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The Unemployment Impact of Immigration in OECD Countries

Sébastien Jean,

Miguel Jimenez

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THE UNEMPLOYMENT IMPACT OF IMMIGRATION IN OECD COUNTRIES

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By Sébastien Jean and Miguel Jiménez

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ABSTRACT/RESUME

The unemployment impact of immigration in OECD countries

This paper assesses the consequences of immigration for natives' unemployment in OECD countries and investigates the role played by product and labour market policies in the economy's adjustment to immigration inflows. The estimations, combining a skill-level and an aggregate approach using data for males, cover eighteen OECD countries over the period 1984-2003. While no significant long-run impact is found, an increase in the share of immigrants in the labour force is estimated to raise temporarily natives' unemployment, over a period of approximately five to ten years. Anticompetitive product market regulations are found to increase both the magnitude and the persistence of this impact, while more stringent employment protection legislation magnifies its persistence, and a higher average replacement rate of unemployment benefits increases its magnitude.

JEL classification codes: E24, J61, L43.

Key words: immigration; unemployment; product market regulation; labour market policy.

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L'impact de l'immigration sur le chômage dans les pays de l'OCDE

Ce document de travail évalue les conséquences de l'immigration pour le chômage des autochtones dans les pays de l'OCDE, en s'intéressant particulièrement au rôle joué par les politiques sur les marchés des produits et du travail. Les estimations, combinant une approche par catégorie de qualification et une approche agrégée sur la base de données pour les hommes, couvrent dix-huit pays de l'OCDE sur la période 1984-2003. Aucun impact permanent significatif de la part des immigrés dans la population active sur le niveau de chômage parmi les autochtones n'est trouvé, mais une augmentation de cette part accroît temporairement le chômage des autochtones, pour une période de cinq à dix ans. Les régulations anticoncurrentielles sur le marché des produits augmentent l'ampleur et la persistance de cet impact, une législation plus stricte de protection de l'emploi accroît sa persistance, et un taux de remplacement moyen des allocations chômage plus élevé augmente son ampleur.

Classification JEL : E24, J61, L43.

Mots-clés : immigration; chômage; régulation des marchés de produits; politique du marché du travail.

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THE UNEMPLOYMENT IMPACT OF IMMIGRATION IN OECD COUNTRIES

Sébastien Jean and Miguel Jiménez[1]

1. Introduction

1. The gap between economic analysis and public belief on the labour market impact of immigration is particularly large. According to the survey studied by Dustman and Glitz (2006), fears that immigrants would "take jobs away" from native workers are widespread, at least in Europe. These fears are hardly supported by economic research.[2] Exploiting the spatial dimension of the data, some empirical studies have investigated the impact of immigration on regional labour markets, and found a small and often insignificant effect of immigration on labour market outcomes. Longhi *et al.* (2005) calculate that, across 165 estimates from nine recent studies for various OECD countries, the average estimated impact on natives' employment of a 1% increase in the number of immigrants is stronger for low-skilled than for high-skilled workers (-0.04% for low-skilled only), but on average it amounts to a negligible -0.02%.[3]

2. While public fears seem to be grossly exaggerated, it remains questionable whether economic studies have grasped the exact nature of labour market adjustments to immigration. This paper takes a new look at this question, motivated by three concerns about most of the results established so far: the possible bias associated with the geographical approach of local impacts; the frequently overlooked dynamic nature of labour market adjustment; and the role played by structural policies in labour and product markets. These issues are dealt with jointly by the approach proposed, which is applied to OECD countries and for which suitable data is available over the last two decades.

3. The review by Longhi *et al.* (2006) provides a good illustration of the potential bias implied by focusing the analysis at the local level. The estimated impact of immigration is usually weaker in smaller geographical areas than in larger ones. The smaller estimated impact at the local level may reflect the internal migration of natives across regions as a consequence of immigration. The relevance of such immigration-induced movements by natives, already emphasised by Borjas *et al.* (1997), has been disputed in the recent literature (see in particular Borjas, 2005, and Card, 2005). However, it is an obstacle to proper identification of the effects investigated, even though changes in native population by region (and by skill group when available) may be used as a control, as in Dustman *et al.* (2005). Estimates based on local impacts may also suffer from endogeneity bias to the extent that immigrants may be attracted by areas in which employment and/or wage growth is strongest. Borjas' (2003) skill-level analysis of wages sidesteps

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1. Both authors were working with the OECD Economics Department when the paper was being written. They are especially grateful to Isabelle Wanner for outstanding research assistance, to Giuseppe Nicoletti, Mike Feiner, Jorgen Elmeskov, Irene Sinha and Florian Pelgrin for their help and comments, as well as several OECD colleagues for comments. The views expressed in this paper do not reflect the position of the OECD.

2. Many articles have focused on the impact of immigration on wages, in particular in the United States. The consequences for natives' employment and/or unemployment have also been dealt with in numerous studies. Recent surveys of the literature can be found in Dustman and Glitz (2006) and Hijzen and Nelson (2006).

3. This impact is larger on earlier immigrants, but still low, at –0.05%.

these problems by taking advantage of changes in wages across skill categories[4] for the economy as a whole, in order to identify the impact of immigration. Borjas finds a significant impact on wages in the US case, with an inflow worth 10% of the labour force lowering natives' wages by 3 to 4%. Applying the same methodology to Germany, Bonin (2005) finds a significant, but four times lower, negative impact of immigration on wages.[5] Skill-level approaches have also been applied to natives' employment (instead of wages) for Germany (Bonin, 2005) and Spain (Carrasco *et al.* 2004), without identifying significant impacts in either case.

