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Foreign direct investment and search unemployment

Theory and evidence

Hans-Jörg Schmerer

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Hans-Jörg Schmerer (IAB)

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Abstract

This paper proposes a simple multi-industry trade model with search frictions in the labor market. Unimpeded access to global financial markets enables capital owners to invest abroad, thereby fostering unemployment at the extensive industry margin. Whether a country benefits from FDI in terms of unemployment depends on the respective country's net-FDI, measured as the difference between in- and outward FDI. The derived FDI and unemployment nexus is tested employing macroeconomic data for 19 OECD countries on unemployment, FDI, and labor market institutions. Results support the model in that net-FDI is robustly associated with lower rates of aggregate unemployment.

Zusammenfassung

Diese Arbeit präsentiert ein einfaches Mehrsektoren-Außenhandelsmodell mit Suchfriktionen auf dem Arbeitsmarkt. Der ungehinderte Zugang zum weltweiten Kapitalmarkt ermöglicht Kapitaleignern mittels FDI im Ausland zu investieren. Dies hat einen Einfluss auf die Arbeitsnachfrage am extensiven (Branchen-)Rand und auf die aggregierte Arbeitslosenrate einer Ökonomie. Inwieweit die Arbeitslosenrate in einem Land positiv oder negativ beeinflusst wird, hängt von den ausländischen Netto-Direktinvestitionen ab, gemessen durch die Differenz der Kapitalim- und exporte. Dieser aus dem Modell abgeleitete Zusammenhang von ausländischen Direktinvestitionen und Arbeitslosigkeit wird anhand makroökonomischer Daten für 19 OECD Länder getestet. Die Daten enthalten Informationen über Arbeitslosenquote, ausländischen Direktinvestitionen und Arbeitsmarktinstitutionen der verschiedenen Länder. Im Einklang mit den theoretischen Ergebnissen lässt sich empirisch zeigen, dass ausländische Netto-Direktinvestitionen mit einer niedrigeren, aggregierten Arbeitslosenrate verbunden sind.

JEL classification: F16, E24, J6, F21

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1 Introduction

The ongoing internationalization of product and labor markets has stimulated a lively debate about the pros and cons of globalization. Supporters often stress the beneficial effects that arise due to increased export opportunities, whereas globalization's detractors are usually more concerned about job losses due to heightened competition from so-called low-income countries. Economics can contribute to this debate in that it can rationalize the fear that more intensive global economic-interdependency generates by identifying the merits and downsides of this process and by quantifying the labor market outcomes of the potentially opposing effects. The public debate that surrounds these issues has frequently been characterized by a lack of clarity regarding the definition of globalization and a failure to account for different elements of this process which may have contrasting implications for domestic and international labor markets. In this paper we devote our attention to the implications of capital mobility for domestic and international labor markets by proposing an empirical test on the FDI and unemployment nexus. The test is based on a simple multi-industry model with unemployment due to search frictions. Integrated capital markets facilitate the study of foreign direct investment and its effects on equilibrium unemployment. The outcome of the model is different from previous studies in that the effect is ex-ante ambiguous and highly depends on whether a country is the FDI receiving or sending country.

The intuition behind that result is that *FDI* directly affects intermediates (labor) demand at the extensive margin through endogenous adjustments of capital costs. The adjustments in production costs trigger an expansion of the *FDI* receiving country's range of active industries through the increased competitiveness in industries located close to the former cutoff. This boosts demand for intermediates and thus reduces equilibrium unemployment.

To the best of my knowledge, this paper is the first focusing on the unemployment effects of global sourcing in a model with a continuum of industries from both an empirical and a theoretical perspective. Lin and Wang (2008) present empirical evidence on the effects of capital-outflows on equilibrium unemployment, but their analysis does not feature the distinction between inward and outward FDI. This distinction is crucial at least in the model presented in the theory section of this paper where we show that the sign of the effect is different depending on whether a country is the receiving or the sending country. The same empirical strategy as proposed by Dutt, Mitra and Ranjan (2009), or Felbermayr, Prat and Schmerer (2011 b) was used to shed light on the FDI and unemployment nexus.

Also closely related to this paper are two contributions by Mitra and Ranjan (2007) and Davidson, Matusz and Schevchenko (2008) both focusing on the employment effects of outsourcing in trade models with search frictions. Mitra and Ranjan

(2007) propose a two sector model with one input factor labor. In their model outsourcing decreases equilibrium unemployment. Outsourcing in Davidson et al. (2008) forces some of the high skill workers in the North to search for jobs in the low skill sector. This stirs up job competition in the low skill sector and thus triggers a rise in unemployment.

Kohler and Wrona (2010) highlight the existence of a non-monotonicity between offshoring and unemployment. They identify channels through which offshoring can affect demand for intermediates at the intensive and extensive margin. The two opposing effects lead to an outcome where the sign of the effect hinges on the level of offshoring. Also closely related is an emerging literature on the labor market effects of globalization. Brecher's (1974) seminal paper about the labor market effects of a minimum wage in the Heckscher Ohlin model can be seen as a foundation for a large and emerging literature about the employment effects of globalization. Davidson, Martin and Matusz (1988, 1999) incorporated the Pissarides search and matching framework into a Heckscher Ohlin type of trade model. Moore and Ranjan (2005) investigate the link between trade liberalization and skill-specific unemployment in such an extended Heckscher Ohlin framework. More recently the spotlight has been directed towards the popular Melitz (2003) international trade model. Egger and Kreickemeier (2009) show how rent-sharing with heterogeneous firms that pay fair wages helps to explain the residual wage inequality and the so-called exporter wage premium. Trade liberalization in their approach increases wage inequality. Helpman and Itskhoki (2010) and Felbermayr, Prat and Schmerer (2011 a) analyze potential employment effects in a heterogeneous firms model with search frictions. Based on their earlier study, Helpman, Itskhoki and Redding (2010 a,b) investigate the effects of globalization on wage inequality and unemployment when workers and firms are heterogeneous.

2 Theory

The model employed to study potential labor market effects of FDI is an extended version of the Feenstra and Hanson (1996, 1997) general equilibrium trade model with search friction a là Pissarides (2000) in the labor market. One modification of the original Feenstra and Hanson (1996, 1997) model is that the production of the continuum of final consumption goods takes place on two different levels. Final goods are assembled using intermediate inputs and capital within each industry. Intermediates are produced by input of homogeneous labor only, which is a simplification of the original model that distinguishes between high- and low-skill workers. The main contribution to the literature is the micro-foundation of the wage-setting mechanism through search and matching and wage negotiation between employers and employees. Firms have to post vacancies in order to recruit

new workers, and once met they bargain about wages. After a successful wage-negotiation the firm sets up shop and starts producing the intermediate good. The modeling of search frictions is based on the simpler Pissarides (2000) version of the Mortensen and Pissarides (1994) search and matching framework. Intermediates are produced by small firms so that each intermediate good producer hires exactly one worker and produces one unit of the intermediate good. Wages, goods prices, and thus world income is jointly determined in general equilibrium, which creates an interdependency between the final- and the intermediate goods producers. Put differently, wages paid to workers producing the intermediates map into intermediate goods prices, which implicitly determines the price of the final good.

