

Study No. 18

**Immigrants at the Workplace
and the Wages of Native Workers**

**Nikolaj Malchow-Møller
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The Rockwool Foundation Research Unit

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Foreword

In 2005, the Rockwool Foundation decided to initiate, through its Research Unit, a project that would investigate the significance for the Danish labour market of the immigration of foreign labour. Such a project became especially relevant in light of the enlargement of the EU in 2004 to include a number of Eastern European countries. Moreover, the immigration of labour and integration into the labour market have always constituted one of the most highly prioritised areas of research for the Foundation.

The Research Unit then entered into a collaboration agreement with the Centre for Economic and Business Research (CEBR) at the Copenhagen Business School. Nikolaj Malchow-Møller (Director of Research), Jakob Roland Munch (Associate Professor) and Jan Rose Skaksen (Professor), all of CEBR, then carried out the major task of collecting and analysing the available data.

This publication at a midway stage of the project presents some of the main results concerning the consequences of immigration for the wages of Danish workers. We focus in particular on some of the potential consequences of immigration that are often overlooked in the literature. These concern the short-term costs of immigration to Danish workers currently in employment. Are there indeed such costs associated with adaptation to the new situation? And if there are, then who gains and who loses in the short term with respect to wage formation?

Since the immigration of labour in connection with the enlargement of the EU has only been going on for a short while, it has only been possible to trace the consequences of immigration until the end of 2004 in the present working paper, and, of course, the EU enlargement only accounts for a small part of the effects of immigration up to that point.

In addition to the researchers mentioned above, I would like to thank Vibeke Borchsenius, Jonas Helth Lønborg and David Tønners for their extremely competent research assistance. My thanks also go to Assistant Professor Anna Piil Damm (University of Aarhus), Professor Christian Dustmann (University College London), Professor Peder J. Pedersen (University of Aarhus) and Associate Professor Michael Svarer (University of Aarhus) for their expert commentary on the researchers' analyses.

I would also like to mention the contribution of Mai-britt Sejberg of the Research Unit, who has been responsible for proof-reading the text.

As always with the Research Unit's projects, this research has been carried out in complete academic independence and free from the influence of any party, including the Rockwool Foundation itself. The Foundation has, however, with its usual dependability, provided the project with the necessary resources, and the research group and I are indebted to the staff of the Foundation, including the

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Director, Elin Schmidt, and the Board and their chair Tom Kähler. Our warmest thanks go to them for their support and cooperation.

Copenhagen, October 2007

Torben Tranæs

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Abstract: We propose a complementary approach to analyze the impact of immigration on the wages of native workers. Using linked employer-employee data from Denmark for a relatively long time period (1993-2004), we study the consequences of an increased use of immigrants at the most disaggregate level – the workplace. We find that an increase in the share of workers from less developed countries at the workplace has a significantly negative effect on the wages of natives – also when controlling for potential endogeneity using both fixed effects and IV. The use of immigrants from more developed countries also appears to be correlated with wages. However, these correlations disappear when controlling for unobserved firm and worker characteristics and are thus likely to reflect selection rather than a causal effect of these immigrants. Finally, we find a positive impact on the wages of native workers from having Eastern European co-workers.



1. Introduction

In recent decades, many developed countries have experienced marked increases in immigration. As a result, there has been a renewed interest in the economic consequences of immigration. Although the issue is controversial, it is fair to say that most studies have found it hard to document strong effects. In this paper, we propose a complementary analysis of the impact of immigration on the wages of native workers by focusing on the effects of an increased use of immigrants at the most disaggregate level – the workplace.

A substantial empirical literature has studied the impact of immigration on the wages of native workers at a more aggregate level. One approach has been to exploit differences in the inflows of immigrants across regional labour markets to estimate the effects of immigration on the wages of native workers; see, e.g., Altonji and Card (1991) as well as Zorlu and Hartog (2005) for a more recent example.¹ Another approach is taken by Borjas (2003, 2006) who partitions the labour market into skill groups instead of geographic areas and regresses the earnings of native workers on the immigrant supply shocks for each skill group. Yet another route followed in the literature is the so-called factor proportions approach where estimated substitution elasticities between native workers and immigrants are used to simulate the consequences of immigration. This approach sometimes yields significantly negative wage effects for low-skilled native workers; see, e.g., Borjas, Freeman and Katz (1997), while others find very limited or even positive effects; see, e.g., Ottaviano and Peri (2005).

