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Globalization Effects on the Distribution of Income

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Abstract

Changes in the distribution of income are one of the main challenges to social cohesion in OECD countries. In particular, empirical evidence points to a large share of growth accruing to the top 1% in the income distribution during the last three decades. The role of globalization in this process is hotly debated. In this paper, I present a theoretical mechanism to explain how globalization affects income distribution, which has not been studied extensively yet. I build my argument on the Melitz model, which I augment with a banking sector to replace the implicit complete financial market in the original paper. The generated rents thus become income-relevant and accrue by assumption to the firms' top managers. This allows me to assess globalization's effect on the top end of the income distribution. I find that globalization has a strong effect on income distribution but I do *not* conclude that reversing globalization is the solution for the challenge to social cohesion.

JEL classification: F12, F62, J31

Keywords: international trade, firm heterogeneity, income distribution

1 Introduction

Recently, globalization has been forced onto the defense in many fields. For example, the WTO process has stuttered since the end of the Uruguay round, European integration has struggled from the beginning of the Euro crisis, and even bilateral trade and investment treaty negotiations have been left uncompleted. Anti-globalization movements and parties have increasingly gained influence and they have particularly prevailed in public debates. The European integration process is a case in point, with a still possible Grexit, a soon-to-come Brexit, and the inability to find a European solution to the migration crisis. The argument most often brought forward to explain this globalization animus is the negative effect of economic integration on income distribution.

So far, this negative effect is only supposed. The jury is still out but the huge effects that Helpman (2016) predicts have not been found. Helpman surveys several theoretical and empirical contributions to the literature of globalization's effects on wage income, finding only a moderate effect of globalization on wage inequality. He reviews several avenues of economic research, documenting the huge work of economists on this issue and concludes: "And while this cumulative knowledge may not be the last word on the subject, it would be a shame to conduct the debate on the impact of globalization on inequality without utilizing this body of work".

Of course I agree. The list of possible channels through which globalization might affect inequality is long: from the Stolper-Samuelson theorem, firm heterogeneity, positive affirmative matching to search frictions. In addition, several channels have been discussed with respect to their theoretical effects and to the evidence of empirical tests. The survey is well-balanced and comprehensive, yet there is still an uncovered issue: the strong increase in market power (and, therefore, rents) of the largest firms. In this work, I will slightly adjust the Melitz model (Melitz (2003)) to show how globalization could have had a significant effect on income distribution. I base my argument on looking at the upper level of the income distribution of the survey by Atkinson et al. (2011), who showed that the increase of the top income has dwarfed all other changes in the income distribution in the last few years.

I introduce a (competitive) banking sector in Melitz (2003) to abandon the implicit perfect financial market. This frees the ex-post realized profits of the successful or lucky firms from being distributed to finance new firms' entrance costs. Instead, part of the rents are paid as bonuses to the managing employees. The other part pays the employees in the banking sector. My banking sector scans prototypes of potentially new products and rejects loan requests for financing market entry costs of less promising projects. Thus, banks increase welfare by preventing resources from being spoiled when paying fixed costs of market entry of firms who are likely to fail because they

are not profitable enough to cover their fixed costs. The banks in this model use labor for this project screening. They pay their employees out of the gross repayments received from active firms' successful loan requests. As long as they exist, each period the firms pay a fixed amount to the bank but not their whole profits, as in Melitz (2003). Banks use the payments to finance their wage costs and the market entry costs of promising projects. Banks play the role of the powerhouse of capitalism, as described by Schumpeter (1934). They select the entrepreneurs (Kurz and Sturn (2012)). Moreover, in the model "no one other than the entrepreneur [i.e. the new entrant] needs credit... " and "he can only become an entrepreneur by previously becoming a debtor." (Schumpeter (1934): 102). Although they are financed by an outside party, thanks to firm heterogeneity there are firm-specific profits (i.e. rents), even in the stationary equilibrium.

Firms are, therefore, no longer implicitly owned by banks and entrepreneurs must sink some of their own equity to develop the prototype. Successful or lucky firms generate profits, which can then be distributed to the owner or the senior executive. Opening to trade increases average productivity but, most importantly in this story, it increases the profits of the most productive firms. In contrast, the rents of firms that only serve the domestic market fall. In this story, inequality increases only because rents of the most productive firms and, thereby, the income of their senior executives increase with "globalization". There is no sorting, no matching, no learning, only more rents that can be reaped. In this channel, my approach is very similar to the explanation of falling labor shares by Autor et al. (2017).

The rest of this paper is structured as follows. In the next section, I will summarize the closed economy in the Melitz model with a small deviation before I introduce the banking sector in Section 3. My small deviation is to introduce quality differences similar to Luttmer (2007), in addition to the productivity draw in Melitz (2003), to give banks a meaningful task. In Section 4, I open the economy to trade, paying particular attention to the income distribution. I discuss my findings in Section 5. In Section 6, I relate my model to two empirical findings: one that finds the mechanism in firm-level data and one that finds the result in the executives' compensation in exporting firms. Autor et al. (2017) search for an explanation of the counterpart to the change in the income distribution on the production side, particularly falling aggregate labor shares. Keller and Olney (2017) study the determinants of executives compensations finding trade as a very robust driver. I conclude this paper in Section 7.

2 The closed economy

I consider long-run equilibria and compare an open and a closed economy in long-run equilibrium. The long-run equilibria in the Melitz framework describe stationary economies with continuous market entry and exit. While I do not harness this property here, I sympathize with an interpretation of the model as being on a balanced growth path rather than as a static framework.

