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The labour market impact of immigration

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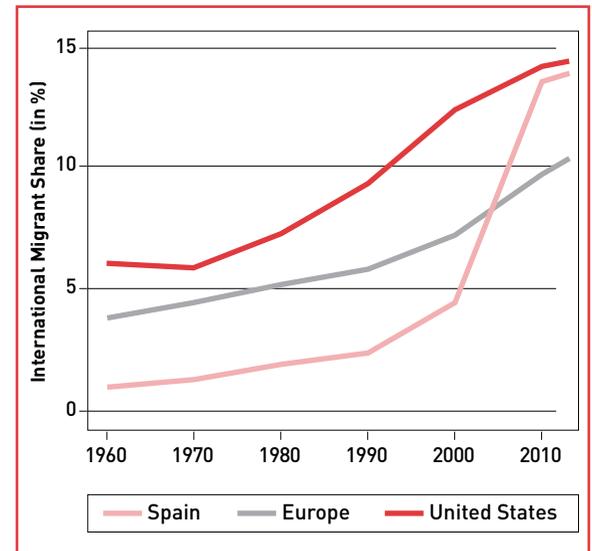
1. Introduction

Around 232 million people or 3.2% of today's world population live outside their country of birth, with projections by the World Bank (2011) estimating this share at 5% within one generation. In Europe, the share of international migrants in the resident population has almost tripled from 3.5% in 1960 to 10.3% in 2013 (United Nations, 2013).¹ These overall figures conceal significant variation in the migration experiences of individual destination countries, both regarding the timing of arrival of their immigrant populations and their composition in terms of skills and origin. A case in point is Spain. As late as the early 1990s, Spain stood out as a country with a very low immigrant share in the population, amounting to only 2.1% in 1990, less than half the European average of 5.6%. However, driven by its rapid economic expansion, Spain has since received the largest immigrant inflow of all European countries, pushing the immigrant share up to 13.8% in 2013, which exceeds the corresponding shares of more traditional European immigration countries such as Germany (11.9%) and the UK (12.4%) and reaches

almost the level of the country with the worldwide largest immigrant population in absolute terms, the United States (14.3%). For illustration, Figure 1 shows the development of the immigrant share in Spain as well as Europe and the United States over the last 50 years.

As we will see later on, while the size of immigrant inflows is obviously important, the composition of the inflow in terms of skills and, to a lesser extent, countries of origin plays an equally important role in determining its impact on the host country's labour market. In terms of formal education levels, Spain's immigrant population is actually relatively high skilled compared to the native population, with only 45.5% having low education levels compared to 66.4% of native Spaniards, and 23.6% having high education levels compared to only 18.0% of natives.² In the United States, the picture is somewhat different with immigrants being over-represented both at the bottom and the top end of the skill distribution, with 32.7% having low education levels compared to 20.3% of natives, and 29.9% having high education levels compared to 27.4% of natives. Intuitively, it makes a difference whether the arriving immigrants are low-skilled or high-skilled relative to the native population, as their skill level determines how easily they are able to integrate and who they "compete with" in the host country's labour market. Similarly, it also matters where the migrants are coming from. Some countries of origin are better able to equip their migrants with skills that are easily transferable to the host country's labour market than others (e.g. language). In 2013, Spain's largest immigrant population originates from Romania, making up 12.3% of the overall immigrant population, followed by Morocco (11.5%), Ecuador (7.0%), the United Kingdom (5.9%) and Colombia (5.6%). The composition of the immigrant population in the United States, in contrast, is much less evenly distributed, with

Figure 1. Immigrant shares from 1960 to 2013



Note: This figure shows the share of international migrants in Spain, the United States, and Europe, where Europe comprises the 27 EU member states (excluding Slovenia, Estonia, Latvia and Lithuania) as well as the non-EU member states belonging to the Schengen Area (Iceland, Liechtenstein, Norway, Switzerland). The shares are calculated as the total stock divided by the total population in the set of countries considered.

Sources: United Nations (2009) for 1960 to 1980, and United Nations (2013) for 1990 to 2013.

Mexico being by far the most important country of origin, providing 28.3% of the immigrant population followed by China (4.9%), India (4.5%), the Philippines (4.4%) and Puerto Rico (3.7%).

In many receiving countries, the arrival of large numbers of immigrants has naturally raised questions about their potential impact on the economy and, in particular, the host country's labour market. There is a widespread belief that immigrants take jobs away from natives and bring down their wages (Card, Dustmann and Preston, 2012). While at first glance, such a relationship seems intuitive since after immigration there are more individuals

competing for jobs, the economic research to date has found relatively little evidence for detrimental effects of immigration on the native population. This is because — as so many things in the real world — the labour market is more complex than basic models of supply and demand suggest, and the channels through which it can absorb new workers are more diverse than simple wage or employment adjustments.