4. These studies, like most analyses of the labour market impact of immigration, are static in nature. They investigate whether the level of immigration may influence that of labour market outcomes, thus addressing the question of a possible permanent impact of immigration, but ignoring the possibility of it having a transitory effect on any labour market outcome. One exception is Hercowitz and Yashiv's (2002) study of the massive migration from the former Soviet Union to Israel in the 1990s (representing an 18% increase in Israel's population in a decade), based on quarterly macro-economic data. Given the political origin of this migration episode, the endogeneity of labour market outcomes is unlikely to blur estimates in this case. They emphasise the dynamic pattern of the impact, arguing that immigrants integrate the product market (as consumers) more quickly than the labour market, thus rapidly boosting labour demand, but only progressively labour supply. Their estimates, based on simultaneous equations of native employment and the relative price of domestic goods, confirm this premise; they point to a delayed and temporary negative impact, of significant magnitude, of immigration on natives' employment.[6] The unusually large order of magnitude of this immigration shock makes it difficult to draw general conclusions from Israel's case, though. Overall, the transitory employment impact of immigration remains an open question.

5. Another difficulty in trying to draw conclusions from existing studies is that cross-country differences in policy settings are likely to imply different adjustment mechanisms of labour market variables to immigration. Interestingly, the estimated negative impact on employment -- although very small in both cases -- tends to be larger in European countries than in the United States (-0.03% vs. -0.01% across the estimates reviewed by Longhi *et al.* 2006); conversely, the impact on relative wages seems to be higher in the United States than in European countries. Angrist and Kugler (2003) investigate how policies may influence the labour market impact of immigration within the European Union. Based on a stylised model, they argue, that "institutions such as firing costs, high replacement rates, rigid wages and the cost of starting a business may ultimately aggravate the negative impact of immigration on equilibrium native employment". They study the long-term impact of the stock of immigrants on equilibrium unemployment among natives, finding some empirical evidence that institutions matter (start-up costs in particular), although the results are often insignificant, in particular when country-specific time trends are included.

6. This paper reconsiders the influence of policies on the unemployment impact of immigration, looking in particular at its dynamic dimension. The empirical analysis covers, for the period 1984-2003, all

4. Skill categories are defined by crossing experience groups with educational attainment.

5. However, Ottaviano and Peri (2005) argue convincingly that such estimates refer to the relative wages of those natives workers in skill categories for which immigration is highest, not to average real wages; besides, it depends on the assumption that the capital stock is fixed, which is disputable in a medium-term horizon. For the United States, their estimates using instrumental variables suggest that, despite its influence on relative wages, immigration does not reduce (and actually may slightly increase) real wages, at least when capital has adjusted.

6. Cohen-Goldner and Paserman (2004), studying the same migration episode through a skill-level approach, find a significant effect on wages, vanishing after four to seven years, but no effect on employment. However, as already emphasised in the case of wages, the question addressed by skill-level outcomes concerns relative labour outcomes across categories, not average outcomes. Their findings thus do not necessarily contradict Hercowitz and Yashiv's findings about aggregate employment.

OECD countries for which suitable data are available. The identification strategy is based on a cross-country analysis, combining a skill-level and an aggregate approach. These different levels of analysis allow better understanding of adjustment mechanisms and their interactions with product and labour market policy settings. No significant, permanent effect of immigration on the unemployment rate of natives is uncovered, but the results suggest that there is a temporary and delayed positive impact, vanishing after three to five years. The size and persistence of this effect is found to be dependent on framework policies. In particular, policy settings hindering product market competition are shown to magnify and lengthen the impact of immigration on the natives' labour market. Weaker evidence is found for employment protection legislation, which increases the persistence of the aggregate impact, and for the replacement rate of unemployment benefits, which increases the magnitude of the aggregate impact.

7. Stylised facts about immigration in OECD countries are presented in Section 2, and Section 3 discusses how policies may influence the impact of immigration. Section 4 describes the estimation strategy and the data. The results are presented and discussed in Section 5. Section 6 concludes.

2. Stylised facts about immigration in selected OECD countries during the last two decades

8. Net immigration flows amount to an annual intake of about 0.35% of OECD population, which represents a sizeable portion of OECD population growth (OECD, 2006a). On a harmonised basis, the stock of immigrants reached 84 million around 2000, or about 7.5% of the OECD population. Immigration experiences differ widely across OECD countries. Traditional "settlement" countries (Australia, New Zealand, Canada, United States) have had a large proportion of immigrants in the labour force for many years now, well above 15%; in European countries like France, Germany, the Netherlands, United Kingdom, which enjoyed widespread immigration after World War II, partly from their former colonies, immigrants represent a lower but still relatively large share of the male labour force,[7] close to 10%; Ireland and Southern European countries, with a longstanding tradition of emigration, have only recently become net immigration countries.

