Globalization effects on the natural rate of unemployment ⋆

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Abstract

Increasing integration of economic activities enforces large scale reallocations of labor between firms. This reallocation pressure requires necessarily an increase in the separation rate of jobs. While new jobs are created, reallocation can not achieved instantaneously if labor markets are characterized by frictions. I introduce hiring costs in a Melitz type model of international trade with non-permanent employment to show that an increase in export activities of firms leads to a temporary increase in the rate of unemployment in the economy. The increase in unemployment is due to labor reallocations and therefore driven more by the *change* in export activities than by its *level*. A permanent increase in export activities leads to a permanently higher rate of unemployment. Thus, globalization can have adverse effects on labor markets beyond the channels already discussed and empirically assessed.

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1 Introduction

In summer 2007, the Financial Times reported about a poll conducted by the newspaper in six developed countries (United Kingdom, France Italy, Germany, Spain, and the United States) asking people "Do you think globalization is having a positive or a negative effect in your country?". In all six countries, more people felt that the effect is negative than positive, in three countries (UK, Spain, France) by a margin of three to one. In Germany, the share of positive answers were highest (36%) but even there the negative answer predominated (42%). In all six countries there was a sizable share of people who were not sure about the sign of the effect (20-38%)(Giles 2007). The German Allensbach Institute for Public Opinion Surveys asked Germans what they associate with increasing integration of markets. 78% answered job exports, 61% job cuts, and 54% the erosion of the safety net (Ludowig (2008)). Referring to such polls, the OECD sees Chapter 3 of its 2007 Employment Outlook partly as "reality check against possibly exaggerated fears about how globalization is affecting OECD labor markets" and the public perception as "useful reality check for economic research and policy making" (OECD 2007: 106-107).

Globalization has been suspected to create labor market effects such as the increasing skill premium, diverging unemployment rates of skilled and unskilled workers, stagnating average wages in continental Europe, and shorter duration times in jobs for quite a while now. In accordance with the economic literature, the OECD finds that international economic integration has coincided with overall improvements in employment and unemployment rates but also with rising earnings inequality and a decline of the wage share of national incomes in large OECD countries (OECD 2007: 107).

Hence, it seems as if the "reality check against possibly exaggerated fears about globalization" has proved them exaggerated. The overall assessment is that "*trade deepening... is a potentially important source of vulnerability for workers.* However, the actual impacts appear to have been quite modest to date." (OECD (2007: 108)). Thus, if "popular concerns about how foreign competition is affecting workers deserve to be taken seriously" (OECD (2007): 142), the "reality check for economic research" might also be needed.

Globalization induces factor reallocation between and within sectors towards more productive uses. These reallocations are not costless. Introducing adjustment costs, here hiring costs, in a general equilibrium model uncovers an additional so far undiscussed effect of globalization on the labor markets: globalization induced increase in the natural rate of unemployment because of sluggish labor market adjustment. In a world with non-permanent employment and cost of finding a new job, labor market equilibrium is characterized by unemployment. This unemployment is natural in the sense that it is outcome of a general equilibrium model (Hall 1979). If, as argued, globalization has increased the dynamics of the economy by increasing market entry and exit, and reallocation of labor among continuing firms, it might have contributed to an increasing natural rate of unemployment. With increased dynamics, more workers seek jobs and more firms search for workers at any time, because more workers are separated from their jobs in every period.

In the model, the labor market is characterized by flows out of unemployment and flows into unemployment in every period. The equilibrium natural rate of unemployment is reached if the flow out of unemployment equals the flow into unemployment. The level of unemployment equalizes both flows because the a firm's probability of finding a worker increases in the number of job seekers to chose from. The number of workers separated from their jobs, in contrast, is unaffected by the number of unemployed. Globalization increases reallocations of jobs and thereby the separation rate. Thus, unemployment must rise to equate flows out of employment and flows into employment. The higher unemployment rate is limited to globalization periods, which are off a long-run stationary general equilibrium. The higher unemployment rate in this model does not result from the high level of trade but from its change. If integration does not increase further, the need for reallocation falls and the separation rate drops. The unemployment rate falls to about the pre-globalization level. Equilibrium unemployment rate before and after globalization does not differ significantly.

Results for the stationary long-run equilibrium are in line with results by Felbermayr *et al.* (2007) who, using a similar approach, find that trade liberalization lowers unemployment and raises wages as long as it improves aggregate productivity net of transport costs. However, the average gains might not come without distributional conflicts. Using a Melitz type model with fair wage preferences, Egger and Kreikemeier (2008) find a simultaneous increase of average profits and involuntary unemployment as well as a surge in within-group wage inequality. Thus, economic integration might have also adverse long-run labor market and distributional effects. I focus in this paper on negative effects that stem from the reallocation of production. They are caused by the globalization *process* which is an off-stationary long-run equilibrium phenomenon.

The analysis builds on the Melitz (2003) model which features trade induced worker reallocation between heterogenous firms. The fully flexible economy in autarky is sketched in Section 2. In Section 3, I give some more structure to the labor market. Worker and firms form only temporary relationships. Some of these are ended at every period, and new relationships are formed. If these changes are frictionless a perfect competitive labor market results. Yet, with search costs, firms reduce employment at any wage level. Unemployment arises. Equilibrium unemployment is determined by the finding rate, which is driven by search costs. In section 4, I open the closed economy with search costs to trade. In equilibrium, the unemployment rate in the open economy does not differ much from its level in autarky. I analyze globalization in Section 5. Globalization is modeled as *increasing* integration through international trade which is induced by *falling* distance costs. Changing distance costs incudes workers reallocation which substantially raise the separation rate while the finding rate in unaffected. Consequently, unemployment jumps up. If the fall in distance cost is a one-time shock, the economy settles at the long-run equilibrium described in Section 4 and unemployment levels off at equilibrium level. If the fall in distance costs is permanent, the economy is in a non-stationary state with changing firm distribution and permanently higher unemployment. I summaries my results and conclude in Section 6.

2 A fully flexible economy in autarky

In this section, I follows Melitz (2003) in modeling the long-run equilibrium of an economy. The equilibrium is characterized by continuous entry and exit of firms. I briefly present the autarky Melitz model. Labor is the only factor of production. It is used in heterogeneous firms to produce a continuum of differentiated goods. The firms engage in monopolistic competition choosing freely entry and exit.

2.1 Consumption

Consumer spend all of their income on consumption. Their preferences are described by the utility function given in (1).

$$\Upsilon = \left[\int_k x_k^{(\sigma-1)/\sigma} dk \right]^{\sigma/(\sigma-1)} \tag{1}$$

x_k is the consumption by an individual of a single variety produced by firm k. The elasticity of substitution σ is the same for any pair of product and larger than one.

