Wages and international factors' mobility[1]

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May 8, 2012- preliminary draft

ABSTRACT

The labor wage is the result of market variables and institutional settings of a country. In an open economy the determination of the market wage rate may be further affected by the extent of international mobility of both factors of production, labor and capital. Labor mobility is represented by migration in and out of a country, while capital mobility relates mostly to the extent of foreign direct investment (FDI) outflows and inflows. Migrants may represent an addition to the native labor force of a country and, in some cases, play a substitute role with respect to incumbent workers. FDI, in particular of the greenfield category, represents either a supplement *to* or a reduction *of* the domestic capital and, by and large, changes the opportunity set of a firm's CEO with respect to the corresponding company operating in a closed economy. International factor mobility and domestic market variables, such as unemployment and productivity, interact in the wage setting process. In this paper, we derive a theoretical wage equation following the above premises, and perform pooled mean group estimates of its parameters on panel data for a group of 13 European countries with quarterly time observation over the period 1996-2007. We find that capital outflows have a robust negative effect on the wage rate. The effects of migration inflows, on the other hand, are not so clear-cut, as they can be nullor negative depending on the sample of countries considered.

Keywords: migration, FDI, wage equation, bargaining.
JEL classification: **F2, J5, J6**,

[1] We wish to thank Paolo Zanghieri, Gaetano Carmeci for comments, help and suggestions. The usual disclaimer applies.
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1. Introduction

The problem

The determination of the market labor wage in an open economy is affected by many variables. Some of them pertain to the very mechanics of the inner domestic markets and structure of a country. That is the case of unemployment, institutional settings, the diffusion and shape of the welfare state, the dynamics of labor productivity, the extent of flexibility of the labor market. Other determinants are the aftermath of globalization of the economy and have an impact on salaries which depends by and large upon the intensity of international openness of an area in terms of both trade in goods and services and international mobility of production factors, i.e., labor and capital. While on the former set of variables we enjoy an abundant crop of theory and applied analyses, contributions on international factor mobility are more recent and display several controversial results, which leave wide room for research. Moreover, the majority of studies tends to be confined to the effect of international labor migration on wage levels in host countries and, to a lower extent, in sending areas. The investigation of the consequences of capital mobility on wages is less popular and is often neglected. Only in recent contributions international financial flows surface as a primary actor on the playground of labor markets equilibria. As a matter of fact the crossborder mobility of both factors of production is relevant and worth investigating in an age of growing delocalization of productive activities via foreign direct investment (FDI) and simultaneous migration flows of human beings. Indeed, the literature on migration mostly emphasizes labor immigration (entrance of foreign workers in a host country), while a lower attention has been paid to emigration (exodus of native workers from their own nation). In a general equilibrium of goods and factors international trade, labour mobility should produce compensating effects in the country of origin (wage increase) and of destination (wage decrease) and opposite movements in capital returns. However, the picture radically differs when market imperfections, different international mobility between capital and labour, large unemployment rates (labour market disequilibria), barriers to trade of factors and goods are taken into account. Turning to capital mobility, our attention is confined to FDI outflows from and inflows to a country. Other sorts of capital flows are thought to be non relevant as to their effects on wages. FDIs make (in particular g*reenfield* FDIs, while *brownfield* FDIs are just acquisitions of existing companies by foreign buyers) either for an addition to existing domestic capital or for a potential subtraction from it. The FDI usually changes the opportunity set of firms' CEOs since it allows an enterprise to choose between locations of production units in different countries. Therefore, before accepting a wage deal, firms which have the opportunity to operate on a multinational scenario, may consider the possibility of investing in a foreign country where wages may be lower. Of course this opportunity is not available for all firms in all countries. Multinationals, regardless of their size, may build new plants in foreign countries giving rise to an FDI either for the production of intermediate or final goods. In other words, the opportunities offered by international capital and production mobility, represented mostly by FDI, may make a firm less willing to accept a wage deal which could endanger its competitiveness vis à vis domestic and foreign rivals. The mirror image of this may be represented by workers willing to accept lower wage deals because of the dual threat of fellow migrants who enter the country willing to work for less and of the opportunity for firms to locate production elsewhere. The moral is that capital mobility may affect in a crucial way labour market equilibria and provide additional downward wage pressure besides that exerted, if any, by the import of foreign labor via migration.

Related literature

In the last two decades, most of the rich and assorted literature[4] on international factor mobility has been devoted to the investigation of the degree of substitutability between migrant and native labor. The focus has a political origin since trade unions and policy makers are quite keen about the wage and social effects of migration and their political consequences in terms of voting preferences. Policy makers oscillate between the Scilla of a thorough opening to migrants inflows pleasing entrepreneurs and the Cariddi of setting barriers limiting entrance of foreign workers to please trade unions. So do many papers moving between two different extremes, wondering whether migrants may represent an addition to the native labor force of a country or just play a substitute role. These two alternatives hide two different reactions of wages: no change in the first case, and a decrease in the second.