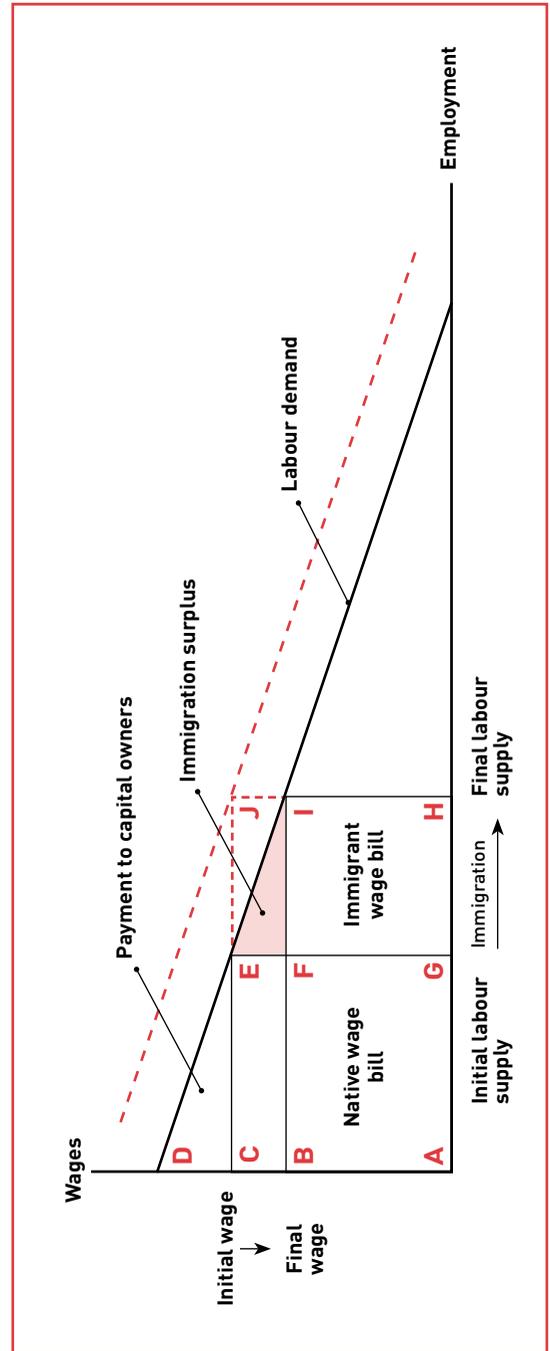
In this *opuscle*, I provide a stylized overview of the theoretical mechanisms through which immigrants may affect the labour markets of their host countries, starting with a basic model of supply and demand and successively extending it to account for some of the complexities of the real world. I explain the main methodological approaches with which economists have tried to empirically test those theoretical mechanisms and their empirical predictions, and provide an overview of some of the key findings in the literature.

2. The impact of immigration on wages and employment

2.1 The basic model

The main mechanism through which immigration is thought to affect the host country's labour market is by increasing the supply of labour. Figure 2 illustrates this basic idea, where the vertical axis shows the wage rate earned by workers and the horizontal axis the supply of workers in the economy. For simplicity, we assume for now that there is only one type of workers, so we abstract from heterogeneity in workers' skills, and that labour supply is inelastic which means that workers are willing to work at any wage rate. The labour supply curve in Figure 2 is then given by the vertical line which intersects the horizontal axis at the

Figure 2. Stylized model of the labour market impact of immigration



level of the initial labour supply. What about labour demand? For this it is useful to think of a representative firm in the economy which produces output using workers and a, for now, fixed stock of capital (machines). Intuitively, what determines whether a firm is willing to hire another worker or not is a comparison of the additional revenue generated by this worker and the additional costs incurred by the firm for hiring this worker, which, abstracting from possible fixed costs, is equal to the wage. Now, while the additional revenue generated by the first few workers hired is generally high (just imagine how the first worker switches on the available machines and gets the whole production process started), at some point any additional worker will generate less and less additional revenue (just imagine more and more workers having to work with the fixed stock of machines). The downward sloping line in Figure 2 illustrates this negative relationship between the level of employment in the representative firm and the additional revenue generated by the last worker hired. Because the firm will continue to hire workers as long as the additional revenue generated by the last worker hired is at least as high as the wage rate, this downward sloping line represents directly the labour demand curve of the representative firm. In equilibrium, labour supply and labour demand will equalize, determining the equilibrium wage rate in the economy. In Figure 2, this initial equilibrium is given by the intersection of the supply and demand curves in point E, yielding the corresponding initial equilibrium wage rate and employment level.

Now, what happens if this economy receives an inflow of immigrants? Immigration effectively increases labour supply, pushing the labour supply curve to the right. The additional supply of workers then creates downward pressure on wages which, after some adjustment period, will settle at the final equilibrium wage. The new equilibri-

um in this labour market, given by point I in Figure 2, is characterized by a higher overall level of employment but a lower wage rate.

This very straightforward mechanism is the basis for much of the concern about the potential detrimental impact of immigration on native wages. Note that by construction, in the model described so far, there is no effect of immigration on native employment since we assumed that natives (as well as immigrants) are willing to work at whatever wage rate is offered to them. In reality, however, labour supply is likely to increase with the wage rate, in particular for natives, which would be reflected by an upward sloping labour supply curve. In that case, immigration would lead to both lower wages (though not as low as in the initial case with inelastic labour supply) and lower employment levels of the native population. In addition, labour market institutions such as statutory minimum wages or labour unions may restrict the ability of wages to adjust downward, similarly giving rise to lower native employment levels.

