

# HOW TO MEASURE LABOUR MARKET EFFECTS OF IMMIGRATION: A REVIEW

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**Abstract.** This paper surveys available empirical evidence on labour market effects of immigration. Many different approaches have been used already to try to find out whether immigration hurts the labour market opportunities of natives. No doubt new approaches will follow in the future as globalization will keep the migration issue on the agenda. This literature review discusses the different approaches concentrating on both the methodology and the results. At the end, it tries to summarize available evidence.

**Keywords.** Immigration; Labour market; Labour economics; Economics of migration

## 1. Introduction

The European Monitoring Centre on Racism and Xenophobia published in 2001 a special analysis of the Eurobarometer 2000 survey on attitudes towards minority groups in the European Union (EU) (Thalhammer *et al.*, 2001). A remarkable finding is that an increasing number of Europeans fear minorities are threatening social peace and welfare. One in two EU citizens is afraid of job losses due to the presence of people from minority groups. Natives clearly worry about the impact of immigration on their own labour market opportunities. Many native citizens believe that foreign workers compete for the same jobs at the labour market and exercise a negative pressure on native wages or employment.

Theoretical aspects of labour market effects of immigration are usually described using a neo-classical competitive model of supply and demand in the market for labour services (see for instance Johnson, 1980; Chiswick, 1982; Greenwood and McDowell, 1994). In general, immigrants lower the price of factors with which they are perfect substitutes and raise the price of factors with which they are complements. Nevertheless, the impact of immigration on labour market outcomes of natives stays theoretically uncertain.

Conclusions of both one-sector and multisector theoretical models are sensitive to changes in the model's assumptions. First, results can change when capital is internationally mobile. When the immigration-induced capital flow re-establishes the pre-migration capital-labour ratio the price of labour or the returns to capital will not change (Borjas, 1999). Second, results depend on the degree of intersectoral capital

mobility. Factor price insensitivity no longer applies if capital is sector specific in a multisector model. Immigration will then decrease the wage rate and increase rental rates in each sector (Rivera-Batiz, 1983). Third, the conclusions depend on the degree of openness assumed for the economy. The presence of a non-traded good in a multisector economy can result in both skilled and unskilled labour losing from immigration (Kuhn and Wooton, 1991).

This theoretical uncertainty created a need for quantitative results and stimulated empirical research. It is hard not to get lost in the multiplicity of empirical research results produced until now. Different studies analyse different data sets over different time periods using different techniques. No doubt new approaches will follow in the future as globalization will keep the migration issue on the agenda. This paper tries to put some structure into this field to allow future research to be more easily situated within and compared with relevant previous research.

Approaches and results discussed in this paper complement the ones discussed in the meta-analysis carried out by Longhi *et al.* (2005) on wage effects of migration. We take a broader definition of labour market effects and are not only interested in effects of immigration on wages. We also question the effects of immigration on labour participation and on the likelihood of being employed or unemployed. We believe migrants can affect native labour market outcomes in many different ways. Studies that focus on other aspects than wage effects also contribute to our insights into the labour market effects of migration.

This paper subdivides available research on labour market effects of migration in two broad categories: simulation-based analyses (Section 2) and econometric analyses (Section 3). Results from simulation-based analyses are more or less theory-driven and sensitive to changes in the underlying theoretical framework. Econometric analyses estimate the effects of immigration and produce more data-driven results. Section 4 tries to summarize available quantitative results and concludes.

## 2. Simulation-Based Analyses

Simulation-based analyses make use of existing economic models to simulate the effects of immigration. We distinguish in this section between two different approaches: the factor proportions approach that is a partial equilibrium approach and the computable general equilibrium approach.

### 2.1 Factor Proportions Approach

During the 1980s there was a large increase in income and wage inequality in the USA (Katz and Murphy, 1992). Many papers in labour economics tried to document and analyse this increasing inequality (Levy and Murnane, 1992). Although there is consensus in the literature about the facts, the causes of the increase in inequality are not that clear. Different studies advance different possibilities like the ageing of the baby boom (Murphy and Welch, 1989), a changing industrial mix of the economy (Bluestone and Harrison, 1988), a worsening of the safety net for the unskilled (Freeman, 1993) or skill-biased technological change (Bound and Johnson, 1992).

Immigration of largely unskilled workers may also have played a role by increasing the supply of less-skilled workers relative to the supply of more-skilled workers. This section discusses the factor proportions approach that evaluates the contribution of less-skilled immigration to the wage gap between more- and less-skilled workers.

The factor proportions approach consists of three steps (Borjas *et al.*, 1992). First, it estimates the amount and educational composition of immigrated labour. Second, it calculates the percentage growth in the ratio of highly educated to less-educated labour attributable to this inflow. Finally, it assesses the potential effect of changes in these skill endowments on earning differentials by education. To summarize: ‘the factor proportions approach compares a nation’s actual supplies of workers in particular skill groups to those it would have had in the absence of immigration and then uses outside information on the elasticity of substitution among skill groups to compute the relative wage consequences of the supply shock’ (Borjas, 1999, p. 1753).

We borrow from Borjas (1999) to illustrate this approach. Assume a linear homogeneous constant elasticity of substitution (CES) production function with two inputs, skilled labour ( $L_s$ ) and unskilled labour ( $L_u$ )

$$Q_t = A_t [\alpha L_s^\rho + (1 - \alpha)L_u^\rho]^{1/\rho} \quad (1)$$

with  $\sigma = 1/(1 - \rho)$  the elasticity of substitution between skilled and unskilled workers and  $Q_t$  the output at time  $t$ . From this CES function a relative labour demand function follows. Suppose further that relative labour supply is perfectly inelastic. The intersection of the relative labour supply and demand function decides relative wages

$$\log(w_{st}/w_{ut}) = D_t - \frac{1}{\sigma} \log(L_{st}/L_{ut}) \quad (2)$$

where  $D_t$  is a log relative demand shifter.

The aggregate supply of skill group  $j$  at time  $t$  comprises native workers ( $N_{jt}$ ) and immigrant workers ( $M_{jt}$ )

$$L_{jt} = N_{jt} + M_{jt} = N_{jt}(1 + m_{jt}) \quad (3)$$

with  $m_{jt} = M_{jt}/N_{jt}$ .