Utility maximization of the representative consumer yields the demand for any variety as given in (2).

$$x_k = (p_k)^{-\sigma} Y P^{\sigma-1} \tag{2}$$

p_k denotes the consumer price of good k. Demand for good k decreases in its own price p_k. Note that demand is firm specific because prices are firms specific. Demand for each gook increases in the income Y. Finally, demand decreases in the price index P. The price index is dual to the utility representation and can be expressed as

$$P = \left[\int_k (p_k)^{1-\sigma} dk \right]^{1/(1-\sigma)} \tag{3}$$

2.2 Production

Firms have different level of productivity that they draw at entry from a common distribution $g(\omega)$. Differences in productivity translate into different marginal costs, different prices and different quantities for each firm k. I denote the marginal costs of a firm k by c_k and the productivity level as ω_k. Firms' profit maximization yields a fixed markup over the marginal costs c_k which equals $\rho = (\sigma - 1)/\sigma$. Thus, the price of firm k is given by $p_k = c_k/\rho$. Marginal costs c_k are affected by productivity ω_k and wages w, since labor is the only factor of production. I normalize wages to one, thus $c_k = 1/\omega_k$.

Production also involves fixed costs f_p. The existence of fixed costs of production separates firms in those that supply customers and those that do not. Firms' variable profits must at least cover their fixed costs of production f_p to survive in the market. Firms with lower productivity quit as soon as they learn that their productivity ω_k, that they have drawn at market entry, is not high enough to generate positive profits. In (4) I give the minimum productivity necessary to survive in the domestic market ω^*.

$$(\omega^*)^{\sigma-1} \frac{Y}{\sigma P^{1-\sigma} \rho^{1-\sigma}} = f_p \tag{4}$$

All firms with productivity draws lower than ω^* quit. Firms with higher productivity chose their optimal price and output with respect to their firm-specific productivity ω_k.

Firm-specific productivity increases profits π_k. Variable profits are a fixed share of $1/\sigma$ of firms revenues $p_k x_k$. Profits π_k additionally depend on fixed costs of production f_p. They are given by

$$\pi_k = 1/\sigma \left(\frac{1}{\omega_k \rho} \right)^{1-\sigma} P^{\sigma-1} Y - f_p \tag{5}$$

Using the minimum productivity condition (4), profits (5) can also be written in terms of minimum productivity as $\pi_k = \left[(\frac{\omega_k}{\omega^*})^{\sigma-1} - 1 \right] f_p$. Melitz (2003) shows that the average productivity level $\bar{\omega}$ is completely determined by the minimum productivity level ω^*. Average productivity is given by

$$\bar{\omega}(\omega^*) = \left[\frac{1}{1 - G(\omega^*)} \int_{\omega^*}^{\infty} \omega^{\sigma-1} g(\omega) d\omega \right]^{1/(\sigma-1)},$$

where $G(\omega)$ denote the cumulative distribution function. Average profits $\bar{\pi}$ can than be written as function of the minimum productivity ω^* as

$$\bar{\pi} = \left[\left(\frac{\bar{\omega}(\omega^*)}{\omega^*} \right)^{\sigma-1} - 1 \right] f_P \tag{6}$$

2.3 Continuous Market Entry and Exit

In every period, some entering firms quit because their drawn productivity is too low to survive in the market. Yet, there is a second group of firms that quit in every period. This group comprises of firms that are hit by a random shock. This purely random shocks occurs with the probability δ. It hits firms independent of their productivity level. Thus, in every period there is market exit of formerly active firms.

Firms' exit reduces competition and increases the profits of all firms in the market. These profit opportunities lure new entrants to enter. Since these new entrants do not know their productivity in advance they base their entering decision on their profit expectations. Thereby they take the possibility of failure into account. Their expected profits weight average profits $\bar{\pi}$ in the market by the probability $1 - G(\omega^*)$ to draw a productivity higher than the minimum productivity. Potential entrants enter the market if the value of a potential home firm V in (7) exceeds zero. The value of the firm is given in (7) as sum of the discounted expected profits minus the fixed costs of entry.

$$V = \frac{[1 - G(\omega^*)]\bar{\pi}}{\delta} - f_e \tag{7}$$

Only firms active in the market can generate profits. Average profits must therefore weighted by the probability that firm's productivity is high enough to survive in the market. That probability is $1 - G(\omega^*)$. There is a second discount factor: $1/\delta$. With δ being the probability to be hit by the exogenous death shock, $1/\delta$ is the "life expectancy" of a firm. The higher is δ, the lower is the value of the firm, since the fixed costs of entry are split among less periods. All, else equal, the higher δ the higher must be the expected profits $\bar{\pi}$ for constant entry costs f_e.

2.4 Market equilibrium

The economy is a stationary long-run equilibrium if the number and distribution of firms remains constant, all goods and factor markets are cleared, neither consumers nor firms or workers can improve their situation, and trade is balanced. I look at the stationary firm distribution first. For the firms distribution to be stationary, entry must equal exit. That is sufficient, since exit and entry are random draws from the same distribution $g(\omega)$. Thus, a stationary distribution is guaranteed if $M\delta = 1 - G(\omega^*)M_e$. The number of firms trying to enter the market M_e is proportional to the number of existing firms in the market M. Free market entry and exit drives the ex-ante value of the firms to zero. The free entry condition (7) and the average profit condition (6) jointly determine the minimum productivity ω^* and the average profits $\bar{\pi}$ in equilibrium.

Second, goods market clearance requires that aggregate revenue equals aggregate income, since income is only used for consumption. Aggregate income is the sum of labor income and profits of the firms. Since the ex-ante value of entry is zero, fixed costs of entry equal average profits in the market. Thus, there are no profits in long-run equilibrium and labor income L equals total income Y, total aggregate expenditure and total revenues R. With exogenously given labor supply L total income Y is also exogenously given.

Third, the labor market is cleared. Aggregate labor demand E equals labor supply L which equals the number of individuals in the economy. Labor demand for production is firm specific, derived from the output decision of firms and given in (8) by

$$E_k = \omega_k^{\sigma-1} \rho^\sigma P^{\sigma-1} Y + f_p \tag{8}$$

Yet, labor is not only required for production but also for market entry, regardless whether successful or not. Thus aggregate labor demand is given by $\int_{\omega^*}^{\infty} E_k dk + M_e f_e$ which adds up to the exogenously given labor supply L. Thus, labor supply L equals labor demand for production E_p plus labor demand for market entry $E_e = M_e f_e$ in every period. The wage w is flexible and there are no other frictions. That ensures that the labor market is always equalized.

The mass of firms M producing in any period is determined by the ratio of aggregate revenue over average revenue.

$$M = \frac{R}{\bar{r}} = \frac{L}{\sigma(\bar{\pi} + f_p)} \tag{9}$$

The general equilibrium in every period is the simultaneous solution to five equilibrium conditions: the price index resulting from consumers optimization, firms' pricing rule, free entry, labor markets equilibrium, and the income equation. The equilibrium can be expressed as vector of five variables $\{P, p_k, \omega^*, w, Y\}$.