The answers to this question are quite different, sometimes even in studies of the same scholars over time. For instance, if we confine to recent contributions, Ottaviano and Peri (2006) maintain that migration decreases the wage of low skilled while increases high skill wages. Later D'Amauri, Ottaviano and Peri (2008) explore the German labor market over the 1990's and empirically adapt a general equilibrium model. Migrants turn out not to be close substitutes for native workers but only for old migrants of similar education and skill. One year later, in an affine vein in a study on the U.S.:"If immigrants and natives in the same skill group are imperfect substitutes, the competitive effects of additional immigrant inflows are concentrated among immigrants themselves, lessening the impacts on natives" (Card, 2009, p. 2). In these contributions and in complementary researches (Ortega and Peri, 2009) immigration simply seems to increase employment and growth with no significant effect on natives' wages. In some sense we may say that migration occurs in a quasi - Rybczynski[5] framework, where the increase in the endowment of a factor of production for a country with no dominant position on international markets leaves relative prices of factors and goods unaffected and boosts aggregate economic activity[6]. The inflow of migrants does seem to reduce neither capital intensity[7], nor total factor productivity in the short-run or in the long run, nor average wages and average income per person. Further evidence of imperfect substitution between migrants and natives is provided in a detailed coverage of the UK in Manacorda, Manning and Wadsworth (2012).

In most of these studies migration seems to exert its negative effect mainly on the wage of incumbent immigrants while natives do not suffer in any discernable way. A distinct strand of literature claims nearly opposite results. In Borjas (2003) and in Aydemir and Borjas (2007) the pressure of migration on labor incomes is highly negative: "the wage impact of immigration depends on the elasticity of product demand, the rate at which the consumer base expands as immigrants enter the country, the elasticity of supply of capital, and the elasticity of substitution across inputs of production. The wage effect of immigration is negative if the impact of immigration on the potential size of the consumer base is smaller than its impact on the size of the workforce"(Borjas, 2009) which is what usually happens. In Borjas, Grogger, and Hanson (2011) the conclusion gets extreme: skilled immigrants and natives in the U.S. turn out to be

[4]Two comprehensive works deserve mentioning. The first considers migration effects in a historical perspective (Hatton and Williamson, 2005). The second provides a survey of recent literature focusing on wage and assimilation effects of migration (Kerr and Kerr, 2011).

[5]After the theorem of Rybczynski (1955)

[6]To be precise, migration, in such framework increases the production of the labor intensive industry while decreasing it in the capital intensive sector.

[7]In a Rybczynski framework the inflow of labor does not alter the capital intensity of each industry, but the production of the labor intensive good increases, thus reducing the aggregate capital intensity.

perfect substitutes. Using Borjas (2009) dataset they obtain elasticities of substitution between natives and migrants which are much higher than those of Ottaviano and Peri (2006). In the same tune, Blanchflower and Shadforth (2009) had previously delved into the effects of migration from Eastern Europe to Britain since 2004, coming across an increased fear of unemployment and a significant downward pressure on salaries. Nonetheless, towards the end of the first decade of the new millennium more comprehensive and syncretic views appear. In Docquier, Özden and Peri (2010) emigration as well as immigration are explored in Europe over a long span of time. It appears that a drop in average wages is caused by emigration, while immigration has a positive influence on mean wages. This result is counterintuitive and is not consistent with non fixed price (non Rybczynski) factor trade theories where immigration should push down wages in host countries while emigration should have the opposite upshot in sending countries, as we mentioned in the first part of this introduction.

As it can be seen, there are different, sometimes radically opposite, views about the overall influence of migrants on natives' incomes. Nonetheless, the indirect channel of influence through incumbent migrants seems to point to a definite substitutability between migrants and natives even after controlling for education and skill. Overall, the evidence is mixed, although there seems to be at least some agreement on the fact that migration touches on wages at least of incumbent foreign workers.

Parallel to the investigation of market relationships between migrants and natives a second stream of contributions regards the issue of wage moderation in Western countries during the last two decades. According to many observers (Alesina, Ardagna and Galasso, 2008) the temperance could be associated to the degree of international opening of labor, capital and goods markets. Quite flat wage dynamics have been observed in the euro area after the introduction of the common currency which imposed to all member countries a fixed exchange rate on almost half of their trade flows[8]. This wage moderation has been interpreted by Bentolila, Dolado and Jimeno (2008) as a sign of a flattening of the Phillips curve. This appears in particular in Spain over the years 1995–2006 when unemployment falls while wage inflation is low and constant as a result of immigration. A similar theoretical conclusion appears in Binyamini and Razin (2008), where, in a New-Keynesian framework, international labor, goods and capital mobility weakens the Phillips curve trade-off.