The aggregate approaches may, however, hide effects at the more local level. Thus, native workers within a given skill-group or a given geographic area may be affected differently by immigrant workers, depending on how “close” they are to these workers. One possibility – which we investigate in this paper – is that native workers employed in firms that hire immigrants are affected differently than otherwise similar native workers.

Our hypothesis is that firms using immigrant workers may improve (or worsen) their bargaining position towards native workers, which results in lower (or higher) wages for these workers. There exists solid evidence that rent sharing between firms and workers takes place in imperfectly competitive labour markets, see, e.g., Blanchflower, Oswald and Sanfey (1996), Hildreth and Oswald (1997) and Arai (2003), which leaves plenty of room for such workplace specific bargaining effects of immigration.

Such local effects will not be captured – or only to a limited extent – by using one of the more aggregate approaches, as many of the local effects are likely to net out at the aggregate level. Furthermore, even the average effect within a

1. To avoid problems with endogeneity of the immigrant supply change, some studies have relied on natural experiments, with the prominent examples being Card's (1990) study of the Mariel Boatlift and the mass immigration of Jews from the former Soviet Union to Israel (Eckstein and Weiss, 2004).

given skill group is hard to capture by considering the resulting average wage, since part of the effects will have a temporary nature. For example, native workers affected adversely by an immigrant inflow in the firm may move to other firms (where the wage is less affected by immigration). This move is typically associated with significant adjustment costs in the form of temporary unemployment and other search costs, which are not captured by looking at the resulting wage. For these reasons, we have to look at the wages of the native workers in the firms where immigrants are hired.

The analysis is made possible by the use of linked employer-employee data for a relatively long time period (1993-2004) from a country (Denmark) that has experienced a particularly pronounced increase in the influx of immigrants. As we have observations on all individuals in the Danish labour market, we are able to construct very detailed measures of the use of immigrants at the workplace level.

An alternative explanation behind any negative correlation between the wages of native workers and the use of immigrants at the workplace may, of course, be that certain types of firms both attract many immigrants and pay lower wages, or that certain native workers select into workplaces with a high share of immigrants. There is also a possibility that immigrants are attracted towards firms that pay higher wages. We control for such potential biases using fixed effects at both the individual and the workplace level as well as by instrumenting the use of immigrants by historical information on immigrant use at the workplace, corrected for local trends in immigration.

We find that the share of immigrants from less developed countries has a significantly negative effect on wages – also when controlling for potential endogeneity problems using both fixed effects and IV. The result is very robust to these checks. The use of immigrants from more developed countries also appears to be correlated with wages. These correlations, however, disappear when controlling for unobserved firm and worker characteristics and are thus likely to reflect selection rather than a causal effect of these immigrants. Finally, workers from the new EU countries from Eastern Europe tend to increase the wages of native workers once endogeneity of the immigration variables is taken into account.

Note that the effects identified in this paper do not preclude any overall positive or negative effects of immigration on a given skill-group or geographic area. We do only attempt to identify differences between native workers who are exposed differently to immigration at the most local level – the workplace.

The rest of the paper is structured as follows. Data are presented in Section 2. In Section 3, we outline the empirical strategy, and in Section 4, we present the estimation results. Finally, Section 5 concludes.

2. Data

From the Integrated Database of Labour Market Research (IDA), we hold information on all Danish residents in the period 1980-2004.² From IDA, we first extract information about individual characteristics for a 5 % sample of workers for the years 1993-2004.³ We restrict the sample to include only full-time private sector native workers in the age of 18-65 years from workplaces with at least 10 employees. Second, this sample is merged with individual information on income from the Income Registers in Statistics Denmark for the same period. Third, the whole population of full-time employees aged 18-65 from IDA is used to construct a number of workplace (and regional) characteristics such as the share of immigrants. These are subsequently merged on to the 5 % sample of workers, as all individuals in IDA are linked to workplaces. After eliminating the observations in the upper and lower 0.5 percentiles of the wage distribution, the final data set for 1993-2004 contains 543,089 observations from 85,892 workers and 42,891 workplaces.