The economy is populated by L identical individuals, each offering one unit of labor. Their preferences are identical, characterized by love of variety and well summarized in a CES utility function:

$$U = \left[\int_{\omega \in \Omega} (q_\omega x_\omega)^\theta d\omega \right]^{1/\theta} \tag{1}$$

Utility increases in consumption of each variety ω and their mass Ω. θ denotes the degree of differentiation, which determines the elasticity of substitution $\sigma = \frac{1}{1-\theta}$. This utility representation differs from Melitz's in the product-specific quality parameter q_ω, which affects demand. Each quality is a realization of a common and known distribution $h(q_\omega)$. Given the preferences (1), demand x_ω for one variety is given by

$$x_\omega = \frac{q_\omega^{\frac{\theta}{1-\theta}} (p_\omega)^{-\frac{1}{1-\theta}}}{P^{-\frac{\theta}{1-\theta}}} Y \tag{2}$$

where $P = \left[\int_\omega q_\omega^{\frac{\theta}{1-\theta}} (p_{\omega \in \Omega})^{\frac{-\theta}{1-\theta}} d\omega \right]^{-\frac{1-\theta}{\theta}}$ denotes the price index, which is due to the consumption bundle and Y the aggregate income in the economy. Consumption is symmetric in that the elasticity of substitution is the same between any two varieties, and is product-specific through product-specific quality q and prices p. Note, that the utility function is homothetic. Therefore, the aggregation of consumption bundles of different values is not critical.

For production, I follow Melitz (2003) in assuming monopolistic competition among the many producers of the differentiated varieties. Each firm produces only with labor using a production function that involves fixed costs of production of f_p units of labor. The production functions of all of the firms are symmetric. The dual cost function is given by $C_\omega = c_\omega x_\omega + f_p w = \frac{w}{\varphi_\omega} x_\omega + f_p w$. Given the market structure assumption and the CES utility function, all of the firms set a fixed mark-up price of

$$p_\omega = \frac{w}{\varphi_\omega \theta}. \tag{3}$$

Note that the mark-up does not depend on the quality of the product but on productivity φ_ω. Firm-specific prices yield firm-specific output, revenues and profits, all of which depend on firm-specific productivity φ_ω. This productivity level is drawn at market entry from a common and known distribution $f(\varphi)$. Output, revenue, and profits also depend on firm-specific quality q_ω, which is drawn during the production of the prototype from the common and known distribution $h(q)$. The two firm-specific variables can be summarized in one firm-specific random variable in $\rho = q\varphi$. Because there are neither negative productivity levels nor negative quality levels, quality-adjusted productivity ρ_ω is positive. Because φ_ω and q_ω are independent draws, the distribution $g(\rho)$ of ρ is given by

$$g(\rho) = \int_0^\infty f(\varphi)\, h\left(\frac{\rho}{\varphi}\right) \frac{1}{\varphi} d\varphi,$$

where f denotes the distribution of the productivity draws (see Rohatgi and Saleh (2001)). In a slight abuse of terminology, I will call quality-adjusted productivity ρ just productivity to stay as close as possible to the Melitz model.

Ex-post (i.e. after market entry), productivity is known and prices, output, revenues and profits are also known. Less productive firms quit because their variable profits π_ω are not high enough to cover the fixed costs of production $f_p w$. More productive firms realize ex-post profits, which are redistributed in an implicit financial market to new entrants to pay those firms' fixed costs of market entry $f_e w$. Firms enter the markets with a new variety if their expected profits π^e are positive. Hence, there is a second, ex-ante profit condition, where ex-ante refers to before market entry and, therefore, before the realization of the productivity draw. In equilibrium, both zero-profit conditions must be met. The equilibrium conditions are given in (4)

$$\pi = \frac{1}{\sigma} p_\omega x_\omega - f_p w = 0 \tag{4a}$$

$$\pi^e = (1 - F(\rho^*))\bar{\pi} - f_e w = 0 \tag{4b}$$

where $F(\rho)$ denotes the cumulative distribution function of productivity ρ and $\bar{\pi}$ the average ex-post profits of active firms. These two conditions jointly determine the minimum productivity level ρ^* and the average profit level $\bar{\pi}$. The minimum productivity level ρ^* is endogenous and depends on the state of competition in the economy. In particular, it varies with the opening of the economy to trade and with the level of trade costs. A more 'dynamic' environment with more market entry yields higher minimum productivity levels. In equilibrium, the number of firms and their productivity distribution does not change. Thus, productivity and the number of entering and existing firms are equal. Melitz, therefore, assumes an exit shock δ that hits every active firm with

the same probability. The number of entering and surviving firms $(1-G(\rho^*))n_e$ equals the number of active firms n hit the shock δ; that is, $(1-G(\rho^*))n_e = n\delta$.

The observed distribution of the active firms is truncated because less productive firms exit immediately after their productivity has been revealed because their productivity is not high enough to cover the fixed costs of production f_p. In contrast to Melitz (2003), quality-adjusted productivity ρ has two components: the quality level q, which affects demand and therefore output; and the productivity draw φ, which affects production costs. The product of both must be high enough to jump the hurdle of successful entry.

The two zero-profit conditions and the optimal pricing rule yield profit maximization of all active and potential firms. Utility maximization yields optimal consumption choices, and goods' market clearance is assured by flexible prices and optimal output decisions. Thus, only labor market equilibrium is left for general equilibrium. Labor markets are assumed to be perfectly competitive. Labor is homogenous and the workers' mobility between firms is free of adjustment costs. There are no frictions of job search or matching. Hence, there is one wage w for all workers in the model and there is full employment. I use labor as numeraire and set the wage to one. The labor market equilibrium is given by

$$L = \int_{\omega} l_{\omega} d\omega + n f_p + n\delta \frac{1}{1-G(\rho^*)} f_e \tag{5}$$

where n denotes the number of active firms. Note that, when the free entry condition (4b) holds, all income is labor income in the general equilibrium. Aggregated ex-post profits $n\bar{\pi} = \int_{\rho^*} \pi_{\rho} g(\rho) d\rho$ equal aggregated fixed costs of market entry of new entrants $n\delta \frac{1}{1-G(\rho^*)} f_e$. All rents that arise in productive firms are redistributed to finance the entrance of new competitors. Aggregate income Y is, therefore, the sum of labor income $Y = wL$. This completes the description of the equilibrium, which consists of a vector of five variables $\{p, n, \rho^*, w, Y\}$ determined by the pricing rule (3), the zero-profit conditions (4a), the labor market equilibrium (11), and the income equation.