Based on this information the predicted impact of an immigrant supply shock on the relative wage of skilled and unskilled workers equals

$$\Delta \log(w_{st}/w_{ut}) = -\frac{1}{\sigma} \Delta \log \left[ \frac{1 + m_{st}}{1 + m_{ut}} \right] \quad (4)$$

Following this approach Borjas *et al.* (1997) calculate the contribution of immigrants to the increasing wage gap between 1980 and 1995. These results are an update of their earlier study (Borjas *et al.*, 1992) covering the period 1980–1988. We will discuss the results for unskilled workers defined as high school dropouts and skilled workers defined as all other education categories. Between 1980 and 1995 the percentage wage differential between skilled and unskilled natives increased

from 30.1% to 41%. During the same period immigrants increased the relative supply of high school dropouts by 14.9%. Borjas *et al.* (1992) estimate  $1/\sigma$  to be around  $-0.322$  using a time series covering the period 1963–1987. This implies that immigrants reduced the relative wage of high school dropouts by  $-0.322 \times 0.149$  or 4.8 percentage points. In other words, immigration is responsible for about 44% of the widening wage gap between high school dropouts and high school graduates.

Jaeger (1995) uses a comparable approach but combines three labour groups in a nested CES production function. His results for the 1980s are consistent with those of Borjas *et al.* (1992, 1997). Immigration explains about 2.9 percentage points of the 13.4 percentage-point increase in the native dropout-college differential, but only 1.6 percentage points of a 12 percentage point increase in the native high school-college premium. Jaeger (1995) reports results not only on the relative wages but also on the level of wages. Immigration during the 1980s accounted for roughly one-third of the decline in real wages for high school dropouts. The effects on the wage levels of other skill groups were comparatively smaller.

Some cautiousness is required when interpreting the results of a factor proportions analysis (Schoeni, 1997). A heterogeneous workforce has to be aggregated in a few skill groups and all members, both natives and immigrants, within each skill group are assumed to be perfect substitutes. If they are not, the depressing effect on wages may be overstated by the factor proportions approach. An aggregation of the labour force in high school dropouts and all other education categories is surely subject to this risk.

In a more recent paper, Borjas (2003) increases the number of labour aggregates using a three-level CES technology. The bottom level combines similarly educated workers with different levels of work experience into labour supply for each education group. The second stage aggregates workers across education groups into the national workforce. Finally, the upper level combines labour with capital. He uses data for four education groups and eight experience levels in 1960, 1970, 1980, 1990 and 2000 to estimate elasticities of substitution for each stage of the CES technology. With these estimates Borjas (2003) calculates the wage impact of the immigrant influx that entered the USA between 1980 and 2000. Results show a wage decrease for the average native worker by 3.2%. Workers at the bottom and top of the education distribution are most affected with wage decreases of 8.9% and 4.9%, respectively.

The factor proportions approach has been criticized for relying too heavily on theoretical models (DiNardo, 1997). It does not estimate the impact of immigration on the wage structure; rather it simulates the impact for given elasticities of substitution. If the model of the labour market underlying the calculations or the estimate of the relative wage elasticity is false, the estimated impact of immigration is also false. Nevertheless, much evidence shows that relative supplies do affect relative wages and the factor proportions approach is a valuable instrument to gain insights in the wage effects of migration.

## 2.2 Computable General Equilibrium Analyses

A computable general equilibrium model describes an economy in equilibrium with endogenously determined relative prices and quantities (Bergman, 1990). A set of equations translates the structure of an economy and describes the behaviour of all agents and the equilibrium conditions of all markets. A calibration or estimation procedure fixes the parameters for the model's equations (Mansur and Whalley, 1984). After calibration, the model can be solved for an alternative equilibrium associated with any changed policy regime. A comparison between the alternative and the benchmark equilibrium makes it possible to assess effects on allocation and on income distribution.

Computable general equilibrium models are not new to economists. They have for instance been used in development economics (Dervis *et al.*, 1982), trade economics and public finance (Shoven and Whalley, 1984). This technique is also suitable for studying the effects of migration. A computable general equilibrium model can consider migration flows and simulate the responses of economic variables to these flows. Economic historians were the first to apply this technique to problems of mass migration. Williamson (1990) made a computable general equilibrium model to study labour market effects of Irish immigration in Great Britain between 1821 and 1861. Another example researches the impact of migration in the USA and out of Great Britain in the nineteenth century on convergence between the two countries (O'Rourke *et al.*, 1994).

More recent examples in the literature show that computable general equilibrium models are an interesting alternative to untangle the effects of migration. Müller (1997) made an exploratory study for Switzerland. He describes the effects of migration within a simple computable general equilibrium model and tested the sensitivity of the results for different modelling hypotheses on labour market segmentation, capital mobility and terms of trade. The results show that in general immigration has a positive but small effect on native welfare.

Barrett *et al.* (2005) try to simulate the impact of immigrants who arrived in Ireland during the economic growth of the 'Celtic Tiger' era (1993–2003). Although the immigrants have notably higher levels of education relative to the domestic populations, they are not all employed in occupations that fully reflect their educational levels. Results show that immigrants increased GNP by 3% but worsened the position of the low skilled who face lower wages or higher unemployment rates. The impact of immigrants would be more favourable if there was no occupational gap and immigrants would have access to the same occupations as natives. GNP would then increase by more than 3% and earnings inequality would reduce.

Weyerbrock (1995) makes use of a computable general equilibrium model to study the effects of immigration into the EU. She concludes that labour migration into the EU does not cause the dramatic consequences that EU citizens often fear. She explains that negative effects, like increasing unemployment or decreasing wages and income per capita, are small even with huge migration flows. Adjustment problems for the labour market are smaller when immigrants also increase the capital stock. With limited migration an increase in income per capita is even possible, especially

when labour markets are flexible. The more flexibly wages can react, the smaller possible negative effects will be. Therefore Weyerbrock argues to make labour markets more flexible in the EU.

Boeri and Brücker (2005) reach similar conclusions in an analysis on cost and benefits of East–West migration in the enlarged EU. They simulate the outcomes of expected migration flows under different assumptions about migrant skills, wage flexibility and levels of welfare benefits. When labour markets are clear, gains are large: immigration of 1% of the population increases GDP of the total EU region by around 0.3%. However, simulations with wage rigidities discover a policy dilemma: the total EU region can substantially gain from migration but only at the expense of the native population in receiving countries. This creates an incentive for a closing-the-door policy and the gains from migration would fail to develop.

The results by Boeri and Brücker (2005) are well in line with findings from more complex simulation models on the impact of Eastern enlargement. The studies of Keuschnigg and Kohler (2002), Heijdra *et al.* (2002) and Brücker and Kohlhaas (2004) yield very similar results for Austria and Germany on the impact of immigration following enlargement. In all these models wages will decline by roughly 0.5% after immigration of 1% of the labour force and GDP in the host country will increase.