2.1 The model

Consumer demand. Following the lines proposed in Dornbusch, Fischer and Samuelson (1977), or Feenstra and Hanson (1996, 1997) we assume that the whole continuum of goods is consumed by a representative household according to a Cobb-Douglas preferences function

$$ln\ Y = \int_0^1 \varphi(z) \ln x(z) dz \ , \tag{1}$$

where $x(z)$ is the quantity of the good from industry z consumed and $\varphi(z)$ is the Cobb Douglas share.[1] Aggregate demand evaluated by the price P must equal total expenditure $YP = E$. Perfect competition and homothetic preferences implies that a fraction $\varphi(z)$ of world expenditure is spent on consumption of good z. Demand is thus determined by

$$x(z) = \frac{\varphi(z)E}{\kappa(z)} \ , \tag{2}$$

which relates expenditure and revenue within industry z. Perfect competition implies that revenue in industry z equals quantity times unit costs, $\kappa(z)$, so that the consumption and production side of the model is interacted through (2).

Final good producers. Intermediates are assembled to final goods within industries z. The assembling process requires capital provided by capital owners for some interest r. Industries are ordered according to the input coefficients $a(z)$, which exogenously determine the requirement of intermediates needed to produce one unit of the consumption good z. Both countries specialize their production to certain industries with a comparative advantage by means of lower unit costs. Input coefficients in z are exogenously given by Ricardian technology parameters in

[1] Summing up the shares over the whole continuum of industries must equal unity.

form of

$$a_i(z) \;\; = \;\; \alpha_i + \gamma_i(z) \;\; , \tag{3}$$

where index i denotes domestic (d) or foreign (f). The labor requirement curves comprise a country-specific component α and an industry-specific component γ that varies over the continuum. As in Dornbusch et al. (1977) technology differences across countries are necessary to derive a clear trade pattern according to each country's comparative advantage.[2]

To model final good production we postulate a Cobb Douglas production function

$$x_i(z) = [a_i(z)]^{\zeta} \, [k_i(z)]^{1-\zeta} \;\; , \tag{4}$$

where $a_i(z)$ denotes the amount of intermediates used in industry z and $k_i(z)$ denotes capital needed to assemble the final good z. The final industry output good is sold for a price $p(z)$. Perfect competition implies that the industry price level equals the respective industry unit costs

$$p_i(z) = \kappa_i(z) = B(q_i a_i(z))^{\zeta} r_i^{1-\zeta} \;\; , \tag{5}$$

where $\kappa(z)$ denotes minimum unit costs in sector z obtained by solving the cost minimization problem of the firm. Cost depend on prices paid for the intermediate inputs, q_i, and capital rental, r. $B = \zeta^{-\zeta}(1-\zeta)^{-(1-\zeta)}$ and $a_i(z)$ are given exogenously.

Wages are determined on the intermediate producer level and thus equalized across industries. Final good producers take prices charged by intermediate good producers as given and adjust their demand for intermediates based on the price q (in common units) charged for one intermediate good.

Intermediate input producers. The small intermediate good producers have to post vacancies in order to recruit new employees which incurs vacancy posting costs c prior to a successful match. To solve the general equilibrium of the model we assume that vacancy posting costs are paid in terms of intermediate prices.[3] The matching process $m(\theta_i)$ is a concave function of θ, the equilibrium market tightness. Due to its constant returns to scale properties, the matching function implicitly determines the probability of a successful match. The problem of the firm

[2] Another approach close to the Dornbusch et al. (1977) model is Eaton and Kortum (2002) where countries draw their productivity parameter from a country-specific distribution. Using equation (3) instead allows us to determine a clear industry ranking that facilitates extensions such as mine.

[3] This assumption is in line with Pissarides (2000).

and worker can be expressed by standard Bellman equations that depend on firms' revenue, unemployment benefits b, the bargaining power β, vacancy posting costs c, the discount rate η, and job destruction rate λ. The solution to the problem of the worker and the firm is derived as in Pissarides (2000) or Dutt et al. (2009). See the appendix for a detailed solution.

Lemma 1. *a) To derive a unique solution for intermediate goods' prices, q, the wage and job creation curves are interacted and solved as*

$$q_i = \frac{(1-\beta)b_i}{(1-\beta) - c(\beta\theta_i + \frac{\eta+\lambda}{m(\theta_i)})} \tag{6}$$

b) Wages, and thus intermediate good prices, are increasing in θ_i since $\frac{\partial q}{\partial \theta_i} > 0$.

Proof. We can exploit $\frac{\partial m(\theta_i)}{\partial \theta_i} < 0$ in order to show that $\frac{\partial q_i}{\partial \theta_i} > 0$. The higher the vacancy to unemployment ratio, θ_i, the higher must be the equilibrium wage rate in order to attract enough workers to fill the vacancies. Higher wages in turn are linked to higher intermediate good prices paid by final good assemblers. □

Labor market clearing. The existence of search frictions in the labor market gives rise to a situation where firms adjust their demand for intermediates (labor) to the intermediate input prices depending on wages and search costs. Perfect competition in context of search frictions implies that an intermediate good's price comprises production and the firm's expected recruitment costs, that depend on the probability of a successful vacancy-post.

Final good assemblers are price-takers. Firms base the decision about their demand for intermediates on the intermediate input goods prices set by the intermediate goods producers. Using Shephard's lemma, demand for intermediates solves

$$\frac{\partial \kappa_i(q, r; z)}{\partial q_i(z)} = B\zeta a_i(z)(q_i a_i(z))^{\zeta-1} r_i^{1-\zeta} \quad . \tag{7}$$

The economy's total labor demand can be found by aggregating industry labor demand over the whole continuum of active industries as

$$L_i(1 - u_i(\theta_i)) = \int_{\underline{z}_i}^{\bar{z}_i} B\zeta \left[\frac{r_i}{q_i a_i(z)}\right]^{1-\zeta} a_i(z) x_i(z) dz \quad , \tag{8}$$

where $\bar{z}_i$ and $\underline{z}_i$ represents the upper and lower bound of the respective country's competitive industries. Search frictions give rise to unemployment, which is determined by the Beveridge curve that secures that flows into unemployment equal

flows out of unemployment. The assumption that the matching technology is concave translates into a convex Beveridge curve so that $\frac{\partial u_i(\theta_i)}{\partial \theta_i} < 0$. Intermediate goods' prices q are determined on the intermediate goods level of the model and depend on the equilibrium market tightness. Equation (2) allows us to simplify the Labor Market Condition *(LMC)* such that the equilibrium depends only on the endogenous parameters z and θ_i as well as other exogenous parameters and reads as

$$L_i(1-u_i(\theta_i)) \quad = \quad \int_{\underline{z}_i}^{\bar{z}_i} \zeta \frac{\varphi(z) E\left\{(1-\beta) - c(\beta\theta_i + \frac{\eta+\lambda}{m(\theta_i)}\right\}}{\{(1-\beta)b_i\}} dz \quad . \tag{9}$$