The hourly wage rate is the dependent variable used in the analyses to follow. The wage rate is calculated as total labor income plus mandatory pension payments divided by the total number of hours worked in any given year.⁴ The measure for total labor income as such is highly reliable as it comes from the tax authorities. However, it is important to take pension payments into account. They have been rising since their introduction in the early 1990s, but not in a uniform manner across the labour market.

A number of individual socioeconomic characteristics are used as control variables in the analyses. There is information about age, gender, marital status, the presence of children aged 0-6 years in the household, city size, labour market experience, tenure and education.⁵ Descriptive statistics for a selected set of these variables are presented in Table 1.

In addition to the variables listed in Table 1, we include individual information on industry of work (19 different industries) and region of residence (51 regions, defined from observed commuting patterns) in the analyses.

With respect to workplace characteristics, we use a variable for the size of the workplace in terms of the number of employees along with a number of variables measuring the composition of the workplace workforce. Table 2 summarises the main workplace level variables averaged over workplaces in 2004. Similar vari-

2. For more details on the IDA data see Abowd and Kramarz (1999).

3. Each person present in the period 1993-2004 is given the same probability of being sampled. For the sampled workers, we use observations on all years for which they are employed.

4. It should be mentioned that a measurement error could arise as potential overtime work is not included in the registered number of hours worked.

5. Information about workplace tenure only goes back to 1980, so an indicator variable for left censored tenure is included.

Table 1: Summary Statistics: Individual Characteristics, 1993-04

	Mean	Std dev	Min	Max
Age 18-24	0.10	0.30	0	1
Age 25-29	0.13	0.34	0	1
Age 30-39	0.31	0.46	0	1
Age 40-49	0.25	0.43	0	1
Age 50-59	0.19	0.39	0	1
Age 60-65	0.03	0.16	0	1
Female	0.33	0.47	0	1
Married	0.54	0.50	0	1
Children 0-6	0.23	0.42	0	1
Experience	16.58	9.56	0	41
Tenure	4.55	5.28	0	24
Tenure censored	0.06	0.24	0	1
Basic education	0.36	0.48	0	1
Vocational education	0.48	0.50	0	1
Further education	0.16	0.37	0	1
Copenhagen	0.21	0.41	0	1
Large city	0.14	0.34	0	1
Small city	0.66	0.48	0	1
Number of person-years	543,089			

ables measuring the composition of employees at the regional level are also constructed and used in the analyses, but not reported in Table 2.

Of particular importance is the definition of immigrants used in the paper. Immigrants are defined as individuals born outside Denmark with non-Danish parents, *i.e.* parents without Danish citizenship or born outside Denmark. If no information is available on the parents, an individual born abroad is also considered an immigrant. As a consequence, in the group of native persons, we include all

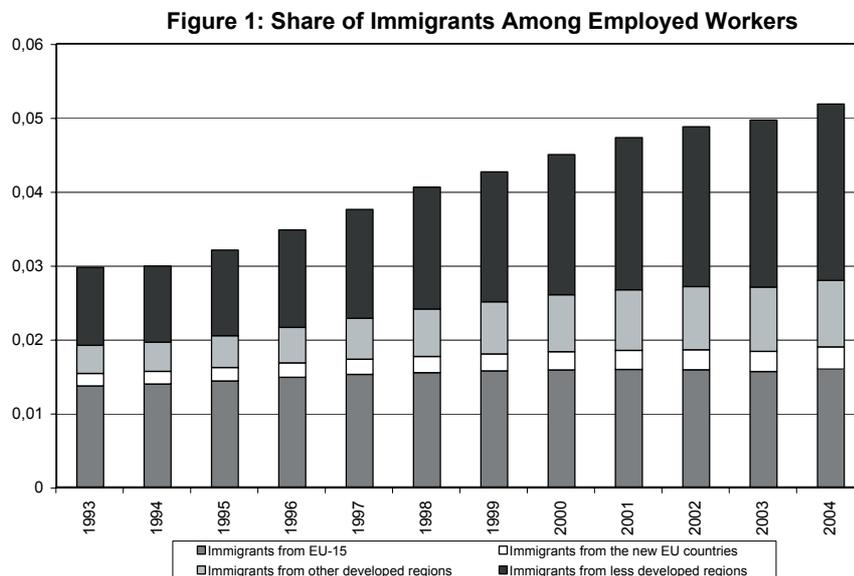
Table 2: Summary Statistics: Workplace Characteristics, 2004