One of the advantages of computable general equilibrium models is that they can distinguish between different households. Negative effects can be strong for certain types of households but negligible for other types of households. Households that supply labour services comparable to labour services supplied by foreign workers are most hit by foreign competition. It often concerns less-skilled or former migrant households that are already at the bottom end of the income scale. In these cases it may be crucial that minimum wages are kept or introduced for less-skilled workers to prevent increasing income inequality. A computable general equilibrium assessment of the impact of illegal immigration on the Greek economy illustrates this point. Sarris and Zografakis (1999) show that illegal immigrants decrease real disposable income of households headed by an unskilled person but favour all other households. The ones who lose, however, make up about 37% of the Greek economy.

To summarize, computable general equilibrium models are an interesting alternative to search for labour market effects of migration. Whereas most empirical approaches study the effects of immigration under a *ceteris paribus* condition, computable general equilibrium models allow for other variables to change as well. They incorporate not only the labour market but also other factor markets, goods markets and external trade markets. Interactions that take place between these different markets are taken into account. These models not only study the effects of immigration on wages and employment but also consider the effects on household and per capita income and on macroeconomic indicators such as real GDP, the real exchange rate and total real exports and imports.

### 3. Econometric Analyses

Econometric analyses estimate the effects of immigration based on correlations that occur between variations in wages or (un)employment rates and variations in migration stocks or flows. Some methods exploit the geographical diversity in migration concentrations (Sections 3.1 and 3.2); others exploit changes in migration patterns over time (Section 3.3). Studies discussed in Section 3.4 exploit changes that occur after large inflows of migrants caused by political factors.

#### 3.1 Area Analysis

A frequently used empirical method to search for labour market effects of migration is area analysis. Migrant populations concentrate in particular geographic areas and area analysis exploits this geographical diversity to look for effects of migration on regional labour markets. This means that employment opportunities or wages of labourers in a local labour market are related to the fraction of migrants in that labour market. If areas with more immigrants have lower wages or higher unemployment rates, that finding would be consistent with the hypothesis that immigrants have a depressing effect on local native labour market conditions.

Most empirical studies in the area approach do not build from a theoretical framework. Only Altonji and Card (1991) and Card (2001) develop some theoretical micro foundations. Studies that use aggregated area cross-section data estimate a regression model of the form

$$Y_i = \alpha + X_i\beta + \gamma P_i + u_i \quad (5)$$

$Y_i$  is a measure of labour market performance of some native group in area  $i$ : for instance average wages, participation rates or unemployment rates.  $X_i$  is a vector of regional explanatory variables such as population size, population density, average education and age, share of female workers and so on. The key explanatory variable is the proportion of migrants in the regional labour force  $P_i$ .

When individual cross-section data are available the regression model can include explanatory variables at individual level such as educational attainment, age and experience:

$$Y_{il} = \alpha + Z_l\delta + X_i\beta + \gamma P_i + u_{il} \quad (6)$$

$Y_{il}$  is here the labour market performance of individual  $l$  in area  $i$ ,  $X_i$  and  $P_i$  are as before and  $Z_l$  is a vector of explanatory variables for individual  $l$ .

Models that consider regional information jointly with individual characteristics but omit some relevant regional variables might fail to have independent disturbances. Moulton (1990) shows the danger of such a misspecification as standard errors can be seriously biased downward. One way to deal with this problem is to use a two-step approach (Schoeni, 1997; Easton, 2001). The first step runs a cross-section regression with a basic set of controls and a full set of regional dummies. The second step regresses the estimated coefficients of the regional dummies on measures of immigration.

When cross-sections are available for two or more years, estimations in first-differenced form are possible. This means that the change in employment opportunities or wages of labourers between two points in time is compared with the change in the fraction of migrants in these regions. First-differenced estimations prevent possible omitted variables biases that arise when there are regional-specific fixed effects that correlate with the fraction of migrants or the labour market performance of natives. Many factors determine the level of wages in a city. Some of these factors may also correlate with immigration. The correlation between immigration and wages then becomes hard to interpret as it may just be picking up the correlation between wages and the third factor. Estimating in first differences will solve the omitted variables bias if the omitted variables do not change over time. They are subtracted away when the problem is considered in changes in variables rather than in levels of variables (Friedberg and Hunt, 1999).

Area analysis has to deal with two problems. The first is a possible endogeneity problem when migrants choose their destination area depending on the local wage or unemployment level. The causality can run in both directions. Immigrants may choose to settle in locations with better labour market conditions, in which case the causality runs from labour market conditions to immigration. The settlement of immigrants may also cause deterioration in the local labour market conditions, in which case the causality runs from immigration to labour market conditions. The resulting correlation between these two variables will measure a net effect and not just one causal relationship. Estimation by ordinary least squares (OLS) needs all explanatory variables to be exogenous. In other words, the concentration of immigrants in local labour markets may not depend on wages or (un)employment rates. This is highly unlikely as the foreign-born concentrate in states with relatively high rates of economic growth (Gurak and Kritz, 2000). Estimations that neglect this endogeneity problem will produce biased coefficients.

One technique to solve the endogeneity problem is instrumental variables (IV) estimation (Altonji and Card, 1991; Pischke and Velling, 1997). Unfortunately it is hard to find one or more instruments that are highly correlated with the concentration of immigrants but uncorrelated with the wage or unemployment levels. An instrument that is often used for the change in migrant share is the share of immigrants in the labour market at the beginning of the period (Schoeni, 1997; Pedace, 1998). This instrument builds on the belief that immigrants often settle in places where previous immigrants already live (Bartel, 1989; Massey *et al.*, 1994). Relatives and friends form an information network that will help new immigrants to find housing and employment. This way an immigrant's decision of where to migrate becomes a function of the share of immigrants already present in the various labour markets at the beginning of the period.

Another way to deal with the endogeneity problem is by looking at 'natural experiments'. These experiments consist of an inflow of migrants that is exogenous or independent of labour market conditions. Political factors rather than economic motivations cause these migrant flows. Some examples are the 'Mariel boatlift' of Cubans to Miami (Card, 1990) or the repatriation of Algerians of European origin

to France after Algerian independence (Hunt, 1992). Section 3.4 discusses these natural immigration experiments in more detail.

The second problem of area analysis is that natives may respond to the entry of immigrants in a local labour market by moving their labour or capital to other areas (Borjas, 1999). Effects may not be detectable when labour markets are linked. If natives are mobile the labour market effect will be diffused throughout the national economy and nothing will be measured locally, but this does not mean that immigration had no effect. Friedberg and Hunt (1999, p. 350) make an analogy to a pool of water: 'If a bucket of water is poured into the pool, the water level at that particular spot will not be higher than the water level in the rest of the pool. Using a geographic, or cross-sectional, approach would lead to the conclusion that pouring water into a pool does not affect the amount of water it contains. This approach would miss the fact that the overall water level of the pool had risen.'