An important assumption underlying the results presented so far is that the capital stock in the economy is fixed. This may be a reasonable assumption when thinking about the short-run effects of immigration. However, over time it is likely that the capital stock in the economy responds to the inflow of immigrants. The reason is that, because of the larger supply of workers in the economy, the additional revenue that can be produced by an additional unit of capital (an additional machine) will increase, which should trigger inflows of capital into this economy from abroad. Such inflows would increase labour demand in the economy and can be represented by a rightward shift of the labour demand curve in Figure 2, indicated by the dashed line parallel to the original labour demand curve. In fact, if capital supply was fully elastic, sufficient new capital should flow

into this economy until the equilibrium wage rate returns to its original level (point J in Figure 2). Assumptions about the speed with which capital flows respond to immigration flows are thus vital for the latter's expected impact on average native wages and employment levels.

2.2 The immigration surplus

An important aspect to consider when it comes to evaluating the economic impact of immigration is that, according to the standard theoretical framework, immigration will generally produce an economic surplus that accrues to the native population and makes them, on average, better off than before immigration. To see this, consider again the stylized economy depicted in Figure 2. In this economy, one can think of the area under the labour demand curve as the overall output that is produced by the available workers and capital stock in the economy. In the initial situation before immigration, the share of this output being paid to workers, the so-called native wage bill, is given by the rectangle ACEG while the share of output going to capital owners is given by the triangle CDE. What happens after immigration? Obviously, overall output produced in the economy increases (to the trapezoid ADIH) but the more interesting question is how this output is now distributed across the different participants in the production process. To start with, immigrant workers earn an overall wage bill represented by the rectangle GFHI. Since wages fall, the native wage bill declines (to the rectangle ABFG), so native workers lose out economically. As Figure 2 shows, the lost share of the native workers' wage bill (the rectangle BCEF) now goes to native capital owners. So far, the effect of immigration on the native population thus consists in a shift of surplus from native workers to native capital owners, so a pure redistribution of resources. However, there is additional surplus that is created as the result of immigration,

represented by the triangle FEI. This so-called immigration surplus, which in the present example accrues to native capital owners, reflects the net benefit of immigration to the native population. So while immigration triggers a redistribution of resources from native workers to native capital owners, the native population as a whole benefits from the arrival of immigrant workers.

Borjas (1995) estimates the immigration surplus in the U.S. economy to be of the order of 0.1% of GDP, so relatively small in magnitude. Importantly, the size of the immigration surplus is directly related to the size of the immigrant inflow and the extent to which wages change in response to an increase in labour supply. Maybe surprisingly, a necessary condition for the materialization of an immigration surplus is that wages in the economy decline as a result of immigration. The bigger the decline in wages (i.e. the less elastic is labour demand), the bigger the immigration surplus.

2.3 Distributional effects

Obviously, the model presented thus far is exceedingly simplistic. Most importantly, it neglects the fact that workers differ in their skill levels, and that the skill composition of the immigrant population may differ from that of the native population. Suppose there are two groups of workers, low-skilled workers and high-skilled workers who are complementary in production, and that in the initial situation before migration, 50% of the native population is low-skilled and 50% is high-skilled. The corresponding labour markets for each of these skill groups can be viewed as different versions of Figure 2, one for low-skilled workers and one for high-skilled workers. Now suppose there is an inflow of low-skilled immigrants. In the labour market for low-skilled workers, we then observe, as in the initial scenario without different skill groups, a shift in labour supply to the right

with a corresponding reduction in the equilibrium low-skilled wage rate (and, possibly, in the employment levels of low-skilled native workers). However, this is not the only effect of the inflow of low-skilled immigrants. Because of their complementarity in production, the increase in the supply of low-skilled workers also increases the demand for high-skilled workers. For example, the arrival of many low-skilled manufacturing workers increases the demand for managers who can put the low-skilled workers' skills to the right use. In the labour market for high-skilled workers, we therefore see a shift in labour demand to the right with a corresponding increase in the equilibrium wage rate (and, possibly, the employment levels of high-skilled native workers). Overall, the inflow of low-skilled immigrants into the economy has therefore important distributional effects, with low-skilled native workers facing declining wages and high-skilled native workers experiencing increasing wages. In the case of low-skilled immigration, wage inequality in the economy thus increases while it would decrease in the opposite case of high-skilled immigration: high-skilled native workers would experience declining wages and low-skilled native workers would experience increasing wages.

The fundamental lesson is that once skills are heterogeneous and native and immigrant workers differ in their skill composition, immigration will have distributional effects in the host economy's labour market, with some groups of native workers — those that are most similar in their skills to the arriving immigrant workers — losing out while other groups of native workers — those whose skills are most complementary to the skills of the immigrant workers — benefitting in terms of wages and employment. Overall, however, immigration will continue to create a surplus for the native population, making it, on average, better off than before.

2.4 Defining skill groups

Having emphasized the importance of the relative skill composition of the immigrant and native populations, an important question is how to define different skills in practice. Most studies have focused on formal educational attainment as the main skill dimension, distinguishing, in the case of the United States, for example, high school drop-outs, high school graduates, workers with some college education and college graduates. Given such a distinction, the assumption is that immigrants with a particular observed education level compete in the labour market primarily with native workers of the same education level. For a finer distinction, some studies have further introduced work experience, often approximated by some function of an individual's age (e.g. age minus years of schooling minus 6 years), as an additional skill dimension, arguing that for example college graduates with little labour market experience constitute a different production factor than college graduates with many years of experience.