	Mean	Std dev	Min	Max	% with value=0
log (# employees)	3.45	0.90	2.30	8.37	
Female share	0.33	0.27	0.00	1.00	
Share with basic education	0.32	0.19	0.00	1.00	
Share with vocational education	0.51	0.60	0.00	1.00	
Share with further education	0.17	0.21	0.00	1.00	
Share aged 40-65	0.46	0.21	0.00	1.00	
Immigrant type 1 share	0.01	0.03	0.00	0.75	72.69
Immigrant type 2 share	0.00	0.01	0.00	0.39	92.28
Immigrant type 3 share	0.01	0.03	0.00	0.71	82.35
Immigrant type 4 share	0.02	0.05	0.00	0.87	74.49
Number of workplaces in 2004	16,823				

individuals born in Denmark, irrespectively of the status of the parents, as well as individuals born abroad when at least one parent is Danish.

It may be important to distinguish between different types of immigrants as some immigrants may have come to Denmark for job-related reasons while others may have come for, *e.g.*, personal or political reasons (refugees). Employment related immigration may be particularly relevant for immigrants from the old EU-countries and the other Nordic countries. As a consequence, in the analyses to follow, we distinguish between four different groups of origin countries for the immigrants: i) EU-15 countries plus Norway and Iceland; ii) The 10 new EU countries as of May 1, 2004; iii) All remaining developed countries according to the UN definition; and iv) All remaining countries, *i.e.* countries from less developed regions according to the UN definition.⁶ Note that the origin country of an immigrant is defined from the parents' countries of birth (or citizenship) whenever that information is available. That is, an individual born by Swedish parents in Germany is considered Swedish.

Denmark is an interesting case to study since it is one of the European countries that has experienced the strongest relative increase in immigration. Figure 1 shows the development in the four groups of immigrants in the period 1993-2004 in Denmark. This is also a period of maintained employment growth in the Danish economy.



6. The UN definition is available at <http://esa.un.org/unpp/definition.html>. The last group also includes immigrants with unknown origins.

Information on immigrant type is used to construct variables measuring the workplace (and regional) shares of the different types of immigrants among the employees. Summary statistics of the workplace level variables are included in the lower part of Table 2. Notice that for each immigrant type, only a minor part of the workplaces employ immigrants.

As a first indication of a relationship between the workplace immigrant shares and the wages of native workers, Table 3 presents average wages for different educational groups of native workers in 2004. We observe that workplaces with immigrants tend to pay higher wages to native workers. This holds for all types of immigrants and across all education levels. Thus, the raw relationship between immigrant share and the wages of native workers seems to suggest a complementarity.

Table 3: Immigrant Shares and Outcomes for Native Workers, 2004

	Immigrant type 1 share		Immigrant type 2 share		Immigrant type 3 share		Immigrant type 4 share	
	=0	>0	=0	>0	=0	>0	=0	>0
Av. Log(wage), basic education	5.03	5.15	5.07	5.16	5.06	5.13	5.06	5.12
Av. Log(wage), vocational education	5.18	5.24	5.20	5.25	5.20	5.23	5.19	5.23
Av. Log(wage), further education	5.38	5.50	5.43	5.52	5.42	5.50	5.42	5.50
Av. Log(# of Employees)	3.17	4.16	3.34	4.65	3.26	4.33	3.19	4.18
Av. Share with basic education	0.32	0.33	0.32	0.36	0.32	0.36	0.31	0.37
Av. Share with vocational education	0.54	0.44	0.52	0.42	0.53	0.45	0.54	0.44
Av. Share with further education	0.14	0.22	0.16	0.22	0.16	0.20	0.16	0.18

3. Theory and Empirical Strategy

As noted above, the traditional approach to analyse the relationship between immigration and the wages of native workers has been to focus on the immigrant share in the local labour market, which is appropriate in studies of the overall impact on the wage structure. However, this approach may mask effects at the more disaggregate level. There may be direct individual implications of having immigrant co-workers at the workplace; implications that are possible to uncover using micro data for workers and workplaces. In this case, the variable of interest is the workplace immigrant share and its impact on wages of individual native workers.⁷

In a perfectly competitive labour market, workers with identical qualifications should get the same wage, irrespectively of where they work. In that case, there should be no effects of the workplace immigrant share. In contrast, if the labour market is imperfectly competitive and firms earn rents, there may be room for firm- or workplace-specific wages when firms and workers share the rents. There exists considerable evidence of such rent sharing taking place; see, *e.g.*, Blanchflower, Oswald and Sanfey (1996), Hildreth and Oswald (1997) and Arai (2003). This leaves room for firm specific characteristics to play a role for individual wages.