9. While immigration has trended upwards in most OECD countries since the mid-1990s, its growth profile varied across countries. Rapid rises in Ireland, Spain and Greece and, to a lesser extent Italy, the United States or the United Kingdom, contrast with the hardly changed share of immigrants in the male labour force observed in Germany, Belgium, Austria and Australia, and with its slow decrease in France (Table 1). Declining transportation and information costs, as well as persistent or widening income differences between developing and OECD countries in the context of stronger demographic growth in developing countries, partly explain rising migration pressures from the South toward the North. Higher than average GDP growth during the last decade may also explain why some OECD countries, like Ireland, Spain, United Kingdom and the United States, have exerted a special attraction. In other OECD areas immigration pressures after 1990 also reflect political events in Central and Eastern Europe and conflict in ex-Yugoslavia. Meanwhile, the influence of policies has been mixed: while developed countries increasingly compete to attract skilled immigrants, the general stance of immigration policies has been tightened in most OECD countries (see *e.g.* Boeri and Brucker, 2005). Notwithstanding these policy choices, the upward trend of the immigrant share has been steeper for lower- rather than for higher-skilled

7. The share of female immigrants in the labour force has generally increased in parallel to that of male immigrants across OECD countries. However, the gap in these two shares has tended to close over the last decade in several European countries (Denmark, Finland, Portugal, Germany, Belgium and Austria). Still, the labour market participation rates of female immigrants remain well below those of native females, mainly for cultural reasons. Exploring this issue is beyond the scope of this paper (but it is investigated *inter alia* by Fernandez and Fogli, 2005). Hence, in line with most of the literature, the econometric analysis below is only carried out for men.

workers, with the exception of Ireland (Figure 1). Still, the share of immigrants in the high-skilled working age population has risen in most countries, especially since 2000, and significantly so in several countries.

10. A significant fraction of immigration flows takes place between countries with strong cultural links, in particular within the EU. Both social and economic integration of immigrants are likely to be easier in this case, rendering such immigration rather specific. However, excluding these immigration flows does not significantly modify the observed evolution during the last two decades.

11. Whether these immigration trends affect native unemployment is not clear at first sight. A scatter plot of the male immigration share in the labour force and male natives' unemployment rate over countries and over averages of five-year periods shows no obvious relationship, either in levels (Figure 2, Panel A) or in rates of change (Panel B). While this preliminary evidence suggests that immigration is not among the main drivers of unemployment, further analysis is needed in order to determine whether immigration has an impact on unemployment.

Table 1. Share of immigrants in the labour force in OECD countries, 1984-2004

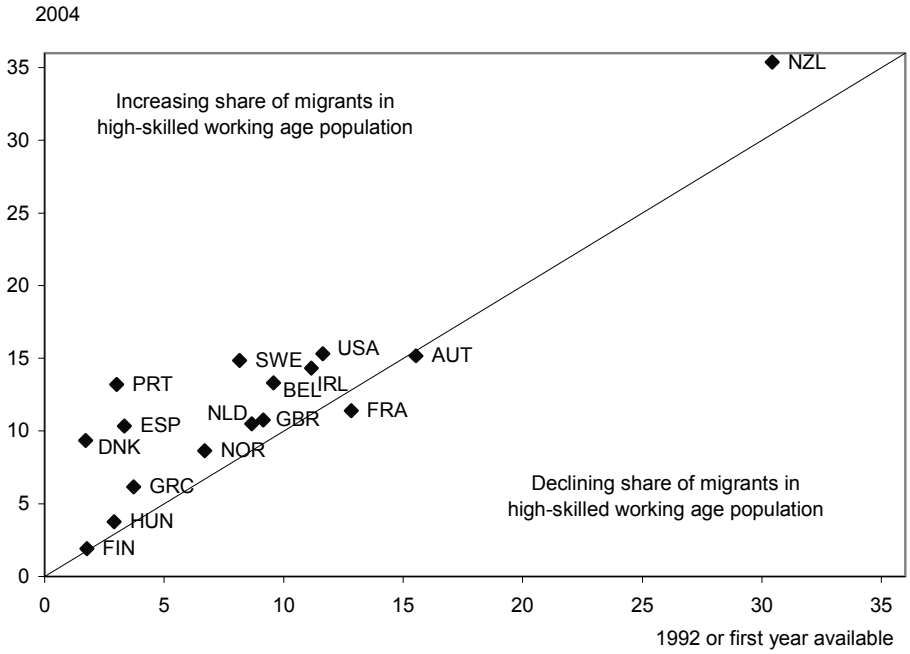
	Males			Females		
	1984	1994	2004	1984	1994	2004
Australia	28.1	26.6	26.3	26.7	24.8	25.3
Austria		10.2	9.4		8.8	7.6
Belgium	9.0	9.8	8.7	5.5	5.7	7.3
Czech Republic		0.5	0.8		0.3	0.7
Denmark	2.1	1.9	3.2	1.9	1.8	3.1
Finland		0.7	1.8		0.8	1.3
France	8.8	7.4	6.1	4.9	4.9	4.6
Germany	9.4	10.2	10.3	7.3	6.9	7.8
Greece	0.7	1.5	6.8	0.7	1.9	6.1
Ireland	2.4	3.0	5.9	3.1	2.9	5.5
Italy		0.6	3.2		0.8	3.3
Netherlands	4.4	4.8	4.0	2.6	3.1	3.3
New Zealand		18.4	21.5		18.8	20.2
Norway		2.8	4.1		2.7	4.0
Portugal	0.5	1.0	2.9	0.4	0.9	3.1
Spain	0.3	0.7	9.5	0.4	0.7	9.6
Sweden		4.5	4.6		4.4	4.7
United Kingdom	4.6	3.5	5.6	4.7	4.0	5.7
United States		12.6	18.1		10.0	13.9

Note: The Table concerns individuals aged 20-59. Immigrants are defined as foreign born for Australia, Italy, New Zealand and the United States, and as foreigners for the rest of the countries. A blank means that the statistic is not available.