3 Market entry and the banking sector

The new element in this set-up compared to the Melitz benchmark is the quality variable q that I have introduced. I did this to split the quality-adjusted productivity level into two dimensions that differ in the information available in different stages of the model. By assumption, information about quality q of a product can be revealed by analyzing a prototype while information about the production process and, therefore, productivity φ cannot be gained from the prototype. Yet,

gaining information about q is costly because it requires us to analyze the prototype, which requires (specialized) labor input. This is where the banks come in. The banks ask potential market entrants for a prototype to assess the future success of the product. By the analysis, one input of the firm-specific quality-adjusted productivity level ρ can be made known ex-ante; that is, before market entry and the productivity draw. Given that q differs systematically with the *expected* quality-adjusted productivity levels ρ, the probabilities of successful entry and the forecasts of the probability distribution of ex-post profits can be improved. Thus, banks generate information in the model and they then use this information to single out any potential entrants that are unlikely to survive in the market. The banks 'select' entrants by financing their market entry costs while potential entrants with less potential are not financed.

3.1 Banking sector set-up

Banks that finance the fixed costs of market entry f_e, collect information about q and they then use this information to compute the different probabilities of success. For simplicity, I assume m symmetric banks that split the process of giving loans in a two-stage procedure. First, they screen the prototypes of the products of potential entrants and they then negotiate a contract with the applicant. Because the firms' quality-adjusted productivity and, therefore, their profits are random, the optimal contract involves a fixed payment (Townsend (1979)). The contract that the banks offer new entrants involves the up-front payment of market entry costs f_e and in return an annual repayment Ψ. Yet, not every applicant's loan request is agreed by the bank. Depending on q, an applicant might be rejected and no loan is given. Banks can reduce the risk of non-successful entrants defaulting on their loans by picking only those with a high prototype quality q. This reduces non-performing loans and this allows them to reduce Ψ. Thus, credit rationing is the solution. However, picking only the high q applicants reduces the overall loan sum; that is, the banks' business. The banks would forego business opportunities with potentially successful firms.[1]

I assume that banks choose the probability for non-performing loans that they are willing to bear and take the required repayment Ψ as given. This reflects the perfect competition assumption that I choose for the banking sector for simplicity. Thus, the banks' profit maximization requires them to choose an optimal minimum quality level q' of the prototype, which is necessary for the

[1] I stick to a uniform loan contract with all firms. Knowing the quality of the prototype allows for quality-specific loan contracts to be issued. These would give quality-specific repayments, which complicates the matter but does not add anything important for the story told here.

bank's willingness to finance the fixed costs up-front. The minimum quality determines the amount of loans given by the bank. The profit function of the bank reads

$$\max_{q'} \pi^b = \left[n^d 0 + n^{pd} \bar{\pi}^{pd} + n^l \Psi \right] (1-\delta) - l^b w - (1-H(q'))n^b f_e \tag{6}$$

where $n^d = \frac{G(\rho^*)-G(\rho^s_{min})}{1-G(\rho^s_{min})} \frac{n^e}{m} = \frac{G(\rho^*)-G(\rho^s_{min})}{1-G(\rho^s_{min})}(1-H(q'))\frac{n^b}{m}$, $n^{pd} = \frac{G(\tilde{\rho})-G(\rho^*)}{1-G(\rho^*)} \frac{n}{m} = \frac{(1-H(q'))}{\delta} \frac{G(\tilde{\rho})-G(\rho^*)}{1-G(\rho^s_{min})} \frac{n^b}{m}$, and $n^l = \frac{1-G(\tilde{\rho})}{1-G(\rho^*)} \frac{n}{m} = \frac{(1-H(q'))}{\delta} \frac{1-G(\tilde{\rho})}{1-G(\rho^s_{min})} \frac{n^b}{m}$ are the number of defaulting firms, partially defaulting firms and fully repaying firms, respectively, that receive a loan from one of the m banks. Here, n denotes the number of active firms in equilibrium and n^b the number of possible entrances that apply for a loan, with $n = (n^b/\delta)(1-G(\rho^*))(1-H(q'))$. ρ^s_{min} denotes the minimum quality-adjusted productivity level of market entrants in an equilibrium that involves screening by banks, which is determined later. Finally, $\bar{\pi}_{pd} = \frac{1-G(\rho^*)}{n[G(\tilde{\rho})-G(\rho^*)]} \int_{\rho^*}^{\tilde{\rho}} \pi_k g(\rho) d\rho$ denotes the average profits of the group of partly defaulting firms.

By choosing q' the bank affects the number of loans it gives to firms and the composition of firms with respect to the three groups of: defaulting, partly defaulting and fully repaying firms. The number of firms in all groups falls because low quality can be compensated by high productivity. Given that productivity is drawn with market entry (later), the bank only has an expected value on which it bases its decision. Yet, low quality firms are more likely to be found in the default and partly default group if the bank does not select the firms whose entry costs it finances. A distribution of quality-adjusted productivity of entering firms with a higher quality cut-off q' first-order stochastic dominate a firm with a lower q'. Hence, selection on the basis of a prototype's quality reduces the low profit groups more than the group of fully repaying firms. Nevertheless, the total amount of payments by firms to the bank falls with increasing quality cut-off q', as do the payments of the bank to entrants.

The bank's profits π^b increase in the minimum quality level q' as long as the saved resources for not financed fixed costs of (low-potential) market entrants $(1-H(q'))n^b f_e$ exceeds the foregone additional returns that could have been generated if the number of firms were higher. The chosen minimum quality q' increases both the minimum productivity level of financed firms ρ^s_{min} and the minimum productivity ρ^* that is necessary to survive in the market but to a different degree depending on q'. Raising the level to q' from a very *low level* would not forego many profits but it would single out many defaulting or partly defaulting firms because it would directly raise q' affects $(1-H(q'))n^b f_e$. If not singled out by the banks unwillingness to pay their entry costs, many low-quality firms are shaken out by competition and this results in a similar returns at higher costs. In contrast, both n^d and n^{pd} fall more strongly than n^l if q' rises. In contrast, at a *high level* of

q', a further increase is not that successful in reducing the number of defaulting firms because with higher q', an entrant will be more likely to pass the minimum productivity hurdle. Thus, n^d and n^{pd} are not as affected. In contrast, the foregone profits increase because the number of successful entrants n^l falls with the lower number of entrants.