One of the advantages of focusing on education and experience measures as the main skill dimensions is that these can be readily observed in most available data sets. However, there are concerns that for the immigrant population, these measures do not reflect well the section of the host country's labour market in which they compete with the native population. This is because most immigrants obtain their formal education as well as part of their work experience in their countries of origin. Due to large differences in educational systems and labour market structures as well as insufficient language proficiency, skills obtained in the immigrants' home countries can often not be easily transferred to the host country's labour market: a college degree obtained in a poor developing home country may not reflect the same skills as a college degree obtained in a

rich developed host country. Similarly, work experience acquired in the home country before migration may not provide a worker with the same skills as the same work experience acquired in the destination country. In fact, most empirical evidence shows that the economic returns to home country education and work experience are close to zero in many destination countries, in particular if the migrant originates from a less developed country of origin (for an overview of this literature, see Dustmann and Glitz, 2011). The taxi-driving physician is the classic example reflecting such a lack of skill transferability between home and host country. Measuring labour market relevant skills correctly and “allocating” immigrants into the right skill groups in which they compete with native workers is therefore not an easy task. Unfortunately, as we will see in the next section, failing to do so has a substantial influence on the conclusions about the labour market impact of immigration drawn from empirical analysis.

2.5 Empirical evidence

Building on the theoretical framework outlined in the previous sections, a large empirical literature has developed over the last few decades that tries to quantify the labour market impact of immigration in a number of host countries (see Okkerse, 2008, for a survey of this literature). The fundamental problem to deal with in this context is that of the so-called missing counterfactual. To estimate the magnitude of the impact of immigration on labour market outcomes in the host country, for example on native wages and employment rates, one needs to know what these outcomes would have been if immigration had not occurred. Obviously, such counterfactual outcomes are fundamentally not observable so researchers need to find ways to proxy for them using available data. In the literature, two main approaches have been proposed that differ in the way they do this: the

spatial correlation approach and the factor proportions approach. While the spatial correlation approach exploits regional variation in the exposure to immigrants to estimate the impact of immigration on labour market outcomes, the factor proportions approach estimates a structural model of the national economy and then uses this model to simulate the labour market effects of immigration. Both approaches have their strengths and weaknesses as we will see next.

2.5.1 Spatial correlation approach

The basic idea of the spatial correlation approach is to compare the labour market outcomes of regions that receive a lot of immigration with those of regions that receive little immigration. In a sense, the latter regions serve as a proxy for the missing counterfactual situation: the observed labour market outcomes in the regions with little immigration are assumed to reflect the labour market outcomes that would have prevailed in the regions with a lot of immigration if these had not received those additional immigrants. A comparison between the observed labour market outcomes in the regions with a lot of immigrants and the corresponding outcomes in the regions without immigrants can then be interpreted as the labour market impact of immigration. In practice, the way the spatial correlation approach is implemented is by regressing the labour market outcome of interest in a given region (sometimes the skill-specific outcomes), say the average wage of the native workforce, on the (sometimes skill-specific) immigrant share in the local population and a set of control variables. The estimated parameter for the immigrant share variable will then allow statements such as “an x percentage point increase of the immigrant share in the local population leads to a $y\%$ reduction in the average native wage and a z percentage point reduction in the native employment rate”. The purpose of the control variables

in such regression models is to capture alternative factors that determine or are correlated with local labour market outcomes, for example the industrial composition or population density in the local economy. Their inclusion effectively increases the comparability of different regions and hence their ability to serve as valid counterfactuals.

As for most empirical strategies, the spatial correlation approach is not free of methodological problems. Among the most important ones are “endogeneity” concerns regarding immigrants’ location choices and the problem of “compensatory migration flows”. The first problem arises because it is reasonable to expect that immigrants tend to settle in those local labour markets in which economic conditions are best. As a result, one typically observes more immigrants residing in areas with high wages and high employment levels and fewer immigrants residing in areas with low wages and low employment levels. The resulting positive correlation between local immigrant shares and local labour market outcomes, however, does not imply that immigration *causes* higher wages and employment rates; rather it shows that regions that receive few immigrants are not suitable as counterfactuals for regions that receive many immigrants. To address this problem, researchers have suggested regressing *changes* in labour market outcomes on *changes* in local immigrant shares. Such estimation in first differences takes account of all unobserved permanent differences between local labour markets that may be driving immigrant inflows, thereby effectively improving the comparability of regions with differently sized immigrant inflows.

However, even after first-differencing, it is still likely that immigrants endogenously choose to move to those areas that experience positive transitory economic shocks. Such behaviour would once more introduce a spurious positive corre-

lation between changes in the local immigrant shares and (positive) changes in labour market outcomes, and lead to a bias that makes the true effect of immigration on native outcomes appear smaller than it really is. To tackle this problem, two empirical strategies are dominant in the literature: using “instrumental variables” or exploiting “natural experiments” of immigration. The instrumental variable approach takes advantage of the fact that, besides economic conditions, newly arriving immigrants tend to move to those areas in which other individuals of the same ethnic background are already present (Bartel, 1989; Munshi, 2003). Under the assumption that past settlement patterns are unrelated to contemporaneous economic shocks, one can then use the pre-existing share of immigrants in a locality, say the share of Ecuadorians living in a given region in Spain, as an instrument for the contemporaneous inflow of Ecuadorians into this locality. Alternatively, researchers can exploit so-called natural experiments of immigration to identify the causal impact of immigration on labour market outcomes. Remember that the endogeneity problem arises from the fact that immigrants tend to choose those areas to settle in that offer the best economic conditions. A natural experiment in this context is then a scenario in which the immigrants can, for whatever reason, no longer choose optimally where to settle. The first study to exploit such a natural experiment was the seminal work by David Card (1990) who analyses the impact of Cuban migration on the Miami labour market in the aftermath of the so-called Mariel boatlift — the unexpected opening of the Cuban borders that allowed 125,000 mostly low-skilled Cuban immigrants to move to the U.S. between May and September 1980. In contrast to typical migration flows, the unexpectedness of the events leading up to the Mariel boatlift and the short duration thereof meant that the Mariel immigrants did not optimally choose when and where to settle in the United States but rather moved to