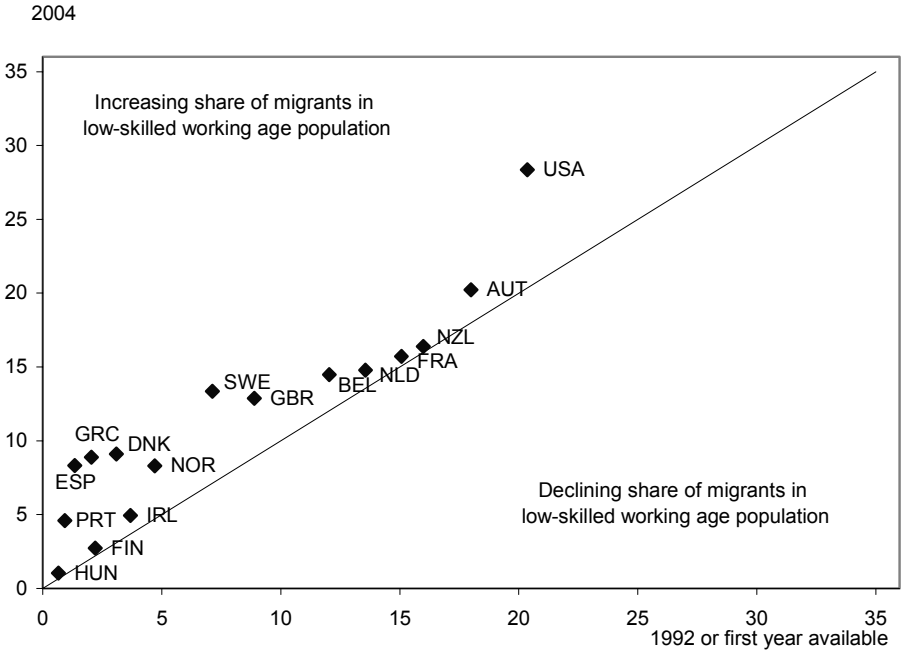
Source: Secretariat calculations based on European Union Labour Force Survey; US Current Population Survey; NZ Income Survey, Household Labour Force Survey.

Figure 1. Share of migrants in high and low-skilled working age population

A. Share of migrants in high-skilled working age population



B. Share of migrants in low-skilled working age population

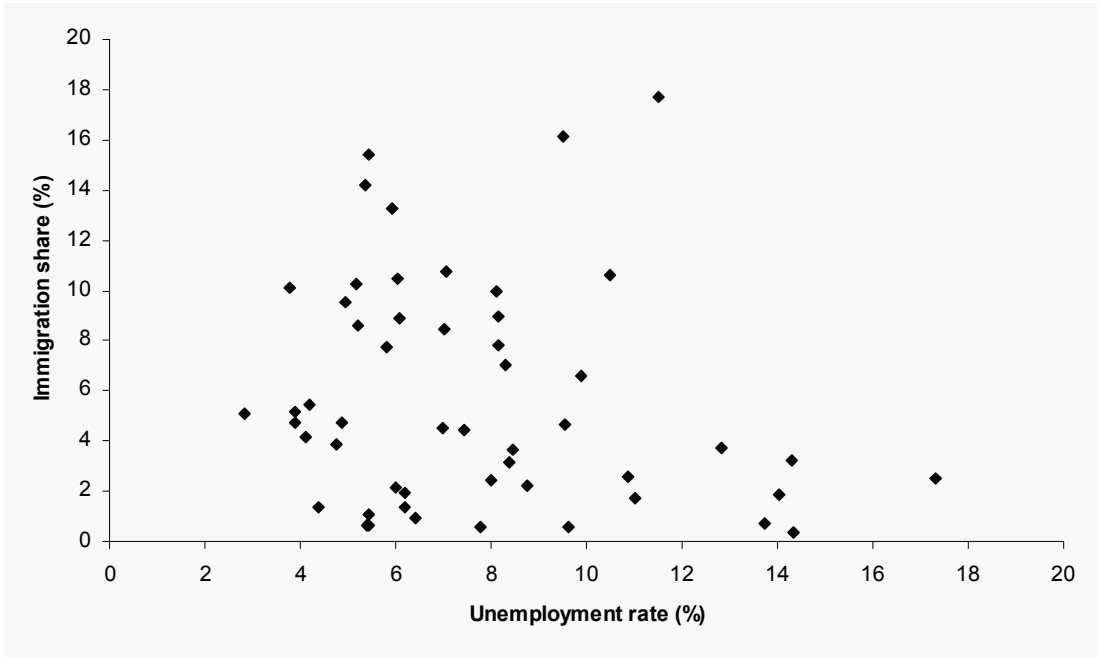


Note: Working age population is defined as people aged 16-64. The x axis refers to year 1992 except for Austria 1995, Finland 1996, France 1993, Hungary 1997, Netherlands 1996, Norway 1996, Sweden 1995, New Zealand 1997, United States 1994