3 Introducing recruitment costs

Having described a no friction, full employment economy in a general equilibrium with continuous entry and exit, in this section I introduce recruitment costs as in Hall (1979). Hall argued that introducing recruiting costs in a Walrasian model results in a general equilibrium model with equilibrium unemployment. Referring to Friedman (1968), Hall called this the natural rate of unemployment. If recruitment costs exist, firms do not extend their job offers as much as in a world of costless recruiting. Hence, not all job seekers find a job. Unemployment results, which is equilibrium outcome because it is optimal for the firms neither to post more job offers nor to reduce their wage offers.

Following Hall (1979), I assume that jobs are filled as soon as they are open. Job seekers accept the first offer, because all firms pay the same wage in equilibrium. That is the result of the assumption that jobs and workers are homogenous. In aggregate, firms offer J jobs to U unemployed job seekers. The probability that a particular worker receives a particular offer is $1/U$, since with homogenous workers job are offered randomly. The probability that a particular worker does not receive any of the J offers is $(1-1/U)^J$ which is the counter probability of finding a job $1-\phi$. Thus,

$$1-\phi = (1-1/U)^J = \left[(1-1/U)^{-U}\right]^{-J/U} \tag{10}$$

For large number of U, the term in square brackets approaches e. The job finding rate ϕ can therefore be written as

$$\phi = 1 - e^{-J/U} \tag{11}$$

The job finding rate approaches one if the number of offers J is very large relative to the number of job seekers U. In contrast, if J is small relative to U, the job finding rate is low. For as many offers as job seekers $J/U = 1$, the job finding rate ϕ is 0.63. An offer-job seeker-ratio of three $J/U = 3$ implies a finding rate of 0.95.

Because job offers are random, job seekers may receive more than one offer and employees must make more offers than they have positions to fill. Uf of the J offers made are accepted. The number of offers needed to yield the expectation of one acceptance is denoted by ι with $\iota(\phi) = J/U\phi$. The ratio J/U can be expressed in ϕ as $J/U = -ln(1-\phi)$. Hence, $\iota(\phi)$ is then given by $\iota(\phi) = -ln(1-\phi)/\phi$. ι increases in the finding rate ϕ. For large ϕ the number of offers needed to yield the expectation of one acceptance can be large. For instance, if the finding rate is at 90%, 2.6 offers are needed for the expectation of one acceptance.

3.1 Costly recruitment

I assume that firms set wages. A job seeker accepts the offers he receives. If a job seeker h receives more than one offer, he decides which offer to accept based on the relative wage w_r and on a random component ϵ_h which might include employer differences such as location, sector or reputation. I assume that a job seeker receiving two offers chooses the one with the higher wage with a higher probability. Yet, this probability is below one, because of the random component ϵ_h.

To see that all firms pay the same wage w in equilibrium, denote the wage firm k sets by w_k. Firm k's wage can be written in terms of a relative wage $w_r = w_k/w$ and the general wage level w, i.e. $w_k = w_r w$. Suppose also hiring is costly. Assume each job offer costs the firm ξw_k, where ξ is a fraction of a period's wage w_k. To fill one position $\iota_k(\phi, w_r)$ offers must be made. The number of necessary job offers of firm k does not only depend on ϕ as discussed above but also on the relative wage w_r firm k offers. The likelihood that a job seeker who receives more than one offer accepts the offer of firm k rather than the offer by another firm increases in the relative wage w_r. Thus, setting a relative price above one reduces the number of offers a firm must post to yield the expectation of one acceptance $\iota_k(\phi, w_r)$, i.e. $\partial\iota_k/\partial w_r < 0$. Firms variable profit function *per worker employed* in production (without fixed costs) is then given by

$$\frac{\pi_k}{E_k^v} = \frac{1-\rho}{\rho} w_k - \xi\iota_k w_k \tag{12}$$

where $E_k^v = E_k - f_p$ denotes labor used by firm k less the labor related to the fixed costs. Fixed input requirements are produced with the same productivity by all firms. Variable profits per employee as given in (12) depend on the wage $w_k = w_r w$ a firm offers, on the costs of recruitment ξ, and on the number of offers yielding the expectation of one acceptance ι_k. Profits per employee are unaffected by firm specific productivity. While setting the relative wage w_r above one decreases the number of needed job offers ι_k, it increases the costs of all employed workers by raising their wage. Thus, firm k choose the relative wage w_r that maximizes profits per employee.

$$\begin{aligned} \frac{\partial\pi_k/E_k^v}{\partial w_r} &= \left(\frac{1-\rho}{\rho} - \xi\iota_k - \xi\frac{\partial\iota_k}{\partial w_r} w_r\right) w \\ &= \left(\frac{1-\rho}{\rho} - \xi\iota_k(1-\eta)\right) w = 0, \end{aligned} \tag{13}$$

where $\eta = -\frac{\partial\iota_k}{\partial w_r}\frac{w_r}{\iota_k}$ is the elasticity of acceptance with respect to the relative wage w_r. I assume that the elasticity η is smaller one which requires that the random job seeker specific component ϵ_h is not too small. With η smaller one firms can not reduce overall recruitment costs by raising their wages. The first equation can be solved for the relative wage w_r which yields a positive term.

Since in equilibrium (13) must hold for all firms, the relative wage w_r must be the same for all firms. Thus, $w_r = 1$. If all firms set the same wages in equilibrium $w_k = w$, the number of offered jobs ι depends only on the job finding rate ϕ in the economy $\iota = \iota(\phi)$. Since all firms set the same wage w, I normalize the wage to one $w = 1$ and use labor again as numeraire.

The second equation in (13) equates marginal variable profits and marginal recruitment costs per employee. Recruitment costs per employee $(1-\eta)\xi\iota$ are lower than recruitment costs per employee $\xi\iota$ that must be paid to have the expectation of one to fill an open position. Hence, each vacancy is likely to be unfilled and in total not all open positions are filled. Employment in firm k E_k is smaller than without recruitment costs, because it is too expensive to fill all positions. Or, put differently, firms exceed employment until the higher marginal profits per employee $\frac{1-\rho}{\rho(1-\eta)}$ equals actual hiring costs pere employee $\xi\iota$. These per employee profits $\frac{1-\rho}{\rho(1-\eta)}$ can be translated into per output unit price-cost difference $p_k - c_k$, which is given by $\frac{(1-\rho)(1+\xi\iota)w}{\rho(1-\eta)\omega_k}$. The resulting mark-up $\frac{p_k}{c_k} = \frac{1-\rho\eta}{\rho(1-\eta)}$ is larger $1/\rho$ and independent from productivity. Thus, firms charge higher mark-ups than in equilibrium without hiring costs. Consequently, their output is smaller and so is their employment. Firm k's employment level in production (without fixed costs of production) is derived from its output level and given by

$$E_k^{rc} = \left[\frac{1-\rho\eta}{\rho(1-\eta)}(1+\xi\iota)\right]^{-\sigma} \omega_k^{\sigma-1} P^{\sigma-1} Y \tag{14}$$

Employment in production of every active firm is lower in equilibrium with recruitment costs than in equilibrium without. That reduces the revenues and the profits, and affects market entry and exit.

