Firm Heterogeneity and the Labour Market Effects of Trade Liberalisation

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Abstract

This paper introduces the idea of fair wage preferences into a general equilibrium model with monopolistic competition between heterogeneous firms. By assuming that the wage considered to be fair by workers depends on the economic success of the firm they are working in, we can study the determinants of profits, unemployment and within-group wage inequality in a unified framework. In a second step, we use our theoretical vehicle to investigate the welfare and labour market effects of globalisation. In particular, we analyse how economic integration changes the productivity distribution of active producers and we show how these changes affect per capita income, unemployment and wage inequality.

JEL-Classification: F12, F15, F16
Key words: Heterogenous Firms, Unemployment, Fair Wages

1 Introduction

There is by now a voluminous theoretical literature on the effect of globalisation on labour markets. Motivated by empirical evidence from the U.S., most contributions to this literature focus on changes in the skill premium, i.e. the relative wage of high-skilled to low-skilled workers.[1] In Europe, changes in the skill premium were less pronounced, but instead many countries suffered from high and persistent unemployment. Taking this as a starting point, a much smaller literature looked at employment effects of globalisation in the presence of labour market distortions that give rise to involuntary unemployment of unskilled workers.[2]

Common to models in both strands of this literature is that they focus on the differential effect globalisation has on workers that are different from each other in the sense that they belong to different skill groups. This literature cannot account for changes of the wage distribution *within* those groups. Empirical evidence shows however that these changes are notable. In particular, there is well documented evidence across many countries that within group wage inequality has increased (see Katz and Autor, 1999; Barth et al., 2005). Although the observed increase in within-group wage inequality has been parallel to the recent surge in intermediate goods trade (usually referred to by the term international outsourcing), theoretical explanations have so far predominately focussed on two other sources: technological progress and/or organisational change (see Galor and Moav, 2000; Aghion et al., 2002; and Egger and Grossmann, 2005). In this literature the role of empirically unobservable individual characteristics (like learning abilities, or analytical and social skills) has been in the centre of interest.

Complementary to the existing literature, in this paper we develop a model that features involuntary unemployment as well as wage inequality between workers that are

[1] Influential contributions to this literature include Feenstra and Hanson (1996) and Krugman (2000).

[2] Krugman (1995) and Davis (1998) are two widely cited examples. More recent contributions include Oslington (2002) and Kreickemeier and Nelson (2006).

identical in terms of both observable and unobservable characteristics. The labour market side of the model uses a fair wage-effort mechanism similar to the one put forward in Akerlof and Yellen (1990). The basic idea is that worker effort is a function of the perceived fairness of the wage: $\varepsilon = g(w/\hat{w})$, where ε is effort, w is the wage and the hat denotes the wage perceived as fair by workers. There is considerable support for a mechanism of this type, as illustrated in the review articles by Howitt (2002) and Bewley (2005). Both stress the wide extent and strength of evidence supporting the fair wage model from a range of sources including: surveys of managers and workers; firm-level studies of pay and termination patterns; experiments; and common sense/personnel management textbooks.

¿From both a theoretical and empirical point of view, the difficult thing is identifying a plausible and observable basis for the evaluation by workers of the fairness of a wage offer. Three different approaches have been put forward in the existing theoretical literature. First, the wage considered to be fair by workers may depend on wages paid to a reference group of similar workers outside their own firm (Akerlof, 1982). Second, as put forward in Akerlof and Yellen (1990), the fair wage for workers of a specific skill group may depend on the remuneration of workers of a different skill group inside their own firm. Third, rent-sharing motives may affect the fair wage preferences of workers, so that the wage considered to be fair also depends on the economic success of the employer (cf. Danthine and Kurmann, 2006).

Fehr and Gächter (2000, p. 172) point out that the idea of *gift exchange*, which underlies the fair wage-effort hypothesis, implies that "more profitable firms pay higher wages". This supports a firm internal reference perspective, with the wage considered to be fair by workers depending on the economic success of the firm they are working in. Paired with a model of heterogeneous firms, the fair wage-effort mechanism can then explain within-group wage inequality of workers that do not differ in their individual characteristics. This is the mechanism which is central to the model presented in this paper. A tractable framework that allows for firm heterogeneity in general equilibrium is given by Melitz (2003). In the Melitz model, active firms in the market are heterogeneous with respect to their productivity, but a perfectly competitive labour market ensures that all producers pay the same wage. In our model, that uses the main ingredients from Melitz (2003), because of workers' fairness preferences more productive firms have to pay higher wages to have their workers provide full effort.

As in the original Melitz model, globalisation in our framework changes the productivity distribution of active firms. Because of workers' fair wage preferences, in addition to welfare effects this has implications for both the distribution of wages and the unemployment rate.[3] We find that losses from trade are possible and that when they occur they are accompanied by higher unemployment and higher wage inequality. Furthermore, even if globalisation raises per capita income, adverse effects on unemployment and wage inequality are possible. The structure of the paper is as follows. In section 2, we introduce a closed economy version of our model and show the impact that changes in fairness preferences and fixed costs have on the equilibrium. Section 3 looks at the effect of globalisation in the benchmark version of the model where entry costs are the same across all markets. Section 4 assesses the robustness of these results by allowing entry costs to differ between markets. Section 5 concludes.

2 Fair Wages and Firm Heterogeneity in a Closed Economy

Consider an economy which is endowed with L units of labour. Two types of goods are produced: differentiated intermediate goods and homogeneous final output. Final output is a *normalised* CES-aggregate of all available intermediate goods. Following Blanchard

[3] In an alternative framework that accounts for heterogeneous firms, Yeaple (2005) studies the impact of globalisation on the wage distribution in a model where producers, depending on their production technology, hire workers of different skill levels. His model therefore sheds new light on the effect of globalisation on the skill premium, rather than the wage distribution for workers of identical ability.

and Giavazzi (2003), we assume

$$Y = \left[M^{-(1-\rho)} \int_{v \in V} q(v)^{\rho} dv \right]^{1/\rho}, \qquad 0 < \rho < 1, \tag{1}$$

with the measure of set V representing the mass of available intermediate goods M. The production technology in (1) avoids the positive market size effects due to external economies of scale in the traditional Ethier (1982) framework. In our analysis such a normalisation is sensible for several reasons. First, it allows us to focus on the most important features of the model and to describe the economic mechanisms in a transparent way. Second, it separates in a natural way the effects that are specific to the Melitz (2003) model of heterogeneous firms from more traditional effects in an Ethier-type framework. Third, when turning to the consequences of trade liberalisation in sections 3 and 4, our results point to the difference between the effects of globalisation on the one hand and the effects of other sources of market size increase, like economic growth, on the other hand.

We take final output as the numéraire and assume perfect competition in the final goods market. The price index corresponding to the CES-aggregated good Y is given by

$$P = \left[M^{-1} \int_{v \in V} p(v)^{1-\sigma} dv \right]^{\frac{1}{1-\sigma}}, \tag{2}$$

with $\sigma \equiv 1/(1-\rho)$ being the elasticity of substitution between the different varieties of intermediate goods. Due to the choice of numéraire, we have $P = 1$. Profit maximisation of competitive final goods producers determines demand for variety v:

$$q(v) = \frac{Y}{M} p(v)^{-\sigma}, \tag{3}$$

where $P = 1$ has been taken into account.

At the intermediate goods level, we assume a continuum of firms, each producing a unique variety. Output q is linear in labour input l and depends on productivity level ϕ: $q(\phi) = \phi l$. There is a fixed input requirement f for each intermediate good, which is assumed to consist of invested final output Y. Firms share the same fixed costs $f > 0$ but differ in their productivity levels ϕ. Intermediate goods producers are monopolistically competitive. Facing (3), they choose the profit-maximising price

$$p(\phi) = \frac{w(\phi)}{\rho\phi}, \tag{4}$$

with $w(\phi)/\phi$ being the marginal costs of a firm with productivity level ϕ.

Following Akerlof and Yellen (1988, 1990), we assume that workers have a preference for fairness and condition their effort on the wage paid relative to the wage considered to be fair. If firms pay at least the fair wage, workers provide the normal level of effort, which, for notational simplicity, is set equal to one. The fair wage for workers is a weighted average between the wage they could expect if they were separated from their current job (taking into account the possibility that they might be unemployed) and the productivity of the firm they are working in. This is a simple way to make the reference wage dependent on a firm-*internal* "market potential" measure.[4] In line with Akerlof (1982) and Danthine and Kurmann (2006), we assume that the reference wage is a geometric average of the above components:

$$\hat{w}(\phi) = \phi^{\theta}[(1-U)\bar{w}]^{1-\theta}, \tag{5}$$

where $\bar{w}$ is the average wage of employed workers in the economy and $\theta \in [0,1]$ can be interpreted as a fairness parameter. Note that unemployment benefits are set equal to zero in equation (5). This assumption will be relaxed at the end of this section. As in the standard Akerlof-Yellen model, it is optimal for firms to pay not less than the fair wage because effort decreases proportionally if the wage falls short of what workers consider to be fair. Hence, we set $\hat{w}(\phi) = w(\phi)$. Then, the fair wage specification in (5) gives rise

[4] To the best of our knowledge, Danthine and Kurmann (2006) present the first formal analysis of a firm-specific internal fair wage reference. They impose a similar assumption and make the reference wage dependent on output per worker, which equals ϕ in our analysis. However, they do not account for productivity differences across firms.

to identical wages in all firms if $\theta = 0$ (cf. Melitz, 2003), while wages are firm-specific if $\theta > 0$.