The standard Pissarides (2000) assumption that each firm employs one worker links final good producers' demand for intermediates and intermediate good producers labor demand (equal to the number of firms) according to equation (9). The specialization pattern under free trade is ex-ante unknown and depends on the unit cost schedule over all industries. The mass of one single industry is zero in the continuous scenario. A sensible interpretation therefore demands the computation of the mass of a certain range of industries within the whole continuum. The consumption share for industry output in z is constant and equalized over the whole continuum, which allows us to solve the integral in (9).

Lemma 2. *Labor markets are in equilibrium if labor demand equals labor supply. The LMC conditions therefore pin down equilibrium market tightness, wages, and unemployment. The equilibrium is well-defined as there exists a unique combination of home and foreign market tightness such that both LMC curves are fulfilled given the cutoff z^*.*

Proof. Let Γ_L denote the left, Γ_R the right hand side of the labor market clearing condition. The left hand side of both conditions has its origin in zero and converges to an upper bound. The intuition is the following. Let θ_i go towards zero. Wages would approach zero, whereas unemployment would go towards infinity such that the left hand side of the LMC curve has its origin in zero and converges towards full employment. The right hand side is also well behaved. Labor demand is positive for θ_i approaching zero and decreases in θ_i. An increase in θ_i triggers an increase in intermediate input goods' prices, which in turn reduces demand for the intermediates. Thus, there is a unique solution for the LMC curve determined by the intersection of Γ_L and Γ_R. □

2.2 General Equilibrium

The general equilibrium requires a framework that pins down the endogenous parameters. To close the model income is normalized to unity and determined by

adding up world factor payments to workers in and outside the pool of unemployed, which is given by

$$E = L_d(1-u_d)q_d + r_d K_d + L_f(1-u_f)q_f + r_f K_f \quad . \tag{10}$$

Capital rentals are determined using the Cobb Douglas shares and the capital market clearing conditions

$$r_d K_d = \frac{1-\zeta}{\zeta} L_d(1-u_d)q_d \quad , \tag{11}$$

$$r_f K_f = \frac{1-\zeta}{\zeta} L_f(1-u_f)q_f \quad . \tag{12}$$

Interest rates are such that capital markets are in equilibrium, conditional on simultaneous goods and labor market clearing. The equilibrium then depends on six endogenous variables: one home- and one foreign- market tightness, capital rentals in the foreign- and the home country, one cutoff that pins down the trade pattern between both countries, and income. Without loss of generality we can set world income as nummeraire by normalizing it to unity. A closed form solution of the model requires a determination of the optimal trade pattern between both countries. This trade pattern also determines the amount of capital required to produce for both home and foreign demand of final goods produced within active industries.

Corollary 1. *The trade pattern between both countries hinges on one unique cutoff* $z^* \in (0,1)$ *satisfying*

$$p_d(z^*) = p_f(z^*) \quad \Leftrightarrow \quad \kappa_d(\theta_d; z^*) = \kappa_f(\theta_d; z^*) \quad . \tag{13}$$

The pattern of trade depends on the country's comparative advantage. The fact that final good producers are price takers in addition to the result that intermediate good's prices and capital costs are equalized within but different across countries allows us to determine a cutoff industry for which both industries produce with same unit-costs. For a given equilibrium market tightness and a given capital rental the pattern of trade is solely determined by the Ricaridian differences in technology. However, the micro-foundation of the wage setting mechanism and endogenous interest rates imply that countries can gain or loose a comparative advantage within certain industries if wages or capital cost change. A comparisons of unit costs is sufficient to determine the optimal comparative advantage pattern across countries. The clear ordering of the continuum of industries according to intermediate goods requirements allows to solve the cutoff industry z^*. In a two-country scenario one country supports demand for goods from industries in the continuum $z \in [0, z^*]$ and the other country supplies goods from $z \in [z^*, 1]$.

2.3 Comparative statics analysis

The unimpeded access to foreign financial markets allows capital owners to invest their capital in markets with the highest returns to capital. The model and the comparative static exercise conducted below thereby totally neglect the role of the government. Instead we focus on an initial scenario with frictionless capital markets but unequal capital rentals in the two countries studied. Starting from that initial disequilibrium we analyze how footloose capital-flows triggered by differences in international capital returns affect equilibrium unemployment. The adjustment process goes through the endogenous change in capital rentals, which influences production costs and thus the comparative advantage pattern across industries.

The effects of *FDI* on equilibrium market tightness. *FDI* in the form of capital inflows and outflows necessarily induce interest rate readjustments so that the capital clearing conditions are in equilibrium again. Capital inflows for instance reduce the scarcity of capital and thus precipitate a reduction in interest rates, which has a decreasing effect on unit costs. Given that all other factor prices remain constant, the unit cost function shifts down associated with lower final good prices over the whole continuum. The opposite happens in the country that looses capital. Suppose that capital flows from Foreign to Home. Interest rates in the receiving Home country decrease, interest rates at Foreign increase.

Suppose that z^* pins down the FDI receiving country's upper, and the sending country's lower bound of active industries. The initial trade pattern is no longer optimal and the new intersection of the domestic and the foreign unit cost schedules is pinned down by $z^{*'} > z^*$. The range of active industries contracts in the *FDI-out* economy and expands in the *FDI-in* economy. This implies that the former labor market equilibrium is not optimal any more: unemployment, wages and the equilibrium market tightness have to adjust.

In the following we distinguish between the adjustments at the extensive and intensive margin. At the extensive margin some industries get lost, which gives rise to a reduction in labor demand on the aggregate level. At the same time the adjustments of capital costs also directly affect the equilibrium by triggering a substitution between capital and labor.