Empirical studies on these compensating native outflows give conflicting results. Filer (1992) finds that in-migration of natives is lower in areas with higher concentrations of immigrants. White and Liang (1998) conclude that states with high levels of recent immigration are less likely to keep native workers or receive new native interstate migrants. Similarly, Frey (1995) claims increased domestic out-migration away from high-immigration areas especially for less-educated residents. Further, Borjas (2005) finds that high-immigration areas are associated with lower native in-migration rates and higher native out-migration rates. This way, the native migration response can account for between 40% and 60% of the difference in the measured wage impact of immigration between the national and local labour market levels.

On the other hand Butcher and Card (1991) conclude that native in-migration flows positively correlate with inflows of recent immigrants to all immigrant-intensive cities except for New York, Los Angeles and Miami. About the net-migration loss of native-born workers from large metropolitan areas, Wright *et al.* (1997) decide that this is more likely the result of industrial restructuring than of competition from immigrants. Contradictory to Borjas *et al.* (1996), Butcher (1998) finds that the size of the impact on the white-black annual earnings gap declines as the level of geographic aggregation increases. Most recent research also fails to support the claim that natives have made migratory responses to recent immigration. Card (2001, 2004) concludes that mobility flows of natives and older immigrants are not very sensitive to inflows of new immigrants. Finally, Kritz and Gurak (2001) show that native-born men and foreign-born men were less likely to leave states that received large numbers of immigrants than they were to leave other states.

To avoid the problem of compensating outflows some researchers changed the unit of analysis from the area to the industry (De New and Zimmermann, 1994a, b; Mühleisen and Zimmermann, 1994), occupation (Camarota, 1998; Card, 2001; Orrenius and Zavodny, 2003) or education or experience group (Borjas, 2003). In other words some studies seek to find out whether there is a relationship between the concentration of immigrants in an occupation or industry and the wages of natives in the same occupation or industry. The underlying idea is that it is harder for natives to change industry or occupation than to change area of employment when

they suffer from increased competition on the labour market. Disequilibrium across occupations will be more persistent than disequilibrium across local labour markets, and the impact of immigration is therefore more clear.

Table 1 surveys research that situates within this approach. Most studies concentrate on the USA and use US Census data. Research for European countries is rare and especially focused on Germany and Austria. As it is common knowledge that wages in Europe are more rigid than in the USA, European studies more often look at (un)employment effects of immigration and less at wage effects. Surprisingly, wage effects found in European studies are more negative than wage effects found in the US studies. Wage effects in the USA are at most  $-1.5\%$  for a 1 percentage point increase in immigrant share (Goldin, 1994). De New and Zimmermann (1994a, b) find wage effects of  $-3.3\%$  and even  $-6.4\%$  for a 1 percentage point increase in immigrant share in Germany.

Only few studies point to a sizeable displacement effect. According to Card (2001) a 1 percentage point increase in the immigrant share would decrease the native employment to population ratio by at most 1 percentage point. Angrist and Kugler (2003) find larger effects for EU countries with a decrease of a maximum of 1.6 percentage points. Winter-Ebmer and Zweimüller (2000) make an important point on the employment effect. They find no significant effect of immigration on the probability of entering unemployment in Austria. However, this does not mean that immigration had no employment effect at all; it only means that employed workers were not affected. The authors show immigration has an impact on the unemployed who find it more difficult to get back to work. When the immigrant share increases by 1 percentage point unemployment duration increases by 5%.

When interpreting results of various studies it is important to note that wage and employment effects can change over time. Altonji and Card (1991) find significant wage effects during the 1970s. Schoeni (1997) finds little or no effects on wages for the 1980s. The same phenomenon is found in Germany with significant wage effects during the period 1984–1989 (De New and Zimmermann, 1994a, b) and no wage effects during 1987–1994 (Winter-Ebmer and Zimmermann, 1999). These differences can be due to institutional changes in barriers to wage adjustments or unionization. The degree of substitutability of immigrants with native workers can also change over time. Borjas (1994) argues that newly arrived immigrants are inherently different from those who migrated 20 years ago. In the USA more recent immigrant waves are less skilled than earlier waves. More recent immigrant waves will therefore affect less-skilled native wages more than earlier waves did.

The results in Table 1 clearly show that immigrants substitute most with less-skilled workers (Camarota, 1998), earlier immigrant cohorts (De New and Zimmermann, 1994a) and seasonal workers (Winter-Ebmer and Zweimüller, 1999). On the other hand workers that can be considered as complementary with foreign labour are not affected by immigration or even benefit from it (De New and Zimmermann, 1994b; Orrenius and Zavodny, 2003).

Table 1. Overview of Migration Literature Based on Area Analysis.

Study	Country	Methodology	Effects on	Results <sup>a</sup>
Addison and Worswick (2002)	Australia	Panel data (1982–1996), two-step estimation, IV	Real wages of natives	No significant effects
Altonji and Card (1991)	USA	Cross-sections (1970 and 1980), first differences, IV	Participation, employment and weekly earnings of less-skilled natives	Wages: $-0.3\%$ to $-1.2\%$ ; employment and participation: negligible effects
Angrist and Kugler (2003)	EU	Fixed effects panel model with IV (1983–1999)	Employment to population ratio of natives by sex	Employment to population ratio native men $-0.7$ to $-1.6$ percentage points; no significant effects for women
Borjas (2003) <sup>b</sup>	USA	Fixed effects panel model (1960, 1970, 1980, 1990, 2000)	Annual and weekly earnings and fraction of time worked of native men	Weekly earnings and fraction of time worked: $-0.5\%$ ; annual earnings: $-0.9\%$
Borjas, Freeman and Katz (1996)	USA	Cross-sections (1980 and 1990), first differences	Weekly earnings of natives by sex	Unstable results, greater depressant effects for wider areas
Butcher (1998)	USA	First differences and IV (1980 and 1990)	Employment probability, weeks worked, hourly wage and annual earnings of native-born black men	No significant effects
Camarota (1998) <sup>b</sup>	USA	Cross-section (1991)	Wages of all workers	Wages: $-0.5\%$ ; for workers in low-skilled occupations $-0.8\%$
Card (2001) <sup>b</sup>	USA	Cross-section (1990), IV	Employment rate and wages of natives and earlier immigrants by sex	Employment to population ratio: $-0.3$ to $-1$ percentage points; wages: $-1\%$