In the rare most comprehensive and general contributions the emphasis is not confined to labor but its is broadened to examine the international mobility of all factors, including capital. However, a pessimistic outlook emerges in Jayadev (2007) where high capital mobility increases the bargaining strength of firms vis-à-vis workers, adding fresh rents to capital. This paper is an important step towards the understanding of the influence of capital mobility on wages and is closer to our approach. On the same topic, a comprehensive theoretical paper had already warned, few years earlier, about the distributive implications of the international mobility of capital, which is obviously higher than that of labor (Zhao, 1998). As a matter of fact FDI appears to reduce the negotiated wage since it shifts the threat point in negotiations between trade unions and firms. An opposite view may be found in the joint analysis of offshoring and immigration of labor in 58 U.S. manufacturing sectors by Ottaviano, Peri and Wright (2010). Over the period 2000-2007, they observe a positive productivity influence of immigration and no net effect of offshoring. Notice that offshoring is fairly close to FDI outflows on which it is frequently based. A different story is narrated by Geishecker and Görg (2011) who maintain that service offshoring negatively affects the real wage of low and medium skilled individuals. High skill workers may benefit from service offshoring in terms of better real wages. Therefore, the overall result is a widening of the wage gap between expert and less expert workers. A similar story emerges from Hummels, Jørgensen, Munch and Xiang (2011)

[8] On the rest of trade the exchange rate discipline has been even more severe because the euro appreciated since its *specie* circulation started in January 2002.

where offshoring tends to increase the highly specialized wage and decrease the low skilled salary. The novel message of this contribution is that exporting increases the wages of all expertise types, while workers displaced from offshoring suffer greater earnings losses than other displaced fellows. Eckel and Egger (2012) maintain that multinational enterprises use FDI to boost their threat option in bargaining over wages with trade unions, and exert a downward pressure on salaries. Trade unions could improve upon their standing by cooperating internationally. Yet this would be possible only if their preferences as to wages and employment converged across countries. Quite a remote scenario.

The aim of the paper

We would like to add our contribution to the above surveyed literature, by assessing the joint effect of migration and capital movements on aggregate wages. We shall assume that wages are determined in a representative bargaining framework where migration flows change the outside option of employed workers and FDI outflows shift and improve the outside option of firms. Entrepreneurs hold a kind of threat option to delocalize their productive units in a foreign country and to dismiss the domestically employed workers. The representative individual bargaining takes place between union delegates and the firm's CEO. The outside option of the firm is given by the returns obtainable from delocalizing production abroad, mostly through FDI. Workers delegates during negotiation have to take into account the possibility of unemployment. In that case the most likely and immediate alternative salary employees may get is that offered by the informal sector, where the wage is highly affected by immigration flows. Indeed new migrants crowd this sector more than any other place. In this framework we jointly analyze the effects of migration inflows and FDI outflows on the bargained wage. By adopting this approach we differentiate our contribution from existing literature and provide a novel assessment of the relationship between international factor mobility and wage determination. The empirical part of our analysis is conducted on quarterly data over the period 1996-2007 for a panel of 13 European countries for which comparable data on migration and FDI outflows are available[9]. Our main results point out that FDI outflows have a significant and robust negative influence on the aggregate real wage. The effects of migration inflows, on the other hand, are not so clear-cut, as the estimated coefficient is null or negative depending on the set of countries considered. The rest of the paper is organized as follows. In section 2 we present the theoretical model of bargaining which will be the reference point for the derivation of the aggregate wage equation. In section 3 we go through the estimation of the wage equation. In section 4 we draw the conclusions of our investigation.

2. The theoretical framework

The theoretical approach we adopt is one of partial equilibrium based on an individual bargaining between workers' and firms' representatives.
We begin by assuming that aggregate production (Y) is based on labor (L) and raw materials (R), linked by a Cobb Douglas technical relation[10]:

$$Y = L^{\alpha} R^{1-\alpha} \qquad (1)$$

[9]From Eurostat and OECD source.
[10]We ignore capital for the sake of simplicity. Interpreted strictly, then, Y should be final output net of capital compensation.

Labor consists of two components, native (L_N) and immigrant (L_M) workers, which, following Borjas (2003, 2009), we assume are perfect substitutes[11] in production ($L = L_N + L_M$).

The aggregate profit function, in real terms, is given by:

$$\Pi = Y - w\,L - vR \qquad (2)$$

where w is the real wage and v is the (real) price of raw materials.
We envisage a scenario where the real wage is not determined in a supply-demand framework but, due to market imperfections on both sides, via a bargaining procedure between workers' and firms' delegates. Specifically, we consider a Nash bargaining solution in which many identical firms and workers' representatives set real wages so as to maximize the following joint utility or bargaining function:

$$\Omega = [V - V^{\circ}]^{\mu}\ [\Pi - \Pi^{\circ}]^{1-\mu} \qquad (3)$$

where V and Π are the unions' and firms' objectives respectively, while V° and Π° are the outside options that the two parties face if the bargaining falls apart.