Proposition 1. *FDI outflows result in capital cost adjustments. Firms' labor demand increases at the intensive margin due to higher capital costs triggering a substitution effect. At the extensive margin the increase in the cutoff destroys all jobs associated with industries formerly belonging to the sending country. The opposite pattern applies for the FDI-receiving country. To restore the labor market equilibrium, θ must increase in the receiving and decrease in the sending country.*

Proof. To see this one has to derive the first derivative of the right hand side of the LMC curve with respect to the cutoff z^*, which is positive for the receiving and negative for the sending country, translating into job creation (*FDI-in* country) and job destruction (*FDI-out* country) at the extensive margin. Note that the distinction between the case where z^* is the upper or the lower bound of active industries is crucial. Suppose for instance that Home's lower bound of active industries is fixed at $\bar{z}_d = 0$ due to the better technology in that corner industry. It follows immediately that z^* is Home's variable upper bound of active industries which adjusts endogenously. An expansion of the range of active industries at Home would be indicated by a an increase in z^*. The derivative of Γ_R with respect to z^* is positive if the fixed bound of the respective country is the lower bound of the mass of industries and it is negative if the fixed bound of the range of industries is the upper bound of the mass of industries. The same logic can be applied for the foreign country where z^* is the lower bound of active industries and $\underline{z}_f = 1$ is the fixed upper bound so that the first derivative of Γ_R with respect to z^* would be negative at Foreign.

In order to restore equilibrium labor supply must adjust too. Since labor demand in the FDI-out country decreases at the extensive margin, a higher rate of unemployment is needed to restore equilibrium. Thus, the equilibrium market tightness must fall, wages go down and unemployment goes up. This in turn boosts labor demand on the individual industry level and strengthens the increase in labor demand on the intensive margin. Income adjustments do not matter in my setup since income is set as nummeraire. A formal proof can be found in the Appendix. □

3 Empirical evidence

For the second part of this study, data from Bassanini and Duval (2009) and the UNCDAT is used to test the main implications of the model presented in the theory section. More precisely, the crucial result is that international capital mobility can feed back into different labor market outcomes. The availability of measures on FDI, unemployment and labor market institutions facilitate the analysis of the FDI and unemployment relationship sketched above, where inward- and outward-FDI have different effects on unemployment. The test itself is based on panel data for 19 OECD countries.

The opposing effects of in- and outward FDI are tested exploiting the information on FDI-net stocks, constructed as difference between FDI-in and FDI-out relative to GDP. We include the net-FDI measures in unemployment regressions where we control for other potential unemployment-drivers as institutions and fluctuations in the business cycle. The expected sign of the FDI coefficient is negative. Exploiting only the within variation of the data by including the whole set of country dummies we are able to show that a net-increase in capital-imports is associated with

a reduction in unemployment. This kind of analysis is surrounded by two major concerns. Firstly, unemployment fluctuates with the business cycle and the results are biased due to omitted variables that have also an effect on unemployment. The first issue is addressed by the inclusion of controls for the output gap constructed as difference between actual and potential GDP. Five-year averages were taken in a second step in order to purge short run fluctuations from the data. The second issue is more involved and addressed by including various control variables that capture the degree of labor and product market regulations, as well as dummy variables to control for country and time specific effects. Second, the regression may be plagued by endogeneity between the globalization measures and unemployment. A surge in unemployment can foster protectionism, which feeds back into lower FDI. The panel dimension of the data allows to tackle endogeneity by treating FDI as endogenous in GMM-regressions.[4]

The empirical setup is borrowed from Felbermayr et al. (2011 b) or Dutt et al. (2009) both focusing on unemployment effects of globalization in cross-country regressions.

3.1 Empirical strategy and data

Empirical strategy. Inspired by numerous labor market studies that analyze the effects of institutional changes on labor market outcomes we estimate a linear model with total unemployment as the dependent variable in order to confront Proposition 1 with data. The model we are going to estimate is

$$u_{it} = \alpha + \beta \times FDI_{it} + \gamma_1 \times LAB_{it} + \gamma_2 \times CON_{it} + \tau_i + \omega_t + \epsilon_{it} \ , \qquad (14)$$

where u_{it} is total unemployment in country i at time t, α is a constant, and FDI is the variable of interest measuring FDI-net intensity as the difference between in- and outward FDI relative to GDP. The vector LAB contains various labor market institutional variables, where the OECD provide measures on the replacement rate, the tax wedge, employment protection, and union density. Additional control variables captured by CON include product market regulations, portfolio investments, and the output gap to cope with short run fluctuations. The panel structure of the data facilitates purging the regressions of country and time invariant effects by including dummy variables τ and ω.

The preferred estimator is a consistent fixed effects estimator including additional time dummies to control for trends common to all countries. To show that the

[4] The requirement on diff-GMM regressions are rather demanding and not always fulfilled. Several test statistics permit the evaluation of the GMM results. Sys-GMM results are not presented since it produces instruments that are not valid due to the over identification problem. Additional Anderson and Hsiao (1981, 1982) results are available upon request.

results do not hinge on the estimation technique, additional random effects, and feasible least square models are employed. In a last step, endogeneity is addressed employing a diff-GMM estimator that treats FDI as endogenous variable. Endogeneity concerns arise from the isolationist sentiments that stem from the perceived negative labor market effects of globalization. Such a negative perception may provoke protectionist tendencies which have to be taken into consideration during the analysis.

Generally speaking, the dimension of the data necessitates five-year averages in order to run diff-GMM regressions, which reduces the impact of short run fluctuations. The construction of valid instruments usually requires a cross-sectional dimension that is larger than the time-dimension. This requirement is obviously not fulfilled by the original Bassanini and Duval data set. Without taking five-year averages the data covers observations for 20 OECD countries in the period 1980 - 2003. Five-year averages ease this problem by reducing the number of instruments and structural breaks in the data.

Data. To bring the model to the data we use measures from the OECD, UNCDAT, and WDI. The dependent variable is OECD total unemployment including 15 - 64 years old male and female observations. The variable of interest is FDI-net stocks constructed using measures on in- and outward FDI from the UNCDAT database. FDI-net is measured as the difference between in- and outward-FDI relative to GDP. FDI includes transactions of firms from foreign countries holding a share of at least 10% in a domestic company. Inward FDI is an investment from abroad in the reporting country, whereas FDI-out measures FDI from the reporting country to the rest of the world. Both are measured in current U.S. dollars. Comparability between different countries with different size is introduced through the construction of FDI-net intensities. Portfolio investment assets and real openness, both in U.S. dollars relative to GDP, are included as additional control variables to proxy financial integration and globalization, where the data was taken from the International Monetary Fund and the World Bank.

Various indices on labor market institutions available through the OECD were exploited to reduce the omitted variable bias caused by other unemployment-drivers. Bassanini and Duval provide and discuss a data set that contains the most important variables. We control for tax wedge, replacement rate, employment protection (EPL), and union density[5]. Unfortunately the OECD stopped updating those variables so that labor market institutions are available for the period 1980 - 2003 only, which is also determining the time dimension in our sample. An output gap mea-

[5] Constain and Reiter (2008) propose to include wage distortion as sum of the replacement rate and tax wedge. The results remain qualitatively unchanged and are available upon request.

sure purge short run fluctuations from the data and further reduces the omitted variable bias from the regressions.