3.2 Price setting, entry and exit

Firms set their prices $\frac{1-\rho\eta}{\rho(1-\eta)}$ above marginal costs. Marginal costs increase by $\xi\iota$ relative to the model set up in Section 2, because recruitment is costly. That increases prices and therefore reduces output and revenues. Additionally, fixed costs of production f_p increase by $\xi\iota$. The additional costs affect all firms active in the market and decrease their profits relative to their profits without recruitment costs.

$$\pi_k = \frac{(1-\rho)(1+\xi\iota)}{\rho(1-\eta)\omega_k}\left(\frac{(1+\xi\iota)(1-\rho\eta)}{\rho(1-\eta)\omega_k}\right)^{-\sigma} P^{\sigma-1}Y - f_p(1+\xi\iota) \qquad (15)$$
$$= (1-\rho)(1-\rho\eta)^{-\sigma}\left(\frac{(1+\xi\iota)}{\rho(1-\eta)\omega_k}\right)^{1-\sigma} P^{\sigma-1}Y - f_p(1+\xi\iota)$$

Profits π_k of firm k fall in recruitment costs ξ. For very low costs $\xi \to 0$, profits approach profits given in (5) in Section 2. As above, I express profits also as function of the minimum productivity in the market $\pi(\omega^{rc}) = \frac{(1-\rho)(1+\xi\iota)}{\rho(1-\eta)\omega_{rc}}\left(\frac{(1-\rho\eta)(1+\xi\iota)}{\rho(1-\eta)\omega^{rc}}\right)^{\sigma} YP^{\sigma-1} - f_p(1+\xi\iota) = 0$. Using this equation the minimum productivity ω^{rc} necessary to survive in the market can be expressed as $\omega^{rc} = \frac{1+\xi\iota}{\rho(1-\eta)P}\left[\frac{f_p(1+\xi\iota)}{Y(1-\rho)(1-\rho\eta)^{-\sigma}}\right]^{1/(\sigma-1)}$. Profits of the average firm $\bar{\pi}^{rc}$ as function of the minimum productivity are then given by

$$\bar{\pi}^{rc} = \left[\left(\frac{\bar{\omega}(\omega^{rc})}{\omega^{rc}}\right)^{\sigma-1} - 1\right] f_p(1+\xi\iota). \qquad (16)$$

$\bar{\pi}^{rc}$ is larger than $\bar{\pi}$ derived in (6) for every minimum productivity level. Thus, the same average profits require only a smaller minimum productivity in the recruitment costs equilibrium.

Free entry condition (7) also changes because recruitment of labor needed for market entry is also costly.

$$V^{rc} = \frac{[1-G(\omega^{rc})]\bar{\pi}^{rc}}{\delta} - f_e(1+\xi\iota) \qquad (17)$$

Firms enter as long as the expected profits are positive. In equilibrium, the expected profits are zero. The negative term in (17) is larger than in (7). Thus, the positive terms must also be larger than in the free entry condition without recruitment costs. Since δ is constant, the product of the probability to survive in the market $1 - G(\omega^{rc})$ and average profits $\bar{\pi}^{rc}$ must be larger. As argued above, higher ex ante average profits requires not necessarily a higher minimum productivity ω^{rc}. The minimum productivity level ω^{rc} can be higher, lower or the same as in the no recruitment costs equilibrium.

3.3 Market equilibrium

The economy is in a stationary long-run equilibrium if the number and distribution of firms remains constant, all goods and factor markets are cleared, and neither consumers nor firms or workers can improve their situation. We look at the stationary firm distribution first. For the firms distribution to be stationary, entry must equal exit. That is sufficient, since exit and entry are random draws from the same distribution $g(\omega)$. Thus, a stationary distribution is guaranteed if $M_{rc}\delta = (1 - G(\omega^{rc}))M_e^{rc}$. The number of firms successfully entering the market M_e^{rc} is then proportional to the number of existing firms in the market M_{rc}. Free market entry and exit drives the ex-ante value of the firms to zero.

Second, goods market clearance requires that aggregate revenue equals aggregate labor income, since aggregate profits are zero and income is only used for consumption. Aggregate revenues are lower than in equilibrium without recruitment costs, because employment E_{rc} is lower than in the full employment equilibrium without recruitment costs, i.e. $E_{rc} < L$. That is because firms do not use all resources in the economy. Costly recruiting yields firm's decision to fill open positions with a probability less than one.

Aggregated revenues R_{rc} are given in (18).

$$R_{rc} = \int_{\omega^{rc}}^{\infty} \left(\frac{1-\rho\eta}{\rho(1-\eta)} \frac{1+\xi\iota}{\omega} \right)^{1-\sigma} g(\omega) d\omega Y P^{\sigma-1} \tag{18}$$

Aggregate revenues R_{rc} fall with the minimum productivity level ω^{rc} and with lower employment due to recruitment costs. Thus in equilibrium with recruitment costs, aggregate income Y_{rc} is also lower than in equilibrium without recruitment costs. Aggregate income is the sum of labor income and profits of the firms. Since ex-ante value of the firm is zero, fixed costs of entry $f_e(1+\xi\iota)$ equal ex-ante profits in the market $\bar{\pi}^{rc}$ weighted by the probability of drawing a productivity lower than the minimum productivity ω^{rc} and the shock occurring with probability δ. Thus, there are no profits in long-run equilibrium and labor income E_{rc} equals total income Y_{rc}, total aggregate expenditure and total revenues R_{rc}.

Third, the mass of firms in equilibrium with recruitment costs is lower than in equilibrium without these costs. With higher average revenues $\bar{r}_{rc}$ of the active firm, which follows from higher average profits $\bar{\pi}_{rc}$ and higher fixed costs, and lower aggregate revenues R_{rc} there are fewer firms in equilibrium. Recall that the mass of firms is just the ratio of total revenues over the revenues of the average firm, $R_{rc}/\bar{r}_{rc}$. The mass of firms in equilibrium with recruitment costs changes to (19)

$$M_{rc} = \frac{R_{rc}}{\bar{r}_{rc}} \tag{19}$$

The smaller mass of firms M_{rc} results from a higher minimum productivity ω^{rc} necessary to survive in the market. Consequently, the price level P_{rc} is higher than in the benchmark scenario without recruitment costs. The reason is that less firms are active in the market which decreases the degree of competition and leaves more variable profits to all active firms. Yet, these higher variable profits are needed to cover the higher fixed costs that occur because hiring is costly.

Finally, for a general equilibrium to hold, the labor market must be equalized. To the equilibrium on the labor market, I turn in the next subsection.