Given the perfect competition assumption in banking, in equilibrium the banks break even. Competition in the banking sector bring bank profits down to zero. In contrast, there are profits in the production sector. The profit of each active firm ω is a function of the quality-adjusted productivity ρ_ω. Expected quality-adjusted productivity ρ equals ex-ante the product of expected quality $E[q]$ and expected productivity $E[\varphi]$. Yet, after assessing the loan application of firm ω by the bank, q_ω is known. Expected quality-adjusted productivity ρ_ω differs among the applicants and the banks use this difference to select the more promising applicants; that is, applicants with a lower probability of default or partly default. By granting loans, the banks affect the quality-adjusted productivity distribution of active firms in the economy.

3.2 Potential entrants

If profits can be expected, then new firms are lured into the market. Market entry involves some risk of not surviving in competition but it also holds the possibility of generating profits. Potential entrants do not differ in their risk perception. Consequently, I assume that they are risk neutral. They enter the market in four steps: (i) when they come up with their idea, they build a prototype to demonstrate their product or service; (ii) they then present their prototype to the bank when they apply for a loan to finance the fixed market entry costs; (iii) if they receive a loan from the bank, they take part in the entrance lottery and they get assigned a productivity level (φ) and enter the market; and, (iv) they compare their quality-adjusted productivity to the minimum level of quality-adjusted productivity ρ^* and decide whether to stay in the market or quit.

When producing the prototype of their product, potential entrants forego a fixed amount f_b of wage w that they could earn if they were employed by another firm. The prototypes are screened by a bank when the potential entrant applies for a loan to cover the market entry costs. Based on the prototype, the employees at the bank decide whether the applicant receives a loan. Because entry costs are identical, the loan contract is standardized. The entrants agree on paying a period amount of Ψ for repayment and interest rate during their whole life time of expected $1/\delta$ periods. If the firms prove ex-post not productive enough to pay Ψ in total, then they pay as much as they can; that is, their total profits. The banks agree on the change in the lending contracts because the entry costs are sunk and suspending the firms would reduce the bank's income without gaining anything.

Thus, the banks have resources out of n loan contracts with all active firms in the economy. Firms with a lower productivity level than $\bar{\rho}$ pay their whole profits because the profits that they generate are lower than the annual repayment Ψ agreed on ex-ante. They partly default (pd) on their loans. More productive firms pay Ψ. These resources are used by banks to pay the l_B employees of the bank wage w and to finance $n_e = \frac{n\delta}{1-G(\rho^s_{min})}$ the entrants fixed entry costs f_e and their participation in the productivity lottery. Thus, in equilibrium, the expenditure of the bank equals its revenues:

$$(1-\delta)\left[n\frac{1-G(\bar{\rho})}{1-G(\rho^*)}\Psi + n\frac{G(\bar{\rho})-G(\rho^*)}{1-G(\rho^*)}\bar{\pi}_{pd}\right] = l_b + nf_e\delta \tag{7}$$

The banks redistribute a part of the rents generated by active firms to new entrants. However, they do so less than in Melitz (2003), where all rents are used to finance the firms' market entry. The part of the rents that exceed the repayment Ψ remains with the firms.

3.3 Screening and selection

Screening by the bank's employees cuts the lower part of the productivity distribution and it lifts the minimum productivity of the entrants from ρ_{min} to $\rho_{min'}$. This prevents the bank from financing unproductive investments in the form of unsuccessful projects and it prevents the economy from spending more resources on market entry. Yet, less market entry does not affect competition negatively if market entry is not chosen too selectively by the banks. The not-selected potential entrants have a higher probability of failing after market entry and, therefore, being later forced to exit. In contrast, the selected firms are not only more likely to survive but the ex-post most productive group (quality-adjusted productivity) is also characterized by the high quality of their product. Ex-post productivity in the economy depends on the number of loan applications and the number of loans granted, as discussed later.

Ex-ante selection (i.e. before incurring fixed costs and entering the market) is based on firm-specific ex-ante probabilities to repay the loan. Selection aims at reducing the number of entrants with a lower expected quality-adjusted productivity ρ. Banks select the more promising projects; that is, those whose prototype is of quality above a minimum q' set by the bank, which is above the minimum q from the distribution h. In selecting entrants with higher quality prototypes, the banks truncate the distribution of the quality adjusted productivity of the entrants. The truncated distribution reads:

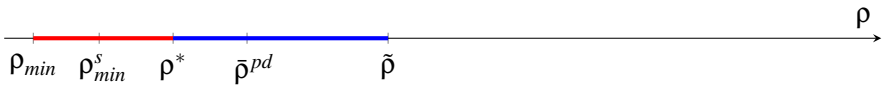
$$h_s(q) = \begin{cases} \dfrac{h(q)}{\int_{q_{min}} h(q)dq} & q \geq q', \\ 0 & q < q' \end{cases} \tag{8}$$

where the s subscripts denote the truncated distribution of the *selected* projects. In the truncated distribution $h_s(q)$, the weight on the high quality realizations $q \geq q'$ is larger than in the non-truncated distribution $h(q)$ while the weight of lower realizations is zero. Hence, $h_s(q)$ first-order dominates $h(q)$. A new distribution of quality-adjusted productivities $g_s(\rho)$ results from the truncated distribution $h_s(q)$ of projects that are financed and independent, and unaffected productivity also draws from the distribution $f(\varphi)$ with market entry.

$$g_s(\rho) = \int_{\varphi_{min}}^{\infty} f(\varphi) h_s\left(\frac{\rho}{\varphi}\right) \frac{1}{\varphi} d\varphi \tag{9}$$

With $h_s(q)$ first-order-dominating $h(q)$, $g_s(\rho)$ and first-order-dominates $g(\rho)$. This necessarily implies that expected productivity $\bar{\rho}_s$ is larger with screening by banks than the expected productivity $\bar{\rho}$ without screening. The minimum productivity level ρ^s_{min} that can be assigned to preselected entrants is higher. Yet, that does not say anything about the minimum productivity ρ^*_s that is required to survive in an economy with screening, which is jointly determined with the other variables in general equilibrium. Because the draws by the entrepreneurs are independent, it is likely that some projects that would have survived in the market are among those sorted out; that is, who do not receive financing and are, therefore, not realized. Banks do not have perfect foresight, they just collect information about the prototype; that is, they choose under uncertainty. Despite not being able to perfectly discriminate among applicants, the differences between the banking sectors are not irrelevant. A more efficient banking sector requires less labor l_b to screen the projects, which in this perfectly competitive structure leads to a lower per-period interest and repayment fee Ψ.