3.2 Results

Proposition (1) translates into a predicted negative sign of the *net-FDI* coefficient when regressing it upon unemployment.

The intuition behind this expected sign is that a negative coefficient indicates that a surge in *net-FDI* is negatively associated with unemployment. This result would be in line with proposition (1) where the reallocation of industries causes job creation in the FDI-receiving and job destruction in the FDI-sending country. The regression results are in line with proposition (1).

Benchmark results. Table (1) presents the benchmark regression results for the consistent fixed effects estimator. In a first step, the full set of available observations is employed without averaging the data, which leaves us more than 400 observations for 19 OECD countries between 1980-2003. Regression (I) is the most parsimonious setup with a focus on the financial market integration measure FDI, which is the variable of interest in all regressions. As controls we include country and time dummies, as well as the output gap. The results indicate a significant and negative relationship between net-FDI and unemployment. The magnitude of the effect is rather strong and likely reflects a spurious correlation driven by the variation in the business cycle and the mentioned omitted variable bias. Another strand of the labor market literature already demonstrated the importance of including globalization controls that capture real trade flows[6]. We therefore extend our setup by a total trade openness measure in regression (II). The FDI coefficient drops from -0.4 to -0.3. Regression (III) finally includes the whole set of globalization controls as portfolio-investment, total-trade openness, and net-FDI.

Sign and significance remain and even the magnitude is rather stable. In a subsequent step we shed light on the role of labor market institutions in context of foreign direct investment. Regression (V) includes institutional measures on the degree of employment protection (EPL), the union density capturing the bargaining power of unions, the replacement rate and the tax wedge, as well as the output

[6] We experimented with different openness measures in our related empirical work, whereas Dutt et al. (2009) used different tariff measures in their cross-sectional regression setup.

Table 1: Aggregate unemployment and FDI-net

Dependent variable: Total unemployment
Variable of interest: FDI-net (FDI-in minus FDI-out relative to GDP)

	I	II	III	IV	V	VI
	FE	FE	FE	FE	FE	FE
FDI-net	−0.041**	−0.030**	−0.029**	−0.045***	−0.033*	−0.026
	(0.019)	(0.012)	(0.012)	(0.016)	(0.018)	(0.023)
Openness		−0.156***	−0.131**		−0.151**	−0.128*
		(0.046)	(0.058)		(0.058)	(0.064)
Portfolio investments			−0.145		−0.005	0.186
			(0.115)		(0.156)	(0.134)
Replacement rate				−0.031	−0.025	−0.053
				(0.043)	(0.050)	(0.043)
Tax wedge				0.315***	0.240**	0.145*
				(0.098)	(0.112)	(0.080)
EPL				−1.281	−1.182	−1.281
				(1.384)	(1.400)	(1.031)
Union density				−0.055	0.001	−0.007
				(0.064)	(0.061)	(0.063)
PMR				0.297	0.636	0.659
				(0.618)	(0.644)	(0.576)
Real interest rate (shock)						0.219*
						(0.113)
TFP (shock)						36.168***
						(6.084)
ToT (shock)						11.165
						(8.769)
LD (shock)						9.122
						(6.354)
Output gap	−0.566***	−0.552***	−0.577***	−0.616***	−0.591***	−0.786***
	(0.092)	(0.087)	(0.085)	(0.061)	(0.055)	(0.060)
R-square	0.509	0.578	0.584	0.594	0.663	0.730
N	456	456	428	386	368	338

Robust standard errors in parentheses, *significant at 10%, ** significant at 5%, *** significant at 1%. Data is available for 19 OECD countries. Time dummies included in all regressions. Real total trade openness included in (II), (III), (V), and (VI)

gap and product market regulations. We extend regression (I) so that all globalization controls other than the variable of interest are excluded again. The magnitude of the effect is slightly higher than that in regression (I) which can be due to the loss of observations[7]. As before the magnitude of the effect declines significantly when we also include openness and portfolio investment controls. However, labor market institutions have less explanatory power as indicated by the modest decline in R-square and the rather weak decrease in the coefficients of the other

[7] Unfortunately the institutional variables contain missings.

variables included. Comparing regression (I) and (IV) we also find that coefficients for the output gap and FDI are higher when the labor market institution controls are included. In regression (VI) all controls and additional macroeconomic shocks are included which yields insignificant results for net-FDI. However, interestingly we also find a positive and significant coefficient for the real interest rate shock. This result is in line with the theory that suggests that capital costs are a potential channel variable between FDI and unemployment. Higher capital rentals trigger FDI-flows, thereby fostering unemployment.

To summarize the benchmark regression results based on the entire information available, without averaging the data, we find negative and significant coefficients for net-FDI in almost all regressions. Openness confirms the results found in our companion paper and in Dutt et al. (2010). Portfolio investment is less robust and becomes insignificant once we control for the business cycle.

Moreover, FDI and openness explain much of the relationship between FDI and unemployment compared to the standard variables as institutions and fluctuations in the business cycle. The inclusion of macroeconomic shocks destroys significance but in line with our story we find positive and significant sign for the interest rate shock. This is a potential explanation for the loss in significance of the FDI measure. To demonstrate the robustness of those findings we go one step further by taking five-year averages of the data in the next paragraph. This procedure facilitates GMM regressions and it reduces the impact of the business cycle by smoothing fluctuations from the data.

Taking five-year averages of the data. We already discussed the problems caused by relatively long time dimension of the data used. Taking five year averages improves the test statistics of the GMM regressions and reduces the omitted variable bias caused by the business cycle. The comparison of the Sargan test statistics obtained from a GMM model based on an averaged version of the data with the outcome of the same model based on non-averaged data confirms our suspicion. The non-averaged data yields a p-value exactly equal to zero, which is in stark contrast to the test statistics reported in Table (2). Put differently taking five-year averages improves the quality of the instruments as expected. But before we turn to the detailed discussion of the GMM-results we first rerun the benchmark fixed effects regressions from Table (1).