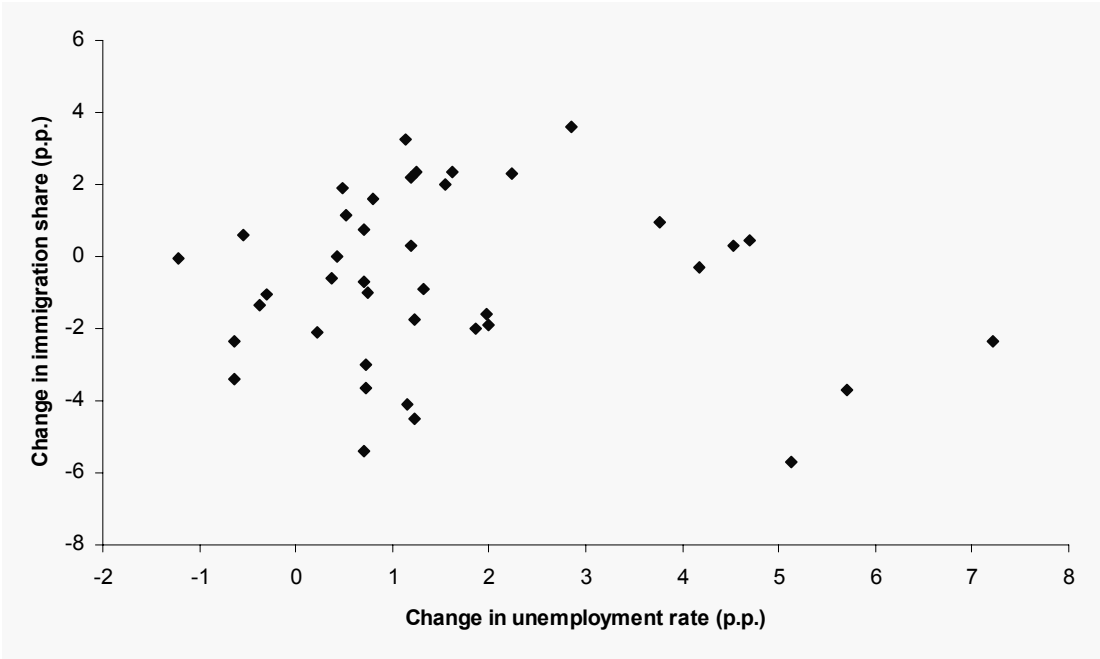
Source: Secretariat calculations based on European Union Labour Force Survey; US Current Population Survey; NZ Income Survey, Household Labour Force Survey. See Annex 3 for details.

Figure 2. Immigration and unemployment rates of male native workers across countries and time

Panel A: Levels



Panel B: Changes



Note: Each point represents a country-period (average level in panel A, change in panel B), where periods are defined at 5 year intervals from 1984 to 2004. Immigrant share is expressed in percentage of the labour force, unemployment rate is computed among natives. Scope : males aged 20 to 59.

Source: Secretariat calculations based on European Union Labour Force Survey; US Current Population Survey; NZ Income Survey, Household Labour Force Survey. See Annex 3 for details.

3. The potential unemployment impact of immigration and its link with policies

12. Immigration increases labour supply almost by definition, but it also raises labour demand through its effect on the demand for goods and services. These effects are not necessarily immediate, neither constant over time. Their magnitude depends on the degree of participation of immigrants in the labour and product markets, and on the adjustment of each of these markets to the immigration shock. Numerous studies have shown that the labour market integration of immigrants is generally imperfect, and increases gradually over time after the arrival in the host country as assimilation takes place. The effect on labour supply is thus likely to be spread out over several years, and does not immediately reach its full scale. In addition, the extent and speed of labour market integration may depend upon labour market policy settings. For instance, Causa and Jean (2007) show that a high degree of dualism in employment protection (as measured by the relative level of the OECD indicator of employment protection for temporary *versus* regular workers) reduces the employment gap between immigrants and natives, while increasing the wage gap. High tax wedges and generous replacement rates for unemployment benefits are found to decrease the employment rate of immigrants.

13. The involvement of immigrants in product markets is affected by various factors, such as their consumption and savings/investment behaviour. This behaviour is linked to the quality of their labour market integration (wage level, job security, eligibility to unemployment insurance and social benefits), their settlement characteristics (initial capital brought at entry in the country, housing investment, etc.), and the amount of remittances sent back to the country of origin. However, a common pattern is likely to emerge. As Hercowitz and Yashiv (2002) state, "during early stages of immigration, participation in the goods market is likely to be relatively stronger" (p. 2), while "later on, relative participation in the labour market (or, indirectly, in the supply of goods) is likely to dominate". "If the differential participation is important only during a transition", they add, "the mechanism (…) should be temporary". In a simple model based on the framework proposed by Bruno and Sachs (1985, Chapter 5) and Altonji and Card (1991), Hercowitz and Yashiv incorporate these differential patterns of participation and show that immigration may boost natives' employment when product market participation is sufficiently high compared to labour market participation, while the reverse is true when labour market participation is comparatively high. Their empirical results confirm their assumptions about the time pattern of relative participation rates, with a positive or insignificant impact on employment in a first stage, a negative impact later on, and no permanent impact.

14. In addition, policy settings may affect the impact of immigration on the labour market. Because immigration is a labour supply shock, any policy that modifies the slope of the labour demand and supply curves (or of the wage- and price-setting schedules) may change its impact on labour market outcomes. Under imperfect labour market adjustment, a policy change that increases the responsiveness of wages to unemployment (*e.g.* a reduction of the average replacement rate) can, for instance, lower the unemployment impact of immigration. Higher wage responsiveness of labour demand (as would result from increased competition in product markets) is also likely to limit the impact on unemployment.

15. Angrist and Kugler (2003) illustrate the possible influence of policies by considering a simple model where the labour supply of natives depends on the replacement rate of unemployment benefits, and where labour demand depends on the stringency of employment protection legislation (EPL), modelled as a firing cost. By contrast, they assume that immigrants' labour supply is exogenous, implicitly because their reservation wage is assumed to be lower than that proposed in the host country, and that EPL does not apply to immigrants, who "are probably less likely than natives to be covered by these provisions, (…) since immigrants are more likely to work in non-union jobs, have fixed-term contracts (*e.g.* if they have only temporary work permits), or work illegally" (*ibid*., p. F304). Under these assumptions, they show that the impact of immigration on native employment is larger the higher the replacement rate and the more

stringent EPL. This result is compounded by a scale effect: since both policies lower *per se* the level of employment among natives, the impact of immigration is worse in relative terms.