Combining (3) and (4), revenues and profits of intermediate goods producers are given by

$$r(\phi) = \frac{Y}{M}\left(\frac{w(\phi)}{\rho\phi}\right)^{1-\sigma}, \qquad \pi(\phi) = \frac{Y}{\sigma M}\left(\frac{w(\phi)}{\rho\phi}\right)^{1-\sigma} - f. \tag{6}$$

Furthermore, accounting for (5), we see that the ratios of any two firms' wages and prices depend on the ratio of their productivity levels and the fairness parameter θ:

$$\frac{w(\phi_1)}{w(\phi_2)} = \left(\frac{\phi_1}{\phi_2}\right)^{\theta}, \qquad \frac{p(\phi_1)}{p(\phi_2)} = \left(\frac{\phi_1}{\phi_2}\right)^{\theta-1}. \tag{7}$$

Accordingly, we find

$$\frac{q(\phi_1)}{q(\phi_2)} = \left(\frac{\phi_1}{\phi_2}\right)^{\sigma(1-\theta)}, \qquad \frac{r(\phi_1)}{r(\phi_2)} = \left(\frac{\phi_1}{\phi_2}\right)^{\xi} \tag{8}$$

and

$$\frac{l(\phi_1)}{l(\phi_2)} = \left(\frac{\phi_1}{\phi_2}\right)^{\xi-\theta}, \tag{9}$$

with $\xi \equiv (\sigma - 1)(1 - \theta)$. A more productive firm has a higher output level, pays higher wages, demands lower prices, and realises higher revenues and profits than a less productive firm. The higher θ, the higher is ceteris paribus the wage differential and the lower is the output and revenue differential between firms of differing productivities.

The employment level in more productive firms is higher if and only if $\xi > \theta$ and therefore $\sigma(1-\theta) - 1 > 0$. On the one hand, for any given level of output more productive firms need fewer workers. On the other hand, due to lower marginal costs they charge lower prices and have higher output. For high levels of σ, price differences between varieties translate into large output differences, and therefore firm-level employment increases with firm productivity. In contrast, a higher θ increases relative marginal costs of more productive firms, thereby mitigating output differences between producers. Employment may therefore be lower in more productive firms.

The positive correlation between productivity levels, profits and wage payments, arising under fair wage specification (5), is well in line with the empirical finding on rent sharing in firms. Blanchflower and Oswald (1996) for example document that a rise in a sector's profitability leads to higher wage payments in that sector. And Hildreth and Oswald (1997) show that changes in profitability induce changes of wages in the same direction. Furthermore, there is empirical evidence for higher wage payments in, with respect to their employment levels, larger firms. Using information from the New Worker Establishment Characteristics Database, Bayard and Troske (1999) conclude that in the U.S. "the greater productivity of workers in larger establishments does account for over half of the firm-size wage premium in both manufacturing and services" (p. 102). Winter-Ebmer and Zweimüller (1999) find that "firm-size wage differentials in Switzerland cannot be explained by job-heterogeneity" (p. 93). These empirical findings on firm (or better employment) size related wage payments are consistent with the formal relationships in (7) and (9), if a sufficiently small $\theta > 0$ leads to $\sigma(1-\theta) - 1 > 0$.

Following Melitz (2003), we determine a weighted average of productivity levels $\tilde{\phi}$ which in our case is defined in a way to ensure that the quantity $q(\tilde{\phi})$ is equal to the average output per firm, Y/M. From (3), this implies $p(\tilde{\phi}) = 1$. Now, rewrite (2) as

$$P = \left[\int_0^\infty p(\phi)^{1-\sigma} \mu(\phi) d\phi \right]^{\frac{1}{1-\sigma}}, \tag{2'}$$

where $\mu(\phi)$ is the distribution of productivity parameters of active firms over a subset of $(0, \infty)$. From (7), we have $p(\phi) = p(\tilde{\phi})(\phi/\tilde{\phi})^{\theta-1}$. Substituting into (2′) and using $P = p(\tilde{\phi}) = 1$ implies

$$\tilde{\phi} \equiv \left[\int_0^\infty \phi^\xi \mu(\phi) d\phi \right]^{1/\xi}. \tag{10}$$

The average productivity $\tilde{\phi}$ gives the weighted harmonic mean of the ϕ's, with relative output levels $q(\phi)/q(\tilde{\phi})$ serving as weights. Denoting by R aggregate revenues in this economy and by Π aggregate profits we find – analogous to Melitz (2003) – that $R = Mr(\tilde{\phi})$ and $\Pi = M\pi(\tilde{\phi})$. Together with the previous results $P = p(\tilde{\phi})$ and (by definition) $Y = Mq(\tilde{\phi})$, this illustrates the usefulness of the particular average defined in (10): The aggregate variables in our model are identical to what they would be if the economy hosted M identical firms with productivity $\tilde{\phi}$. This is in general not true, however, for aggregate employment. In particular, we have

$$(1-U)L = Ml(\tilde{\phi})\tilde{\phi}^{\theta-\xi}\int_0^\infty \phi^{\xi-\theta}\mu(\phi)d\phi, \tag{11}$$

where the RHS equals $Ml(\tilde{\phi})$ only if $\xi = \theta$. This is the case where employment per firm is the same across all firms, according to (9).

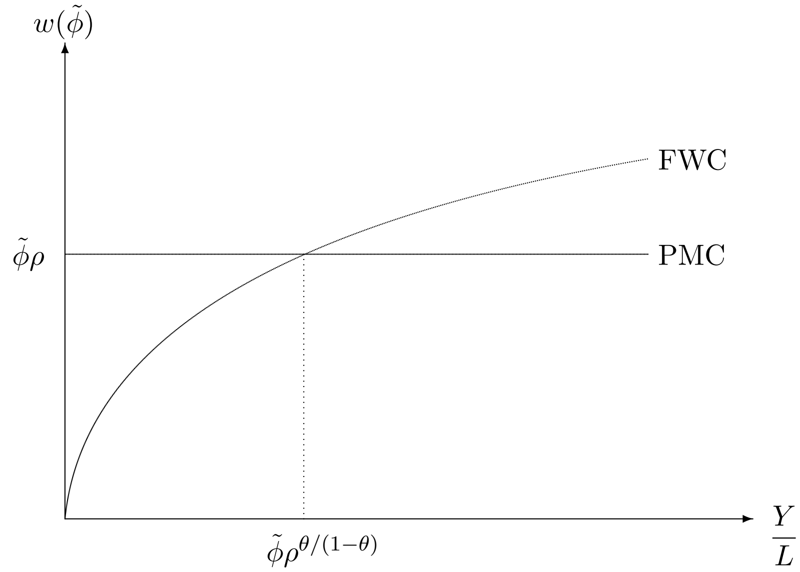

Figure 1: Determination of equilibrium per capita income

In our model with a single homogeneous final good, per capita income (or, alternatively, per capita production) Y/L is the natural utilitarian welfare measure. Given the mark-up pricing rule, labour income is a share ρ of output Y. We therefore have $(1-U)\bar{w}L = \rho Y$, which can be used to substitute for $(1-U)\bar{w}$ in (5). Accounting for $w(\phi) = \hat{w}(\phi)$, this gives us

$$w(\phi) = \phi^{\theta} \left[\frac{\rho Y}{L}\right]^{1-\theta}. \tag{5'}$$

To determine equilibrium welfare we depict the condition for profit maximisation (4) and the modified fair wage constraint (5′) for $\phi = \tilde{\phi}$ in figure 1. The two curves are labelled PMC and FWC, respectively, and their point of intersection gives

$$Y/L = \tilde{\phi}\rho^{\theta/(1-\theta)}. \tag{12}$$

Due to our normalisation of final output in (1), *per capita* income Y/L is independent of the mass of producers M and the total labour endowment L, and therefore changes in market size *per se* do not exhibit a direct welfare effect.

With respect to entry and exit of intermediate goods producers, we keep as close as possible to Melitz (2003), to make our results comparable with his findings. In particular, we assume an unbounded pool of prospective entrants into the intermediate goods market. Prior to entry, firms are identical. To produce, firms must incur fixed entry costs in the form of $f_e \geq 0$ units of final output, which are hereafter sunk. After entry, firms draw their productivity from a cumulative distribution $G(\phi)$ with density $g(\phi)$. We follow Helpman et al. (2004) and Baldwin (2005), and use the Pareto distribution to parametrise $G(\phi)$:

$$G(\phi) = 1 - (\bar{\phi}/\phi)^k \qquad\qquad g(\phi) = \frac{k}{\phi}\left(\frac{\bar{\phi}}{\phi}\right)^k, \tag{13}$$

where $\bar{\phi} > 0$ is the lower bound of productivities, i.e. $\phi \geq \bar{\phi}$. A firm drawing productivity ϕ will produce if and only if the expected stream of profits is non-negative. For the sake of clarity, we should emphasise at this stage the importance of distinguishing the two types of fixed costs present in the model: initial investment costs f_e, which must be incurred to participate in the productivity draw and may, therefore, be associated with costs of developing a blueprint; and per-period fixed costs f, which are associated with market entry and investment in the local distribution system.