Regression (I) replicates regression (I) from Table (1) in that only the net-FDI, as well as the output gap and time dummies are included. The results indicate that

Table 2: Aggregate unemployment and FDI-net (5-year averaged data)

Dependent variable: Total unemployment
Variable of interest: FDI-net (FDI-in minus FDI-out relative to GDP)

	I	II	III	IV	V	VI
	FE	FE	FE	DIFF-GMM	DIFF-GMM	FGLS
FDI-net	−0.039*	−0.049***	−0.037*	−0.113**	−0.146***	−0.033**
	(0.019)	(0.014)	(0.020)	(0.057)	(0.052)	(0.015)
Openness			−0.175**	−0.438***	−0.265*	−0.198***
			(0.075)	(0.135)	(0.135)	(0.038)
Portfolio investment			0.153	1.879**	1.619**	0.117
			(0.257)	(0.785)	(0.650)	(0.206)
Lag. dep. var.				0.594***	0.465*	
				(0.226)	(0.281)	
Replacement rate		−0.034	−0.030	−0.109*	−0.099	−0.010
		(0.046)	(0.057)	(0.063)	(0.062)	(0.026)
Tax wedge		0.376***	0.312**	0.063	0.165	0.205***
		(0.109)	(0.121)	(0.105)	(0.110)	(0.064)
EPL		−0.890	−0.938	−0.389	−0.842	−0.817
		(1.356)	(1.497)	(1.237)	(1.179)	(0.511)
Union density		−0.069	−0.035	−0.062	−0.139**	−0.029
		(0.056)	(0.057)	(0.060)	(0.062)	(0.034)
PMR		0.431	0.702	0.114	0.149	0.887***
		(0.645)	(0.735)	(0.705)	(0.691)	(0.286)
Output gap	−0.710***	−0.649***	−0.616***	−1.201***	−1.199***	−0.637***
	(0.117)	(0.093)	(0.078)	(0.224)	(0.226)	(0.064)
R-square	0.513	0.608	0.673			
AR (1)	.	.	.	0.034	0.076	.
AR (2)	.	.	.	0.407	0.197	.
Sargan OID-test	.	.	.	0.677	0.360	.
N	96	93	90	70	70	90

Robust standard errors in parentheses, *significant at 10%, ** significant at 5%, *** significant at 1%. Data is available for 19 OECD countries. Time dummies included in all regressions. Fixed effects preferred for the benchmark specification according to the Hausman test. In (IV) we treat openness, output gap, and net-FDI as endogenous. In (V) we exclude openness from the set of endogenous regressors but treat FDI-net and output gap as endogenous.

a one standard deviation increase in *net-FDI* reduces unemployment by roughly 0.8 percentage points. Regression (II) includes the institutional controls which increases the magnitude of the effect to a 1 percentage point reduction in a one standard deviation of net-FDI. Controlling for financial integration and openness yields results which are very much in line with (II). We then devote attention to the endogeneity problem in that we generate instruments using lagged variables of the potentially endogenous regressors in a diff-GMM regression setup. The model in (IV) treats net-FDI, the output gap, and openness as endogenous. The performance of the instruments is rather good compared to the results obtained for the non-averaged data. The test on first and second order autocorrelation between the instruments and the error term yields p-values equal to 0.037 and 0.417, and the

Sargan test does not reject the null hypothesis but is still below 0.5. The intuition behind the endogeneity problem is that policy makers could be influenced by a surge in unemployment. This could encourage them to increase barriers to international capital and trade flows so that trade openness is also a potential sources for endogeneity. Regression (V) excludes openness from the set of endogenous regressors as a robustness check. All setups yield the same robust finding. FDI-net and openness is negative and significant supporting the robustness of our main result. Moreover, we also find that portfolio investment is positive and significant which further supports our story by indicating that more financial market integration with investors holding foreign portfolio assets having the same effects as FDI-outflows. However, the finding is interesting but not robust given that it only appears in the GMM regressions. FGLDS in (VIII) also yields comparable results.

4 Conclusion

This paper advances a simple multi-industry trade model a là Dornbusch et al. (1977) or Feenstra and Hanson (1996, 1997) with imperfect labor markets due to Mortensen and Pissarides (1994) type of search frictions. Wages in this setup are jointly determined by labor market institutions and international trade, thereby affecting the equilibrium rate of unemployment at the intensive and extensive margin of labor demand. This two-dimensional causality between foreign direct investments and wages (unemployment) also permits the study of changes in the exogenously given labor market institutional environment. Institutions itself remain unaffected by firm behavior or trade so that wages are set according to the conditions in the labor market. Conversely, policy makers may influence labor market outcomes by readjusting labor market institutions. The model proposed above suggests that such a reform would necessarily affect trade, wages and unemployment in all countries integrated through trade in goods and capital.

The paper's major contribution is to test and to quantify the opposing effects at the intensive and extensive margin of labor demand by confronting the model with data taken from the OECD. We successfully test the main hypothesis derived in the theory chapter in that we show that the FDI-receiving countries tend to have lower rates of unemployment, whereas an increase in FDI-outflows increase equilibrium unemployment.

The newly introduced Mortensen and Pissarides (1994) search and matching mechanism within the Feenstra and Hanson model also opens a novel channel through which changes in the workers' wage rate initiated by changes in labor market reforms induce capital flows between the integrated countries. For exogenous interest rates, a loss in competitiveness due to the labor market reform would lead

to excess capital supply in the contracting and excess-demand in the expanding country.

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5 Appendix

5.1 Data description

Unemployment rates: For our OECD benchmark regressions we use total unemployment, measuring the percentage share of unemployed workers in total labor force (15 - 66 years old individuals). Data taken from Bassanini and Duval. Original Source: OECD, Database on Labour Force Statistics; OECD, Annual Labour Force Statistics.

FDI measures: FDI-net is measured as difference between inward-FDI and outward-FDI relative to GDP. *FDI* is taken form the UNCDAT data base and includes transactions of firms from foreign countries with a share of at least 10% in a domestic company. *FDI* stocks and flows are measured in current U.S. Dollar so that real GDP from the Penn World Table 6.4 was used to construct FDI-net intensities. *Inward-FDI* are investments from abroad into the reporting country. FDI-outflows denotes FDI from the reporting country to other countries.

Replacement rate: Average unemployment benefits taken from the Bassanini and Duval data set. Original source: OECD Benefits and Wages Database. According to Bassanini and Duval data is available for odd years only, so that they had to fill the gaps by linear interpolation.

Tax wedge: This variable measures taxation on wages by computing the difference between wages paid by employers and wages earned by employees. The variable on tax wedge is constructed using the OECD taxing wages data. Some observations were adjusted by B&D in order to fill the gaps in the data, thus providing a complete sample for the period 1982 - 2003.

Union density: Union density measures the percentage share of workers associated to unions. According to B&D the data was taken from the OECD Employment Outlook 2004 and inter / extrapolated in order to maximize the sample.

High corporatism: Dummy variable that takes the value one if wage bargaining is highly centralized. Source: Bassanini and Duval.

EPL: Measures the stringency of employment protection legislation, taken from Bassanini and Duval. Original source: OECD, Employment Outlook 2004.

PMR: Measures the regulation on product markets and competition, taken from Bassanini and Duval. Original source: Conway et al. (2006).