the geographically closest bigger city within reach — which happened to be Miami. Arguing that the Mariel inflow can therefore be viewed as “exogenous” to local conditions (i.e. not driven by them), Card then compares how the native labour market outcomes in Miami changed after the immigrant inflow relative to the labour market outcomes in a set of comparison cities that showed similar outcome patterns as Miami prior to 1980. Overall, Card finds very little evidence of a detrimental effect of this large immigrant inflow on natives.

The central idea of the Mariel boatlift study was to try to identify real-world situations in which for some historical or institutional reason immigrant inflows can be viewed as exogenous to local conditions. While not without problems in the specific context considered by Card (see Angrist and Krueger, 1999), this idea has been hugely influential in raising awareness about the fundamental endogeneity problem of immigration flows and motivated a number of studies following a similar methodological approach. For example, Glitz (2012) exploits the fact that ethnic German migrants arriving to Germany in the 1990s were not free to choose their place of residence but were allocated to certain areas by the government in order to achieve a more even distribution of migrants across the country. As expected if migrants’ location decisions are endogenous, the empirical results based on this exogenous allocation process point towards significantly larger detrimental employment effects on the native German population than those of a standard analysis using more typical migration flows.

The second problem inherent to the spatial correlation approach is that of compensatory migration flows.³ To illustrate this problem, suppose there are two a priori identical local labour markets, one of which experiences an immigrant inflow that shifts the labour supply curve in this

market to the right as seen in Figure 2. Now, since equilibrium wages drop, some of the natives in this labour market may decide to move to the other labour market in which wages are not affected by immigration. As a result of their departure, the labour supply curve in the immigrant-receiving region would shift back to the left while the labour supply curve in the initially unaffected region would shift to the right, causing wages to fall in that region too. In fact, if workers were perfectly mobile, we would expect that internal migration flows between the two markets would continue until the equilibrium wages in both local labour markets were equalized. Since wages are then the same in both markets, the standard spatial correlation regression relating local average wages to local immigrant shares would measure no effect of immigration on wages. Note, however, that as a result of the immigrant inflow and the subsequent internal native migration flows it triggered, the wage level in both local labour markets (and hence the entire economy) has decreased: the effect of the immigrant inflow into one region has effectively been dissipated across the entire economy through compensatory migration flows. Due to its reliance on geographic variation in labour market outcomes, the spatial correlation approach is thus not able to capture effects of immigration on the national level, and tends to imply labour market impacts of immigration that are smaller in magnitude than they are in reality.

To deal with this challenge, researchers using the spatial correlation approach routinely study whether there is any evidence for native migratory responses to local immigrant inflows. For example, Card and DiNardo (2000), Wozniak and Murray (2012), and others have shown that when a U.S. city receives an inflow of unskilled immigrants, its total unskilled labour force (including both natives and immigrants) increases roughly one for one, indicating no migratory responses by natives. In

their absence, estimates based on the spatial correlation approach, possibly together with an instrumental variable or natural experiment strategy, can then reveal credible evidence on the labour market effects of immigration.

Starting with Altonji and Card (1991) and LaLonde and Topel (1991) in the early 1990s, the empirical literature employing the spatial correlation approach has grown rapidly (see Okkerse, 2008). The evidence from the vast majority of these studies is that immigration has only a minor effect on native labour market outcomes. For example, Altonji and Card (1991) find that a one percentage point increase in the fraction of immigrants in a metropolitan area of the U.S. reduces the number of employed less-skilled natives by 0.25 percentage points and reduces their wages by at most 1.2%. Card (2001) estimates that a 10% increase in the population share of a particular skill group through immigration reduces the employment/population rate of that group by 1.0-1.5 percentage points and the relative wage of that group by around 1.5%. For Spain, González and Ortega (2011) find no evidence of a detrimental effect of the substantial recent inflows of immigrants into the Spanish economy on native wages or employment rates, in line with most existing literature for other developed economies.