If a firm starts production, it faces a probability of death $\delta > 0$ (exogenous and independent of ϕ) in each period. We account for an infinite number of time periods and focus on steady state equilibria in which the aggregate variables remain constant over time. Assuming that there is no discounting, each firm's value function can be written as

$$v(\phi) = \max\left\{0, \sum_{t=0}^{\infty}(1-\delta)^t \pi(\phi)\right\} = \max\left\{0, \frac{\pi(\phi)}{\delta}\right\}. \tag{14}$$

The lowest productivity compatible with a non-negative expected profit stream of a firm that chooses to start production is denoted by ϕ^*. Formally, $\phi^* = \inf\{\phi : v(\phi) > 0\}$. From (14), this implies $v(\phi^*) = \pi(\phi^*) = 0$.

The *ex post* distribution of productivities, $\mu(\phi)$, is conditional on successful draw. Hence,

$$\mu(\phi) = \begin{cases} \dfrac{g(\phi)}{1-G(\phi^*)} = \dfrac{k}{\phi}\left(\dfrac{\phi^*}{\phi}\right)^k & \text{if } \phi \geq \phi^* \\ 0 & \text{otherwise} \end{cases}, \tag{15}$$

where $1 - G(\phi^*)$ is the *ex ante* probability of a successful draw. Together, (10) and (15) determine $\tilde{\phi}$ as function of cutoff productivity level ϕ^*:[5]

$$\tilde{\phi} = \left(\frac{k}{k-\xi}\right)^{1/\xi} \phi^*, \tag{16}$$

where $k > \xi$ is assumed. The differential between the average productivity of active firms $\tilde{\phi}$ and the cutoff productivity ϕ^* is therefore only a function of the model parameters σ, θ and k.

Let us now turn to the determination of the cutoff productivity ϕ^*. The free entry condition requires that in equilibrium the sunk costs $f_e > 0$ of entering the productivity

[5] See the derivation in the appendix.

draw is equal to the present value of profits for the average firm in the market, multiplied by the probability of a successful draw, i.e. a draw that results in $\phi \geq \phi^*$. Formally, using (13) and (14) this gives us the free entry condition (FE)

$$\pi(\tilde{\phi}) = \delta f_e \left(\frac{\phi^*}{\bar{\phi}}\right)^k. \tag{17}$$

Clearly, $\partial\pi(\tilde{\phi})/\partial\phi^*$ is strictly positive: With a higher cutoff productivity ϕ^* – and therefore a lower probability of getting a favourable draw – a higher profit of the average firm is needed to keep a firm indifferent between entering and staying out of the productivity draw.

A second relation between the average profit of active firms and the cutoff productivity can be derived from the condition that the marginal firm in the market makes zero profits, i.e. $\pi(\phi^*) = 0$. As shown in (6) this implies $r(\phi^*) = \sigma f$, and using (8) and (16) we get the zero cutoff profit condition (ZCP)

$$\pi(\tilde{\phi}) = \left(\frac{\xi}{k-\xi}\right) f. \tag{18}$$

Figure 2 plots equations (17) and (18). The cutoff productivity level ϕ^* is determined by the intersection of the two curves and formally given by

$$\phi^* = \left[\frac{\xi f}{(k-\xi)\delta f_e}\right]^{1/k} \bar{\phi}. \tag{19}$$

In order to ensure the existence of an equilibrium with a positive mass of producers, we clearly need $\phi^* > \bar{\phi}$, and hence the term in brackets has to be larger than one, which is the case if f is sufficiently high and/or δ, f_e is sufficiently small.

The equilibrium mass of producers M is determined by $Mr(\tilde{\phi}) = Y$. Substituting (6) and (12) gives

$$M = \frac{Y}{r(\tilde{\phi})} = \frac{\tilde{\phi}\rho^{\theta/(1-\theta)}L}{\sigma(\pi(\tilde{\phi}) + f)} \tag{20}$$

and hence M is proportionally increasing in labour endowment L.

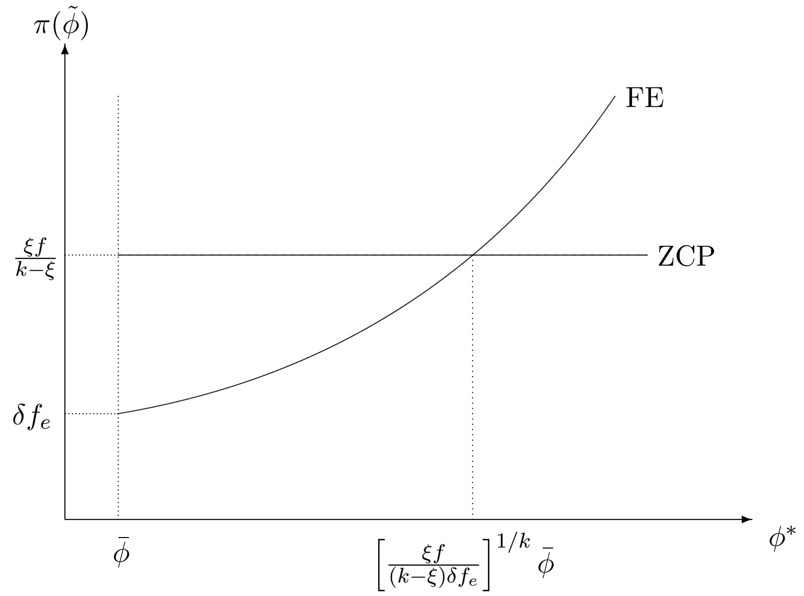

Figure 2: Determination of the cutoff productivity level

In order to determine the rate of unemployment U, we make use of the accounting identity that aggregate employment $(1-U)L$ has to equal firm specific employment, summed over all firms M. By virtue of (15), we obtain

$$(1-U)L = M \int_{\phi^*}^{\infty} l(\phi) \frac{k}{\phi} \left(\frac{\phi^*}{\phi}\right)^k d\phi$$

Using (9), this can be rewritten as[6]

$$1-U = \frac{Y}{L\tilde{\phi}} \left(\frac{k}{k-\xi}\right)^{\theta/\xi} \frac{k-\xi}{k-\xi+\theta}, \tag{21}$$

and substituting for Y/L from (12) we get

$$1-U = \rho^{\theta/(1-\theta)} \left(\frac{k}{k-\xi}\right)^{\theta/\xi} \frac{k-\xi}{k-\xi+\theta}. \tag{22}$$

One can immediately see that $\theta = 0$ implies $U = 0$, showing the relevance of having the fair wage depend on a firm internal performance measure. With $\theta > 0$, we can ensure that

[6]See the appendix for a detailed derivation.

that $U \in (0,1)$ if k is large enough, implying that there are relatively many firms in the market whose productivity is close to the cutoff level. A sufficient condition that holds for all levels of $\theta \in (0,1)$ is[7]

$$k \geq \frac{\sigma - 1}{1 - \rho^{\sigma-1}}. \tag{23}$$

We can use (22) as well to gain insights into the distribution of wages in the model. There is broad consensus among economists (i) that within-group wage inequality is an important determinant of overall wage inequality (Juhn et al., 1997; Katz and Autor[8], 1999) and (ii) that the increase in within-group wage inequality observed in the last three decades was − in contrast to the rise in between-group wage inequality − not confined to the U.S. (Katz and Autor, 1999; Fitzenberger et al., 2001; Barth et al. 2005). In the empirical literature, wage rates in different percentiles are often compared (90/10 or 50/10) to gain insights on income/wage dispersion between individuals. For the purpose of analytical tractability, we choose a (slightly) different approach and focus on the ratio of the average to the lowest wage rate, i.e. $\bar{w}/w(\phi^*)$.

This inequality measure is derived in two steps. From (4) and (5) we know $(1-U) = \rho^{\theta/(1-\theta)} w(\tilde{\phi})/\bar{w}$. Substituting into (22) gives the differential between the wage paid by the average firm and the average wage as

$$\frac{w(\tilde{\phi})}{\bar{w}} = \left(\frac{k}{k-\xi}\right)^{\theta/\xi} \frac{k-\xi}{k-\xi+\theta}. \tag{24}$$

This differential is equal to one if either $\theta = 0$ or $\theta = \xi$. In the former case, this is due to all firms paying the same wage. In the latter case firms pay different wages, but the two averages $w(\tilde{\phi})$ and $\bar{w}$ coincide because all firms have the same employment level, according

[7]For a given θ, $\rho^{\sigma-1}k/(k-\xi) \leq 1$ implies $RHS \leq 1$ in (22). Since $k/(k-\xi)$ declines in θ, we can derive (23) as a sufficient condition for an interior solution, with $RHS \leq 1$ for any possible θ.

[8]Katz and Autor (1999, Table 5) show that within-group inequality explains three-fourth of overall wage inequality in the U.S.

to (9). From (7) and (16), we have $w(\tilde{\phi})/w(\phi^*) = [k/(k-\xi)]^{\theta/\xi}$. Together with (24), this gives our desired inequality measure

$$\frac{\bar{w}}{w(\phi^*)} = \frac{k-\xi+\theta}{k-\xi}. \tag{25}$$

Importantly, wage inequality is not triggered by differences in the individual characteristics of workers. But rather it is the interplay of productivity differences between firms and fairness preferences of workers which leads to wage differentiation in the present model. Since workers are identical in all respects, $\bar{w}/w(\phi^*)$ can be interpreted as a measure for the dispersion of wage income within a *particular* skill group.