Figure 1: Quality-adjusted productivity



The red part in Figure 1 illustrates the productivity range of the defaulting firms, while the blue part indicates the productivity range of partly defaulting firms. Each individual bank can change the minimum quality threshold q' it requires and, therefore, the minimum quality-adjusted productivity ρ^s_{min} of debtors in its loans portfolio. As argued previously, increasing the threshold q' reduces the probability of financing a defaulting or partially defaulting firm but it also increases the probability of missing a profit opportunity by financing a successful entrant. Being small in this perfectly

competitive world, the bank's decision does not effect the equilibrium minimum productivity of active firms ρ^* or the productivity threshold of non-defaulting firms $\tilde{\rho}$.

Ψ is the lowest possible annual payment that is required to avoid losses by banks. New banks compete for customers by offering lower interest rate repayments for firms that received loans as long as there are profits in the market. The payment of firms to banks must still be high enough to pay the bankers and the fixed costs of the new entrants, as shown in (7). There are many combinations of repayments Ψ and minimum quality cut-off level q' set by banks that guarantee zero profits of the banks but only one that additionally solves the profit maximization condition. Due to perfect competition in the banking sector, the combination is the one which minimizes repayment Ψ. Repayment Ψ also depends on exogenous parameters, which are more related to the competitive environment in the goods' producing sector. A smaller exogenous death rate δ reduces the payment Ψ while higher fixed costs of market entry f_e increase the payment Ψ that is needed to guarantee zero profits for the banks.

While the ex-post zero profit condition (4a) is the same as in the Melitz model, the ex-ante zero profit condition in expectations (4b) does change relative to the Melitz benchmark. There are less fixed costs of market entry to be paid in aggregate because of the screening, which increases the expected profits after successful entry. But entry is more costly for each potential entrant because producing the prototype has the opportunity costs of not not being employed; that is, not receiving a wage f_b. Potential entrants decide to enter the market if the expected profits exceed the wage foregone. Thus, in equilibrium the opportunity costs of producing the prototype equal the expected profits

$$f_b w = \frac{1}{\delta}[1 - G(\tilde{\rho})(\bar{\pi}_r - \Psi] = \frac{1}{\delta}\frac{1}{n}\int_{\tilde{\rho}}^{\infty}[\pi_k(\rho)g(\rho)d\rho] - \Psi \tag{10}$$

where $\bar{\pi}_r$ denotes the expected (average) rents of the firms that are able to repay the banks loan completely. The size of the group of firms that enjoy rents ($n(1 - G(\tilde{\rho}))$) and their level depends on annual repayment Ψ. Ψ is in turn driven down by competition so that (7) holds in equilibrium. $\bar{\rho}$ denotes the productivity that is at least needed to fully repay the loan. Given that the structure of (10) differs from Melitz's free entry condition, a comparison in this feature is pointless. Starting from excessive payments Ψ, there would be no or very low market entry and no profits for the banks. The banks profits would rise by lowering repayment and, therefore, luring entry. Moreover, competition in the banking sector drives repayment Ψ down.

3.4 Changes in the labor market equilibrium

By including the banking sector and requiring the production of a prototype, the labor market changes slightly. Individuals who manufacture a prototype are not available for the labor market. Yet, there is also labor demand l^b from banks who need workers to screen the projects. I see each worker as being equally able and willing to work for a firm or a bank. The labor market equilibrium then is given by

$$L - f_b = \int_{\omega} l_{\omega} d\omega + n f_p + n\delta \frac{1 - G(\rho^s_{min})}{1 - G(\rho^*)} f_e + m l^b. \tag{11}$$

3.5 An example of the productivity distribution

To illustrate the selection process, let us assume that qualities q are Pareto distributed with q_{min} denoting the lowest quality and μ denoting the shape parameter of the distribution. The probability function $h(q)$ is given by

$$h(q) = \begin{cases} \frac{\mu q^{\mu}_{min}}{q^{\mu+1}} & q \geq q_{min} \\ 0 & otherwise \end{cases} \tag{12}$$

Combined with a Pareto distribution describing the heterogeneity in productivity φ as $f(\varphi) = \frac{\kappa \varphi^{\kappa}_{min}}{\varphi^{\kappa+1}}$, quality-adjusted productivity ρ is distributed according to

$$g(\rho) = \int_{\varphi_{min}}^{\infty} \frac{\kappa \varphi^{\kappa}_{min}}{\varphi^{\kappa+1}} \frac{\mu (\rho_{min}/\varphi_{min})^{\mu}}{(\rho/\varphi)^{\mu+1}} \frac{1}{\varphi} d\varphi = \frac{\kappa \mu}{\kappa - \mu} \frac{\rho^{\mu}_{min}}{\rho^{\mu+1}} \tag{13}$$

It is straightforward to see that a productivity distribution $g_s(\rho)$ resulting from a screening of banks that lifts the minimum quality of the entrants from ρ_{min} to $\rho_{min'} > \rho_{min}$ first-order stochastically dominates $g(\rho)$. Screening reduces the number of firms that sink the fixed costs of market entry. Entering firms have, after screening and being selected to receive a loan, a higher expected quality adjusted productivity. There are, nevertheless, some firms who draw a productivity that is not high enough to cover the fixed costs. Yet, these are less than those without screening. Thus, the banking sector finances less unsuccessful entrants than does the complete financial market in Melitz (2003) and the economy saves resources. These saved resources are used to pay the bankers and they are left to the management of the active firms in the economy.