We assume that the workers' objective is simply given by the average real wage

$$V = w \qquad (4)$$

As for workers' outside option, we assume that it is either the real wage that they can earn by getting employed in some other firm, w', or the alternative income, w_0, they may get in case they become unemployed and work irregularly in the informal sector (moonlighting). If the probability of becoming unemployed is a positive function (f) of the total unemployment rate, (u), then worker's outside option can be expressed as:

$$V_0 = (1-f(u))w' + f(u)w_0 \qquad (5)$$

Real income in case of unemployment, w_0, is a fraction of the real wage which depends on the "moonlight" wage that unemployed workers can earn from off-the-book employment[12].
We assume that the"moonlight" wage is a negative function of migration inflows, which in turn may be captured by the ratio between the unemployment rate of foreigners and the total unemployment rate. Since new migrants tend to be unemployed for a while when they arrive, an immigration flow should be mirrored by a rise of the ratio between migrant and total unemployment rates, and a drop of the moonlight wage. This assumption is consistent with the large portion of literature on immigration, seen in the introduction, that endorses the perfect substitutability between new and incumbent migrants.

The expression for w_0 is then:

$$\frac{w_0}{w} = b\left(\frac{u_f}{u}\right) \ with \quad b' < 0 \qquad (6)$$

[11] The rational for this assumption lies in the diffusion in many countries especially in Europe of national contracts whereby no discrimination in terms of jobs and wages can be made between native and foreign workers. This is consistent with our hypothesis that the effects of migration feed back mostly in the informal sector wages.
[12] We ignore unemployment benefits for the sake of simplicity. These could easily be introduced (they are a constant fraction of the wage), without altering the analysis. See, for instance, Podrecca (2011).

where u_f is the unemployment rate for migrants.

The outside option for firms takes into account the possible transfer of production facilities in a lower wage country via FDI. As emphasized in the introduction a bunch of papers point out that this opportunity is going to affect wage bargaining in a way which is unfavorable to workers. For this reason we assume that:

$\Pi^{\circ} = g(FDI)$ *with* $g' > 0$. (7)

In other words, firms are assumed to be able to obtain a return from relocating production abroad in case the bargaining is not successful. Such a return is assumed to be a positive function of the amount of direct investment the firms carry out abroad.

The joint maximization of Ω (eq. 3) with respect to *w* implies that the real wage must satisfy the following first order condition (FOC):

$$\frac{\Pi - \Pi^{\circ}}{L} = \frac{1-\mu}{\mu}(V - V_0) \qquad (8)$$

By maximizing Ω individual bargainers take *w'* as given and behave as if the outcome of their bargaining had no effect on the wage paid elsewhere in the economy[13]. However, an affine bargaining is taking place between all firms and workers' representatives in the economy. Therefore, the real wage is eventually going to be the same across all bargaining units. On the basis of these arguments we may maintain that $w'=w$, so that:

$$V - V_0 = f(u)w - f(u)w_0 = wf(u)\left(1 - \frac{w_0}{w}\right) = wf(u)\left(1 - b\left(\frac{u_f}{u}\right)\right) \quad . \qquad (9)$$

From equations (2) and (7) one gets:

$\Pi - \Pi^{\circ} = Y - w\,L - vR - g(FDI)$. (10)

Substituting (9) and (10) into the first order condition (8) we get:

$$\frac{Y - v\,R}{L} - w - \frac{g\,(FDI)}{L} = \frac{1-\mu}{\mu} wf(u)\left[1 - b\left(\frac{u_f}{u}\right)\right], \qquad (11)$$

and finally:

$$w = \left(\frac{Y - v\,R}{L} - \frac{g\,(FDI)}{L}\right)\left[1 + \frac{1-\mu}{\mu} f(u)\left(1 - b\left(\frac{u_f}{u}\right)\right)\right]^{-1}, \qquad (12)$$

which suggests that, in equilibrium, the real wage is affected by four fundamental variables: value added per worker[14] or labor productivity, the total unemployment rate, the ratio between migrant and total unemployment rates and firms' outside option to relocate abroad via FDI.

[13] This sort of conjecture is similar to the one adopted in Lucas (1973).

[14] Which is gross output minus the cost of raw materials (in real terms), $Y - v\,R$. Since we are ignoring capital this should be, strictly speaking, value added net of capital compensation .