It is also noteworthy that both the unemployment rate in (22) and the wage differential in (25) are independent of parameter L. This result is a direct consequence of the Blanchard and Giavazzi (2003) type production technology in (1), which rules out pure market size effects on the key economic variables. That changes in labour endowments do not have have an impact *per se*, seems to be a plausible outcome as there is no empirical support for a size pattern in the labour market variables, and unemployment is a problem for large as well as small economies.

2.1 Comparative Statics I: Fairness Preferences

We have shown above that the borderline case $\theta = 0$ leads to the perfectly competitive labour market outcome in our model: all firms pay the same wage and there is full employment. We now turn to more generally determining the effects that changes in θ have on the key labour market variables as well as per capita income. These effects are summarised in the following proposition.

Proposition 1. *Under parameter restriction (23), a higher θ leads to lower per capita income, higher unemployment and greater wage inequality.*

Proof. See the appendix. □

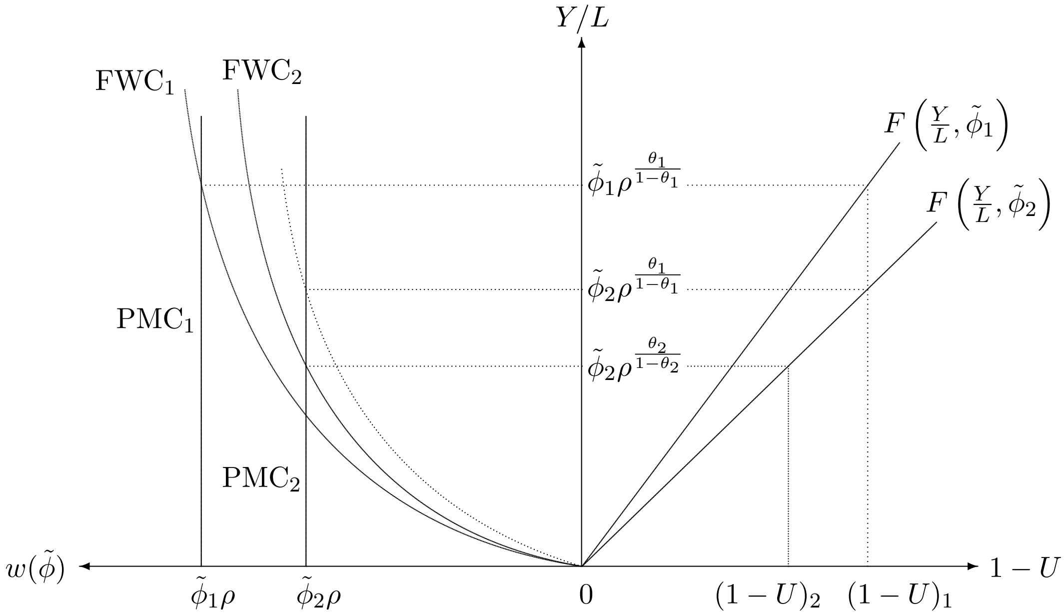

Figure 3: Welfare and employment effects of a change in θ

The intuition behind these results is as follows. Consider an increase in the fairness parameter from θ_1 to θ_2. This improves the relative position of less productive firms because in relation to their more productive competitors they now have to pay lower wages, which mitigates part of the disadvantage they suffer from an unfavourable draw in the productivity lottery. Consequently, less productive firms than before can now survive in the market and the cutoff productivity ϕ^* falls. Both the lower cutoff productivity and the steeper wage profile naturally lead to a widening in the wage differential.

The productivity of the average firm declines along with the cutoff productivity. Using this, the effects on per capita income and employment can be illustrated with the help of figure 3. The left quadrant is a rotated but otherwise identical version of figure 1, and the right quadrant is a graphical representation of equation (21), with $F(\cdot)$ giving the economy-wide employment ratio as a function of per capita income and the productivity of the average firm. Old and new productivity levels are denoted by $\tilde{\phi}_1$ and $\tilde{\phi}_2$, respectively. *Ceteris paribus*, the decrease in average productivity rotates the fair wage constraint inwards to the dotted position, while the profit maximisation condition shifts to position PMC_2, leading to a first-round decrease in per capita income. However, given productivity $\tilde{\phi}_2$ an increase in θ increases the fair wage demand in the average firm, thereby rotating the fair wage constraint backwards into position FWC_2. As the wage is fixed by PMC_2, per capita income has to fall further in order to keep workers – by worsening the workers' outside option – satisfied with the going wage rate. It is this second-round decline in per capita income which leads to a fall in employment, as is illustrated by the movement along $F(Y/L, \tilde{\phi}_2)$ in the right quadrant of figure 3. There is a further effect on aggregate employment that depends on the size distribution of firms in terms of employment levels (which, as shown above, depends on $\xi - \theta$). In figure 3, this has the effect of rotating $F(Y/L, \tilde{\phi}_2)$ (not shown). While the sign of this effect is ambiguous, we know from proposition 1 that it can never overturn the primary negative employment effect.

2.2 Comparative Statics II: Fixed Costs

In a next step, we investigate the role of fixed costs in our model. Two components of these fixed costs can be distinguished, namely inital investment costs f_e and per-period fixed costs f.

Proposition 2. *Per capita income decreases with higher initial investment costs f_e and increases with higher per-period fixed costs f. Unemployment and within-group wage inequality are unaffected by changes in either component of fixed costs.*

Proof. Use (16) together with (19) in (12) to determine $d(Y/L)/df_e < 0$ and $d(Y/L)/df > 0$. Furthermore, $dU/df_e = dU/df = 0$ and $d(\bar{w}/w(\phi^*))/df_e = d(\bar{w}/w(\phi^*))/df = 0$ follow immediately from (22) and (25), respectively. □

Higher initial investment costs f_e render participation in the productivity draw less attractive so that ceteris paribus competition becomes less intense and profits rise for any productivity level ϕ. This provides an incentive for less productive firms to start production and the cutoff productivity level ϕ^* falls. The associated decline in average productivity $\tilde{\phi}$ (from (16)) exactly offsets the positive profit effect from lower competition so that profits of the average firm $\pi(\tilde{\phi})$ remain unchanged after an increase in the initial investment costs f_e. This result can be illustrated in figure 2 by noting that an increase in f_e shifts the FE curve upwards but does not affect the position of the ZCP locus.

The lower average productivity leads to a lower per capita income, according to (12), and exhibits two counteracting effects on the unemployment rate. On the one hand, a lower $\tilde{\phi}$ implies that more workers are required to produce a given level of output. On the other hand, the decline in per capita income Y/L lowers demand for intermediate goods. These two effects exactly offset each other, thereby rendering the unemployment rate independent of changes in the investment cost parameter f_e.[9] Finally, since an increase in the initial investment costs lowers per capita income and at the same time leaves the unemployment rate unaffected, the average wage rate $\bar{w} = \rho(Y/L)/(1-U)$ unambiguously declines. However, the wage paid in the least productive firm $w(\phi^*)$ declines as well, according to (5), leaving their relative size and hence our measure of wage inequality $\bar{w}/w(\phi^*)$ unchanged.

In contrast to initial investment costs f_e, higher per-period fixed costs f reduce ceteris paribus the profits of all active firms. The least productive firms therefore leave the market and cutoff productivity increases. This leads to a higher average productivity $\tilde{\phi}$ (see (16)) and average per-period profits $\pi(\tilde{\phi})$ increase, according to (18). These effects can also be read off figure 2, where higher per-period fixed costs f shift the ZCP locus upwards, without affecting the position of the FE curve.

[9] Per capita income and unemployment effects can also be read off figure 3 by holding the fairness parameter constant at $\theta = \theta_1$ and considering an increase in f_e that lowers ϕ from $\tilde{\phi}_1$ to $\tilde{\phi}_2$.

By raising $\tilde{\phi}$, an increase in the fixed costs f leads to higher per capita income, according to (12). With regard to the unemployment and the wage-inequality implications, we can identify two counteracting effects of an increase in average productivity $\tilde{\phi}$, which exactly cancel out in our model. (See the detailed discussion above.) Hence, unemployment and wage inequality are independent of changes in both initial investment costs f_e and per-period fixed costs f.

Although our model is very stylised, of course, the effects of fixed costs just derived suggest a more differentiated view of market entry barriers than is commonly held, namely that a reduction of these barriers is necessarily beneficial. On the one hand, it is true that reducing initial investment costs raises average productivity and, therefore, per capita income. On the other hand, a reduction in the per-period fixed costs exhibits detrimental productivity and per capita income effects via the impact on the productivity distribution of active firms. To the extent that policy makers interested in aggregate welfare have an influence on these per-period fixed costs, they might want to keep them so high that firms that turn out to be unproductive are replaced by more productive ones. Initial market entry on the other hand should be facilitated to make the pool of potentially successful competitors bigger.

2.3 The Role of Unemployment Benefits

As a final step in the description of the autarky equilibrium, we consider the effect of unemployment benefits. In the derivation of equations (12), (22) and (25) unemployment benefits have been set to zero. While this simplification is useful to present the theoretical framework in the most transparent way, it is clearly at odds with reality. Indeed, it is often argued that generous compensation systems in Europe are an important source for its unemployment problem. To account for the role of such payments, we assume that workers earn a share $\gamma \in (0, 1)$ of the *average* wage in the economy if they become unemployed.

