omega}\right) = \frac{b_i v^G - (b-b^*)s_i v(s_i)}{v^G + bv^* + b^* v}\frac{1}{z_i},$$

$$\text{where}\quad b_i = d_i v(s_i) - \frac{\sigma-1}{\sigma}\frac{1}{1-\pi}\frac{\sum_i s_i^2}{\sum_i s_i}\left(2h_i - d_i\right)v(s_i), \quad b = \sum_i b_i,$$

$$\text{and}\quad b^* = \sum_i\left(d_i^* v(s_i^*) - \frac{\sigma-1}{\sigma}\frac{1}{1-\pi^*}\frac{\sum_i s_i^{*2}}{\sum_i s_i^*}\left(2h_i^* - d_i^*\right)v(s_i^*)\right).$$

Plugging back into the derivative of unit labour costs,

$$\frac{d\pi}{dz_i} = \frac{\sigma-1}{\sigma}\frac{\sum_i s_i^2}{\sum_i s_i}\left[\left(2h_i - d_i\right)v(s_i) - \sum_j\left(2h_j - d_j\right)v(s_j)\left(\frac{s_i v(s_i) + b_i v^* + b^* s_i v(s_i)}{v^G + bv^* + b^* v}\right)\right]\frac{1}{z_i}.$$

Note that $\frac{\sigma-1}{\sigma}\frac{\sum_i s_i^2}{\sum_i s_i}\left(2h_i - d_i\right)v(s_i) = (1-\pi)\left(d_i v(s_i) - b_i\right)$. Plugging in,

$$\frac{d\pi}{dz_i} = \frac{1-\pi}{v^G + bv^* + b^* v}\times\left[\left(\sum_i d_i v(s_i) - b\right)\left(s_i v(s_i)(1+b^*) + v^* b_i\right)\left(d_i v(s_i) - b_i\right)\left(v^G + bv^* + b^* v\right)\right] =$$

$$\frac{(1-\pi)}{v^G + bv^* + b^* v}\left[\frac{v^*}{Y}\left(s_i v(s_i) - b_i Y\right) + \left(1 + b^* + \frac{v^*}{Y}\right)\left(s_i v(s_i) b - b_i v\right)\right] =$$

$$-\frac{(1-\pi)}{v^G + bv^* + b^* v}\left[\frac{v^* s_i v(s_i)}{Y(1-s)}\left(2s_i - s\right) + \left(1 + b^* + \frac{v^*}{Y}\right)\frac{2s_i v(s_i)}{Y(1-s)}\left(\sum_j s_j v(s_j)\left(s_i - s_j\right)\right)\right].$$

$1 + b > 0$, $1 + b^* > 0$, so the denominator in the first term is positive.
For $s_i = s_1$, $2s_1 \geq s$ and $s_1 \geq s_j$ for all $j \in N$, so the square bracket is positive and $\frac{d\pi}{dz_1} > 0$.
For $s_i = s_N$, $s_N \leq s_j$ for all $j \in N$, so the last term is non-positive for the least productive firm. A sufficient condition for the whole expression in the square brackets to be non-positive is that $2s_z \leq s$, in which case $\frac{d\pi}{dz_N} \leq 0$.

B.2 Proof of Proposition 2

First note that capital demand decreases in aggregate profit share:

$$\frac{K}{Y} = \frac{\alpha}{r_a}(1-\pi), \quad \frac{d\frac{K}{Y}}{d\pi} = -\frac{\alpha}{r_a} < 0.$$

Aggregate asset demand, on the other hand, increases in aggregate profit share:

$$\frac{A}{Y} = \zeta_c(\mu(1-\alpha)(1-\pi)+\pi) + \zeta_w(1-\mu)(1-\alpha)(1-\pi),$$
$$\frac{d\frac{A}{Y}}{d\pi} = (\zeta_c - \zeta_w)\left(1-\mu(1-\alpha)\right) + \zeta_w\alpha > 0.$$

Finally, autrakic interest rate decreases in the aggregate profit share:

$$r_a = \frac{\alpha(1-\pi)}{\zeta_c(\mu(1-\alpha)(1-\pi)+\pi) + \zeta_w(1-\mu)(1-\alpha)(1-\pi)},$$
$$\frac{dr_a}{d\pi} = -\alpha\left(\frac{A}{Y}\right)^{-2}\left(\frac{A}{Y} + (1-\pi)\frac{d\frac{A}{Y}}{d\pi}\right) < 0.$$