Table 1. *Continued.*

Study	Country	Methodology	Effects on	Results <sup>a</sup>
Card (2004)	USA	Cross-section (1990), IV	Relative wages and employment of low-skilled natives	No effect on relative wages, small negative impact on relative employment
De New and Zimmermann (1994a) <sup>b</sup>	Germany	Random effects panel model, IV (1984–1989)	Hourly gross wages of German and foreign male blue-collar workers	Overall wage: -6.4%; more negative effects for foreign workers
De New and Zimmermann (1994b) <sup>b</sup>	Germany	Random effects panel model, IV (1984–1989)	Hourly gross wages of blue- and white-collar native workers	Wage blue-collar workers: -5.9%; wage white-collar workers: +3.5%; weighted average wage: -3.3%
Dolado, Jimeno and Duce (1996)	Spain	First differences with IV (1990–1992)	Skilled and unskilled wages and employment	Evidence for positive wage and employment effects
Dustmann, Fabbri and Preston (2005)	UK	Pooled cross-sections and first-differences with IV (1983–2000)	Participation rate, (un)employment rate and hourly wages of the working population by education	Little evidence for overall adverse effects
Easton (2001)	USA	Cross-section (1990), two-stage procedure	Hourly nominal wages of natives by sex, race and education	No evidence for negative wage effects, weak evidence for positive wage effects for women
Fairly and Meyer (2003)	USA	Pooled cross-sections (1980 and 1990), two-stage procedure with IV	Probability of self-employment and self-employment earnings of natives by sex and education	Large significant negative effect on probability of self-employment, positive effect on earnings

Gang and Rivera-Batiz (1994)	Germany	Probit analysis (1988)	Probability of being employed of native-born workers	No significant effects
Gang, Rivera-Batiz and Yun (1999)	EU	Probit analysis (1988)	Probability of being employed of EU-citizens	No significant effects
Gavosto, Venturini and Villosio (1999)	Italy	Pooled cross-sections (1986–1995), two-stage procedure	Wages of native manual workers	Positive wage effect: +7.5%; negative effect only possible after crucial threshold
Goldin (1994)	USA	First differences (1890–1907)	Wages of labourers and artisans	foreign share Wages: –1% to –1.5%
Haisken-De New and Zimmermann (1999) <sup>b</sup>	Germany	Random effects panel model, IV (1984–1992)	Monthly earnings and job mobility of high- and low-skilled workers	No effect on low-skilled wages, positive effect on high-skilled wages
Hofer and Huber (2003) <sup>b</sup>	Austria	Multinomial logit, first differences (1991 and 1994)	Wage growth and sectoral mobility of white- and blue-collar male manufacturing workers	Wage growth blue-collar: –0.2 percentage points; increase in probability of moving to non-employment
LaLonde and Topel (1991)	USA	Cross-sections (1970 and 1980), first differences	Wages of earlier immigrant cohorts and natives	Negative wage effects for new immigrants, effects die out for earlier immigrant cohorts, no effects for natives
Mühlaisen and Zimmermann (1994) <sup>b</sup>	Germany	Panel probit analysis (1984–1989)	Probability of being unemployed and changing jobs of men	No significant effects

*(continued)*

Table 1. *Continued.*

Study	Country	Methodology	Effects on	Results <sup>a</sup>
Orrenius and Zavodny (2003)	USA	Panel model with IV (1994–2000)	Wages of natives by occupation groups	Wage low-skilled natives: –0.26%; no effect for more-skilled labour
Pedace (1998)	USA	Cross-section (1990), IV	Wages and number of weeks worked of natives by race and education	Most effects not significant
Pischke and Velling (1997)	Germany	Mean reversion model, first differences, IV (1985 and 1989)	Employment and unemployment rate of all residents and Germans	Little evidence for (un)employment effects
Schoeni (1997)	USA	Cross-sections (1970, 1980 and 1990), first differences and IV, two-stage procedure	Participation, employment, wages and annual earnings of natives by race and education	Substantial effects on least-educated groups, small economy-wide effects
Simon, Moore and Sullivan (1993)	USA	Different panel data models (1960–1977)	Unemployment rate of all citizens	No significant effects
Venturini and Villosio (2002)	Italy	Pooled cross-section probit (1993–1997)	Probability of moving into (un)employment	Complementary or nil effect
Winegarden and Khor (1991)	USA	Simultaneous equations model (1980)	Unemployment rate of all citizens by age and ethnicity	Increase in unemployment rate by 2.4 percentage points
Winegarden and Khor (1993)	USA	Cross-section (1980) with IV	Income inequality of native-born households	Immigration has a disequalizing effect, but the impact is small
Winkelmann and Zimmermann (1993) <sup>b</sup>	Germany	Panel Poisson model (1974–1984)	Probability of unemployment, number of unemployment spells and job changes of male workers	Substantial increase in unemployment frequency, no effect on job changes

Winter-Ebmer and Zimmermann (1999) <sup>b</sup>	Austria, Germany	Panel model in first differences with IV (1987–1994)	Employment and wage growth of all workers and natives only	Austria: employment –1.87%, wages –2.34%; no effects in Germany
Winter-Ebmer and Zweimüller (1996)	Austria	Cross-section (1991), first differences (1988–1991), simultaneous equations model	Monthly earnings and earnings growth of native blue-collar workers	No negative effect on earnings, negative effect on earnings growth for immobile workers
Winter-Ebmer and Zweimüller (1999)	Austria	Pooled cross-sections and random effects panel probit model (1988 and 1991), IV	Unemployment probability of employees	Only modest impact on natives, larger impact on seasonal workers and already employed immigrants
Winter-Ebmer and Zweimüller (2000) <sup>b</sup>	Austria	Probit analysis and Weibull duration model (1989–1992)	Probability of unemployment entry and unemployment duration of employees	No effect on unemployment probability, unemployment duration: +5%
Zorlu and Hartog (2005)	UK, Norway and The Netherlands	Cross-sections with IV (NL:1997, UK: 1997 and NO: 1989 and 1996)	Natives' wages	Very small effects, no dominant robust patterns of substitution or complementarity

<sup>a</sup>Numerical results for a 1 percentage point increase in the immigrant share.

<sup>b</sup>Comparisons between the immigrant share in different industries, occupations or education/experience groups instead of areas.