Unemployment benefits are financed by a lump-sum tax on workers. In this case, the fair wage specification (5) has to be reformulated. It is now given by

$$\hat{w}(\phi) = \phi^{\theta} \left[\left(1 - U(1-\gamma)\right) \bar{w} \right]^{1-\theta}. \tag{5''}$$

From our analysis above, it is obvious that this modification has no consequences for per capita income Y/L and unemployment rate U: Due to the mark-up pricing rule the share of aggregate output accruing to workers (employed or unemployed) is not affected by the introduction of unemployment benefits. These benefits are therefore a purely redistributive measure among employed and unemployed workers, and the size of $(1 - U(1-\gamma))\,\bar{w}$ is independent of γ. One can see in (5″) that hence the fair wage a firm of productivity ϕ has to pay, and therefore its labour demand, is unaffected. The effect of unemployment benefits on the wage differential is given by

$$\frac{\bar{w}}{w(\phi^*)} = \frac{k - \xi + \theta}{(k - \xi)} \frac{1 - U}{1 - U(1-\gamma)}. \tag{25'}$$

Not surprisingly, a higher γ reduces the wage inequality as measured by $\bar{w}/w(\phi^*)$.

Putting together, our results are consistent with the empirical fact that European labour markets are characterised by higher unemployment rates and lower wage inequality as compared to the U.S. While the high unemployment rates in Europe are due to stronger preferences for fairness (a higher θ), the more generous unemployment compensation system explains the lower dispersion of (within-group) wage inequality (see Fitzenberger et al., 2001).

Since the introduction of unemployment benefits does not change the main economic mechanisms in our framework, we stick to the more parsimonious model variant below and set $\gamma = 0$. A brief discussion of how unemployment compensation influences the labour market effects of globalisation is delegated to the end of section 3.

3 A Benchmark Model of the Open Economy

When economists think about integration effects, they often turn to the theoretically appealing (but empirically not fully convincing) borderline case of full integration of product markets. Full integration of countries which do not differ in their economic fundamentals, is formally equivalent in our model to an increase in L and, under technology (1), exhibits no effect on Y/L, U and $\bar{w}/w(\phi^*)$. Only the number of competitors M rises proportionally with market size parameter L. However, if we account for transport costs, things are different and the key macroeconomic variables no longer remain constant in the process of market integration. Focusing on the empirically relevant case, we assume positive transport costs below.

Two types of transport costs are distinguished: (i) iceberg transport costs, which are usually considered in trade models with monopolistic competition, and (ii) fixed transport costs, which have been put forward by Melitz (2003) to explain the empirical regularity that larger, more productive firms engage in exporting. We denote by $\tau \geq 1$ the iceberg transport cost parameter and by $f_x \geq 0$ fixed per-period transport costs, which can be interpreted as foreign market entry costs or investment in the foreign distribution system. We investigate integration between $n+1$ fully symmetric countries. This simplifies our analysis and makes country indices obsolete.

We use index x to refer to variables associated with export sales, while domestic variables are left index free, as in the previous section. Export prices are given by $p_x(\phi) = \tau p(\phi)$, with $p(\phi)$ being determined according to (4). Export sales to any partner country and the respective revenues at the firm level are given by $q_x(\phi) = \tau^{-\sigma} q(\phi)$ and $r_x(\phi) = \tau^{1-\sigma} r(\phi)$, with $q(\phi)$ and $r(\phi)$ being determined, according to (3) and (6). Then, under free trade, total revenues of a firm with productivity level ϕ are given by

$$r_t(\phi) = \begin{cases} r(\phi) & \text{if it does not export} \\ r(\phi) + n\tau^{1-\sigma} r(\phi) & \text{if it exports} \end{cases}. \tag{26}$$

Furthermore, profits associated with local sales and exports are given by,

$$\pi(\phi) = \frac{r(\phi)}{\sigma} - f, \qquad \pi_x(\phi) = \frac{r_x(\phi)}{\sigma} - f_x, \tag{27}$$

so that $\pi_t(\phi) = \pi(\phi) + \max[0, n\pi_x(\phi)]$ determines the overall (per period) profits of an active producer.

Similar to Melitz (2003), we can distinguish two scenarios. First, if trade costs are sufficiently low, all active firms will engage in exporting, i.e. $\phi^* = \phi_x^*$. Then, free entry of firms determines the cutoff productivity level ϕ^*, according to $\pi_t(\phi^*) = \pi(\phi^*) + n\pi_x(\phi^*) = 0$. In contrast, partitioning of firms by their export status arises under sufficiently high transport costs. In this case ϕ^* is determined by $\pi(\phi^*) = 0$, while $\phi_x^* > \phi^*$ is determined by $\pi_x(\phi_x^*) = 0$. Such a partitioning of firms requires $\pi_x(\phi^*) < 0$. Substituting $r_x(\phi) = \tau^{1-\sigma} r(\phi)$ into (27), we can therefore conclude that all firms engage in exporting if $\tau^{\sigma-1} f_x \leq f$, whereas $\tau^{\sigma-1} f_x > f$ leads to partitioning of firms by their export status. In analogy to (16), we find

$$\tilde{\phi}_x = \left(\frac{k}{k-\xi}\right)^{1/\xi} \phi_x^*, \tag{28}$$

and hence we have $\tilde{\phi}_x/\tilde{\phi} = \phi_x^*/\phi^*$.

The *ex ante* probability that a successful entrant will engage in exporting is $\chi = [1 - G(\phi_x^*)]/[1 - G(\phi^*)] = (\phi^*/\phi_x^*)^k$. Since firms know their productivity levels before they decide upon their export status, χ also gives the *ex post* fraction of exporters. If all countries are symmetric, the total number of producers selling to one market is given by $M_t = M(1 + n\chi)$. The weighted average productivity of all firms active in any one country is determined in analogy to (10) and given by

$$\begin{aligned} \tilde{\phi}_t &= \left\{ \frac{1}{1+n\chi} \left(\tilde{\phi}^\xi + n\chi\tau^{1-\sigma}\tilde{\phi}_x^\xi \right) \right\}^{1/\xi} \\ &= \tilde{\phi} \left\{ \frac{1}{1+n\chi} \left[1 + n\chi\tau^{1-\sigma}(\tilde{\phi}_x/\tilde{\phi})^\xi \right] \right\}^{1/\xi}, \end{aligned} \tag{29}$$

where $\tilde{\phi}$ is the average productivity of all domestic firms and $\tilde{\phi}_x$ is the average productivity of exporting firms. The difference between the two averages $\tilde{\phi}$ and $\tilde{\phi}_t$ is due to two effects: the *lost-in-transit* effect due to goods melting away en route when variable transport costs are positive and the *export-selection* effect due to the fact that with partitioning it is the most productive firms who export. Inspection of (29) confirms that $\tilde{\phi}_t = \tilde{\phi}$ when there are no variable transport costs and all firms export. Increasing τ decreases $\tilde{\phi}_t/\tilde{\phi}$ directly due to the lost in transit effect, but increases $\tilde{\phi}_t/\tilde{\phi}$ due to the export selection effect if it leads to partitioning of firms by their export status.

The definition of $\tilde{\phi}_t$ in (29) ensures that the quantity produced by the average firm *for its domestic market*, $q(\tilde{\phi}_t)$, is equal to the average output per firm selling to this market, Y/M_t. In analogy to the closed economy case, we furthermore have $P = p(\tilde{\phi}_t) = 1$, $Y = R = M_t r(\tilde{\phi}_t)$, and $\Pi = M_t \pi(\tilde{\phi}_t)$. Hence, for the open economy version of the model $\tilde{\phi}_t$ assumes the role that $\tilde{\phi}$ has for the closed economy version.

In the remainder of this section we look at the case where the per-period fixed costs of domestic production f and the per-period fixed costs of exporting to each of the foreign markets, f_x, are equal. Making the model symmetric in this way allows us to bring to the forefront the role played by firm heterogeneity in the globalisation process. We delegate a discussion of the general case $f \neq f_x$ to section 4. With the assumption $f_x = f$, and using (8) as well as $r(\phi^*) = \sigma f$ and $r_x(\phi_x^*) = \sigma f_x$ (from the respective zero profit cutoff conditions), we get

$$\left(\frac{\phi_x^*}{\phi^*}\right)^{\xi} = \frac{r(\phi_x^*)}{r(\phi^*)} = \frac{\tau^{\sigma-1} r_x(\phi_x^*)}{r(\phi^*)} = \tau^{\sigma-1}. \tag{30}$$

Substitution in (29) gives $\tilde{\phi}_t = \tilde{\phi}$, where differential of the two average productivities is independent from τ because with $f_x = f$ the lost-in-transit effect and the export-selection effect exactly offset each other. This simplifies the analysis dramatically because the relative size of ϕ^* and $\tilde{\phi}$ depends only on model parameters σ, θ and k, as shown in (16), and is therefore the same in the closed and open economy. We can therefore focus on deriving the effect that opening up to trade has on the cutoff productivity ϕ^*.