16. The role of labour market policies, however, may be more subtle in a dynamic context. In a first stage, EPL is likely to make substitution of immigrant for native workers more costly (because of the cost of firing native incumbent workers), thus limiting the impact of immigration on native employment. Later on, stricter EPL may on the contrary boost immigrants' employment, precisely because they are less likely than natives to be covered by the relevant legislation, making their labour cost (inclusive of the extra cost associated with job protection) comparatively lower. Indeed, except in specific cases such as employer-nominated immigration, immigrants are not incumbent in the labour market upon arrival in the country, and, therefore, they remain overrepresented among outsiders (see Causa and Jean, 2007). As such, they are unlikely to benefit from EPL provisions, at least during the first years following migration. Similarly, in the early years since immigration immigrants are also less likely to be eligible for unemployment benefits. A higher replacement rate of unemployment benefits is, therefore, likely to widen the difference in reservation wages between natives and immigrants, thus potentially increasing the relative impact of immigration on native unemployment. In the longer term, however, these effects should vanish.

17. Based on the observation of the key role played by firm creation in the readjustment of the labour market to shocks, Angrist and Kugler (2003) also argue that entry barriers to product markets may worsen the negative impact of immigration on natives' employment. In a dynamic framework, entry barriers can be regarded as an element that slows the impact of immigration on labour demand, because of the slower reaction of capital and the number of firms to increased product demand.[8] Dynamic complementarities across skill levels and between labour and capital inputs are stressed by Ottaviano and Peri (2005). Indeed, new immigrants, whatever their skills, bring additional product demand, thus raising (profitability in the short run and) the capital stock in the longer term, with a positive impact on the demand for all types of labour. The magnitude and timing of these effects thus depend on how immigration translates into higher product demand, and on how the capital stock adjusts to it. In the latter case, product market regulation (entry barriers in particular) presumably influences the speed and ease of adjustment. Another likely source of complementarity is the differential behaviour of immigrants with respect to natives that may help "grease the wheels" of the labour market. By removing bottlenecks, the greater willingness of immigrants to accept jobs unfilled by natives may foster activity levels and create other complementary jobs. Immigrants' higher responsiveness (in terms of locational choices for instance) may also result in improved resource allocation, with positive aggregate income effects (Borjas, 2001). Such impacts are closely linked to policy settings.

4. Empirical approach

Identification strategy

18. The main goal of this paper is to assess the impact of immigration on unemployment and its interaction with policy settings. The empirical analysis focuses on unemployment of native males across OECD countries[9] combining two levels of aggregation:

8. In Hercowitz and Yashiv's model, this effect is equivalent to slowing the rise in immigrants' participation in the product market.

9. An alternative is to study employment rates. This does not make a big difference since immigration does not influence men's participation rate very much. This is not the case for women, where variations in the participation rate are more difficult to control.

- A disaggregated level in which each national labour market is divided into 18 segments or skill levels, corresponding to categories of experience (defined by six-year spans) crossed by educational attainment (distinguishing three degrees).[10] The skill-level approach *à la* Borjas (2003), based on the relative changes of immigration and natives' unemployment observed across skill categories improves identification in two ways. First, it limits the endogeneity bias arising from the attractiveness for immigrants of booming labour markets: the link between labour market outcomes and immigration is likely to be much looser across skill categories than across countries. Second, it sharply increases the degrees of freedom, as the variability of immigration and labour market outcomes across skill levels (in addition to country and time) is fully exploited.

- An aggregate level covering the labour market for native males as a single entity.

Combined with the skill-level approach, the aggregate analysis allows to better understand the nature of the mechanisms involved in the adjustment to immigration and the impact of policies.

19. The focus of each approach is different: the analysis of changes across skill levels describes changes in relative outcomes for categories of workers, while the aggregate analysis looks at average outcomes. As emphasised by Ottaviano and Peri (2005) in the context of the impact of immigration on wages, estimates using a skill-level approach in fact deal with the elasticity of wages of a skill category to a change in the supply of immigrants in that skill category ("own" effect), keeping total production and the skill mix for the relevant education level fixed. The aggregate approach includes also the impact of immigration on labour market outcomes of workers with different skills, which takes place through changes in the quantity produced and in the factor mix, including that of labour across different skill levels ("cross" effects). This additional effect is important because, "due to complementarities, cross effects are likely to be positive even while own elasticity effects on wages are negative" (Ottaviano and Peri, 2005). Combining different levels of aggregation allows better studying the mechanisms involved: positive effects across all categories of workers are fully accounted for in the aggregate analysis, but they are largely overlooked in a skill-level analysis, where only the own effect of immigration in each skill cell on outcomes for similar workers is accounted for. If product market regulation hampered this adjustment channel, this should show up in the aggregate analysis, but not necessarily in the disaggregate analysis.

Data

20. The analysis is performed using annual Labour Force Survey data for the United States, New Zealand, Australia and fifteen European countries (see Annex for details), over the period 1984-2003 for the aggregate analysis, and 1992-2003 for the disaggregate analysis.