### 3.2 Production Theory Approach

Area analysis examines the empirical relationship between the relative size of an immigrant group and the labour market performance of native workers without an explicit model of the labour market. This section borrows from production theory to derive estimable wage specifications. Estimates of the parameters of a production function with different labour and non-labour inputs provide important information about the degree of substitutability or complementarity between the various production factors. Following this approach, various studies have examined the substitution possibilities among labour inputs defined by skill level, age, sex or educational attainment (Hamermesh, 1986). Here we will focus on comparable studies looking at labourers by race, immigrant status or immigrant cohort.

To explain the method assume a generalized Leontief production function with  $n$  production factors (Diewert, 1971)

$$Q = \sum_i \sum_j \gamma_{ij} (X_i X_j)^{1/2} \quad (i, j = 1, \dots, n) \quad (7)$$

with  $Q$ , output,  $X_i$ , input used of factor  $i$  and  $\gamma_{ij}$ , technology coefficients. The technology coefficient between a pair of inputs is negative if the inputs are substitutes and positive if the inputs are complements.

Some studies use a translog production function instead of a generalized Leontief production function. Both are second-order approximations to any arbitrary production function and there is no empirical evidence to prefer one function over the other (Griffin, 1982). For those interested in the translog approach we refer to Grossman (1982). For the generalized Leontief production function the first-order conditions of profit maximization within perfect competition and with constant input prices  $w_i$  yield the following marginal productivity conditions:

$$w_i = \gamma_{ii} + \sum_{j \neq i} \gamma_{ij} (X_j / X_i)^{1/2} \quad (i, j = 1, \dots, n) \quad (8)$$

These equations (one for each production factor) are linear in parameters and can easily be estimated with least squares techniques given data on wages and the relative proportions of the various inputs. Most studies use individual-level cross-section data with the relative sizes of the different labour force groups expressed at a more aggregate level of the regional labour market. To allow for individual heterogeneity a stochastic version of the wage equations is usually estimated for individual  $l$ :

$$w_{il} = Z_l \beta_i + \sum_{j \neq i} \gamma_{ij} (X_j / X_i)^{1/2} + \varepsilon_l \quad (9)$$

with  $Z_l$  a function of observable socioeconomic characteristics and  $\varepsilon_l$  a random uncorrelated error.

OLS estimation of this specification implicitly assumes that labour supply variables (expressed in ratios) are exogenous. The validity of this assumption can be questioned. Wage differentials across labour markets may induce internal migration patterns. An IV procedure can correct for this econometric problem. First an equation

is estimated that specifies how other regional labour market characteristics affect the relative supplies of regional labour force groups. The predicted values are then used in the wage determination equations to yield unbiased estimates of the technology coefficients.

The estimated parameters  $\gamma_{ij}$  already give useful information about the possibilities for technical substitution. A better measure of the degree of substitution between two inputs is the Hicks partial elasticity of complementarity (Hicks, 1970) defined by

$$C_{ij} = \frac{Q Q_{ij}}{Q_i Q_j} \quad (10)$$

with  $Q_i = \partial Q / \partial X_i$  and  $Q_{ij} = \partial^2 Q / \partial X_i \partial X_j$

The Hicks partial elasticity of complementarity measures the proportional change in the relative wage for factor  $i$  given a proportional change in factor  $j$ 's endowment, holding the output price and other input quantities constant. Factors  $i$  and  $j$  are  $q$ -substitutes if  $C_{ij}$  is negative and  $q$ -complements if  $C_{ij}$  is positive. For the special case of a generalized Leontief production function these elasticities are equal to

$$C_{ij} = \frac{\gamma_{ij}}{2(S_i S_j w_i w_j)^{1/2}} \quad \text{for } i \neq j \quad (11)$$

$$C_{ii} = \frac{\gamma_{ii} - w_i}{2S_i w_i} \quad \text{for } i = j \quad (12)$$

with  $S_i = w_i X_i / Q$ , the relative share of income going to factor  $i$ .

The last step uses the Hicks partial elasticities of complementarity to quantify own and cross-price elasticities for the different factors. The elasticity of factor price, which measures the percentage change on the earnings of group  $i$  due to a 1% increase in the supply of group  $j$ , is proportional to the elasticity of complementarity (Hamermesh, 1993)

$$\frac{d \ln w_i}{d \ln X_j} = S_j C_{ij} \quad (13)$$

To summarize, cross-sectional data on factor prices and the relative proportions of different inputs can be used to estimate the technology coefficients of the production function. These estimated parameters decide the elasticities of complementarity showing the degree of substitutability or complementarity between two production factors. Finally, knowledge of the elasticities of complementarity can provide a clear picture of price shifts occurring among native labourers after a supply shift in an immigrant labour category.

Although this approach allows more input factors than theoretical models can handle, the disaggregation of the labour force into subsamples is still limited. This limitation is especially important for the labour force of ethnic minorities. Immigrants concentrate in some geographical areas while there are almost no immigrants in other areas. Therefore, many immigrant groups must be treated as a single labour input to allow a minimum of observations for every labour category. Borjas (1986b) tested for the importance of this problem by re-estimating his

model after deleting all the individuals living in areas where the minority groups represent less than 1% of the labour force (and where therefore some relative labour supply proportions take extreme values). The changes induced by this radical sample selection were remarkably insignificant.

Existing empirical research following the production theory approach is almost entirely based on the US data. We could only find two European illustrations: one for Germany (Bauer, 1997) and one for Switzerland (Kohli, 1999). The overview in Table 2 shows that results are mixed with respect to substitutability or complementarity between foreign and native labour. On the one hand, Borjas (1983, 1986b) suggests that immigrants and native-born male labourers are complements. On the other hand, Borjas (1987), Grossman (1982) and Kohli (1999) do find small negative effects of immigrants on the earnings of natives although the numerical impact of this competition is trivial. Akbari and Devoretz (1992) conclude that foreign-born are neither substitutes nor complements to natives. Again it becomes clear that competition of new immigrants hits immigrants themselves most. Borjas (1987) finds that a 1% increase in the number of white immigrants reduces the earnings of white immigrants by 1%.

Greenwood *et al.* (1996, 1997) note that some of the studies discussed so far estimate production functions that violate the curvature conditions. For instance the estimated production function by Grossman (1982) fails to be concave. The estimates reported by Borjas (1983) and Bean *et al.* (1988) are also not compatible with well-behaved production functions. Yet these conditions are part of the theoretical framework, and they must be met for the estimates to make any economic sense. Therefore Greenwood *et al.* (1996, 1997) estimate normalized quadratic functions that allow curvature conditions to be imposed. Their results are comparable with previous ones: few negative effects are found; they are very small and previous immigrants bear most of the adjustments following migration.