3.1 Comparing Autarky and Trade

As shown above, ϕ^* is jointly determined by the free entry condition and the zero cutoff profit condition. As in Melitz (2003), the free entry condition is the same as in the closed economy, with $\pi_t(\tilde{\phi})$ replacing $\pi(\tilde{\phi})$ in (17). The profit for the average firm is now $\pi_t(\tilde{\phi}) = \pi(\tilde{\phi}) + n\chi\pi_x(\tilde{\phi}_x)$, and using the conditions $\pi(\phi^*) = 0$ and $\pi_x(\phi_x^*) = 0$ we get, in analogy to (18), the modified zero cutoff profit condition (ZCP)

$$\pi_t(\tilde{\phi}) = \frac{\xi f}{k - \xi}(1 + n\chi). \qquad (31)$$

Together, (17) and (31) determine the cutoff productivity under free trade. It is given by

$$\phi^* = \left[\left(\frac{\xi f}{(k - \xi)\delta f_e}\right)(1 + n\chi)\right]^{1/k} \bar{\phi} \qquad (32)$$

Comparing ϕ^* to its autarky level[10] ϕ_a^* as determined in (19), we see that trade liberalisation leads to a higher productivity cutoff level: $\phi^* > \phi_a^*$. Graphically, trade liberalisation induces an upward shift of the ZCP locus in figure 2. For a given FE curve, this leads to a higher cutoff productivity level.

As the ratio of average productivity $\tilde{\phi}$ and cutoff productivity ϕ^* is the same under autarky and free trade, it follows from (19) and (32) that

$$\frac{\tilde{\phi}_t}{\tilde{\phi}_a} = (1 + n\chi)^{1/k} > 1 \qquad (33)$$

Hence, in the completely symmetric case considered here trade liberalisation induces an increase in the average productivity level of active firms in all countries: $\tilde{\phi}_t > \tilde{\phi}_a$. This translates into an increase in per capita income – and therefore welfare – for all trading economies, as shown by (12). This result holds for any admissible value of θ and confirms

[10]From now on, we use index a to refer to autarky levels.

the respective findings in Melitz (2003). However, under a Blanchard and Giavazzi (2003) type production technology, the welfare effects are independent of changes in the mass of input producers.

In the open economy, we have to distinguish between M_t, which denotes the mass of input varieties available for final goods production, and M, which denotes the mass of locally produced varieties. Noting $r(\tilde{\phi}_t) = r(\tilde{\phi}_a)$ and $Y = M_t r(\tilde{\phi}_t)$, according to (18) and (27), $M_t/M_a = \tilde{\phi}_t/\tilde{\phi}_a > 1$ follows immediately from (20). This implies that more varieties are available for final goods production after trade liberalisation. The mass of local producers on the other hand declines if and only if $k > 1$.[11] These results are consistent with those in Melitz (2003) and they confirm the respective findings in more traditional trade models à la Dixit and Stiglitz (1977) or Ethier (1982) with monopolistic competition and identical firms.

Besides changes in per capita income, we are particularly interested in the unemployment effects of trade liberalisation. Summing up employment at the firm level we get

$$(1-U)L = M\int_{\phi^*}^{\infty} l(\phi)\frac{k}{\phi}\left(\frac{\phi^*}{\phi}\right)^k d\phi + nM_x\int_{\phi_x^*}^{\infty} l_x(\phi)\frac{k}{\phi}\left(\frac{\phi_x^*}{\phi}\right)^k d\phi \tag{34}$$

where $l(\phi)$ is the employment in a domestic firm of productivity ϕ for its domestic sales, while $l_x(\phi) = \tau^{1-\sigma} l(\phi)$ is the employment in a domestic exporting firm of productivity ϕ for its export production. This can be rewritten as[12]

$$1-U = \Gamma\frac{Y}{L\tilde{\phi}_t}\left(\frac{k}{k-\xi}\right)^{\theta/\xi}\frac{k-\xi}{k-\xi+\theta}, \tag{35}$$

with

$$\Gamma \equiv \frac{1+n\chi\tau^{-\frac{\theta}{1-\theta}}}{1+n\chi} < 1. \tag{36}$$

[11] Use (33) and $M_t = (1+n\chi)M$ to get $M/M_a = (1+n\chi)^{(1-k)/k}$. Note that (23) does not imply $k > 1$.
[12] See the derivation in the appendix.

Substituting for Y/L from (12) we get

$$1 - U = \Gamma \rho^{\theta/(1-\theta)} \left(\frac{k}{k-\xi} \right)^{\theta/\xi} \frac{k-\xi}{k-\xi+\theta}, \tag{37}$$

Comparing (22) with (37), we see that the move from autarky to free trade increases unemployment. Hence, we can summarise our results on welfare and unemployment effects as follows:

Proposition 3. *With positive variable transport costs and fixed market entry costs that are the same across all markets, opening up to international trade increases welfare as well as the rate of unemployment in the participating countries.*

For an intuition of these effects, consider first the limiting case of zero variable transports costs ($\tau = 1$). Each firm in this case sells equal shares of its output in all $n+1$ markets, and a movement from autarky to trade is equivalent to increasing the market size parameter in the closed economy to $(n+1)L$ and the fixed costs of production to $(n+1)f$. Applying the reasoning from the previous section we see that firms at the lower end of the productivity distribution are forced to close, thereby increasing the average productivity in the market. The effects of globalisation now follow immediately from proposition 2: per capita income increases and the unemployment rate remains unchanged.

Compared to this benchmark, positive variable transport costs lead to an additional effect on both per capita income and employment. On the one hand, they soften the selection process that leads to the increase in average productivity. In each country there is now a mixture of national firms and exporters ($\chi < 1$), and not every firm unable to cover fixed costs $(n+1)f$ has to leave the industry. The average productivity (and therefore per capita income) still increases as compared to autarky, but not by as much as it would in the absence of variable transport costs. On the other hand, positive variable transport costs lead to a fall in aggregate employment that is driven the decreasing employment for export production in all firms. This is trivially true for firms that cease exporting because of higher transport costs, but holds as well for those that continue exporting, as their destination-specific employment in export production falls from $l(\phi)$ to $\tau^{1-\sigma}l(\phi)$.

With the per capita income and employment effects at hand, we can now investigate how a movement from autarky to free trade affects wage payments. Let us first look at the wage of the average worker, which is given by $\bar{w} = \rho(Y/L)/(1-U)$. From proposition 3, we know that per capita income rises while the employment rate declines, so that $\bar{w}$ unambiguously increases. This outcome is consistent with empirical evidence which shows that export is typically associated with an increase of wages in OECD members and in many developing countries (see Fontagné and Mirza, 2002). However, there are also distributional consequences through changes in the wage dispersion. The wage differential between the worker receiving the average wage and the lowest paid worker can be derived in analogy to the autarky case. It is given by

$$\frac{\bar{w}}{w(\phi^*)} = \Gamma^{-1}\frac{k-\xi+\theta}{k-\xi} \tag{38}$$

Comparing $\bar{w}/w(\phi^*)$ with its autarky level in (25), we can summarise the wage effects in the following way:

Proposition 4. *With positive variable transport costs and fixed market entry costs that are the same across all markets, opening up to trade raises the average wage and widens the wage differential $\bar{w}/w(\phi^*)$ in all participating countries.*

This proposition gives new insights into the distributional consequences of trade liberalisation. While most of the existing theoretical studies investigate the effects on wages of one skill group relative to another one, our model emphasises the wage dispersion effects within education/skill groups (as all workers have the same individual characteristics). Complementary to the existing literature, the model points to the role of trade liberalisation as a candidate for explaining the observed increase of within-group wage inequality if productivity differences of firms paired with fairness preferences give rise to occupationspecific payments to labour. This effect is triggered by a change in the composition of firms that differ in their productivity levels.

To complete our discussion on the labour market effects of trade liberalisation, let us finally consider the role of unemployment benefits. Again, we assume that the unemployment payments are a constant share $\gamma \in (0,1)$ of the average wage, which are financed by a lump-sum tax on workers. This leads to fair wage specification ($5''$) and renders unemployment rate U and per capita income Y/L independent of the replacement ratio γ. As a consequence, the trade liberalisation effects in proposition 3 remain unaffected. This result challenges the often articulated concern that high unemployment benefits render a country more vulnerable to detrimental employment effects in the process of international market integration.

If workers earn a compensation when becoming unemployed, the average wage in the economy is given by $\bar{w} = \rho(Y/L)/[1-U(1-\gamma)]$. Furthermore, the wage differential in the open economy is determined by

$$\frac{\bar{w}}{w(\phi^*)} = \Gamma^{-1}\frac{k-\xi+\theta}{(k-\xi)}\frac{1-U}{1-U(1-\gamma)}. \qquad (38')$$

according to ($5''$) and (38). Since the introduction of the compensation system does neither affect per capita income nor the unemployment rate, it is straightforward, that the qualitative results in proposition 4 survive in the case of $\gamma > 0$.[13]

3.2 Marginal Trade Liberalisation

Comparing the two scenarios of autarky and (restricted) trade, as we have done in the previous section, is analytically convenient but clearly does not adequately reflect the globalisation experience of the past decades, which has arguably been a gradual process. In the last twenty years more and more countries have opened there borders for international

[13]Note that $(1-U)\Gamma^{-1}$ is unaffected by trade liberalisation, according to (35) and (36). Hence, the wage differential in ($38'$) unambiguously increases with U.

goods transactions and transport costs have fallen dramatically since World War II, leading some observers to proclaim the “death of distance” (Cairncross, 1997) to be imminent.