Total factor productivity shock: a macroeconomic shock variable that measures the derivation of total factor productivity from its trend using a Hodrick-Prescott filter. Data on TFP is obtained by computing the Solow residual. Source: Bassanini and Duval.

Terms of trade shock: Terms of trade measure the relative price of imports weighted by the share of imports in GDP.

Real interest shock: Measure of the difference between the 10-year nominal government bond yield and the annual change in the GDP deflator.

Labour demand shocks: Definition: logarithm of the labor share in business sector GDP purged from the short-run influence of factor prices.

Output gap: Output gap measures the difference between actual and potential GDP as percentage of potential output. As source B&D cite the OECD Economic outlook and IMF International finance statistics.

OECD panel			OECD panel (5 year averages)		
Variable	Mean	Std. Dev.	**Variable**	Mean	Std. Dev.
Unemployment *(total)*	8.028	4.460	Unemployment *(total)*	7.056	3.827
FDI-net stocks *(FDI-in minus FDI-out)*	−1.065	15.718	FDI-net stocks *(FDI-in minus FDI-out)*	−0.205	20.580
Wage distortion *(replace. r. + tax wedge)*	58.234	18.499	Wage distortion *(replace. r. + tax wedge)*	58.213	17.835
Replacement rate *(index)*	29.175	13.090	Replacement rate *(index)*	28.403	12.73
Tax wedge *(index)*	29.058	9.026	Tax wedge *(index)*	28.712	8.928
Union density *(index)*	39.577	21.019	Union density *(index)*	41.653	20.301
High corporatism *(dummy)*	0.557	0.497	High corporatism *(dummy)*	0.561	0.486
EPL *(index)*	2.026	1.058	EPL *(index)*	2.086	1.091
PMR *(index)*	3.875	1.236	PMR *(index)*	3.848	1.293
Output gap *(actual - potential GDP)*	−0.899	2.473	Output gap *(actual - potential GDP)*	−0.718	1.739
TFP *(shock)*	−0.0004	0.021	TFP *(shock)*	−0.0009	0.011
Interest rate *(shock)*	4.873	2.183	Interest rate *(shock)*	3.534	2.834
Labor demand *(shock)*	0.0301	0.059	Labor demand *(shock)*	0.025	0.060
Terms of trade *(shock)*	−0.039	0.062	Terms of trade *(shock)*	−0.028	0.070

Table 3: Summary statistic

5.2 Proofs

Proof of Lemma 1. The labor market equilibrium can be characterized by standard Bellman equations as shown in Pissarides (2000) or Dutt et al. (2010). After solving for the so-called Wage and Job Creation curves that describe the problem of the worker and the (small) firm one can solve for the equilibrium market tightness by interacting both. This allows us to express the intermediate good prices as functions of exogenous labor market parameters and the equilibrium market tightness, θ.

Both, the final good's prices and the intermediate goods prices are interdependent. The small intermediate goods producers produce under perfect competition and support their goods to the final good assemblers. The small firm assumption implies that each firm recruits one worker and produces exactly one unit of the intermediate good.

Intermediate good producers have to post vacancies in order to recruit new workers which incurs additional vacancy posting cost. The matching itself can be modeled employing a standard Cobb-Douglas matching function $m(\theta)$, which satisfies $m'(\theta) < 0$.

Job Creation J denotes the present discounted value of expected profit from an occupied job in skill group k. The value of a vacant job is denoted by V. V depends on vacancy posting costs (c evaluated at a common price p) and the difference between the value of taking the job and the opportunity costs of filling the job.

The value generated by a successful match is revenue of the intermediate good producer minus variable production cost. The value of the job can be destroyed by an exogenous shock, λ, that hits the firm with poisson arrival rate λ.

$$\eta V = -cp + m(\theta)(J - V) \tag{15}$$

$$\eta J = \varrho(z) - w - \lambda J \tag{16}$$

Optimal vacancy posting by the firm implies that the value of vacancies V is zero in equilibrium.

$$J = \frac{cp}{m(\theta)} \tag{17}$$

Interaction of both equilibrium conditions yields the Job Creation condition

$$\varrho(z) - w - \frac{cp}{m(\theta)}(\eta + \lambda) = 0 \ , \tag{18}$$

which states that revenue equals variable production and recruitment costs. It will be shown that all intermediate good producers pay the same wage to the homogeneous workers. Final good producers however do differ with respect to unit

costs/prices due to differences in input requirements amongst final good producers producing in different industries.

Wage Curve From a worker perspective, the job is worth the wage received as compensation for her effort minus the opportunity cost of forgone outside opportunities. However, the firm a worker is employed for can be destroyed with a certain probability. The value of the job will be destroyed so that the worker is left with her outside option, which is worth ηU. This outside option comprise unemployment benefits b and the value of a successful reemployment.

$$\eta W = w - \lambda(W - U) \tag{19}$$

$$\eta U = b + m(\theta_h)(W^e - U) \tag{20}$$

W^e is expected value of a job. By introducing W^e we take into account that workers are randomly matched to firms and therefore have to build expectations about W. This also implies that all firms pay the same wage rate and therefore only differ with respect to their production given the equilibrium wage. See Dutt et al. (2009) for further discussion.

Wages itself are bargained and satisfy

$$W - U = \beta(J + W - V - U) \tag{21}$$

This implies

$$w = \eta U + \beta(\varrho(z) - rU) \tag{22}$$

and

$$\eta U = b + \frac{\beta}{1 - \beta} cp\theta \tag{23}$$

In the end we obtain an aggregate wage equation

$$w = (1 - \beta)b + \beta cp\theta + \beta\varrho(z) \tag{24}$$

Which is the pendant to the labor supply curve in the standard Feenstra and Hanson model.

To solve for the job creation curve equation (17) and (16) are combined so that

$$(\eta + \lambda)\frac{cp}{m(\theta)} = \varrho(z) - w \tag{25}$$

which can be rearranged to equation (18). To solve for the wage curve we start

with rearranging equation (21) as

$$W - U = \frac{\beta}{1-\beta} J \tag{26}$$

where we can substitute for J using equation (16)

$$\begin{aligned} (\eta + \lambda) J &= \varrho(z) - w && (27) \\ & && (28) \end{aligned}$$

Rearranging equation (19)

$$\begin{aligned} (\eta + \lambda)(W - U) &= w + \lambda U - (\eta + \lambda)(U) && (29) \\ (\eta + \lambda)(W - U) &= w - \eta U && (30) \end{aligned}$$

The outside option is obtained by solving equation (20)

$$\eta U = b + \theta m(\theta) \frac{\beta}{1-\beta} \frac{cp}{m(\theta)} \tag{31}$$