A log-linearized version of (12) can be taken to be our "core" wage equation, valid as a long-run equilibrium relationship:

$$\log w = a_0 + a_1 \log\left(\frac{VA}{L}\right) - a_2 \log(u) - a_3 \log\left(\frac{u_f}{u}\right) - a_4 \log\left(\frac{g\,(FDI)}{L}\right) \quad . \qquad (12')$$

3.Estimation of the wage setting parameters

The level wage equation (12') is relevant when one thinks of long run (equilibrium) behavior. In what follows we will use an Autoregressive Distributed Lag (ARDL) approach to model the short run dynamics of real wage adjustment, and we will estimate it and derive the associated long run parameters in a panel data framework.
Given data on time periods t=1, 2, ..., T and countries i=1, 2, ..., N, we think of the short run dynamic specification of the wage equation as an ARDL(p, q,…, q) model, which can be reparametrized in Error Correction Mechanism (ECM) form as:

$$\Delta log w_{it} = \Phi_i log w_{i,t-1} + \mathbf{b}_i' log \mathbf{x}_{i,t} + \sum_{j=1}^{p-1} c_{ij} \Delta log w_{i,t-j} + \sum_{j=0}^{q-1} \mathbf{d}_{ij}' \Delta log \mathbf{x}_{i,t-j} + \mu_i + \varepsilon_{it} \quad (13)$$

$$i = 1..N; \;\; t = 1..T$$

where $\mathbf{x}_{it}$ is the 4x1 vector of the explanatory variables in the core wage equation (12'), $\mathbf{b}_i$ and $\mathbf{d}_{ij}$ are 4x1 vectors of coefficients, Φ_i and c_{ij} are scalar coefficients and μ_i is a fixed effect[15]. Time trends and seasonal dummies could be included but we omit them in the text for notational convenience. We will however introduce them in the empirical estimates.
The error terms, ε_{it}, are assumed to be identically distributed with zero mean and constant variance and independent across time and groups.
Notice that equation (13) is identified if lagged levels of *w* do not enter the determination of the $\Delta\mathbf{x}$'s.[16] Given (13), the parameters of the long run level relation between log *w* and the log **x**'s (i.e., coefficients a_1, a_2, a_3 and a_4 in (12') can be derived as: $\mathbf{a}_i = [a_{1i}, a_{2i}, a_{3i}, a_{4i}] = -(\mathbf{b}_i/\Phi_i)$[17].

We will perform estimations on quarterly data over the period 1996_q1 – 2007_q4 for a group of 13 European countries.[18] Data for the real wage, real value added per worker, total and migrant unemployment rates are from Eurostat source[19]; FDI data are from OECD source, and we use outward FDI as a share of GDP as a proxy for *g(FDI)/L*. The group size is limited by the availability of homogeneous data on migrant employment and unemployment over a time span

[15] We model the real wage w_t *conditionally* to the realizations of the explanatory variables in $\mathbf{x}_t$ and given past values of w_t and $\mathbf{x}_t$.
[16] This hypothesis in words means that past values of the wage level do not affect current changes of the explanatory variables (i.e. of unemployment, productivity, migration flows, and FDI). Notice that the hypothesis does not exclude that lagged changes of w enter the determination of $\Delta\mathbf{x}$'s.
[17] The identifying condition for the short run wage equation (i.e. that past values of w do not enter the determination of the $\Delta\mathbf{x}$'s) also implies that there is only one conditional long run level relationship between w_t and the conditioning variables.
[18] The list of countries is: BE, DK, GE, GR, ES, FR, NL, AT, PT, FI, SE, UK, NO.
[19] As a measure of the average wage, an index of average monthly earnings is used.

long enough to allow meaningful estimations.[20] The panel includes 13 countries and, where possible, 48 quarterly observations per country. However, the panel is unbalanced since in 4 countries the time span is shortened due to missing data on migration variables in earlier years.[21]

Before proceeding with the estimation, we check for unit roots in each series, using the Im, Pesaran and Shin (2003) test for heterogeneous panels (IPS). The results of the test are shown in Table 1. As one can see the unit root hypothesis is always accepted: there is clear evidence of non stationarity for all of the variables series.[22] We then test for cointegration, using the Kao (1999) and the Pedroni (1999, 2004) Engel Granger based panel cointegration tests. As one can see in Table 2, the null hypothesis of no cointegration is rejected both by the Kao test and by the Pedroni's Panel PP, Panel ADF, Group PP and Group ADF statistics.[23] Having assessed cointegration, we now turn to the estimation of the short run dynamics of wage adjustment and the derivation of the associated long run parameters.