3.4 Equilibrium level of unemployment

At the beginning of a period workers who have been dismissed from their previous jobs join the job seekers who did not find a position in the last period. Dismissed workers are those who quit or are dismissed from continuing firms, and those who's firms quit because of the exogenous shock or because their productivity was not high enough to survive. There is a fraction s of the E employed workers that are separated from their jobs each period. Firms announce their vacancies and offer jobs to the job seekers. $U\phi$ successful job seekers fill the open positions. The remaining $U(1-\phi)$ workers are unemployed for this period. Thus, there are $(1-\phi)U$ job seekers who do not find a position which are in the next period joined by the sE_{rc} worker who are separated from their jobs at the beginning of the next period.

The fraction of workers that quit or are dismissed from *continuing firms* $\bar{s}$ is exogenous. The number of workers that are dismissed because their firms quit compose of two groups. There are first the workers who have been employed in the firms hit by the random shock. These are $\delta M_{rc}\bar{E}_{rc}$, where $\bar{E}_{rc}$ the number of workers employed in the average firm. There are second the workers employed in firms, that had to leave the market because their productivity was not sufficient to prevail in competition. These are $E_e G(\omega^{rc}) M_e^{rc} = f_e(1 + \xi\iota) G(\omega^{rc}) \frac{\delta M_{rc}}{1-G(\omega^{rc})}$ workers. Thus, the number of workers loosing their jobs sE_{rc} is given by $sE_{rc} = \bar{s}(1-\delta)\bar{E}_{rc}M_{rc} + \delta\bar{E}_{rc}M_{rc} + f_e(1+\xi\iota)G(\omega^{rc})\frac{\delta M_{rc}}{1-G(\omega^{rc})}$. The separation rate s is given by

$$
\begin{aligned}
s &= \left[\frac{1-\delta}{\delta}\bar{s}\bar{E}_{rc} + \bar{E}_{rc} + f_e(1+\xi\iota)\frac{G(\omega^{rc})}{(1-G(\omega^{rc}))}\right]\frac{\delta M_{rc}}{E_{rc}} \\
&= \frac{(\bar{s}/\delta + 1 - \bar{s})\bar{E}_{rc} + f_e(1+\xi\iota)\frac{G(\omega^{rc})}{1-G(\omega^{rc})}}{\bar{E}_{rc}/\delta + f_e(1+\xi\iota)}
\end{aligned} \tag{20}
$$

The separation rate s is mainly determined by the exogenous job specific separation rate $\bar{s}$, the exogenous firm death rate δ, and the endogenous minimum productivity level ω^{rc}.

The evolution of mean unemployment is given by the difference of the flow into unemployment and the flow out of unemployment

$$
\dot{u} = sE - \phi U. \tag{21}
$$

In stationary equilibrium, the rate of unemployment must be constant, i.e. $\dot{u} = 0$. Thus, the flow out of employment sE must equal the flow into employment ϕU. Hence, $sE = \phi U$. Using this condition, the unemployment rate $u = (1-\phi)U/L = (1-\phi)U/(E+(1-\phi)U)$ in equilibrium can be expressed in the job finding rate ϕ, and the separation rate s.

$$
u = \frac{(1-\phi)U}{\phi U/s + (1-\phi)U} = \frac{s}{s+\phi/(1-\phi)} \tag{22}
$$

The second equation in (13) uniquely determines the job finding rate ϕ in the economy. $\frac{1-\rho}{\rho} = \xi\iota(1-\eta)$ is solved for just one finding rate ϕ. The finding rate ϕ is positively correlated with ι. Thus, ϕ falls in the recruitment costs ξ and rises in the elasticity of acceptance η. If search costs ξ approach zero, ι approaches infinity and the finding rate ϕ approaches one. The equilibrium unemployment rate u falls in the finding rate ϕ, $\frac{\partial u}{\partial \phi} = -\frac{s}{(s+\phi/(1-\phi))^2} < 0$, and rises in the separation rate s, $\frac{\partial u}{\partial s} = \frac{\phi/(1-\phi)}{[s+\phi/(1-\phi)]^2} > 0$. The separation rate s is a positive function of the exogenous death rate δ and the minimum productivity ω^{rc}.

4 The natural rate of unemployment in an open economy

Long-run equilibrium unemployment arises in this model, because recruitment costs prevent complete adjustment. Firms do not post as many offer as necessary to fill a vacancy with the expectation value of one, because making a job offer is costly. Hence, not all workers can find a new job within the period.

In such a setting, the degree of unemployment depends on the degree of adjustment in the business sector. Low need for adjustment, here a low separation rate, results in a lower rate of unemployment. The separation rate, in turn, depends on the exogenous death rate δ and the minimum productivity ω^{rc}. Let's assume that the exogenous death rate δ is not affected by foreign trade. The minimum productivity, in contrast, is endogenous and therefore determined in general equilibrium.

In this section, I show that the equilibrium unemployment rate is higher in an open economy. International trade raises the minimum productivity necessary to survive in the market (Melitz (2003). The separation rate s increases causing unemployment to rise. To show this, I extent the autarky framework from above to a framework with two symmetric countries, Home H and Foreign F that engage in international trade in differentiated varieties.

4.1 Domestic and exporting firms

The following analysis requires a two country model. I assume the foreign country to be identical to the home country H, thus the description of the autarky equilibrium applies also to the foreign country. Opening the economy in autarky to trade gives firms the additional opportunity to export their goods to the foreign market F. These exports involve variable iceberg transport costs τ and fixed costs f_x. The existence of fixed costs of exporting separates firms in two groups: those that supply customers in the foreign market and those that do not. Sales in the foreign market are firm-specific because goods differ in their price. Moreover, export sales are always lower than sales at home because distance costs raise the consumer price in the foreign market. Yet, lower sales translates into lower variable profits, because variable profits are, given this market structure, a fixed fraction of sales. If variable profits in the export market are large enough to cover the fixed costs of exporting, firms export. If not they supply only their domestic market. Thus, firms self-select into export activities. This self-selection depends on firm level on firm's productivity ω. More productive firms, which have larger sales, export while less productive firms produce only for the domestic market. Using the reasoning that the least productive exporting firm just breaks even in the foreign market, we can derive the minimum productivity necessary to export ω^x to the foreign country.

$$\omega_H^x = \frac{1+\xi\iota}{\rho(1-\eta)P_F}\left[\frac{f_x(1+\xi\iota)\tau_{HF}^{\sigma}}{Y_F(1-\rho)(1-\rho\eta)^{-\sigma}}\right]^{1/(\sigma-1)} \tag{23}$$

Given the symmetry assumed here, consumer in the home country can also choose goods that are produced in the foreign country F and exported to H. Hence, their consumption bundle in (1) and their price index (3) now include also goods produced in the foreign country F.