3.6 Income distribution

Ex-post profits above bank loan repayments $\pi_k - \Psi$ accrue to the (group of) founder(s) of the firm. Thus, while in expectation the ex-ante income of all individuals are the same, there are differences ex-post. Some entrepreneurs have sunk their labor input into a subsequently useless prototype and do not enter, while others enter without earning more than an employed worker, and a third group has been lucky and earns income above the benchmark wage of employed workers. Note, that it is luck that divides the entrants from each other in this model because productivity is drawn randomly from the same distribution.

Introducing a banking sector changes the income distribution because the profits of the most productive firms are not completely redistributed to finance the fixed costs of market entry and recover the losses of less lucky competitors. It is the objective of a bank to channel resources to new firms. It is, however, important to note that the bank does not take away all of the profits but only takes a fixed amount that is agreed on ex-ante on expectation basis. The rest accrues to the owner and, therefore, affects the income distribution. The right part of the income distribution is, therefore, a monotonic transformation of the productivity distribution. The middle part is flat, as in the Melitz model with the workers receiving the same wage w_0. To the far left of the income distribution, $G(\varphi_{min'})n_e$ entrepreneurs, forego their wage for the employed workers. Consequently, instead of one wage for all workers, as in Melitz (2003), there are three groups, whose income differs. Entrepreneurs with rejected projects are worse off and lucky entrants are better off than workers in the model. The distribution of wages is given by

$$g_w(w) = \begin{cases} 0 & \text{if an individual is an entrepreneur and } q < q' \\ w_0 & \text{if an individual is a worker} \\ \left[\left(\frac{w-\Psi}{C}\right)^{\frac{1-\theta}{\theta}}\right]^{-(\kappa+1)} & \\ \kappa w_0 & \text{if an individual is an entrepreneur and } q \geq q' \text{ and } \rho \geq \bar{\rho} \end{cases} \tag{14}$$

It is impossible to say something about welfare without a specified welfare function. Yet, I can say something about aggregate output, the price index, and average real income. The purpose of the model is, however, to study the income distribution and, in particular, the far right part, which is where most of the dynamics has been in the last few decades. Further harnessing Melitz (2003), I will show in the next subsection how globalization might have contributed to this development. Here, I just state that the top income in the data follows a distribution which is often approximated by a power law.

4 The open economy

Following Melitz (2003), I introduce other countries and trade with the home country that was previously described into the model. Firms incur fixed costs of exporting f_{ex} and variable costs of exporting τ. Foreign countries are symmetric with the home country in every respect, including country size. There is a home bias because consumers who buy goods produced at home do not incur trade costs τ, which reduces the prices of home goods relative to the prices of imported goods and this lets the consumer substitute away from the imports. This substitution reduces the (potential) export market of a firm relative to its domestic market. Between any two firms, the relative size of the foreign market is determined by the relative productivity. More productive firms have higher sales in foreign markets. Because there are fixed costs of exporting, revenues in the foreign market might not be high enough to cover the fixed costs of exporting. Therefore, firms with lower productivity refrain from exporting. If a firm can cover their fixed costs of exporting, then their profits will rise with exports. Thus, firms self-select into export markets if their productivity exceeds the minimum productivity of exporting ρ_{ex}. Because the markets are independent for already active firms, foreign market profits $\pi_{\omega ij}$ of firm ω from country i selling in j are enough to determine the minimum export productivity $\rho_{ex,ij}$. Note that the minimum productivity levels are country-pair specific. Given that I have assumed symmetry between the countries, I will drop the country pair index for the sake of simplicity.

$$\pi_{\omega ij} = \frac{1}{\sigma}\left(\frac{\tau}{\theta\rho_{ex}}\right)^{1-\sigma} P_j^{\sigma-1} Y_j - f_{ex} = 0 \quad \Rightarrow \quad \rho_{ex} = \left(\frac{\sigma f_{ex}}{P_j^{\sigma-1} Y_j}\right)^{\frac{1}{\sigma-1}} \frac{\tau}{\theta} \tag{15}$$

The minimum export productivity level increases in variable trade costs τ, fixed costs f_{ex} and it falls in country size Y_j and the foreign price level P_j. If the fixed costs of exporting are high enough, then the minimum export productivity ρ_{ex} exceeds the minimum productivity to survive in the market ρ_o^* and not all firms export.

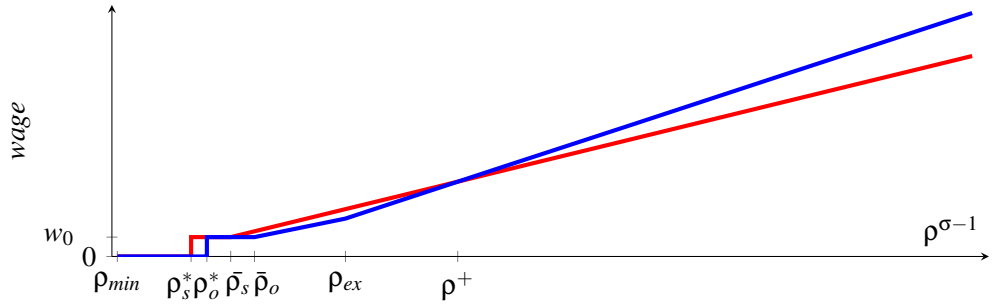
4.1 Distribution of profits and income

In each of the countries, imports from the other countries reduce the residual demand for goods produced in the country. Thus, domestic sales and, therefore, profits generated in the domestic market fall. Some firms returns fall so much that they can no longer recover their fixed costs and they quit. These are the least productive active firms in the closed economy equilibrium. Some more productive firms (i.e. with trade) partly default on their loans because their profits

are lower. Because the fixed costs of exporting rule out positive profits in the foreign market, firms that produce only for the domestic market necessarily have lower total profits. Moreover, the profits from exporting do not necessarily compensate for all of the losses that are incurred at home. The shrinking home market also affects exporting firms. For some firms, the profits from the new markets are not high enough to compensate for the losses. They lose profits compared to the non-trade equilibrium. There are, however, also firms who increase their profits because they now sell their 'successful product' in many countries. Ottaviano and Mayer (2007) call these the *happy few*. Their luck when drawing their productivity allows them to generate profits in several countries and they reap larger profits for their firm. Because the fixed costs of exporting are by assumption paid out of profits from abroad, there are no additional bank loans to repay. Thus, the profits generated abroad only add to domestic profits. The distribution of the profits of a country's firms is shown in Melitz's Figure 2: p. 1715.