B.3 Proof of Proposition 3

The global interest rate clears the global asset market:

$$\begin{aligned}A + A^* = \eta\left(\zeta_c(\mu(1-\alpha)(1-\pi)+\pi) + \zeta_w(1-\mu)(1-\alpha)(1-\pi)\right) + \\ (1-\eta)\left(\zeta_c(\mu(1-\alpha)(1-\pi^*)+\pi^*) + \zeta_w(1-\mu)(1-\alpha)(1-\pi^*)\right) = \\ \left(\zeta_c(\mu(1-\alpha)(1-\pi^G)+\pi^G) + \zeta_w(1-\mu)(1-\alpha)(1-\pi^G)\right) = \\ \eta\frac{\alpha}{r_a}(1-\pi) + (1-\eta)\frac{\alpha}{r_G}(1-\pi^*) = \frac{\alpha}{r_G}(1-\pi^G) = K + K^*, \quad \rightarrow \\ r^G = \frac{\alpha(1-\pi^G)}{\zeta_c(\mu(1-\alpha)(1-\pi^G)+\pi^G) + \zeta_w(1-\mu)(1-\alpha)(1-\pi^G)}.\end{aligned}$$

Net foreign assets are the difference between asset demand and capital as a share of GDP:

$$\begin{aligned}\frac{A-K}{Y} = \zeta_c(\mu(1-\alpha)(1-\pi)+\pi) + \zeta_w(1-\mu)(1-\alpha)(1-\pi) - \\ \frac{1-\pi}{1-\pi^G}\left(\zeta_c(\mu(1-\alpha)(1-\pi^G)+\pi^G) + \zeta_w(1-\mu)(1-\alpha)(1-\pi^G)\right) = \zeta_c(1-\eta)\frac{(\pi-\pi^*)}{1-\pi^G}.\end{aligned}$$

C Calibration of the Quantitative Model

C.1 Algorithm for Calibration

First, I solve for $\sigma, \underline{z}_{ik}, \theta_i, \theta_k, d_{jik}$ that match(i) sector- and country-pair trade shares X_{jik}/X_{jk}, (ii) sector-country real output per worker from WIOD, (iii) the coefficients from a regression of country-sector-year logarithms of Herfindahl–Hirschman Indices on a set of sector and country dummy variables, (iv) average aggregate profit rate. I do so as follows:

1. Guess a vector of $\sigma, \underline{z}_{ik}, \theta_i, \theta_k$.
2. Take firm-level productivity draws z_{ikn} from a set of country-sector Pareto distributions parameterized by $\{\underline{z}_{ik}, \theta_i\theta_k\}$ a hundred times, sort the draws in a decreasing order, and average by rank.
3. Guess a set of firm-level sales, y_{jikn}, and use to solve for implied sales shares s_{jikn}, wages w_i and GDP Y_i.
4. Use firm-level productivities, wages and trade shares as observed in the data to back out iceberg trade costs that reconcile trade shares in the data and the model.
5. Use trade costs, wages and firm productivities to solve for firm-level sales. Verify if matches the sales guessed in Step 3. If not, update the guess and repeat.
6. When the sales have converged, compute the logarithm of Herfindahl–Hirschman Indices, real output per worker and average aggregate profit rates in the model. Compare with that in the data. If matches, the calibration of the production side is complete; if not, update the guess of $\sigma, \underline{z}_{ik}, \theta_i, \theta_k$ and repeat from Step 1.

I then calibrate the household side of the model. I do so as follows:

1. Take average Y, π and L from the production side of the model.
2. Guess a vector of $c_1^w, c_1^c, a_T^w, k, 0, \underline{a}, \nu_{slope}, T^{soc}$.
3. Solve for wage given Y, π, L
4. Use the Euler conditions of both types to obtain consumption levels for each age.
5. Solve for the tax rate that results in balanced government budget given the wage w.
6. Solve for non-financial income for both types.
7. Back out the capitalist bequest consistent with targeted aggregate bequest share of Y.
8. Use budget constraint to solve for asset holdings for both types.
9. Verify that bequests left by both types satisfy the respective bequest optimality conditions and equal assets held at the end of life, global asset markets clear, and that workers and capitalists asset ratio, bequest ratio, and net replacement ratio match the empirical targets. If yes, the calibration of the household side is complete; if not, update the guess of $c_1^w, c_1^c, a_T^w, k, 0, \underline{a}, \nu_{slope}, T^{soc}$ and repeat from Step 1.