Exporters additionally generate profits in the foreign market. These profits depend on foreign market characteristics, i.e. market size Y_F and the price index P_F, on distance costs τ_{HF} and on the fixed costs of exporting $f_x(1+\xi\iota)$. Profits from exports are given in (24).

$$\pi_{kF} = \frac{(1-\rho)(1+\xi\iota)}{\rho(1-\eta)\omega_k}\left(\frac{(1-\rho\eta)\tau_{HF}(1+\xi\iota)}{\rho(1-\eta)\omega_k}\right)^{-\sigma} P_F^{\sigma-1}Y_F - f_{Ex}(1+\xi\iota) \tag{24}$$

The additional profits from the foreign market and the increased competition on the home goods and factor markets alter the average profits of active firms in H. These now include profits from the foreign market weighted by the probability to export to the foreign market.

$$\bar{\pi}_{gl} = \frac{1}{M_H}\int_{\omega^{gl}}^{\infty} \pi_{kH} g(\omega_k) dk + \frac{(1 - G(\omega^x))}{M_H}\int_{\omega^x}^{\infty} \pi_{kF} g(\omega) dk \tag{25}$$

Export profits (24) and average profits of home firms (25) are functions of the minimum productivity ω^{gl} of active firms in the open economy trade equilibrium. They can be written as $\pi_{kF} = [(\omega_k/\omega^x)^{\sigma-1} - 1]f_x(1 + \xi\iota)$ and $\bar{\pi}_{gl} = [(\bar{\omega}/\omega^{gl})^{\sigma-1} - 1]f_p(1+\xi\iota) + (1 - G(\omega^x))[(\bar{\omega}/\omega^x)^{\sigma-1} - 1]f_x(1+\xi\iota)$ respectively.

The opportunity to export increases the average profits in country H. Weighted average profits, in turn, determine ex-ante profits of a potential firm.

$$V = \frac{[1 - G(\omega^{gl})]\bar{\pi}_{gl}}{\delta} - f_e(1 + \xi\iota) \tag{26}$$

Potential entrants enter the market as long the value V of a home firm in (26) exceeds zero. In equilibrium, the ex-ante value of the firm is zero. Average profits $\bar{\pi}_{gl}$ exceed the average profits in autarky while the death rate δ and the fixed costs of entry f_e are unchanged. Hence, $1 - G(\omega^{gl})$ must fall and thus the minimum productivity level ω^{gl} must rise in a trade equilibrium relative to the autarky case.

4.2 Market Equilibrium

The economy is in a stationary long-run equilibrium if the number and distribution of firms remains constant, all goods and factor markets are cleared, and neither consumers nor firms or workers can improve their situation. Again, let's look at the stationary firm distribution first. For the firms distribution to be stationary, entry must equal exit, i.e. $M_{gl}\delta = (1 - G(\omega^{gl}))M_e^{gl}$.

Second, goods market clearance requires that aggregate revenue equals aggregate income, since income is only used for consumption. As in autarky aggregate revenues are given by the level of employment E_{gl} of the economy which is determined in equilibrium. Thus, the level of employment E_{gl} determines whether the revenues increase with opening the economy up to trade. There are no profits in long-run equilibrium and labor income E_{gl} equals total income Y_{gl}, total aggregate expenditure and total revenues R_{gl}.

Third, the mass of firms in the home country in the trade equilibrium is lower than in autarky equilibrium. The smaller mass of firms M_{gl} results from a higher minimum productivity ω^{gl} necessary to survive in the market. The mass of firms in the trade equilibrium with recruitment costs is given by (27)

$$M_{gl} = \frac{R_{gl}}{\bar{r}_{gl}} \tag{27}$$

Although, the number of firms producing in the home country is smaller than in the autarky equilibrium, the price level P_{gl} is lower. In addition to M_{gl} home firms there are $(1 - G(\omega^{Ex}))M_{gl}$ foreign exporters active in the home market. Regardless whether more or less firms sell in the home market than in the autarky equilibrium, the price index is lower in the trade equilibrium because the active firms are more productive and therefore sell at lower prices.

4.3 Labor market equilibrium

Profit maximization of firms concerning recruitment is unchanged. Thus, the second equation in (13) still uniquely determines the job finding rate ϕ in the economy, i.e. $\frac{1-\rho}{\rho(1-\eta)} = \xi\iota$ is solved for just one finding rate ϕ which is the same as in the autarky case.

While the finding rate ϕ is the same as in the autarky case, the separation rate s is higher, although not significantly. The endogenous part of the separation rate increases with the minimum productivity level. To see this, note that labor in the economy is more intensively used for market entry relative to production in the trade equilibrium. A larger share of firms fails when trying to enter the market, since $G(\omega^{gl}) > G(\omega^{rc})$. These firms fail with probability one and dismiss their employees. The share of labor employed in production which is dismissed only when the random shock hits the firm with probability δ is lower in the trade equilibrium. Thus, the separation rate s is higher in the trade equilibrium because more employees are engaged in entry activities and a larger fraction of these are unsuccessful. Hence, equilibrium unemployment u is higher in the trade equilibrium because of the separation rate is higher in the trade equilibrium while the finding rate remains the same, i.e. $\frac{\partial u}{\partial s} = \frac{\phi/(1-\phi)}{[s+\phi/(1-\phi)]^2} > 0$. Thus, the equilibrium rate of unemployment u_{gl} is higher than the equilibrium rate of unemployment in autarky u_{rc}. However, the difference in the separation rates is not large. The separation rate is mainly determined by the exogenous job specific separation rate $\bar{s}$ and the exogenous firm specific shock δ which are unchanged by assumption.

The higher unemployment is result of a higher entry and exit dynamic in the market. In every period, more firms try to enter and more firms fail in the trade equilibrium than in the autarky equilibrium. The higher number of firms trying to enter results from the higher ex-ante expected profits in equilibrium. Their attempt to enter the market requires labor input. The higher number of failing firms results from higher competition on the labor market which drives up the wages and requires a higher minimum productivity to survive in the market. The higher number of failing firms increases the separation rate.

Thus, it is not import competition that increases the separation rate but labor market pressure that *drives up wages* and results in a higher separation rate in the trade equilibrium. Search costs make reallocation of labor between firms expensive. That leads to unemployment which increases in the magnitude of reallocation. For a given level of search costs and a given elasticity of acceptance, equilibrium unemployment increases in the dynamics in the market, i.e. in market entry and exit. Equilibrium unemployment is higher in trade equilibrium because dynamics are higher in trade equilibrium.

The general equilibrium in every period is the simultaneous solution to eight equilibrium conditions in each economy: the price index resulting from consumers optimization, firms' pricing rules, free entry, the export decision, the equilibrium wage level, the equilibrium unemployment rate, and the income equation. The equilibrium can be expressed as vector of eight variables {P, p_k, p_k^x, ω^{gl}, ω^x, w, u, Y}.