To estimate the model on panel data, we apply the Pooled Mean Group (PMG) estimator proposed by Pesaran, Shin and Smith (1999). Contrary to traditional pooling approaches like Dynamic Fixed Effects, the PMG estimator allows not only the intercepts (μ_i), but also the short run coefficients ($\mathbf{b}_i$ and $\mathbf{d}_{ij}$) and the error variances in equation (13) to differ freely across groups, while constraining the long run coefficients to be the same across groups ($\mathbf{a}_i = \mathbf{a}$). Since it does not impose homogeneity of short run slope coefficients, the PMG estimator also allows the lag structures in the dynamic specification to be different across countries. The estimator is efficient and consistent provided homogeneity of long run parameters holds (Pesaran, Shin and Smith (1999)).
We estimate the model including time trends and quarterly dummies, and allowing the lag structure to differ across countries in the short run dynamic specification. In particular, the preferred (parsimonious) ARDL specification is selected for each country using the Schwartz information criterion.
The results of the PMG estimates of the long run parameters are reported in Table 3, which also reports the Hausman tests for homogeneity of long run coefficients. These tests are applied to the differences between the PMG estimates and the Mean Group estimates (i.e., the mean of the estimates of long run parameters obtained separately on time series data for each individual country)[24].
Let us focus first on column a), which reports the estimates for the whole group of 13 countries. A glance to the Hausman tests (both for each individual parameter and the joint test) reveals that the hypothesis of homogeneity of long run coefficients is not rejected at high levels of significance. Looking at the coefficient estimates, notice that the coefficients of total unemployment, productivity and the share of outward FDI on GDP are highly significant and their signs are in line with theoretical priors. Real productivity has a positive effect on the real wage with an estimated

[20] Many countries had to be excluded because data splitting total employment and unemployment between native and migrant workers are not available, or are available for too short a time span to allow estimation (for Italy, for example, Eurostat data are available only starting in 2005)
[21] Countries with missing data on migrations are: NL (migration data start in 98), PT (migration data start in 99), SE (migration data start in 97) and NO (migration data start in 2000)
[22] We also performed the CIPS test for panel unit root proposed by Pesaran (2007), which controls for possible cross section dependence. The results (not reported, available from the authors upon request) , confirm the acceptance of the unit root hypothesis, and the presence of non stationarity for all of the series.
[23] We tested many different specifications besides those reported in table 2 (with and without trend and with different lag orders). The cointegration result is always supported. We also performed a cointegration test controlling for possible cross section dependence, based on Pesaran (2006) Common Correlated Effects estimates and on the CIPS test for panel unit root on the residuals of such estimates. In this case the unit root hypothesis on the residuals is rejected (thus confirming cointegration) only for a specification of lags of 2 or less; the hypothesis is accepted for higher order lags specifications.
[24] See Pesaran, Shin and Smith (1999)

elasticity close to unity, as one expects. The total unemployment rate has a negative influence on the wage with an estimated elasticity of -0.110, a magnitude which is in line with previous results in the cross country literature[25]. The share of outward FDI on GDP has a negative effect on the real wage, with a 1% increase in the share of outward FDI over GDP decreasing the log real wage by 0.026%.[26]

As to the wage effect of the immigration flows (as proxied by the ratio between migrant and total unemployment rates), although it has the expected negative sign, it is not significantly different from zero at conventional levels: migrations inflows do not seem to have any significant effect on the aggregate average real wage.

The group specific diagnostic statistics for the short run equations of individual countries are reported in Table 4 panel (a), which also reports the country specific estimates of the autoregressive parameters. The overall performance is satisfactory, given that in the present context we are not able to take into account the particular features of each single country, and that our standard estimates cannot but sketch a first broad-brush picture. A very high percentage of the change in the log real wage is explained in almost all countries[27]; the standard error of the regression varies from 0.3% to 6%[28]; at the 5% level of significance there is evidence of residual autocorrelation in one country[29], of functional form misspecification in one[30] and of non-normal errors in one[31] while there is no evidence of heteroskedasticity in any of the countries.

In column b) of Table 3, we drop from the sample the 4 countries for which observations on migration flows are missing in the earlier years[32], and repeat the estimates on a restricted balanced panel of 9 countries, with the complete series of 48 time observations per country. In the restricted sample, the coefficients of unemployment, productivity and outward FDI remain highly significant and with the expected sign, and their estimated magnitude is quite stable with respect to the estimates of column a); on the other hand the result on the wage effects of migration inflows changes: the coefficient of the ratio between migrant and total unemployment rates is now negative and highly significant, with an estimated elasticity of -0.15.

The hypothesis of long run coefficient homogeneity is accepted by the individual Hausman tests, and the diagnostic statistics in the bottom panel of table 4 are quite satisfactory, as 8 of the 9 country specific equations show no evident sign of misspecification.

Although the ARDL specification used should mitigate the problem, the coefficient estimates in columns a) and b) of Table 3 could be affected by the potential endogeneity of outward FDI, immigration flows, and unemployment[33]. Notice however that the causal effects from outward FDI to wages and viceversa work in opposite directions[34], and the same is true for immigration flows and for the total unemployment rate[35]. Therefore we expect that endogeneity bias, if present, would

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[25] Where the elasticity of the real wage to unemployment varies from around -10% (e.g. in Blanchflower and Oswald (1990,1994) and Podrecca (2011)) to -5% (in Nunziata (2005)).