2.5.2 Factor proportions approach

Partly owing to the perceived shortcomings of the spatial correlation approach in systematically dealing with equilibrating inter-regional factor flows, Borjas, Freeman and Katz (1997) proposed the alternative factor proportions approach to estimate the labour market impact of immigration. The most important difference to the spatial correlation approach is that this approach views the entire host economy as the unit of analysis and estimates the impact of immigration on, say, wages

on the national level. The typical starting point is the assumption that the production process in the host country's economy can be reasonably well described by a production function in which labour and capital are combined to produce a single aggregate output good. In the seminal application of this approach by Borjas (2003), the overall labour input is then further modelled as an aggregate of education-specific labour inputs which are, in turn, aggregates of education-experience-specific labour inputs.⁴ In essence, such a hierarchical model captures in a parsimonious way the idea that more supply of a given skill group reduces equilibrium wages in that same and closely substitutable skill groups but increases wages in complementary skill groups. To what extent this happens depends primarily on the magnitude of a few key parameters of the assumed production function, the so-called "elasticities of substitution", which measure broadly speaking the similarity of different types of labour. Once these elasticities have been estimated, the fully parameterized production function can be used to simulate the wage effects of an immigration flow of any desired size and composition. Following this procedure and assuming a fixed capital stock, Borjas (2003) simulates the effect the around 11% immigration-induced increase in U.S. male labour supply over the 1980s and 1990s had on the wage rate of differently skilled natives. Table 1 reproduces his main results which show that these inflows had an overall negative effect on average native wages which decreased by 3.2%. Importantly, owing to the bi-modal skill composition of the arriving immigrant population which included disproportionately many high school dropouts and college graduates, the wage impact differed significantly across education groups, with the wage rates for high school dropouts and college graduates falling by 8.9 and 4.9%, respectively, while those of high school graduates and workers with some college only moderately declining by 2.6 and 0.3%, respectively.

While circumventing the issue of equilibrating inter-regional factor flows by estimating at the national level, the factor proportions approach is itself not without problems either. First, the maintained assumption regarding the speed with which the host country's capital stock can change in response to the immigrant inflow is vital in determining the magnitude of the simulated wage effects of immigration. Once capital supply is assumed to be fully elastic — an assumption for which there is some empirical support — the effect on the overall average wage will actually be zero by construction in this framework, implying that immigration only affects the *relative* wages between different subgroups in the receiving economy. Second, the factor proportions approach relies on a correct allocation of workers into skill cells, which may be difficult due to a lack of comparability of educational degrees and work experience between home and host countries (see Dustmann, Frattini and Preston, 2013). Finally, and most importantly, the factor proportions approach requires a correct specification of the nesting structure in the underlying production function. In particular, Borjas (2003) assumes that natives and immigrants within the same education-experience cell are perfect substitutes in the production process. Ottaviano and Peri (2012, for the U.S.) and Manacorda, Manning and Wadsworth (2012, for the UK) question this assumption by adding an additional layer to Borjas' original production function and showing that the elasticity of substitution between immigrants and natives within education-experience cells is indeed not infinity. This finding has important implications for the subsequent simulation of the impact of immigration on native wages since with imperfect substitutability, the impact of newly-arriving immigrants on native wages is substantially mitigated. To illustrate this, the second row of Table 1 reproduces the corresponding simulation results of Ottaviano and Peri (2012) for the period 1990-2006, under the assumption of full capital ad-

Table 1. Simulated wage effects based on the factor proportions approach

	Country	Group	High school dropouts	High school graduates	Some college	College graduates	All workers
Borjas (2003)	U.S.	Natives & Immigrants	-0.089	-0.026	-0.003	-0.049	-0.032
Ottaviano and Peri (2012)	U.S.	Natives	-0.020	0.011	0.019	-0.003	0.006
		Immigrants	-0.074	-0.063	-0.029	-0.088	-0.068
No vocational education							
		Natives	0.017	-0.001		-0.010	
D'Amuri et al. (2010)	Germany	Immigrants	-0.015	-0.009		-0.027	
Vocational education							
University education							
Secondary education							
		Natives	0.01			-0.03	
Manacorda et al. (2012)	U.K.	Immigrants	0.06			-0.56	
Tertiary education							

Note: Immigration periods considered for simulation are 1980-2000 (Borjas, 2003), 1990-2006 (Ottaviano and Peri, 2012), 1975-2005 (Manacorda et al., 2012), and 1992-2001 (D'Amuri et al., 2010). Capital is assumed to be fully elastic in all studies but Borjas (2003) where it is assumed to be fixed. Results for Germany refer to the "Direct Immigration Effect" for better comparability. Results for the U.K. are translated into relative changes. Sources: Borjas (2003, Table IX), Ottaviano and Peri (2012, Table 6), Manacorda et al. (2012, Table 8) and D'Amuri et al. (2010, Table 8).

justment. According to this extended framework, average native wages actually increased by 0.6% as the result of immigration, and only two education groups experienced actual wage declines: the group of high school dropouts whose wages decreased by 2.0% and the group of college graduates whose wages decreased by a very moderate 0.3%. However, while imperfect substitutability between immigrants and natives implies more moderate wage impacts for natives, it also means more detrimental effects for the wages of immigrants already living in the host economy since this is the group with whom the newly arriving immigrants are competing most intensely in the labour market. This is illustrated in row 3 of Table 1 which shows that the existing foreign-born population in the U.S. economy experienced substantial wage declines as a result of new immigration, ranging from 2.9% for workers with some college education to 8.8% for workers with a college degree, and an average decline of 6.8%. For comparison, Table 1 also reports simulation results for the wage impact of immigration from recent studies for Germany (D'Amuri, Ottaviano and Peri, 2010) and the UK (Manacorda et al., 2012). In general, the evidence from studies based on the factor proportions approach tend to show somewhat larger detrimental effects of immigration on wages than those from spatial correlation studies, in particular for older cohorts of immigrant already living in the host country.