The idea here is that firms using many immigrants may see their bargaining position vis-à-vis native workers improve (or worsen). A higher immigrant share reduces the size of the original native insider group and hence the bargaining power of this group. Below, we set up a simple stylized model to show this point. It should be emphasized that the model is for illustrative purposes only – we do not attempt any subsequent structural estimation. This is followed by a description of the estimation procedure.

3.1 A Simple Stylized Model

We assume that native workers and immigrants are two distinct types of labour. First, immigrants do not possess the same skills as native workers. For example, they may not master the language as well as native workers. Therefore, when hiring immigrants, a firm has to make an investment – either in training the immigrants or in new technology to accommodate the missing skills of immigrants. Second, we assume that native workers are insiders in the labour market. They are organized in trade unions which bargain with firms over employment and wages at the firm level. The immigrants, on the other hand, are outsiders. Their interests are not represented in the trade union.

7. Of course, the more disaggregate approach is not independent of local labour market developments as firms in areas with a relatively high immigrant share will tend to have high workplace immigrant ratios. Consequently, in the empirical analysis, we will also condition on local labour market immigration ratios.

We consider a single firm with a revenue function given by

$$R = R(L_N + aL_I) \quad (1)$$

where L_N and L_I are the employments of native workers and immigrants, respectively, and $a < 1$ is the productivity of immigrants relative to native workers. We assume that $R' > 0$ and $R'' < 0$. Thus, the marginal revenue is assumed to be positive but decreasing.

The profit of the firm is:

$$\pi = R(L_N + aL_I) - w_N L_N - w_I L_I - F \quad (2)$$

where w_N is the wage of native workers, and w_I is the (exogenous) wage of immigrants. F represents fixed costs.

The pay-off to the trade union organising the native workers is assumed to be the total income of trade union members:

$$U = w_N L_N + (M - L_N) \bar{w} \quad (3)$$

where $M (\geq L_N)$ is the number of trade union members (insiders), and \bar{w} is the income of the trade union members who do not achieve employment in the firm. This could be unemployment benefits or wages in other firms (less transaction and search costs).

Since the employment of immigrants requires investments, we assume that the firm first decides on how many immigrants to hire. Next, the firm and the trade union determine wages and employment of native workers. As the purpose of this section is solely to illustrate how the employment of immigrants may affect the wages of native workers, we do not explicitly consider how the firm decides upon how many immigrants to hire. We simply assume that the firm has decided to “invest” in L_I immigrants, and we then consider how this affects the native workers.

The outcome of the bargaining over the wage and employment of native workers, (w_N^*, L_N^*) , is assumed to be given by the Nash-product; see, *e.g.*, McDonald and Solow (1981). *I.e.*

$$(w_N^*, L_N^*) = \underset{w_N, L_N}{\operatorname{argmax}} (\pi - \bar{\pi})^\alpha (U - \bar{U})^{1-\alpha} \quad (4)$$

where α is the relative bargaining power of the firm, π and U are the pay-offs to the firm and the trade union, respectively, if the two parties do not reach an agreement. The fall back pay-off to the firm is:

$$\bar{\pi} = R(aL_I) - w_I L_I - F \quad (5)$$

Hence, if there is no agreement with the trade union, the firm receives the profit it can achieve by only employing the immigrants. For the trade union, the fall back pay-off is:

$$\bar{U} = M\bar{w} \quad (6)$$

From the first-order conditions to the maximization problem in (4), we get that:

$$R'(L_N^* + aL_I) = \bar{w} \quad (7)$$

and

$$w_N^* = \alpha\bar{w} + (1 - \alpha) \left(\frac{R(L_N^* + aL_I)}{L_N^*} - \frac{R(aL_I)}{L_N^*} \right) \quad (8)$$

The condition in (7) shows that the marginal revenue of employment is equal to the alternative wage of native workers. Hence, the employment of native workers is efficient. From this it follows that, as long as the firm employs native workers, total effective employment, $\bar{L} = L_N^* + aL_I$, will be independent of the employment of immigrants. Therefore, the revenue, $R = R(L)$, will also be independent of the employment of immigrants.