[26] Since -0.026 = dlogw/dO_FDI, the reaction of the real wage to changes in O_FDI is: dw/dO_FDI = -0.026 w. Given the range of wage indexes in our sample, the reaction of wages to a doubling of O_FDI is in the range of 2%-3%.

[27] With the exception of Norway, UK and Finland, where the adjusted R-squared drops to 27%, 44% and 3% respectively.

[28] In Sweden and the UK respectively.

[29] The UK.

[30] Norway

[31] Greece

[32] The countries dropped are NL, PT, SE and NO. Missing observations on migration in the earlier years considerably lower the time span of the series for these countries, since in the estimation procedure observations on all explanatory variables are dropped in time periods with missing data for one of them .

[33] As a matter of fact, productivity could be endogenous as well, if one thinks of efficiency wage theories.

[34] The causal effect from outward FDI to wages is negative, while the reverse causal effect from wages to outward FDI is positive, with higher wages triggering higher outward FDI.

[35] Both immigration flows and the total unemployment rate negatively affect wages, while the reverse causal effects from wages to immigration flows and from wages to unemployment are both positive.

lower the magnitudes of the estimated effects of outward FDI, immigration flows and unemployment, i.e. would make them less negative. [36]
Overall, the results strongly support our model's theoretical predictions on the negative effects of outward FDI on wages, and there is some evidence in favour of the predicted negative effect of migration inflows as well.

4.Conclusions

In this paper we tried to assess the joint effect of migration and capital movements on aggregate wages. We presented a theoretical model where wages are determined in a representative bargaining framework in which migration inflows and FDI outflows change the outside option of employed workers and firms respectively. Specifically, workers have to consider the possibility of being unemployed and the fact that the alternative salary they may get in case of dismissal is the one available in the informal sector, where the wage is highly affected by immigration flows since new migrants crowd this sector more than any other section of the labor market. Migration inflows tend to lower the informal sector wage, and the lower value of the outside option for workers tends to translate in a lower bargained wage. The outside option for firms is given by the profits obtainable from delocalizing production abroad, mostly through FDI. FDI outflows shift and improve the outside option of firms mimicking a kind of threat of entrepreneurs to delocalize their productive units in a foreign country and dismissing the domestically employed workers. This in turn translates in a lower bargained wage. In this framework, we derived an aggregate wage equation where the level of the real wage is a function of the unemployment rate, productivity, migration inflows and outward FDI's. The parameters of the wage equation were estimated on quarterly data for a group of 13 European countries over the period 1996-2007 by applying the Pooled Mean Group maximum likelihood estimator.
The results strongly confirm the theoretical predictions on the effects of FDI outflows, which have a significant and robust negative effect on the aggregate real wage. The influence of migration inflows, on the other hand, are not so clear-cut: the estimated effect may be null or negative depending on the set of countries considered.

[36] The coefficient on productivity, on the other hand, would be biased upwards if endogeneity was present, since the causal effect of productivity on wages are both positive.

Table 1. *Panel Unit Root Tests*

Null Hypothesis: Unit root (individual unit root process)

*Series**	IPS W statistic**	P-value
log (w)	3.0380	0.9988
log (U)	-0.03173	0.4873
log(VA/L)	1.75244	0.9602
log(U_M/U)	0.42342	0.3360
FDI/GDP	-0.81932	0.2063

*w: real wage; U: unemployment rate; VA/L: real value added per employed worker; U_M : unemployment rate of migrants. FDI/GDP : share of outward FDI on GDP.
**Im, Pesaran and Shin (2003).
Lag length selection based on SIC. Individual effects included. 13 cross sections. No trend included.

Table 2. *Cointegration tests*

(i) Kao Residual Cointegration Test
Series: log(w), log(U), log(VA/L), log(U_M/U), FDI/GDP
Null Hypothesis: No cointegration

	t-Statistic	P-value
ADF	4.869504	0.0000
Residual variance	0.010368	
HAC variance	0.002786	

No deterministic trend included.
Automatic lag length selection based on SIC

(ii) Pedroni Residual Cointegration Test
Series: log(w), log(U), log(VA/L), log(U_M/U), FDI/GDP
Null Hypothesis: No cointegration

Alternative hypothesis: common AR coefs. (within-dimension)

	Statistic	P-value	Weighted Statistic	P-value.
Panel v-Statistic	0.825612	0.2045	1.077848	0.1406
Panel rho-Statistic	2.996315	0.9986	2.813071	0.9975
Panel PP-Statistic	-43.63414	0.0000	-52.69117	0.0000
Panel ADF-Statistic	-23.15424	0.0000	-11.13527	0.0000

Alternative hypothesis: individual AR coefs. (between-dimension)

	Statistic	P-value
Group rho-Statistic	4.628643	1.0000
Group PP-Statistic	-46.75686	0.0000
Group ADF-Statistic	-2.997096	0.0014