3. The Impact of immigration on task specialization

Given the crucial role the degree of substitutability between immigrants and natives plays in determining the labour market impact of immigration, it is important to understand its micro-economic foundations. A priori, it is not obvious why,

even within the same education and experience cell, immigrants and natives should not be perfect substitutes. Investigating this issue in more detail, Peri and Sparber (2009) hypothesize that native workers have a comparative advantage in communication-intensive tasks relative to immigrants, while the latter have a comparative advantage in more manual tasks. As a result, when faced with an immigrant inflow, native workers tend to abandon manual-intensive occupations and shift towards more communication-intensive occupations, leaving the former type of jobs for the newly arriving immigrants to fill. Through this specialization process, natives are able to escape some of the competitive pressure that arises as a result of the increased supply of immigrant workers, which, on the aggregate level, could explain the observed imperfect substitutability between immigrants and natives with the same education and experience. Consistent with this theory, Peri and Sparber (2009) provide empirical evidence that less educated natives in high immigration cities in the U.S. switched disproportionately more from manual-intensive occupations to communication-intensive occupations than comparable natives in low immigration cities, thereby mitigating the wage losses they would have otherwise incurred. For Spain, Amuedo-Dorantes and De la Rica (2011) find similarly strong evidence for the occupational specialization hypothesis, using data from the Spanish Labour Force Survey for the period 2000–2008. They also show that immigrants from Spanish-speaking countries of origin tend to specialize in communication-intensive occupations relative to other immigrants, providing further support for the hypothesis that task specialization is driven by considerations of comparative advantage.

4. The impact of immigration on output mix and technology adoption

The recurring finding of a lack of adjustments in relative wages and employment following an immigrant inflow in many spatial correlation studies has been viewed as somewhat of a puzzle given the expected negative relationship between labour supply and wages illustrated in Figure 2. We have seen in the previous sections that part of the reason could be that immigrants and natives are imperfect substitutes in the production process and that they therefore do not directly compete with each other in the labour market. However, this does not have to be the only explanation. In particular, researchers have put forward endogenous technology adoption by local firms and changes in the locally produced output mix as two alternative adjustment mechanisms to immigration that are consistent with the absence of local wage (and employment) effects.

4.1 Adjustment through changes in the output mix

According to this first alternative adjustment mechanism — advocated by traditional open economy trade models and subject of the so-called Rybczynski Theorem (Rybczynski, 1955) — the way local economies respond to immigration-induced changes in labour supply is by changing the mix of locally produced output goods. This mechanism is based on the assumption that each local economy produces several tradable output goods using different ratios of high- and low-skilled workers, for example high-tech machines which require mostly high-skilled workers and textiles which require mostly low-skilled workers. Suppose such a local economy now receives an inflow of low-skilled immigrants. Since both machines and textiles are traded on the national market, their prices are

fixed which implies that relative wages are fixed, too, unless the immigrant inflow is large enough to trigger a complete specialization in the production of textiles in this economy. With a sufficiently moderate inflow, however, what will happen in this economy in order to absorb the additional supply of low-skilled workers is that the output of those industries that use low-skilled workers more intensively, in our example the textile industry, will increase while the output of those industries that use high-skilled workers more intensively will decrease, thus changing the locally produced output mix of tradable goods. The ability to sell any additional output at fixed prices in the national or international market ensures in this type of open economy models, that the local labour market is able to fully absorb an immigrant inflow without having to go through adjustments in the relative wages of its low- and high-skilled workforce.

4.2 Adjustment through changes in technology

Advocates of this second alternative adjustment mechanism argue that rather than changing relative wages or the output mix, local firms respond to immigration by shifting towards production technologies that are more intensive in the use of those skills that have become more abundant as a result of the immigrant inflow. For example, after witnessing the inflow of a large number of low-skilled immigrants, the textile firms of the previous example will change the way in which they produce their products, using less automated weaving looms that require primarily high-skilled workers to maintain them and more manual production techniques using the available low-skilled workers in the local economy (see e.g. Beaudry and Green, 2005). Such endogenous shifts in production technologies within firms can ensure a full absorption of the arriving immigrants into the local labour market without triggering long-run changes in relative wages.

4.3 Empirical evidence

There are a number of studies that try to empirically assess the relative magnitude of the output and technology adjustment mechanisms in a number of different host countries. Following Lewis (2003), the starting point of these studies is typically a spatial correlation analysis that establishes that there is no effect of immigration on relative wages in the (tradable sector of the) host country's local labour markets. Given this finding, the output- and technology-based adjustment mechanisms are then assessed by means of a between-within-decomposition that breaks down the change in skill-specific local labour supply into a part that is absorbed by changes in the size and hence output of different production units, and changes in the relative use of different skill groups within production units, where in the absence of changes in relative wages, the latter can be interpreted as reflecting endogenous changes in production technologies. The empirical results overall paint a very consistent picture: both in the United States (Hanson and Slaughter, 2002, Lewis, 2003) and Spain (González and Ortega, 2011), changes in the relative use of different skill groups within industries contribute substantially more to the overall absorption of immigration-induced local labour supply changes than changes in the relative size of different industries: 74 vs. 4% in the United States (Lewis, 2003) and 60 vs. 7% in Spain (González and Ortega, 2011), respectively. One restriction of the aforementioned studies, however, is that they are universally carried out on the industry level. As a result, if firms within the same industry produce different output goods, the estimates of the relative contribution of the different adjustment channels may be biased. Dustmann and Glitz (2013) address this concern by carrying out a firm-level analysis using administrative data that comprise the universe of firms operating in the tradable sector in Germany. Their main findings show that