D Quantitative Trade Model

D.1 Steady State of the Quantitative Trade Model

There are I economies, K sectors, and N firms in each. Production functions are as before:

$$q_{ikn} = z_{ikn} k_{ikn}^{\alpha} l_{ikn}^{1-\alpha}.$$

The intermediate varieties are combined into a sectoral good using a CES technology with an elasticity of substitution $\sigma > 1$, and are then combined using Cobb-Douglas technology:

$$Q_i = \prod_K Q_{ik}^{\gamma_{ik}}, \quad \text{where} \quad Q_{ik} = \left[\sum_{j \in I} \sum_{n \in M_{ijk}} q_{ijkn}^{\frac{\sigma-1}{\sigma}} \right]^{\frac{\sigma}{\sigma-1}}, \quad \sum_K \gamma_{ik} = 1 \quad \rightarrow \quad P_{ik} Q_{ik} = \gamma_{ik} E_i.$$

Firm prices are now:

$$P_{jikn} = \frac{\sigma}{\sigma - 1} \frac{c_{jikn}}{1 - s_{jikn}}, \tag{15}$$

where marginal costs of production are market specific:

$$c_{jikn} = \begin{cases} \left(\dfrac{w_i}{1-\alpha} \right)^{1-\alpha} \left(\dfrac{r_i + \delta}{\alpha} \right)^{\alpha} \dfrac{1}{z_{ikn}} & \text{if sold domestically,} \\ \\ \left(\dfrac{w_i}{1-\alpha} \right)^{1-\alpha} \left(\dfrac{r_i + \delta}{\alpha} \right)^{\alpha} \dfrac{1}{z_{ikn}} d_{jik} & \text{if sold in } j. \end{cases} \tag{16}$$

Now that capital depreciates, I assume that the firms are required to maintain the capital they borrow by investing to make up for the depreciated stock. The capital is produced by the final good producer. Firm sales shares are now defined for a given market j, k:

$$s_{jikn} = \frac{P_{jikn} q_{jikn}}{P_{jk} Q_{jk}} = \frac{P_{jikn}^{1-\sigma}}{\sum_{i \in I} \sum_{n \in M_{jik}} P_{jikn}^{1-\sigma}}. \tag{17}$$

The profit rate in each of the markets the firm serves is as before:

$$\pi_{jikn} = \frac{\Pi_{jikn}}{P_{jikn} q_{jikn}} = \frac{P_{jikn} q_{jikn} - c_{jikn} q_{jikn}}{P_{jikn} q_{jikn}} = 1 - \frac{c_{jikn}}{P_{jikn}} = \frac{1}{\sigma} + \frac{\sigma - 1}{\sigma} s_{jikn}.$$

Finally, since there are no fixed costs of operation, $M_{jik} = N$.

Note that the households only consume domestically produced final good, and firms can only buy capital stock locally. Thus, the revenue of the final good producer equals

$$E_i = C_i + \Delta A_i + \delta K_i = w_i L_i + r_i A_i + \Pi_i + \delta K_i,$$

where A_i is the aggregate assets held by the domestic households, ΔA_i is the aggregate household investment, and the right hand side expression plugs in the household income.

The GDP, on the other hand, is the sum of the revenue of the varieties goods producers:

$$Y_i = w_i L_i + (r_i + \delta) K_i + \Pi_i.$$

If asset markets are in autarky, the two coincide (Case a); else the two are distinct (Case b):

$$A_i = K_i + \lambda F_i \quad \rightarrow \quad E_i = Y_i, \tag{18a}$$

$$A_i \neq K_i + \lambda F_i \quad \rightarrow \quad E_i = Y_i \left(1 + r^G \frac{(A_i - K_i)}{Y_i}\right) = Y_i \left(1 + r^G \frac{NFA_i}{Y_i}\right). \tag{18b}$$

The two are linked via the goods market clearing condition of the final good producer:

$$Y_i = \sum_{j \in I} \sum_{k \in K} \sum_{n \in M_{jik}} s_{jikn} \gamma_{jk} E_j. \tag{19}$$

Firm level factor demands can be aggregated into total factor demand. The labour market clearing condition is then:

$$w_i L_i = \sum_{j \in I} \sum_{k \in K} \sum_{n \in M_{jik}} (1 - \alpha) \frac{\sigma - 1}{\sigma} (1 - s_{jikn}) s_{jikn} \gamma_{jk} E_j. \tag{20}$$