Now, (8) can be expressed as:

$$w_N = \alpha\bar{w} + \frac{(1 - \alpha)}{\bar{L} - aL_I} (R(\bar{L}) - R(aL_I)) \quad (9)$$

By differentiating this expression with respect to L_I , it is now easily found that, $\partial w_N / \partial L_I < 0$ so the wage of native workers is unambiguously decreasing in the employment of immigrants. There are two reasons for this. First, with more immigrants, the bargaining position of the firm improves, as the fall back profit of the firm becomes higher. Second, more immigrants increase the revenue in the firm which is shared between the owners of the firm and the native workers.

The above argument requires immigrants and native workers to be substitutes in production. If they are, in fact, complements, a higher immigrant share may instead improve the bargaining power of native workers. This happens because a higher immigrant share will in this case reduce the fall back profit of the firm. This in turn results in higher wages for native workers. As a consequence, we may expect different types of immigrants to have different implications for the wages of native workers.

In sum, the theoretical relationship of interest is given by:

$$w_{ijt} = f(X_{it}, P_{jt}, Z_{jt}) \quad (10)$$

where w_{ijt} is the hourly wage rate of native worker i in workplace j at time t . X_{it} includes individual characteristics such as age, education, experience, and tenure, while the variables of interest are the workplace immigrant shares contained in the vector P_{jt} . Other workplace specific variables are contained in the vector Z_{jt} .

3.2 Estimation

OLS estimation of (a linearised version of) the model in (10) may be biased for several reasons. First, unobservable firm characteristics may cause some firms to both pay different wages and attract more immigrants. This could be the case for, *e.g.*, foreign-owned firms where it is well established empirically that they pay higher wages; see, *e.g.*, Lipsey (2002). Alternatively, firms with unattractive working conditions may be required to pay higher wages (as compensation) and may at the same time attract more immigrants, if these are less picky than native workers. Both of these effects should bias OLS estimates upwards, but should be eliminated when controlling for firm fixed effects.

Second, unobservable individual characteristics may be correlated with the firm immigrant share, if certain (low-productivity) native workers select (or are selected by) firms that also hire many immigrants. For example, production processes that do not require advanced skills or knowledge may attract both immigrants and relatively low-skilled native workers, creating a negative correlation between immigrant share and the wages of native workers. This would bias OLS estimates downwards. This type of bias should, however, be eliminated with the inclusion of individual fixed effects in the estimation.

Thus, we end up with the following Mincer-type specification for the empirical model:

$$\log(w_{ijt}) = \beta X_{it} + \gamma P_{jt} + \delta Z_{jt} + \varphi_t + \theta_{ij} + \varepsilon_{ijt} \quad (11)$$

where φ_t is an unobservable year effect, and θ_{ij} is an unobserved effect for each combination of worker and workplace (a so-called job-spell fixed effects) to capture the above mentioned unobservables.

While OLS estimation of (11) may result in biased estimates, estimation with fixed effects for each worker-workplace combination implies that identification is based on changes in the immigrant shares at a workplace over time within a job-spell. Here the relatively long time horizon of our panel (12 years) is very useful.

Finally, reverse causality may bias estimates even with fixed effects included. This could happen if immigrants are attracted to firms that (in some periods) pay higher wages due to unobserved shocks. The argument should be that immigrants are more likely than native workers to be attracted to these firms, as they

have lower mobility costs, especially when they are settling for the first time in a country; see Borjas (1999). Alternatively, native workers could be more likely than immigrants to flee from firms receiving a negative shock to wages. Of course these issues bear resemblance to the discussion referred to in the introduction about potential endogeneity problems created by mobility across local labour markets. To address this problem, we apply the instrumental variables strategy described in the following subsection. However, it is important to stress that reverse causality is only a problem if native workers and immigrants are expected to react differently to a firm-specific temporary shock to wages.