To gain insights into the development of unemployment and wage inequality during the process of globalisation, we analyze the comparative static effects of changes in transport costs τ and the number of trading partners n. As in the last section, we look at the fully symmetric case where $f_x = f$. This implies $\chi = \tau^{-k/(1-\theta)}$ with $\partial\chi/\partial\tau < 0$, and hence the proportion of firms that export increases with falling variable trading costs, as can be expected. Using this result, we find that a decrease in τ increases the average productivity $\tilde{\phi}_t$ (from (33)) and therefore per capita income (from (12)). The same equations can be used to see that average productivity and per capita income increase in the number of partner countries n. This result is not surprising, as trade liberalisation *per se* exhibits positive welfare effects. This positive effect is reinforced if more countries become economically integrated.

The effect of trade liberalisation in the form of either lowering τ or increasing n on unemployment and the wage differential are determined by their respective effects on Γ, as can be seen from (37) and (38). Partially differentiating (36), we find $\partial\Gamma/\partial n < 0$, and therefore an increase in the number of trading partners raises unemployment as well as the wage differential $\bar{w}/w(\phi^*)$. On the other hand, the effect of changes in variable transport costs on Γ is non-monotonous. This follows from the result established earlier that the employment level in an integrated world with zero variable transport costs ($\tau = 1$) is equal to the autarky situation (which follows if $\tau \to \infty$), while employment falls if one moves from autarky to trade with positive variable transport costs ($\tau > 1$). Differentiating (36) with respect to τ, we have

$$\text{sign}\left(\frac{\partial\Gamma}{\partial\tau}\right) = \text{sign}\left(\frac{k\left[\tau^{\theta/(1-\theta)} - 1\right]}{1 + n\chi} - \theta\right), \tag{39}$$

which allows us to identify a critical $\bar{\tau} > 1$, such that $\partial\Gamma/\partial\tau > 0$ if $\tau > \bar{\tau}$ and $\partial\Gamma/\partial\tau < 0$ if $\tau < \bar{\tau}$. Trade liberalisation in the form of a marginal reduction in variable transport costs increases (decreases) unemployment and wage inequality if τ is larger (smaller) than $\bar{\tau}$.

The results derived so far allow us to address an issue that has been of some concern recently (and perhaps not so recently as well) to many politicians as well as the popular press: the simultaneous occurrence of increasing profits and increasing unemployment in the face of globalisation. As a case in point, the *International Herald Tribune* remarks on 11 April 2005 that across wealthy nations "job creation stalled at a time when corporate profits are soaring." Is there a reason to believe that these two phenomena are related? Our framework suggests that the decline in transport costs could be a common cause for both phenomena, and indeed might in addition have contributed to the increase in wage inequality. Notably however, the opposite changes of employment and firm profits in our model are a phenomenon that disappears for low levels of transport costs. While further globalisation hence would have the potential for further increasing the profits of active firms, it should eventually, as the "death of distance" becomes a reality, lead to an increase in employment as well.

4 Heterogenous Market Entry Costs

We now check the robustness of our results by looking at the case where entry costs into domestic and export markets are different. There is no presumption as to which of these costs we should expect to be higher (which is what makes our benchmark case of $f_x = f$ interesting to begin with), and hence we will consider both $f_x > f$ and $f_x < f$. The analysis in this section is confined to deriving the effects of a movement from autarky to trade, i.e. an adaptation of the analysis in section 3.1 for the case of asymmetric market entry costs. Total profits of the average firm are now given by

$$\pi_t(\tilde{\phi}) = \frac{\xi f}{k - \xi} \left(1 + n\chi \frac{f_x}{f} \right) \tag{31'}$$

with $\chi = 1$ if $\tau^{\sigma-1} f_x \leq f$. The productivity differential $\tilde{\phi}_t/\tilde{\phi}_a$ determining the welfare effect of globalisation is now given by

$$\frac{\tilde{\phi}_t}{\tilde{\phi}_a} = \begin{cases} \left(\frac{1+n\tau^{1-\sigma}}{1+n}\right)^{1/\xi} \left(1 + n\frac{f_x}{f}\right)^{1/k} & \text{if} \quad \tau^{\sigma-1} f_x \leq f \\ \left(\frac{1+n\chi\frac{f_x}{f}}{1+n\chi}\right)^{1/\xi} \left(1 + n\chi\frac{f_x}{f}\right)^{1/k} & \text{if} \quad \tau^{\sigma-1} f_x > f \end{cases}, \tag{33'}$$

with the first term at the right-hand side of (33′) being equal to $\tilde{\phi}_t/\tilde{\phi}$ and the second term equalling ϕ^*/ϕ_a^* (or, equivalently, $\tilde{\phi}/\tilde{\phi}_a$). The effect of globalisation on aggregate employment is still determined solely by the sign of $\Gamma - 1$ (see (35) and (38)), where Γ is now given by[14]

$$\Gamma = \begin{cases} \left(\frac{1+n\tau^{1-\sigma}}{1+n}\right)^{\frac{\theta}{\xi}} & \text{if} \quad \tau^{\sigma-1} f_x \leq f \\ \left(\frac{1+n\chi\frac{f_x}{f}}{1+n\chi}\right)^{\frac{\theta}{\xi}} \frac{1+n\tau^{1-\sigma}\chi^{\frac{k-\xi+\theta}{k}}}{1+n\tau^{1-\sigma}\chi^{\frac{k-\xi}{k}}} & \text{if} \quad \tau^{\sigma-1} f_x > f \end{cases}. \tag{36'}$$

The first term on the right hand side in both lines of (36′) equals $(\tilde{\phi}_t/\tilde{\phi})^\theta$, and the second term in line two is smaller than or equal to one (as $\chi \leq 1$).

For simplicity, we start by looking at the effects of globalisation for the borderline case of zero fixed and variable transport costs ($f_x = 0$, $\tau = 1$). As mentioned before and confirmed by inspection of (33′) and (36′), goods market integration in this case leaves welfare and employment unchanged. Now, increasing τ leaves relative cutoff productivities ϕ^*/ϕ_a^* unchanged, but decreases $\tilde{\phi}_t/\tilde{\phi}$ due to the lost-in-transit effect. Overall, welfare and aggregate employment decrease. On the other hand, with $f_x > 0$ we have $\phi^*/\phi_a^* > 1$ and in addition $\tilde{\phi}_t/\tilde{\phi} > 1$ due to the export-selection effect once the partitioning threshold is reached. Overall, welfare increases. Employment remains unchanged below the partitioning threshold, as it only depends on $\tilde{\phi}_t/\tilde{\phi}$, but not on ϕ^*/ϕ_a^*. In the partitioning regime, the employment effect may be positive or negative, depending on the particular parameter constellation.

[14] See the derivation of (35) in the appendix as well as (29).

With both fixed and variable transport costs strictly positive, the effects just described interact, and the overall welfare and employment effects depend ceteris paribus on the relative size of these costs. Rather than go through an unwieldy catalogue of cases, we focus on some insights that can be gained directly from inspecting (33′) and (36′). Firstly, higher variable transport costs reduce welfare and employment if there is no partitioning of firms. Hence, there is a tendency of globalisation to exhibit detrimental welfare and employment effects if variable transport costs are high and foreign market entry costs are low. Secondly, $f_x > f$ is sufficient for positive welfare effects and necessary for positive employment effects of globalisation.[15] Thus, there is a tendency for trade liberalisation to be beneficial if foreign market entry costs are sufficiently high and there is partitioning of firms by their export status.

5 Concluding remarks

The role of globalisation for labour market performance has featured prominently in the economics debate for a long time. While the implications of trade liberalisation for the relative return of different skill groups and – to a lesser extent – the unemployment rate have been intensively debated in the recent past, its consequences for the wage inequality between workers of the same skill group have so far not been at the agenda of academic research. To fill this gap, we have introduced the idea of fair wage preferences into a general equilibrium model with heterogeneous firms, which differ in their productivity levels. This gives a theoretical framework in which within-group wage inequality and unemployment are co-determined by the interplay of the fairness preferences of workers and the heterogeneity of firms in their productivity levels.

[15]It is difficult to show positive employment effects of globalisation analytically. However, numerical simulation exercises indicate that such positive employment effects are possible if there is partitioning of firms by their export status.

The theoretical framework is used in the present paper to study the effects of international integration of goods markets on national labour markets. Noting from previous theoretical work that economic integration affects the productivity distribution of active producers, we have been particularly interested in how these changes translate into per capita income, unemployment and within-group wage inequality effects. Our analysis shows that the particular pattern of these effects depends on the fixed costs of foreign relative to domestic market entry. In the borderline case of entry costs being the same across all markets, there are gains from trade. However, the associated increase in per capita income goes hand in hand with higher unemployment and a higher wage dispersion. This indicates a distributional conflict national governments are confronted with in the process of globalisation. In an extension to our basic setting we allow for differences in the costs of domestic and foreign market entry. In this more general setting, two important results have been identified: If foreign market entry costs are sufficiently high, there are gains from trade and economic integration may reduce both within-group wage inequality and the unemployment rate. However, if foreign market entry costs are low, trade liberalisation may reduce per capita income. In this case, both within-group wage inequality and the unemployment rate definitely increase.

Even though the possibility of immiserizing trade effects is not entirely new, the economic mechanisms in this paper provide novel insights into the potential sources for these adverse consequences. In our framework partitioning of firms by their export status is necessary for positive employment effects and a decline in the within-group wage disversion. Put differently, economic integration can only be a “success story” if not all but only the most productive firms are active at an international basis.