21. The analysis considers all immigrants. However, the labour market impact is also likely to differ with the country of origin of immigration (especially when immigrants are not distinguished by skill levels). This source of heterogeneity cannot be directly controlled due to data limitations; still, a robustness check is carried out for the aggregate analysis, focusing only on non-EU immigrants in EU countries, in

10. Experience is assumed to be equivalent in both origin and host countries, although in practice entrepreneurs in the host country do not always fully recognise experience accumulated before entry.

order to capture the impact of immigration from countries with lower per capita income than OECD countries.[11]

22. Due to data limitations, immigrants are defined as foreigners in the aggregate analysis for EU countries, and as foreign born in all other cases. This may blur the comparability of results between levels of aggregation, to the extent that naturalisation is widespread in many OECD countries. Robustness checks carried out using data based on nationality in the disaggregate analysis suggest that this limitation does not modify the results qualitatively.

23. The policy variables considered include the unemployment benefit replacement rate (averaged across a variety of income levels, family situations and duration of unemployment), the stringency of employment protection legislation (EPL),[12] and the extent of anti-competitive product market regulation (PMR), computed yearly based on data covering regulation in seven non-manufacturing industries (see Conway and Nicoletti, 2006).

Econometric model

24. The econometric specification aims at identifying the time profile of the unemployment impact of immigration, as well as its interaction with labour and product market policies. As in Hercowitz and Yashiv (2002), the economic impact of changes in immigration is modelled as an "impulse response". The following base specification is adopted for the disaggregated estimations:

$$U_{xdct} = \alpha + \left(\lambda + \gamma_u \mathbf{Pol}_{ct}\right) U_{xdc(t-1)} + \sum_{l=0}^{L} \left[\beta_l + \gamma_l \mathbf{Pol}_{ct}\right]\left[\Delta I_{xdc(t-l)}\right] + \left(\beta_{LR} + \gamma_{LR} \mathbf{Pol}_{ct}\right) I_{xdc(t-L-1)} + \mathbf{D}\times\mathbf{X}\times\mathbf{C} + \mathbf{D}\times\mathbf{C}\times\mathbf{T} + \mathbf{X}\times\mathbf{C}\times\mathbf{T} + u_{xdct} \quad (1)$$

where U is the unemployment rate of natives, I is the share of immigrants in the labour force, **Pol** is a vector of product and labour market policies, u is an error term. Subscripts d, x, and c refer to educational attainment, experience, and country, respectively, and jointly define a labour market segment, whereas t refers to time. **D**, **X**, **C** and **T** represent fixed-effects for educational attainment, experience, country and time, respectively. The three crossed fixed-effect terms control, within each country, for average differences in unemployment levels across labour market segments (D x X x C), and for time fixed effects specific to each level of education (D x C x T) and of experience (X x C x T). As is customary in unemployment analyses, the specification includes the lagged dependent variable. The parameters of interest are here the βs and γs.[13] The first term on the RHS of equation (1) captures the average impact of policies on unemployment persistence. The second and third terms capture how the effects of (lagged and contemporaneous) changes and (lagged) levels of the immigrants' shares, respectively, are affected by policies.

11. Immigrants from Switzerland, Norway and Iceland are not taken into account either in this case. In these regressions, non-European recipient countries (New Zealand, United States and Australia) are not considered.

12. For EPL and the replacement rate, the definition of variables is the same as in Bassanini and Duval (2006), based on OECD data.

13. For the sake of brevity, γ actually refers here to diagonal matrices of coefficients, with dimension equal to the number of policies considered.

25. At the aggregate level, the direct effects of policy variables are also considered. The specification is as follows:

$$U_{ct} = \alpha' + \left(\lambda' + \gamma'_u \mathbf{Pol}_{ct}\right) U_{c(t-1)} + \sum_{l=0}^{L} \left[\beta'_l + \gamma'_l \mathbf{Pol}_{ct}\right]\left[\Delta I_{c(t-1)}\right] + \left(\beta'_{LR} + \gamma'_{LR} \mathbf{Pol}_{ct}\right) I_{c(t-L-1)} + \mathbf{C} + \mathbf{T} + \mathbf{C} \times t + u'_{ct} \quad (2)$$

where **C** and **T** are country and time fixed effects, while **C** x *t* are country-specific time trends. Interactions of this lag with policy variables are also included, since the institutional setting may influence the resilience of the labour market to shocks (Duval *et al.*, 2007).[14] By introducing these dynamic terms, the estimation focuses on the time profile of immigration over and above the average persistence of shocks. Such specification is consistent with the assumption made above that immigration shocks are neither immediate nor instantaneous.

26. Disaggregate regressions are weighted by the labour force of each segment in order to avoid segments with few individuals having a disproportionate impact on the estimated effect for the average worker. The estimations are performed using fixed-effect feasible generalised least squares, accounting for heteroscedasticity across panel units (that is, labour market segments) and for autocorrelation of residuals. No cross-sectional correlation is assumed, since time-specific disturbances are controlled through time fixed effects.[15]

27. The aggregate analysis, covering males aged 24-60,[16] uses system GMM estimators (Blundell and Bond, 1998). Instrumental variables are used to correct for endogeneity. If some endogeneity were to persist, it would bias the results downwards: even in this case, the estimated effect of immigration on unemployment could safely be considered as a lower bound. Instrumental variables based on the assumption that immigrants cluster with previous immigrants of the same origin (*à la* Card, 2001) proved too weak; this is not surprising in the present context, given that cross-country differences in immigration are largely driven by differences in migration policies, in contrast to what happens across US states studied by Card. In any case, given the dynamic specification used here, only the contemporaneous change in immigration may be endogenous. Endogeneity is thus less of a problem than in other studies, where the effect of the *level* of immigration was estimated.