The asset market clearing condition differs between autarky and financial liberalization:

$$r_i \left(K_i + \lambda F_i\right) = \sum_{j,k,n} \alpha \frac{\sigma - 1}{\sigma} (1 - s_{jikn}) s_{jikn} \gamma_{jk} E_j + r_i \lambda F_i = r_i A_i, \tag{21a}$$

$$r^G \sum_{i \in I} \left(K_i + \lambda F_i\right) = \sum_{j,k,n} \alpha \frac{\sigma - 1}{\sigma} (1 - s_{jikn}) s_{jikn} \gamma_{jk} E_j + r^G \sum_{i \in I} \lambda F_i = r^G \sum_{i \in I} A_i, \tag{21b}$$

where F_i is the present discounted value of future profit streams in economy i, $F_i = \frac{\Pi_i}{r_i}$. Finally, the aggregate profits are as follows:

$$\Pi_i = \sum_{j \in I} \sum_{k \in K} \sum_{n \in M_{jik}} \Pi^N_{jikn} = \frac{1}{\sigma} + \sum_{j \in I} \sum_{k \in K} \sum_{n \in M_{jik}} \frac{\sigma - 1}{\sigma} s^2_{jikn} \gamma_{jk} E_j. \tag{22}$$

Non-financial income of domestic workers and capitalists is age specific:

$$y^w_s = \begin{cases} (1 - \tau^{lab}) w & \text{if } t_1 \leq s \leq t_2, \\ T^{soc} w & \text{if } t_2 < s \leq t_3, \end{cases} \quad y^c_s = \begin{cases} (1 - \tau^{lab}) w + \dfrac{\Pi(1 - \lambda)}{\mu L (t_3 - t_1)} & \text{if } t_1 \leq s \leq t_2, \\ T^{soc} w + \dfrac{\Pi(1 - \lambda)}{\mu L (t_3 - t_1)} & \text{if } t_2 < s \leq t_3, \end{cases}$$

where the country subscripts are suppressed for ease of exposition. The budget constraint is standard:

$$c^i_s + a^i_s = y^i_s + (1 + r_i) a^i_{s-1}, \quad \text{where} \quad i \in \{w, c\}. \tag{23}$$

The agent receives the inheritance from their grandparent, so the asset holdings at the start of life are the assets held at the date of death by their grandparent, $a_0^i = a_T^i$. Utility function for each type is as follows:

$$U = \sum_{s=0}^{t_3} \beta^s \frac{(c_s^i/o)^{1-\nu_s}}{1-\nu_s} + k\frac{((a_T^i + \underline{a})/o)^{1-\nu_T}}{1-\nu_T},$$

where $\nu_{s+1} = \nu_{slope}\nu_s$ and all parameters are positive. First order conditions require that

$$c_{s+1}^i = [\beta(1+r_{t+1})]^{\frac{1}{\nu_{s+1}}} o^{\frac{\nu_{slope}-1}{\nu_{slope}}} \left(c_s^i\right)^{\frac{1}{\nu_{slope}}}, \tag{24}$$

$$c_T^i = k^{-\frac{1}{\nu_{slope}}}(a_T^i + \underline{a}). \tag{25}$$

Aggregate asset demand in economy i is the sum of assets held by agents of each age and summed across types:

$$A_i = (1-\mu)L_i \sum_{s=0}^{t_3-1} a_s^w + \mu L_i \sum_{s=0}^{t_3-1} a_s^c. \tag{26}$$

Definition 1A: **(Steady state under financial autarky)**. The autarkic steady state equilibrium is a set of firm-level shares of each of country-specific sectoral goods markets $\{s\}_{jikn}$, as well as wages $\{w\}_i$, autarkic interest rates $\{r\}_i$, and the levels of GDP $\{Y\}_i$ and expenditure $\{E\}_i$ for each economy such that:

1. Each firm's share of each of the markets it serves satisfies the firm's optimal pricing equations (15) and (16) and the final good producers' demand (17),
2. Each $\{Y\}_i$ and $\{E\}_i$ satisfy the GDP accounting condition (18a) and the final good market clearing condition (19),
3. Each wage in $\{w\}_i$ satisfies the respective labour market clearing condition (20),
4. Each interest rate in $\{r\}_i$ satisfies the asset market clearing condition (21a), where domestic asset demand is determined subject to (22), (23), (24), (25), (26).

Definition 1B: **(Steady state under financial integration)**. The free capital flow steady state equilibrium is a set of firm-level shares of each of country-specific sectoral goods markets $\{s\}_{jikn}$, the global interest rate r^G, as well as wages $\{w\}_i$, the levels of GDP $\{Y\}_i$ and expenditure $\{E\}_i$ for each economy such that:

1. Each firm's share of each of the markets it serves satisfies the firm's optimal pricing equations (15) and (16) and the final good producers' demand (17),
2. Each $\{Y\}_i$ and $\{E\}_i$ satisfy the GDP accounting condition (18b) and the final good market clearing condition (19),
3. Each wage in $\{w\}_i$ satisfies the respective labour market clearing condition (20),
4. The global interest rate r^G satisfies the global asset market clearing condition (21b), where each country's asset demand is determined subject to (22), (23), (24), (25), (26).