5 Globalization and the natural rate of unemployment

Globalization alters the open-economy equilibrium. Increasing economic integration through trade or through production abroad raises the minimum productivity necessary to survive in the market as in Melitz (2003) and Helpman *et al.* (2004). Thus, with increasing integration, the separation rate s increases, causing unemployment to rise. During adjustment, unemployment rises significantly, because increasing economic integration causes labor reallocations between continuing firms, too. This increase comes in addition to the long-run equilibrium effect of trade on unemployment shown in the last section. For simplicity, I only consider international trade.

5.1 Falling transport costs

I model globalization as increase of international trade resulting from falling transport costs. Globalization therefore necessarily requires an off-stationary equilibrium analysis. Falling distance costs shock the stationary equilibrium yielding adjustment in the labor force that lead to a short run increase in unemployment. In the long run, however, the economy settles at an unemployment rate which is only slightly higher than in the initial equilibrium. Higher unemployment is only transitory.

With falling (iceberg) transport costs, goods' prices in the foreign country fall, raising sales in the foreign market and variable profits generated from these sales. Differentiating profits in the foreign country (24) with respect to transport costs τ is negative.

$$\frac{\partial \pi_{kF}}{\partial \tau} = -\sigma \frac{(1-\rho)(1+\xi\iota)}{\rho(1-\eta)\omega_k} \left(\frac{(1-\rho\eta)\tau_{HF}(1+\xi\iota)}{\rho(1-\eta)\omega_k} \right)^{-\sigma} \tau^{-1} P_F^{\sigma-1} Y_F < 0 \quad (28)$$

Falling transport costs increase the profits of all firms that have exported before. Yet, falling transport costs do also induce new firms to start export activities, because variable export profits increase while the fixed costs of exporting f_x remain constant. Hence, falling transport costs reduce the minimum productivity level of exporting firms (23) which unambiguously increases the number of exporters in equilibrium.

$$\frac{\partial \omega^x}{\partial \tau} = \frac{\sigma}{\sigma-1} \tau^{1/(\sigma-1)} \left[\frac{f_x(1+\xi\iota)}{Y_F(1-\rho)(1-\rho\eta)^{-\sigma}} \right]^{1/(\sigma-1)} \frac{1+\xi\iota}{\rho(1-\eta)P_F} > 0 \quad (29)$$

With average profits $\bar{\pi}_{gl}$ and the minimum productivity ω^{gl} simultaneously determined by the intersection of the zero cutoff profit condition and the free entry condition, average productivity $\bar{\pi}_{gl}$ and minimum productivity ω^{gl} must increase with falling distance costs. The reason is that the zero cutoff profit condition moves up because both π_{kF} and $1 - G(\omega^x)$ increase with falling distance costs while the free entry condition is unchanged.

5.2 Labor reallocation

Falling distance changes the labor demand of every firm. First, export sales increase for exporters because lower distance costs lower the prices in the foreign market and therefore increase the sales. Thus, exporters increase their production and their demand for labor. Second, new firms start to export to the foreign country. That further increases labor demand. Third, higher ex ante profits in the market increases market entry which in turn increases labor demand. Higher labor demand drives up wages. That increases the costs of production. While higher profit opportunities in the export markets apply only to exporters, the higher costs apply to all firms, those producing only for the domestic market and exporters. Since domestic firms do not have higher export profits, they are left only with higher costs, and hence with reduced profits. Consequently, domestic firms shrink. Some of them can not cover their fixed costs anymore and exit.

Increasing labor demand by more productive exporting firms drives wages up and the least productive firms out of the market. All domestic firms shrink. There is large labor reallocation among the firms resulting from the change in distance costs and the following expansion of export activities.

Falling distance costs raises sales abroad $\frac{\partial r_{kF}}{\partial \tau} = (1-\sigma)\tau^{-\sigma} \frac{(1-\rho\eta)(1+\xi\iota)}{\omega_k \rho(1-\eta)}^{1-\sigma} P_F^{\sigma-1} Y_F$ < 0. These larger sales require higher output and more labor input. The higher labor demand that results from larger exports is given in (30), where τ_b and

τ_a denote the distance cost level before and after the change, respectively.

$$\Delta E_{Fk} = (\tau_a^{-\sigma} - \tau_b^{-\sigma})\frac{(1+\xi\iota)}{\omega_k}\left[\frac{(1-\rho\eta)(1+\xi\iota)}{\omega_k\rho(1-\eta)}\right]^{-\sigma} P_F^{\sigma-1}Y_F \tag{30}$$

The most productive firms from those that have served only the domestic market before start exporting, because the minimum productivity level of exporting firms ω^x has fallen. These firms demand additional labor as given in (31)

$$\Delta E_k^{nx} = \frac{(1+\xi\iota)}{\omega_k}\left[\frac{(1-\rho\eta)(1+\xi\iota)\tau_a}{\omega_k\rho(1-\eta)}\right]^{-\sigma} P_F^{\sigma-1}Y_F + (1+\xi\iota)f_x \tag{31}$$

The new positions established by exporting firms increase the number of jobs offered J. A higher J in turn increases the number of offers necessary to fill a vacancy with certainty ι, since $\frac{\partial\iota}{\partial J} = 1/U\phi > 0$. Yet, in optimum profits per employee must still equal cost of hiring otherwise it would pay to hire more or less workers. Maximizing profits per workers requires now a higher relative wage w_r as can be seen from (13). The higher relative wage w_r increases the third term which is needed to equalize the increase in the number of offers ι_k necessary to fill a vacancy in the second term.

$$\frac{\partial\pi_k/E_k^v}{\partial w_r} = \left(\frac{1-\rho}{\rho} - \xi\iota_k - \xi\frac{\partial\iota_k}{\partial w_r}w_r\right)w = 0$$

With more offers needed to fill a position it is profitable for firm k to raise the relative wage to attract more workers. The probability that a worker accept a particular offer increases so that the number of costly offers can kept down. With all firms raising their relative wage w_r in the same manner, the wage level w rises while the relative wage is w_r is one again.

Increasing wages raise costs. Higher costs translate into higher prices and lower sales. Lower sales in turn generate lower profits. Consumers demand less quantity of each good. Thus, *all* firms adjust their output downwards which results in lower labor demand. Some firms can not generate enough profits anymore to pay for their fixed costs. These firms quit. Labor demand change of a shrinking and an exiting firm are respectively given in (32)

$$\Delta E_k = \frac{(1+\xi\iota)}{\omega_k}\left[\frac{(1-\rho\eta)(1+\xi\iota)}{\omega_k\rho(1-\eta)}\right]^{-\sigma}\left[(\sigma-1)P_j^{\sigma-2}\frac{\partial P_j}{\partial w}Y_j + \frac{\partial Y_j}{\partial w}P^{\sigma-1}\right]\Delta w \tag{32a}$$

$$E_k^{exit} = -\frac{(1+\xi\iota)}{\omega_k}\left[\frac{(1-\rho\eta)(1+\xi\iota)}{\omega_k\rho(1-\eta)}\right]^{-\sigma} P_H^{\sigma-1}Y_H - (1+\xi\iota)f_p \tag{32b}$$

Assuming perfect foresight, wages and job offers jump to the new level that satisfy equation (13). The value of an additional position established is zero for all active firms. Although the number of positions lost is larger than the number of additional positions created by expanding firms, due to restructuring the number of job offers J is vastly higher than before the fall in distance cost. However, the number of job seekers U increases too what strongly dampens the effect on the number of offers ι which is necessary to fill one position with certainty. The finding rate ϕ remains unchange since ϕ is determined by (13).