For my purpose, I show the distribution of income in Figure 2. The income distribution is very similar to the profit distribution because in this model without capital, the profits are additional incomes of the owner or the top manager. I identify the individual being blessed with the profits of firm ω as ω in the distribution of individual incomes. Opening up to trade changes the income distribution of *entrepreneurs* in three characteristics. First, the number of entrepreneurs failing at entry increases; that is, $G(\rho_s^*) < G(\rho_o^*)$ because $\rho_s^* < \rho_o^*$, where o indicates the open economy. Unsuccessful potential or actual entrants have the opportunity costs of wage income; that is, they earn $0 < w_0$. This group is larger in the open economy (blue line) than in autarky (red line). Second, the income of entrepreneurs who's product are sold domestically in the open economy environment find themselves worse off than in the closed economy. This also holds true for the least productive exporters who do not export large amounts; that is, every firm with a productivity less than ρ^+. Third, the happy few, who are owners or managers of the group of firms who become global players. Their income increases strongly and most of the gains of globalization accrue to them. Finally, and not shown in the graph, the workers see their *real* income rising through lower goods prices.

Figure 2: Entrepreneurial income varying with quality-adjusted productivity



In Figure 2, I compared entrepreneurial income in two different states of the economy: the closed economy (red line) and the open economy (blue line). Note, that all entrepreneurs heading a firm with a productivity of less than ρ^+ lose relative to the closed economy equilibrium. In the open economy, profits shift towards more productive firms. Precisely this shifting of resources towards the most productive firms yields the productivity increase in the economy. Baldwin and Robert-Nicoud (2008) have already pointed out that this reallocation effect is hard to distinguish from a growth effect in a dynamic model.

4.2 Other effects of increased profit heterogeneity

The model has two further implications that are worth elaborating on and which are, however, beyond the scope of this paper and are, therefore, only outlined here. First, looking at the banking sector. Opening up to other countries reduces the variable profits of the less productive firms. More firms fail and default on their loans. Moreover, the group of firms who completely or partly default on their loans becomes larger. Thus, there is a higher ex-ante probability that a firm defaults. Banks must reduce their risk or increase repayment Ψ to prevent losses. The optimal mix will include a higher minimum quality level a' of the prototype and higher interest rates, which drive up Ψ. This reduces certeris paribus market entry dynamics in the economy.

Second, the diverging effects of globalization on firms' profits cause problems for collective bargaining agreements between employers organizations and labor unions. Sector averages are not as informative as they used to be in economies that have not been so much integrated by trade. While large exporters, such as the German automobile firms, easily coped with wage increases and even paid higher "house contract wages", smaller and less productive firm struggle with wage increases. From the mid-1990s to the early 2000s, many small and mid-sized firms left the employers organization to flee the collective wage agreement. The system of sector-specific wage negotiations

was challenged by the diverting globalization effects on firm profits. The analysis of this struggle is beyond the scope of this paper but it points to another source of income inequality which refers to workers, which is the ”exporters wage premium” and it characterizes significant wage differences for comparable jobs in exporting and domestic firms (see Klein et al. (2013)).

5 Globalization and income distribution

The adjusted Melitz model that was previously presented reveals a channel through which globalization has affected the income distribution that has not yet received much attention in the academic discussion. There are two features that conform with empirically important features of the change in the income distribution that are often discussed. First, the personal income distribution is affected even more than the functional one. Second, while there is not so much change in most segments of the distribution, the upper part has experienced a strong increase. This strong increase is, according to the model, the consequence of the redistribution of profits in the process of increasing and intensifying foreign trade.

There are, nevertheless, overall productivity gains in the model. These can be seen in a reduced price index of in the economies and in an increased number of goods that the consumers can choose from. Empirically, these productivity gains come mainly as quality improvements of goods and services rather than as lower price levels. They are, nevertheless, sizable and we would forego them without international integration. The solution for the inequality that comes with trade can, therefore, not be to tax and thereby reduce trade but to take the old insight seriously in that foreign trade can produce losers as well as winners (Stolper and Samuelson (1941)). Concerning trade and other forms of globalization such as outsourcing, the Brookings Institution has pushed for nearly 30 years in this direction (see Wandner (2016) for a survey). However, while different programs have been discussed and considered in the United States, the programs that have been implemented have been rather modest. Meanwhile, the European welfare states have neither stopped nor altered the change in the income distribution.

Finally, a major problem in assessing globalization’s contribution in the change of the income distribution is its process character, which makes it hard to disentangle its effects from those of technical change (Feenstra and Hanson (1997)): they are very often interrelated anyway. In many cases, adjustment towards seizing new opportunities or answering increased competitive pressure could go either way; that is, globalization and technical change are often substitutes. Seen from this perspective, it is even more difficult to argue in favor of protectionist policies and neither is there hope for improving the income distribution by protectionism. Protectionism will replace

outsourcing by automatization but it will not freeze or even improve the income distribution by itself.

6 Falling labor shares and executives' salaries

Autor et al. (2017) explain the fall of the labor share in several developed economies in the last decades by a model that is very similar to the one proposed here. Market share dynamics towards more productive firms yield increasingly higher markets shares of firms who employ relatively little (below average) labor per unit of output because labor productivity in these firms is higher (above average). A larger share of sales accrues to profits after the reallocation of market shares towards more productive firms. This reallocation yields a lower aggregate labor share. This mainly descriptive paper presents impressive empirical support for between-firms reallocation of market share and labor as the main channel to falling labor shares, which I see as empirical support for labor reallocation as the channel of increasing wage inequality (as proposed in this paper). Seeing falling labor shares as studied by Autor et al. (2017) as driven by globalization effects has (at least) two aspects that must be discussed: (i) firm-level productivity and not the workers' abilities is the key driver of the differences between the firms, and (ii) globalization is a significant driver of market concentration.