### 3.3 Aggregate Time-Series Analysis

Several studies use time-series analysis to explore the link between immigration and unemployment. Two different approaches subdivide these studies: the first approach uses non-structural estimation techniques, and the second approach estimates conventional structural models. These two approaches reflect the debate on whether analysis should take a theory-driven or data-driven approach (Cooley and Le Roy, 1985; Leamer, 1985).

The non-structural estimation techniques take a data-driven approach. They examine whether there is a causal linkage between immigration and unemployment and in which direction causality runs. These techniques do not use a structural representation of the labour market but use causality testing procedures and minimize restrictions imposed on the data. Non-parametric time-series methods are more suitable when little *a priori* knowledge about the underlying structural model is available. Withers and Pope (1985) use Granger causality tests to examine the relationship between Australian immigration and unemployment rates between

**Table 2.** Overview of Migration Literature Based on the Production Theory Approach.

Study	Data	Estimated production function	Production factors	Conclusions
Akbari and Devoretz (1992)	1981 Canadian Census	Translog	Native workers, pre-1971 and post-1971 foreign-born workers	Foreign-born neither substitutes nor complements to native-born
Bauer (1997)	1990 German Beschäftigtenstatistik	Translog	Blue- and white-collar native and foreign male workers	Negligible wage effects for all native workers
Bean, Lowell and Taylor (1988)	1980 Census data	Generalized Leontief	Legal, illegal and native-born Mexican males, black and white males and females	Natives-illegal immigrants, complements; natives-legal immigrants, substitutes
Borjas (1983)	1976 Survey of Income and Education	Generalized Leontief	Black, Hispanic and white labour	Blacks-Hispanics and Hispanics-whites, complements; relation blacks-whites unstable
Borjas (1986a)	1980 Census data	Generalized Leontief	White, black and immigrant males and females	Negative wage impact for white men, positive wage impact for black men
Borjas (1986b)	1970 Census data	Generalized Leontief	White, black and Hispanic native and immigrant workers	Immigrant males seem to be complements with native males but substitutes with native females
Borjas (1987)	1980 Census data	Generalized Leontief	White, black, Hispanic and Asian natives and immigrants	Immigrants have small effects on native-born but sizeable impact on earnings immigrants themselves

Table 2. *Continued.*

Study	Data	Estimated production function	Production factors	Conclusions
Greenwood, Hunt and Kohli (1996)	1980 Census data	Different functional forms	Native workers, non-recent immigrants, recent immigrants	Wages of native workers fall only slightly, wages of recent immigrants fall considerably
Greenwood, Hunt and Kohli (1997)	1980 Census data	Symmetric normalized quadratic semiflexible function	Unskilled, low-, medium- and high-skilled native and foreign-born labour and capital	Unskilled migrants have a considerable negative effect on unskilled foreign-born workers and a small negative effect on low- and medium-skilled native workers, all other production factors tend to benefit
Grossman (1982)	1970 Census data	Translog	Native, Second generation and foreign-born workers	Second generation and foreign-born workers are substitutes for natives
Kohli (1999)	Swiss aggregate time series 1950–1986	Translog	Imports, migrant labour, native labour and capital	Small negative wage impact on resident workers, capital owners benefit

1948 and 1982. They were unable to find evidence of immigrants affecting the unemployment rate. Marr and Siklos (1994) test for causality between unemployment and immigration in Canada in a vector autoregression model. They find a positive association between past immigration and current unemployment for the period 1978–1985. Shan *et al.* (1999) do the same for Australia and New Zealand but find no such causality from immigration to unemployment.

The structural approach borrows from a theoretical framework of the labour market as developed for example in Andrews (1988) or Layard *et al.* (1991). Such a model enables the theoretically specified linkages between immigration and unemployment to be empirically estimated. This approach models conventional labour market aggregates simultaneously with immigration flows. Labour market theory is used to specify the relevant form and content of the equations to be estimated. Applying this technique on different theoretical frameworks, Withers and Pope (1985) and Pope and Withers (1993) reach the same conclusion as from the statistical causality technique. They find no evidence of any association from migration to unemployment.

One of the advantages of time-series analysis is that it allows under certain conditions of cointegration both estimation of the long-run relationship between variables and identification of short-run structural parameters. Gross (1998, 2002, 2004) exploits this procedure to look into the effects of migration flows in France and Canada on the unemployment rate. His structural model is a system of four simultaneous equations for unemployment, labour force participation, the real wage and the immigration rate:

$$u = u [w, l, m, x] \quad (14)$$

$$w = w [u, l, m, y] \quad (15)$$

$$l = l [w, u, m, z] \quad (16)$$

$$m = m [w, u, l, k] \quad (17)$$

with the variable  $u$  standing for unemployment,  $w$  for wage rate,  $l$  for labour force participation and  $m$  for immigrant workers. Vectors  $x$ ,  $y$ ,  $z$  and  $k$  are exogenous variables.

This general framework is based on a simple labour market model. Union bargaining controls wages and firms take the bargained wage rate as given to decide on employment by maximizing profits. Both the level of employment and the wage rate determine labour force participation and unemployment. Immigration influences wage setting, (un)employment and labour force participation through a supply effect. The level of immigration itself is also endogenous and determined by standard pull-factors such as the wage level and employment prospects in the host country.

The first step in the estimation procedure looks for valid cointegration vectors that determine long-run relationships. The second step estimates short-run dynamics using a specification in first differences where the parameters from the first step are fixed and enter as an error-correction mechanism. Gross's findings show that

distinguishing between short-run and long-run effects is important. In the short run, immigrants slightly increase the unemployment rate. There are reasons to believe this positive impact on unemployment is attributed to an increase in job search time rather than to displacement of native workers. In the long run, immigrants create more jobs than they occupy and unemployment lowers permanently.

Both approaches, data-driven or theory-driven, have to be seen as complementary in a sense that ‘facts’ could be determined by non-structural tests as a preliminary to subsequent structural estimation (Withers and Pope, 1985). The consistent results across alternative methods encourage confidence in the overall finding of no unemployment effects of immigration. Both approaches (except for the findings by Marr and Siklos, 1994) suggest that in the long run migrants create at least as many jobs as they take.

### 3.4 *Natural Experiments*

In the past some political events took place that caused enormous migration flows in a limited period of time. It is not so problematic to determine causality of these migration flows as they are caused by political factors and not triggered by a thriving host economy. These migration flows are interesting natural experiments to study the labour market effects of migration. How easily does the host country’s labour market absorb these migration flows and which native labourers have experienced negative effects?