Combining equation (26), (29), and (30) gives

$$\begin{aligned} (\eta + \lambda) \frac{\beta}{1-\beta} J &= w - \eta U && (32) \\ (\eta + \lambda) \frac{\beta}{1-\beta} \frac{\varrho(z) - w}{\eta + \lambda} &= w - \eta U && (33) \\ (\eta + \lambda) \frac{\beta}{1-\beta} \frac{\varrho(z) - w}{\eta + \lambda} &= w - b - \theta m(\theta) \frac{\beta}{1-\beta} \frac{cp}{m(\theta)} && (34) \\ \beta \varrho(z) - \beta w &= (1-\beta) w - (1-\beta) b - \theta \beta cp && (35) \\ w &= (1-\beta) b + \beta(\varrho(z) + \theta cp) && (36) \end{aligned}$$

To solve for the equilibrium intermediate good price we can interact the wage curve (24) and the job creation curve (18) and solve for $\varrho(z)$

$$\begin{aligned} (1-\beta) b + \beta(\varrho(z) + \theta cp) &= \varrho(z) - (\eta + \lambda) \frac{cp}{m(\theta)} && (37) \\ \varrho(z) &= b + \frac{cp}{1-\beta} \left(\beta\theta + \frac{\eta + \lambda}{m(\theta)} \right) && (38) \end{aligned}$$

Equilibrium on the intermediate producer level. In equilibrium, the wage and the equilibrium market tightness θ are determined by interacting the wage curve and the job creation curve such that

$$(1-\beta) b + \beta cp\theta + \beta \varrho(z) = \varrho(z) - \frac{cp}{m(\theta)} (\eta + \lambda) \quad . \tag{39}$$

Simplifying then yields

$$\varrho(z) = \left(b + \frac{cp}{1-\beta} \left(\beta\theta + \frac{\eta + \lambda}{m(\theta)} \right) \right) \quad . \tag{40}$$

We can substitute the common price index by q_i due to the assumption that vacancy posting costs are paid in terms of the intermediate good. Moreover, due to perfect competition and the small firm assumption, the intermediate good producer's revenue must equal the price paid by the final good producers so that $\varrho(z) = q_i$ must hold in equilibrium. Therefore, all final good assemblers pay the same price for intermediate goods denoted $q(z)$ so that $q(z') = q_h(z'')$ for $z' \neq z''$. Prices only depend on exogenous parameters and the equilibrium market tightness, which is common to all firms in all industries.

Proof of Lemma 2. First, notice that the left hand of the LMC curve Γ_L is well behaved due to the convexity of the Beveridge curve. For $\lim_{\theta\to\infty}\Gamma_L = L$ since $\lim_{\theta\to\infty}u(\theta) = 0$. Let the equilibrium market tightness go to zero and we find that $\lim_{\theta\to 0}\Gamma_L = 0$ since $\lim_{\theta\to 0}u(\theta) = 1$. Thus, for $\theta = 0$ we have full unemployment and no worker is willing to search for a job.

The right hand side of the LMC curve is also well behaved. Demand for intermediates hinges on the intermediate goods prices q and q depends on exogenous parameters and the equilibrium market tightness. However, equation (39) is asymptotic in θ so that the necessary restriction for θ is

$$\beta\theta + \frac{\eta + \lambda}{m(\theta)} < \frac{(1-\beta)}{c}$$

to secure that $q(\theta) > 0$. However, this is not a strong assumption for reasonable values of the exogenous parameters as shown in the calibration section. The first derivative of equation (39) is positive since

$$\frac{\partial q(\theta)}{\partial \theta} = -\frac{-c\left[\beta + \alpha(\eta+\lambda)m\theta^{\alpha-1}\right](1-\beta)b}{\left[(1-\beta) - c(\beta\theta + \frac{\eta+\lambda}{m(\theta)})\right]^2} > 0$$

which is needed to derive $\frac{\partial \Gamma_R}{\partial \theta} < 0$. It is enough to apply the Leibnitz rule on Γ_R in order to derive

$$\frac{\partial \Gamma_R}{\partial q} = \int_{\underline{z}_d}^{\bar{z}_d} -\zeta\varphi(z)E(q_d(\theta))^{-2}dz < 0 \tag{41}$$

which implies that $\frac{\partial \Gamma_R}{\partial \theta} < 0$. To derive this proof the assumption that the upper and the lower bound remain constant.

Proof of Proposition 1. The first part follows immediately from the first derivative of Γ_R with respect to z^*. Notice, that for each country we ex-ante know whether z^* is the upper or lower bound. In the two country scenario both countries have one constant bound (either 0 or 1) and one variable bound z^*. So it is important to determine whether z^* is the upper or lower bound for each country, which depends on the regarded country's comparative advantage. For the moment we assume that home has a comparative advantage in the production of goods closer to 0 and foreign has a comparative advantage in the production of goods closer to 1, determined by the assumption about the exogenously given technology $a(z)$ where we assume that $a_d(1) > a_f(1)$ and $a_d(0) < a_f(0)$. For the home country z^* is therefore the lower bound of active industries. Changing the bounds and deriving the first derivative with respect to z^* therefore yields

$$\frac{\partial \Gamma_R}{\partial z^*} = -\frac{\varphi(z^*)E}{q_i} > 0 \tag{42}$$

for the FDI-receiving home country and

$$\frac{\partial \Gamma_R}{\partial z^*} = \frac{\varphi(z^*)E}{q_i} < 0 \tag{43}$$

for the FDI-sending foreign country. An increase in the cutoff industry thus reduces labor demand at the extensive margin due to a reduction in active industries.

The second part follows from Lemma 2, which is necessary to proof Proposition (1). The assumption that interest rates are endogenously determined implies that capital flows must be compensated by a change in interest rates. Capital outflows for instance makes capital more scarce. The reduction in supply therefore must be compensated by a readjustment in capital cost. Suppose that everything else remains equal for the moment. Such an increase in capital cost shifts the unit cost curves upward. The reverse applies for the capital inflow country where the increases capital supply will shift the unit cost curves downward. The former cutoff z^* cannot be optimal anymore and must change. The capital outflow country loose its comparative advantage in some industries close to the former cutoff and the capital inflow country will extend its production to industries formerly associated to the outflow country and z^* will readjust. Proposition 1 immediately implies that Γ_R in the outflow country will fall and Γ_L in the inflow country will rise. To restore equilibrium, wages and thus unemployment have to readjust so that $\Gamma_L = \Gamma_R$ again. Wages and thus intermediate good prices in the outflow country must decrease and wages in the inflow country must increase.

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Editorial address
Institute for Employment Research
of the Federal Employment Agency
Regensburger Str. 104
D-90478 Nuremberg

Editorial staff
Regina Stoll, Jutta Palm-Nowak

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For further inquiries contact the author:

Hans-Jörg Schmerer
Phone +49.911.179 3756
E-mail hans-joerg.schmerer@iab.de