Autor et al. (2017) establish five facts with regard to falling labor shares that support the first aspect: "(i) there has been a rise in sales concentration within four-digit industries across the vast bulk of the U.S. private sector; (ii) industries with larger increases in product market concentration have experienced larger declines in the labor share; (iii) the fall in the labor share is largely due to reallocation of sales between firms rather than a general fall in the labor share within incumbent firms; (iv) the reallocation-driven fall in the labor share is most pronounced in precisely the industries which had the largest increase in sales concentration; and (v) these pattern are also present in firm- and industry-level datasets from other OECD countries" (Autor et al. (2017): 3). I see these facts as support for the presented effect of globalization on the income distribution in the sense that globalization-induced concentration goes hand in hand with the within-industry, between-firm reallocation of labor towards more productive (i.e. less labor-intensively producing) firms. The fall of the labor share does not apply for a single firm but only for the aggregate because it results from a change in the composition of firms.

Such a composition effect is absent in Barkai (2016), who relies on the representative firm. He finds falling labor *and* capital shares in the data and explains this by an increase in the mark-up over time; that is, increasing rents. Including capital in the analysis allows Barkai (2016) to point to the

fact that the capital share has also fallen. Consequently, increasing profits strengthens the case for increasing concentration and market power of (few large) firms as source of the redistribution of income. However, the representative firms model cannot account for the fact that increased profits are not evenly distributed across firms but are heavily concentrated in a few "superstars". In neither Barkai (2016) nor in Autor et al. (2017) do changes in the heterogeneity in the labor force play a role as source of the fall in the labor share. Thus, skill bias or upgrading is not considered.

Assortative matching is discussed in Helpman (2016), this is a channel through which worker heterogeneity can yield wage inequality. The idea is that more productive workers match with more productive firms. This can explain rising wage inequality and does it to a modest degree (Helpman (2016): 34), but not in the part of the distribution that I have in mind in this paper. Moreover, these findings are hard to relate to falling labor shares because higher skilled workers match with more productive firms earn higher wages. The empirical evidence discussed in Helpman (2016) suggests that assortative matching is not likely to be the main driver behind the strong increase in wage inequality.

If market concentration is accepted as a reason for the fall in the labor share and, therefore, for increasing wage inequality, then it the reason for the increased market concentration remains to be explained. Harnessing the Melitz approach, I propose globalization as source of the increase in market concentration. Export opportunities let some firms grow and demand more labor while others cannot use this growth opportunity because the fixed costs involved in this geographical expansion are too high to make exporting profitable. Small (domestic) firms come under pressure from two sides: imports bite into their demand in the goods markets and exporters drive up factor prices at home. Domestic firms shrink. This does not require a change in the degree of differentiation in the CES utility aggregate as proposed by Autor et al. (2017). While the degree of differentiation remains constant, increasing export and import activities drive the reallocation of factors towards more productive firms. Nevertheless, I agree that globalization has increased price sensibility of consumers and business partners.

Skepticism against globalization as the driver of the fall in labor share stems from two facts. First, Autor et al. (2017) present evidence that "an increase in Chinese imports predicts a *rise* in industry labor share" (Autor et al. (2017): 24) and second, that "similar pattern of a decline in labor's share [are observed] in largely non-traded sectors such as wholesale trade, retail trade, and utilities" (Autor et al. (2017): 2). The first point gives support to the theory in the sense that within-industry change in market concentration drives reallocation and not between-industry reallocation. The second observation can also be seen as support because importing involves fixed costs and is conducted only by more productive firms. Globalization can explain the reallocation of market

shares among heterogeneous retailers and wholesalers, although these sectors are classified as non-traded industries.

Having looked at empirical support for the mechanism for income inequality proposed in the model given above, I would finally like to direct attention to empirical evidence on the result of export activities. Keller and Olney (2017) examine executives' compensation of major US firms over the last few decades. They find not only that compensation is higher for more global firms but also that these higher compensations are rents and not rewards for higher productivity of more able mangers who have matched with more global firms. Moreover, compensation reacts asymmetrically as it rises with positive export shocks but it does not fall with negative ones. Thus, they conclude that rent-capture plays an important role.

In summary, I see the new empirical evidence on labor shares as very supportive of the proposed model focusing on globalization as source of the change in wage inequality. The argument runs through the increase in profits (as in Barkai (2016)), which are far less evenly distributed than wage income. Profits accrue to a very few owners or top managers of very few superstar firms. This is in line with the general empirical evidence on the change in income distribution presented in Atkinson et al. (2011) and with the particular evidence of export effects on executives compensation presented in Keller and Olney (2017).

7 Conclusions

Starting from the impressive work by Helpman (2016) on globalization's effects on income distribution, I proposed an additional channel that has not been looked at extensively: the rent-shifting effect of international trade. I augmented the seminal approach by Melitz (2003) to show how trade affects the income distribution if the rents accruing to more productive firms in the model are not completely redistributed through a complete financial market to finance market entry. I replace the assumption of a complete financial market by a banking sector that offers loan contracts; that is, a fixed repayment fee. This leaves the most productive firms with rents above interest and repayment fees. These rents are relevant for the income distribution. In the model, they accrue solely to few top managers or owners. Thus, the income distribution is rather simple: it is mostly flat and is a transformed power law at the top.

Yet, the focus of this paper is not the income distribution by itself but its change through international trade. The model illustrates a channel to explain how globalization shifts rents from less productive to more productive firms. Thereby, income is shifted towards the top income receivers in the economy. This is the empirical pattern that can be observed in many if not all OECD coun-

tries. However, in empirical analyses of the effect of globalization on the income distribution, this channel is rarely looked at. Whatever empirical studies might find, it is worth looking for another solution than protectionism to stop the change in the income distribution. Protectionism does not only not guarantee an improvement of the distribution but it also reduces the means to compensate the losers by lowering average productivity.

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