No deterministic trend included.
Automatic lag length selection based on SIC

Table 3

Pooled Mean GroupMaximum Likelihood Estimates of the Long Run Coefficients and tests for homogeneity of long run parameters

	(a) 13 countries*		**(b) 9 countries****	
		H test		*H test*
log(U)	-0.110	*0.00*	-0.126	*1.28*
	(-8.66)	*[0.96]*	(-5.70)	*[0.26]*
log(VA/L)	1.010	*0.01*	1.125	*0.27*
	(13.20)	*[0.93]*	(11.99)	*[0.60]*
log(U_M/U)	-0.012	*0.20*	-0.150	*0.01*
	(-0.73)	*[0.65]*	(-5.53)	*[0.93]*
O_FDI	-0.026	0.28	-0.038	*2.88*
	(-2.93)	[0.60]	(-3.33)	*[0.09]*
Joint H Test	*0.72 [0.95]*		n.a.	

Dependent variable: log(w)
w: real wage; U: unemployment rate; VA/L: real value added per employed worker; U_M : unemployment rate of migrants. O_FDI : share of outward FDI on GDP.
t-ratios in parenthesis, p values in square brackets.
H test = Hausman test for homogeneous long run parameters, applied to difference between Mean Group (MG) and Pooled Mean Group (PMG) estimates).
*BE, DK, GE, GR, ES, FR, NL, AT, PT, FI, SE, UK, NO.
**BE, DK, GE, GR, ES, FR, AT, FI, UK.

Table 4

Group-specific diagnostic statistics and estimates of the group-specific autoregressive coefficient Φ_i

(a) – 13 countries

	SER	AR(χ^2_1)	χ^2_1-FF	χ^2_2-NOR	χ^2_2-HET	Adj. R^2	LL	Φ_i
BE	0.015	18.23	0.16	0.25	0.00	0.98	134.00	*-1.0000*
DK	0.006	10.14	2.60	0.81	2.55	0.99	177.33	*-0.0327*
GE	0.010	9.41	17.85	0.34	8.09	0.99	157.26	*-0.0435*
GR	0.036	5.89	13.49	91.19	7.13	0.95	92.95	*-0.1687*
ES	0.018	8.45	4.59	0.85	11.54	0.94	128.71	*-0.0132*
FR	0.010	7.98	2.01	6.40	1.38	0.97	156.54	*0.0003*
NL	0.018	10.83	5.69	1.01	1.22	0.99	92.46	*-0.0382*
AT	0.011	2.72	3.47	4.61	0.01	1.00	153.62	*-0.2507*
PT	0.029	25.57	0.00	2.09	0.17	0.96	77.73	*-1.0000*
FI	0.014	3.76	1.53	1.25	0.27	0.03	139.05	*-0.0104*
SE	0.003	2.20	3.08	2.99	2.12	0.87	184.21	*-0.0204*
UK	0.060	173.34	1.02	1.39	0.99	0.27	71.09	*-1.0000*
NO	0.007	2.58	29.26	0.79	1.40	0.44	68.94	*-0.4904*

SER: Standard Error of the regression. AR(χ^2_1): LM test for first and second order autocorrelation of residuals. χ^2_1-FF: Reset test for functional form. χ^2_2-NOR: test for normality of residuals. χ^2_2-HET: test for heteroskedasticity. Adj. R^2: adjusted R2. LL: log likelihood.

(b) – 9 countries

	SER	AR(χ^2_1)	χ^2_1-FF	χ^2_2-NOR	χ^2_2-HET	Adj. R^2	LL	Φ_i
BE	0.017	28.47	0.53	0.66	2.80	0.97	127.83	*-1.0000*
DK	0.006	9.04	2.68	0.83	2.54	0.99	177.03	*-0.0222*
GE	0.009	6.48	5.79	0.26	7.20	0.99	158.01	*-0.0699*
GR	0.035	4.39	0.86	80.19	5.24	0.95	94.84	*-0.3316*
ES	0.018	8.38	4.88	0.88	12.44	0.94	128.97	*-0.0193*
FR	0.010	6.64	2.51	10.46	0.85	0.97	156.79	*-0.0190*
AT	0.011	3.27	0.53	3.02	1.07	1.00	153.48	*-0.1515*
FI	0.014	4.03	0.05	0.72	0.09	0.04	139.38	*0.0035*
UK	0.047	26.94	0.23	3.01	6.68	0.55	82.39	*-1.0000*

SER: Standard Error of the regression. AR(χ^2_1): LM test for first and second order autocorrelation of residuals. χ^2_1-FF: Reset test for functional form. χ^2_2-NOR: test for normality of residuals. χ^2_2-HET: test for heteroskedasticity. Adj. R^2: adjusted R2. LL: log likelihood.

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