One example of such a natural experiment is the ‘Mariel boatlift’ and dates from 1980 when Fidel Castro decided that Cubans who wished to emigrate could leave from the port of Mariel. In a few months 125,000 mostly less-skilled Cubans migrated to Miami where half of them settled permanently. Through this labour influx the labour force in Miami increased by 7% and the number of Cuban workers by 20%.

Card (1990) studied the effects of the boatlift on Miami’s labour market focusing on wages and unemployment rates of less-skilled workers. He compared wage rates and unemployment rates of whites, blacks, Cubans and other Hispanics in the Miami labour market between 1979 and 1985 with comparable data for four other cities with a similar pattern of economic growth. He also predicted wages for each non-Cuban worker in Miami based on the parameters of a regression equation fitted to workers in the comparison cities. His data analysis and the comparison between predicted and actual wages show almost no effect on the wage rates and employment opportunities of non-Cuban workers. Even more surprising, the Mariel immigration had no strong effect on the wages of other Cubans. The Miami labour market absorbed rapidly the Mariel immigrants because the boatlift induced Miami’s industries to employ more unskilled-intensive production technologies (Lewis, 2004).

A second example is that by Jennifer Hunt (1992), which examines the repatriation of Algerians of European origin to France. Algerian independence in 1962 caused 900,000 mostly skilled people of European origin to emigrate especially to France. By 1968 the repatriates represented 1.6% of the total French labour force. Many repatriates settled in the south of France where the climate was more similar

to Algeria's and where some Algerians had already settled during the war of independence. The regional variation in the number of repatriates makes this natural experiment suitable for a cross-sectional study as described in the area analysis section of this paper. The local temperature and the density of pre-1962 repatriates are suitable instruments for the fraction of immigrants to avoid the usual cross-section bias caused by endogeneity.

Hunt's analysis shows that repatriates had little impact on the unemployment of others, although they suffered a high unemployment rate themselves. A 1 percentage point higher proportion of repatriates implied an increase in native unemployment of at most 0.2 percentage points. Wage equations show a weak downward pressure: a 1 percentage point higher proportion of repatriates decreased wages by 0.8%. Caution is needed when interpreting the wage effect because it could be due to the 'composition problem'. As no salary data are available on the repatriates separately, the area-level wages are a composition of the wages of repatriates and non-repatriates. If repatriates earn less than natives, areas with higher proportions of immigrants will have lower-than-average wages, even if repatriates have no negative impact on the native wage. The absence of significant wage effects could not be due to compensating non-repatriate migration. Internal migration within France did not respond to the location choice of repatriates. Areas with more repatriates even attracted foreign non-repatriate immigrants.

A comparable natural experiment is that of the 'retornados' who immigrated to Portugal in the mid-1970s following independence of Portugal's African colonies Angola and Mozambique (Carrington and de Lima, 1996). These immigrants increased the Portuguese labour force by roughly 10% between 1974 and 1976. A firm conclusion on the effects of this natural experiment is difficult to reach as different approaches yield different results. Comparisons of Portugal with Spain and France suggest that the retornados did cause some unemployment in Portugal but the increase is negligible compared with the European-wide increase in unemployment during the same period. Comparisons across districts within Portugal show that high-immigration districts had much slower wage growth in the decade after the arrival of the retornados than before. However, these cross-sectional results are not very reliable as they are driven by three areas that were hit by other factors that could also cause this wage downturn. In general, Carrington and de Lima (1996) conclude that immigration does not have a large adverse effect on natives' labour market outcomes.

A more recent natural experiment is that of mass migration of Russians to Israel in the early 1990s. A politically unstable Soviet Union abolished emigration controls and the majority of the Jewish community chose to leave. They emigrated to Israel because there were neither entry restrictions nor waiting periods. At the peak of the immigration influx in 1990 and 1991 Russian immigrants increased Israel's working-age population by 8%.

Friedberg (2001) exploits the variation in immigration across occupations to study the impact of this mass migration on the Israeli labour market. Least-squares estimates on the earnings of native Israelis show that natives in occupations that receive more immigrants experienced lower earnings growth over the period 1989–

1994. However, when previous occupations are used to instrument for current occupations, IV results suggest that immigrants enter occupations with low wages, low wage growth and contracting employment, rather than that they have an adverse impact on native labour market outcomes.

All these natural experiments deal with enormous migration flows in limited periods of time compared with normal migration movements. Nevertheless, these migration flows do not prove to be damaging for native labour market outcomes. Host economies can often absorb migrants in a small period of time. In other words, the natural experiment literature adds to the evidence suggesting a limited impact of immigrants on natives.

#### 4. Conclusions

This paper reviews empirical research on labour market effects of immigration. Labour market effects are broadly defined covering not only effects on wages but also on labour participation and (un)employment. In the same way, we focus on the effects not only on natives' labour market position but also on previous immigrants' or other minorities' labour market position. It is hard not to get lost in the multiplicity of research carried out in the field of migration. It is our hope that we succeeded in putting some structure into this field such that future research can be more easily situated within and compared with relevant previous research.

Sizing up the enormous amount of research results produced in this field, some general conclusions appear on wage and employment effects of immigration. First conclusion: immigration negatively affects wages of less-skilled labourers and earlier immigrants. Many different studies using different approaches produce evidence for this conclusion. To name a few: the factor proportions approach of Jaeger (1995), the computable general equilibrium model of Sarris and Zografakis (1999), area analyses by Camarota (1998), De New and Zimmermann (1994b) and Orrenius and Zavodny (2003) and the production theory approach of Greenwood *et al.* (1997).

Second conclusion: the probability that immigrants increase unemployment is low in the short run and zero in the long run. Most area analyses and time-series analyses fail to find a significant influence of immigration on (un)employment probabilities. See for instance the findings of Gang *et al.* (1999) and Shan *et al.* (1999) for the EU and of Simon *et al.* (1993) and Marr and Siklos (1994) for the USA and Canada. Nevertheless, some studies do find an increase in unemployment rate (Winegarden and Khor, 1991), unemployment frequency (Winkelmann and Zimmermann, 1993) and unemployment duration (Winter-Ebmer and Zweimüller, 2000). Both area analysis and time-series analysis produce reasons to believe that if there is an employment effect it will especially hit the unemployed (Winter-Ebmer and Zweimüller, 2000; Gross, 2004). In the long run, immigrants create more jobs than they occupy and unemployment lowers permanently (Gross, 2002).

Considered altogether immigrants affect the native labour market position only slightly. Natural experiments show that economies are able to absorb many new labourers without worsening the labour market position of residents. Nevertheless,

we must keep in mind that some residents, especially those at the bottom end of the income scale, are vulnerable to increased competition from foreigners.

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