Appendix

Proof of proposition 1

First, it follows from (12), that

$$\frac{d(Y/L)}{d\theta} = \frac{1}{Y/L}\left[\frac{1}{(1-\theta)^2}\ln\rho + \frac{1}{\tilde{\phi}}\frac{d\tilde{\phi}}{d\theta}\right]$$

which given that $\rho \in (0,1)$ is negative if $d\tilde{\phi}/d\theta < 0$. Substituting (19) into (16) and differentiating the respective expression with respect to θ we obtain

$$\frac{d\tilde{\phi}}{d\theta} = \left[\frac{\tilde{\phi}}{\xi}\Omega(k,\xi) + \frac{\tilde{\phi}}{\phi^*}\frac{d\phi^*}{d\xi}\right]\frac{d\xi}{d\theta},$$

with

$$\Omega(k,\xi) \equiv -\frac{1}{\xi}\ln\left(\frac{k}{k-\xi}\right) + \frac{1}{k-\xi}$$

To determine the sign of $\Omega(\cdot)$ we use

$$\frac{\partial\Omega(k,\xi)}{\partial k} = -\frac{\xi}{k(k-\xi)^2} < 0.$$

Together with $\lim_{k\to\infty}\Omega(k,\xi) = 0$, this implies that $\Omega(k,\xi) > 0$ for any $k \in (\xi,\infty)$. Noting further that $d\phi^*/d\xi > 0$ (from (19)) and $d\xi/d\theta = -(\sigma-1) < 0$, we have $d\tilde{\phi}/d\theta < 0$ and thus $d(Y/L)/d\theta < 0$.

Second, differentiating (22) with respect to θ gives

$$\frac{d(1-U)}{d\theta} = (1-U)\left\{\frac{1}{(1-\theta)^2}\left[\ln\rho + \frac{1}{\sigma-1}\ln\left(\frac{k}{k-(\sigma-1)(1-\theta)}\right)\right]\right.$$
$$\left. -\frac{1}{k-(\sigma-1)(1-\theta)}\left[\frac{\theta}{1-\theta} + \frac{k-(\sigma-1)}{k+1-\sigma(1-\theta)}\right]\right\},$$

which is negative if inequality (23) holds. Third, differentiating (25) with respect to θ gives

$$\frac{d(\bar{w}/w(\phi^*))}{d\theta} = \frac{k-(\sigma-1)}{(k-\xi)^2},$$

which is positive, as $k > (\sigma-1)$ has been assumed.

Derivation of eq. (16)

$$\begin{aligned}
\tilde{\phi} &= \left[\frac{1}{1-G(\phi^*)}\int_{\phi^*}^{\infty}\phi^{\xi}g(\phi)d\phi\right]^{1/\xi} \\
&= \left[\frac{1}{1-G(\phi^*)}\int_{\phi^*}^{\infty}\phi^{\xi}\frac{k}{\phi}\left(\frac{\bar{\phi}}{\phi}\right)^{k}d\phi\right]^{1/\xi} \\
&= \left[\frac{k\bar{\phi}^{k}}{1-G(\phi^*)}\int_{\phi^*}^{\infty}\phi^{\xi-k-1}d\phi\right]^{1/\xi} \\
&= \left[\frac{k\bar{\phi}^{k}}{1-G(\phi^*)}\left(\frac{1}{\xi-k}\phi^{\xi-k}\Big|_{\phi^*}^{\infty}\right)\right]^{1/\xi} \\
&= \left[\frac{k\bar{\phi}^{k}}{1-G(\phi^*)}\frac{1}{k-\xi}\left(\phi^*\right)^{\xi-k}\right]^{1/\xi} \\
&= \left[\frac{1}{1-G(\phi^*)}\left(\frac{\bar{\phi}}{\phi^*}\right)^{k}\frac{k}{k-\xi}\right]^{1/\xi}\phi^* \\
&= \left[\frac{k}{k-\xi}\right]^{1/\xi}\phi^*
\end{aligned}$$

Derivation of eq. (21)

$$\begin{aligned}
(1-U)L &= M\int_{\phi^*}^{\infty} l(\phi)\frac{k}{\phi}\left(\frac{\phi^*}{\phi}\right)^{k}d\phi \\
&= M\int_{\phi^*}^{\infty} l(\tilde{\phi})\left(\frac{\phi}{\tilde{\phi}}\right)^{\xi-\theta}\frac{k}{\phi}\left(\frac{\phi^*}{\phi}\right)^{k}d\phi \\
&= Ml(\tilde{\phi})\tilde{\phi}^{\theta-\xi}\left(\phi^*\right)^{k}k\int_{\phi^*}^{\infty}\phi^{\xi-\theta-k-1}d\phi \\
&= Ml(\tilde{\phi})\tilde{\phi}^{\theta-\xi}\left(\phi^*\right)^{k}k\left(\frac{1}{\xi-\theta-k}\phi^{\xi-\theta-k}\Big|_{\phi^*}^{\infty}\right) \\
&= Ml(\tilde{\phi})\tilde{\phi}^{\theta-\xi}\left(\phi^*\right)^{k}k\frac{\left(\phi^*\right)^{\xi-\theta-k}}{k-\xi+\theta} \\
&= Ml(\tilde{\phi})\left(\frac{\tilde{\phi}}{\phi^*}\right)^{\theta-\xi}\frac{k}{k-\xi+\theta}
\end{aligned}$$

$$= Ml(\tilde{\phi})\left(\frac{k}{k-\xi}\right)^{\frac{\theta-\xi}{\xi}}\frac{k}{k-\xi+\theta}$$

$$= Ml(\tilde{\phi})\left(\frac{k}{k-\xi}\right)^{\frac{\theta}{\xi}}\frac{k-\xi}{k-\xi+\theta}$$

$$= \frac{Y}{\tilde{\phi}}\left(\frac{k}{k-\xi}\right)^{\frac{\theta}{\xi}}\frac{k-\xi}{k-\xi+\theta}$$

Dividing both sides by L gives eq. (21).

Derivation of eq. (35)

$$\begin{aligned}
(1-U)L &= M\int_{\phi^*}^{\infty} l(\phi)\frac{k}{\phi}\left(\frac{\phi^*}{\phi}\right)^k d\phi + nM_x\int_{\phi_x^*}^{\infty} l_x(\phi)\frac{k}{\phi}\left(\frac{\phi_x^*}{\phi}\right)^k d\phi \\
&= M_t l(\tilde{\phi}_t)\tilde{\phi}_t^{\theta-\xi}k\left(\frac{(\phi^*)^k}{1+n\chi}\int_{\phi^*}^{\infty}\phi^{\xi-\theta-k-1}d\phi + \frac{\tau^{1-\sigma}n\chi\,(\phi_x^*)^k}{1+n\chi}\int_{\phi_x^*}^{\infty}\phi^{\xi-\theta-k-1}d\phi\right) \\
&= M_t l(\tilde{\phi}_t)\tilde{\phi}_t^{\theta-\xi}\frac{k}{k-\xi+\theta}\left(\frac{(\phi^*)^{\xi-\theta}+\tau^{1-\sigma}n\chi(\phi_x^*)^{\xi-\theta}}{1+n\chi}\right) \\
&= M_t l(\tilde{\phi}_t)\left(\frac{\tilde{\phi}_t}{\tilde{\phi}}\right)^{\theta-\xi}\left(\frac{\tilde{\phi}}{\phi^*}\right)^{\theta-\xi}\frac{k}{k-\xi+\theta}\left(\frac{1+\tau^{1-\sigma}n\chi\left(\frac{\phi^*}{\phi_x^*}\right)^{\theta-\xi}}{1+n\chi}\right) \\
&= M_t l(\tilde{\phi}_t)\left(\frac{k}{k-\xi}\right)^{\frac{\theta-\xi}{\xi}}\frac{k}{k-\xi+\theta}\left(\frac{\tilde{\phi}_t}{\tilde{\phi}}\right)^{\theta-\xi}\left(\frac{1+\tau^{1-\sigma}n\chi\left(\frac{\phi^*}{\phi_x^*}\right)^{\theta-\xi}}{1+n\chi}\right) \\
&= M_t l(\tilde{\phi}_t)\left(\frac{k}{k-\xi}\right)^{\frac{\theta}{\xi}}\frac{k-\xi}{k-\xi+\theta}\left(\frac{\tilde{\phi}_t}{\tilde{\phi}}\right)^{\theta-\xi}\left(\frac{1+\tau^{1-\sigma}n\chi\left(\frac{\phi^*}{\phi_x^*}\right)^{\theta-\xi}}{1+n\chi}\right) \\
&= \frac{Y}{\tilde{\phi}}\left(\frac{k}{k-\xi}\right)^{\frac{\theta}{\xi}}\frac{k-\xi}{k-\xi+\theta}\left(\frac{\tilde{\phi}_t}{\tilde{\phi}}\right)^{\theta-\xi}\left(\frac{1+\tau^{1-\sigma}n\chi\left(\frac{\phi^*}{\phi_x^*}\right)^{\theta-\xi}}{1+n\chi}\right)
\end{aligned}$$

Dividing both sides by L and using $\tilde{\phi}_t = \tilde{\phi}$ as well as $\phi_x^*/\phi^* = \tau^{1/(1-\theta)}$ (due to $f = f_x$) gives eq. (35).

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