3.3 Instruments

As instruments for the different immigrant shares in firm j in period t , we use the historical immigrant shares in the firm corrected for the regional and the country-level developments in the different types of immigrants since then.^{8,9}

The idea behind these instruments is that immigrants are likely to seek employment in firms which already employ immigrants. First, because these firms have overcome barriers associated with employing immigrants: They have changed their working language and have made special allowances for cultural and religious diversities, etc. Second, because of network effects among immigrants. Networks have previously been shown to be important for the location choices of immigrants as they facilitate assimilation and the job search process; see, e.g., Munshi (2003). Thus, it seems obvious to hypothesise that they should also matter for job decisions.

We interact the historical immigrant shares in the firms with the country level trends in migration. With four immigrant shares to instrument, $immshare(1)$ - $immshare(4)$, this gives us four instruments for each year. Specifically, the instruments for the four immigrant shares in firm j in period t are given by:

$$immshare(x)_{j,1992} \cdot \frac{imm(x)_t}{imm(x)_{1992}}, \quad x = 1, \dots, 4 \quad (12)$$

where $imm(x)_t$ is the total number of employed immigrants of type x in the country (or region) in year t . Thus, we are basically using the 1992 distribution of immigrants across firms to allocate the subsequent increases in immigrant employment at the regional or country level.

8. In a fixed-effects estimation, instruments should be strictly exogenous, *i.e.* uncorrelated with demand shocks in all years in the sample. For this reason, we use the immigrant shares in the years prior to our sample as instruments.

9. A similar approach is taken by Cortes (2006) who instrument the number of low-skilled immigrants in a city with the historical number of low-skilled immigrants in that city interacted with the increase in immigration at the country level.

The instruments are valid as long as the unobserved factors determining the historical immigrant shares do not affect subsequent wages. As individual and firm fixed effects are included in the IV regressions, this is only a problem if, *e.g.*, a pre-sample temporary shock to firm wages (prices) affects both the immigrant share in 1992 and wages in the sample period. *I.e.* the shock should last at least more than one year. If the shock is permanent, it will be captured by the firm fixed effect.

To minimise the risk of long-lasting temporary shocks invalidating the instruments, we also estimate the model using the 1990 shares of immigrants as alternative instruments. These are much less likely to be invalid, as it would require temporary shocks to last more than 3 years. On the other hand, they may not predict current immigrant shares as well because fewer of the workplaces existed in 1990.

As yet another check on the validity of the instruments, we use the following alternative instruments:

$$\frac{imm(x)_{j,1992}}{imm(x)_{1992}} \cdot (imm(x)_t - imm(x)_{1992}), \quad x = 1, \dots, 4 \quad (13)$$

where $imm(x)_{j,1992}$ is the number of immigrants of type x in firm j in 1992. These instruments are not invalidated by native workers reacting to temporary shocks, as they are only based on the initial number of immigrants in the firm. These instruments are also constructed using the 1990 number of immigrants in the firm. Thus, in total we have 16 instruments for our four potentially endogenous regressors.

In a situation with multiple potential instruments for each potentially endogenous variable, we may test for relevance and validity of the instruments. Our strategy is as a first step to include all eight instruments implementing two-stage least squares, since this may generate more efficient estimates.¹⁰ Second, with respect to the validity requirement, we test each instrument individually using the C-statistic. If the null hypothesis that the instrument is valid is rejected, we drop the instrument. Third we evaluate the relevance of instruments by implementing the test of redundancy suggested by Hall and Peixe (2003) for each instrument.¹¹

10. It should be noted that our potentially endogenous regressors take values in the interval [0,1], so in principle the first stage equation is a non-linear Tobit. However, Angrist and Krueger (2001) argue that two-stage least squares is a robust estimation method and that consistency of the second-stage estimates does not depend on getting the first-stage functional form right.

11. Instruments are redundant if the asymptotic efficiency of the estimation is not improved by using them.

4. Results

This section presents the results of the estimations. Table 4 contains the results of estimating three variants of the model in (11); a simple pooled OLS regression, a regression with job spell fixed effects and a 2SLS regression with job spell fixed effects. In the first model, we find a positive coefficient estimate on the share of immigrants from EU-15 countries, and this confirms the findings from the raw correlations reported in Table 3. However, immigrants from the other three areas are now all associated with a negative coefficient. This means that observed individual and workplace heterogeneity account for the initial positive correlation. For example, workplace size is well known to have a positive impact on individual wages (this is also confirmed in our regressions) and workplace size is also positively correlated with immigrant shares, so failure to control for workplace size may create spurious correlation between wages and immigration shares.