While the finding rate ϕ is unchanged, the separation rate s increases due to the losses of positions of shrinking and exiting firms. Exiting firms' labor demand amounts to $\int_{\omega^{gl}}^{\omega^{ngl}} E_k^{exit} g(\omega)d\omega = \frac{G(\omega^{ngl})-G(\omega^{gl})}{1-G(\omega^{gl})} M_{gl}\bar{E}^{exit}$ and E_k^{exit} given by (32b) and $\bar{E}^{exit}$ is the average firm in the group of exiting firms. Aggregated shrinking firms labor demand equals $\int_{\omega^{ngl}}^{\omega^{nex}} \Delta E_k g(\omega)d\omega = \frac{G(\omega^{nex})-G(\omega^{ngl})}{1-G(\omega^{ngl})} M_{ngl}\Delta\bar{E}$ where ΔE_k is given in (32a) and $\Delta\bar{E}$ is the average firm supplying only the domestic market. These position losses add to the separation rate which therefore increases to

$$s' = \frac{(\bar{s} + \delta - \bar{s}\delta)\bar{E}^{gl} + \delta f_e(1+\xi\iota)\frac{G(\omega^{gl})}{1-G(\omega^{gl})}}{\bar{E}^{gl} + \delta f_e(1+\xi\iota)} + \frac{\frac{G(\omega^{ngl})-G(\omega^{gl})}{1-G(\omega^{gl})}|\bar{E}^{exit}| + \frac{G(\omega^{nex})-G(\omega^{ngl})}{1-G(\omega^{ngl})}\frac{M_{ngl}}{M_{gl}}|\Delta\bar{E}|}{\bar{E}^{gl} + \delta f_e(1+\xi\iota)} \quad (33)$$

If the separation rate rises while the finding rate remains constant, unemployment rises. Out of long-run equilibrium, unemployment changes according to (21), $\dot{u} = s'E_{gl} - \phi U_{gl}$. With $s' > s$, $\dot{u_0} > 0$. Falling distance costs raise unemployment. The rise in unemployment results from more extensive *export* activities. Import competition is not the reason for the rise. Increased export opportunities raise wage to facilitate labor reallocation among domestic firms.

If the fall in distance costs is a one-time shock, the separation rate goes down to s again in the next period. Unemployment falls because the number of job seekers U_1 is higher so that it is easier for the firm to hire a worker and fill open positions, i.e. $\dot{u}_1 < 0$, because $\phi U_1 > \phi U_{gl}$. The reduction in unemployment does not make up for the increase before, $u_0 > u_1 > u_{gl}$. With no further shock on the distance costs, unemployment converges to its new equilibrium level from above. As discussed above, the new unemployment level is slightly above the equilibrium level prior to the shock, $u_{ngl} > u_{gl}$.

Yet, globalization is a process of continuously increasing integration due to continuous fall in distance costs. Let's assume next periods' fall in distance costs is so high to keep the separation rate on its high level s'. Unemployment increases even further reaching a stationary state of the unemployment rate from below when unemployment U has increased enough to ease job finding that much that flows out of unemployment ϕU equal flows into unemployment $s'E$. Note, that this situation is not an stationary long-run equilibrium, because continuously falling distance costs result in a continuously changing firm distribution.

6 Conclusion

I propose an additional channel through which unemployment is pushed up by increasing economic integration through international trade. The labor market is characterized by non-permanent employment and hiring costs. Labor market equilibrium is reached if the flow of job seekers out of unemployment equals the flow of employees into unemployment. The stationary long-run equilibrium features stable unemployment. The rate of unemployment in a stationary long-run equilibrium in an open economy does not differ much from the autarky unemployment level. Thus, the degree of integration does not affect the labor market adversely.

A *change* in the degree of integration and therefore in trade levels, in contrast, has significant adverse effects on the labor market. Increasing integration requires reallocation of labor between firms which is not costless. Increasing integration raises endogenously the separation rate by forcing firms to shrink or even exit the market. The finding rate is unaffected so that the level of unemployment increases. If integration is a one-time shock, unemployment goes back over time to its pre-shock level. If the integration process with ever increasing trade levels last for longer, unemployment rises strongly at the beginning and continues to rise until a new labor market equilibrium is found which is characterized by a higher unemployment rate.

With respect to labor market effects of globalization, there are two things worth to pick up again. First, job losses in the model are due to a change in economic integration and to its degree. Thus, that the world today is much more integrated than in the nineteen seventies or eighties does not necessarily mean that we would expect less adjustment in these decades. Job reallocation depends on the change in integration. Second, exports drive job reallocations and therefore unemployment in this model, not imports. Import competition might be additionally force job reallocations. Yet, in the model proposed here, all the effect stems from export opportunities which arise with falling distance costs.

Finally, globalization fears of the public might be justified to a larger degree than we have found so far in the data. Globalization increases job separation which drives up the unemployment rate. At least globalization increases the forced separations which result from failing and shrinking firms. That leads to an increased number of people that have made the experience of being dismissed. Even if the majority finds a new job in a rather short time span, the fear of vulnerability remains.

References

Egger, Hartmut and Udo Kreikemeier (2008). Firm Heterogeneity and the Labor Market Effects of Trade Liberalization. *International Economic Review* forthcoming.

Felbermayr, Gabriel, Julien Pratt, and Hans-Joerg Schmerer (2007). Globalization and Labor Market Outcomes: Wage Bargaining, Search Frictions, and Firm Heterogeneity. University of Tuebingen. mimeo.

Friedman, Milton (1968). The Role of Monetary Policy. *American Economic Review* 58 March: 1–15.

Giles, Chris (2007). Globalisation Backlash in Rich Nations. Financial Times. July 22nd 2007.

Hall, Robert, E. (1979). A Theory of the Natural Unemployment Rate and the Duration of Employment. *Journal of Monetary Economics* 5 153–169.

Helpman, Elhanan, Melitz, Marc J., and Yeaple, Stephen R. (2004). Export

Versus FDI with Heterogeneous Firms. *American Economic Review* 94 (1), 300–316.

Ludowig, Kirsten (2008). Bedroht und Bedrückt. Süddeutsche Zeitung. January 21st 2008.

Melitz, Marc J., (2003). The Impact of Trade on Intra-Industry Reallocations and Aggregate Industry Productivity. *Econometrica* 71 (6), 1695–1725.

OECD (2007). OECD Employment Outlook. Paris.

7 Appendix

7.1 Existence of the equilibrium with recruitment costs