around 71% of immigration-induced changes in local labour supply are absorbed by changes in the relative use of different skill groups, 14% by changes in the output mix of permanent firms, and 15% by the net creation of new firms, thus qualitatively supporting the findings of the earlier industry-level studies. The main conclusion that changes in technology play a vital role in local labour market adjustments to immigration is further supported by studies that focus more directly on the endogenous adoption of technology. Beaudry, Doms and Lewis (2010), for example, show that local skill abundance in U.S. metropolitan areas leads to a faster adoption of personal computers, while Lewis (2011) shows that the use of automation machinery indeed expands more rapidly in those areas of the United States in which the relative supply of skilled labour grows fastest.

5. The impact of immigration on productivity and innovation

Apart from the micro-oriented literature discussed so far, there is a complementary literature that examines the labour market effects of immigration from a more macroeconomic perspective by studying economic outcomes such as national income per capita or total factor productivity. These studies typically use country-level data and exploit variation in immigrant inflows across different countries to estimate the impact on the outcome of interest. The empirical strategy is therefore not dissimilar to a spatial correlation approach in which the geographical units of analysis are entire countries rather than local labour markets within a country. This mitigates some of the important problems of the spatial correlation approach since native outmigration from the home country in response to immigrant inflows is relatively unlikely (compared to inter-regional flows

within a country) and the choice of immigrants when and in which country to settle may be suitably instrumented by push factors in the country of origin such as economic crises or other exogenous factors such as geographical distance or historical links between home and potential host country. On the other hand, as in any cross-country analysis, it is more difficult to adequately control for alternative factors that may be driving the analyzed outcome of interest and hence ensure that countries with little immigration can serve as valid counterfactuals for countries with a lot of immigration. Following such a cross-country approach, Ortega and Peri (2011) show a robust positive effect of a country's openness to immigration on long-run income per capita. This effect operates through immigrants' positive effect on total factor productivity, which the authors argue is due to their enhancing effect on the variety of skills available for production. Consistent with this hypothesis, the degree of diversity within the immigrant population in terms of countries of origin is shown to have an additional positive effect on income per capita. In support of these findings, Di Giovanni, Levchenko and Ortega (2012) estimate that in the main receiving countries in the world, immigration increases income per capita in the long run by as much as 5%, primarily due to the creation of new product varieties available for consumption and as intermediate inputs. In a similar spirit but using a different theoretical framework, Docquier, Machado and Sekkat (2013) also predict efficiency gains from international migration of the order of 4% of world GDP.

Apart from their effect on available product varieties, immigration may also positively affect the labour market of the host country by boosting innovation which in turn raises overall productivity. Hunt and Gauthier-Loiselle (2010), for example, show that college-educated immigrants in the United States patent at double the rate of college-edu-

cated native workers and that a 1 percentage point increase in immigrant college graduates' share in the local population increases patents per capita by 9-18%. Corroborating these findings, Peri, Shih and Sparber (2013) show that regional inflows of so-called STEM workers — scientists, technology professionals, engineers, and mathematicians — can explain between 10 and 25% of the aggregate productivity growth in the United States between 1990 and 2010.

6. Conclusion

In many countries throughout the world, immigration is one of the most hotly debated issues in the public sphere, with much of the concern revolving around immigrants' impact on the host country's labour market. This opuscle summarizes the main theoretical mechanisms through which immigrants may impact their receiving economies' labour markets, discusses the different approaches with which researchers have tried to measure these impacts, and presents some of the key findings of the empirical literature to date. Contrary to the widely held view that immigration has a detrimental effect on the labour market outcomes of the native population, the evidence so far shows a predominantly positive effect of immigration on the native population. This is because in most destination countries, immigrants do not compete directly with natives in the labour market but rather provide skills that are overall complementary to those of natives. Furthermore, the arrival of, in particular, skilled immigrants fosters innovation activities, thereby contributing to productivity growth in the receiving country which benefits all workers. However, while overall positive, both theory and empirical evidence also show that immigration has important distributional effects, with some groups of individuals gaining and other groups losing out.

In general, those groups of workers most similar to immigrants in terms of their skill set are bound to be the most detrimentally affected. Finally, the more recent literature also emphasizes that the labour market impact of immigration does not necessarily need to be restricted to the impact on wages and employment rates, but may extend to other structural features of the labour market, such as production technologies and output mix. The labour market with all the different agents involved is a complex environment that requires great care when it comes to making predictions about the potential labour market impacts of immigration. The public debate about immigration should do justice to this complexity and be explicit about the potential aggregate gains from immigration as well as its likely distributional effects.

Notes

(1) Europe refers to the current 27 EU member states plus the 4 non-EU member states of the Schengen Area (Iceland, Liechtenstein, Norway and Switzerland).

(2) Figures are taken from Widmaier and Dumont (2011) and are based on the Database on Immigrants in OECD Countries (DIOC) of the OECD for the year 2005/2006. Low education refers to at most lower secondary education, high education to tertiary education.

(3) A similar argument holds for compensatory flows of capital.

(4) This type of hierarchical structure is typically modeled by a so-called nested constant elasticity of substitution (CES) production function.

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