Table 4. Wage Effects of Immigrants at the Workplace

	Coeff.	Std.error	Coeff.	Std.error	Coeff.	Std.error
Immigrant type 1 share	0,3318	0,0520	0,0276	0,0168	0,6431	0,8074
Immigrant type 2 share	-0,2878	0,1022	0,0788	0,0429	1,6791	0,3645
Immigrant type 3 share	-0,1623	0,0525	-0,0667	0,0212	0,1146	0,3137
Immigrant type 4 share	-0,2376	0,0271	-0,1428	0,0138	-1,8241	0,2708
Method	OLS		OLS		2SLS	
Job spell fixed effects	No		Yes		Yes	
Control for clustering	Yes		No		No	

Note: All models include individual control variables (see Table 1), workplace control variables (see Table 2), year fixed effects, industry fixed effects and local labour market controls in the form of fixed effects, local labour market specific time trends and variables measuring the share of the four types of immigrants, the share of workers with further education and basic education and the average unemployment rate. Bold numbers indicate significance at the 5 percent level. Number of obs.: 543,089 (5 percent sample).

Moving to the estimations containing spell fixed effects removes the significance of the coefficients for the first two immigrant groups, although the coefficient to type 2 immigrants is now significantly positive at the 10 percent level. Higher shares of immigrants from other developed countries and less developed countries are, however, still associated with a negative effect on the wages of native workers. More specifically, an increase in the share of immigrants from less developed countries of 10 percentage points reduces earnings of native workers by approximately 1.4 %.

The fact that spell fixed effects remove the effects of the first two immigrant types indicate that the OLS estimates of these can be ascribed to selection. Thus, the OLS estimate of *immshare(1)* appears to be upward biased. This could be due to a multinational effect: Firms with higher shares of immigrants of type 1 are likely to be multinational firms. They pay higher wages and attract more of these immigrants. The OLS estimate of *immshare(2)*, on the other hand, seems to be downward biased. Firms with many Eastern European immigrants tend to pay lower wages to native workers, but not as a consequence of the presence of Eastern European immigrants.

22 *Results*

Moving to the IV estimations, we first investigate validity and relevance of our 16 instrument following the strategy described above. After removing invalid instrumental variables we end up with five instruments which all pass the relevance/redundancy test.¹² The third model in Table 4 contains parameter estimates for the variables of interest in the second stage wage regression. These results confirm that type 4 immigrants have a negative effect on native workers' wages and the coefficient now increases numerically. There is no longer any effect of type 3 immigrants, and immigrants from Eastern Europe (type 2 immigrants) now have a strong positive impact on wages.¹³

12. The surviving instruments are: the 1992 (eq. 12)-instruments for type 2 and type 3 immigrants, the 1990 (eq. 12)-instrument for type 4 immigrants, the 1992 (eq. 13)-instrument for type 2 immigrants and the 1990 (eq. 13)-instrument for type 2 immigrants.

13. The fact that this effect was not positive in the OLS estimation could be because native workers move away from firms paying low wages thereby creating a negative causal relation between wages and immigration shares and thus a negative bias in the coefficients.

5. Conclusion

In this paper we argue that a fruitful way to analyse the impact of immigration on wages is by taking a disaggregated approach, namely by studying how individual native worker wages are affected by the use of immigrant labour at the workplace. In a firm-level bargaining model for the labour market, we illustrate that firms using immigrants may change their bargaining position towards native workers, which in turn affects wages of native workers.

Empirically, our approach, of course, calls for detailed worker-firm data, and we have access to data from the Danish labour market covering all workers and all workplaces for the years 1993-2004 – period with a very substantial increase in the influx of immigrants. A very robust finding is that firm with a high share of immigrants from less developed countries pay lower wages to native workers. This result holds controlling for observed worker and workplace heterogeneity, worker-firm fixed effects and after applying instrumental variables techniques. We also find that workers from the new EU countries from Eastern Europe tend to increase the wages of native workers once reverse causality is taken into account. This means that Eastern European immigrants may complement native workers at the workplace such that productivity and wages increase.

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