14. Since Blanchard and Wolfers (2000), the role of macro-economic shocks, and their interactions with institutions as determinants of unemployment has been central in the empirical literature (*e.g.* Nickell *et al.* 2005; Bassanini and Duval, 2006). These shocks are not included here, because macro-economic shocks (generally related to labour demand, total factor productivity, terms of trade and interest rates) are "at best proximate cause, and should be traced to deeper causes" (Blanchard and Wolfers, 2000, p.C11). Immigration is among these deeper causes, and introducing intermediate shocks, which by themselves partly result from immigration, is likely to blur the estimation of the impact of immigration.

15. See Nunziata (2005) for a discussion on that point and on the consequences for the estimator's reliability.

16. This restricts the analysis to ages when activity is generally high, but including younger people does not change the results substantially.

5. Estimation results

Direct effects

28. Estimates are first carried out without introducing the possible interactions with policy variables (Table 2). While a higher number of lags has also been considered, the results are only displayed for L=5, *i.e.* including the previous five changes in the share of immigrants, and the level of this share at *t-5*. As confirmed by estimates involving a higher number of lags (including estimates with policy interactions), the impulse given by immigration to unemployment is found to be insignificant after three years, both at the aggregate and at the disaggregated level (Figure 3). This could suggest that the share of immigrants in the labour force does not have a permanent impact on unemployment. If so, a flow of immigrants that maintains the share of immigrants in the labour force constant over time (*e.g.* a net inflow with the same growth rate as the native labour force) would have no influence at all on natives' unemployment.

Table 2. Estimated impact of the share of immigrants in the labour force on the unemployment rate of natives
(men aged 24-60)

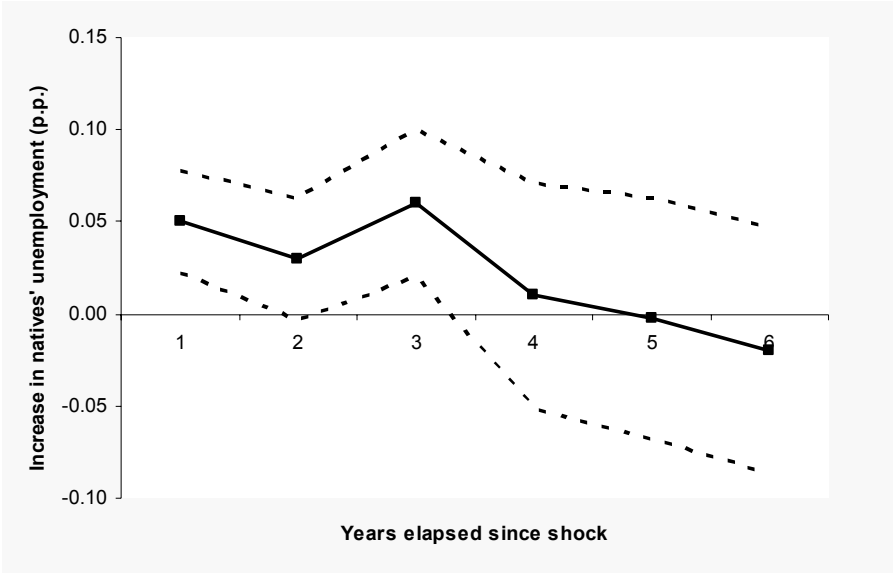
	Disaggregated estimations		Aggregate estimations			
	All immigrants		All immigrants		Non-EU imm.	
	OLS	FGLS	OLS	GMM	OLS	GMM
	(1)	(2)	(3)	(4)	(5)	(6)
I(t) - I(t-1)	0.05	0.05 ***	0.19	0.20 *	0.17	0.13
	(1.52)	(3.56)	(1.24)	(1.82)	(0.79)	(0.61)
I(t-1) - I(t-2)	0.06	0.03 *	0.35 *	0.35 **	0.47 **	0.43 **
	(1.24)	(1.76)	(1.85)	(2.04)	(2.17)	(2.13)
I(t-2) - I(t-3)	0.09	0.06 ***	0.38 *	0.39 ***	0.41	0.37
	(1.61)	(2.93)	(1.81)	(2.90)	(1.38)	(1.57)
I(t-3) - I(t-4)	0.03	0.01	0.08	0.08	-0.03	-0.03
	(0.49)	(0.32)	(0.38)	(0.45)	(-0.08)	(-0.14)
I(t-4) - I(t-5)	0.04	-0.00	0.17	0.16	0.03	-0.07
	(0.51)	(-0.06)	(0.56)	(1.01)	(0.07)	(-0.14)
I(t-5)	-0.00	-0.02	0.04	0.05	-0.21	-0.30
	(-0.01)	(-0.59)	(0.13)	(0.38)	(-0.40)	(-0.45)
Lagged unemployment	-0.03	0.04 *	0.74 ***	0.74 ***	0.71 ***	0.66 ***
	(-0.64)	(1.83)	(8.37)	(15.24)	(7.12)	(6.13)
R-squared	0.942		0.943		0.949	
Observations	1974	1953	178	178	144	144
Countries	18	18	16	16	13	13
Log likelihood	7079	7803				
Sargan test (p-value)				1.00		1.00
AR(1)				0.037		0.066
AR(2)				0.257		0.678

Source: Authors' estimations based on equation (1) for results presented in columns (1) and (2), and based on equation (2) for results in columns (3) to (6). Data sources are described in the text.

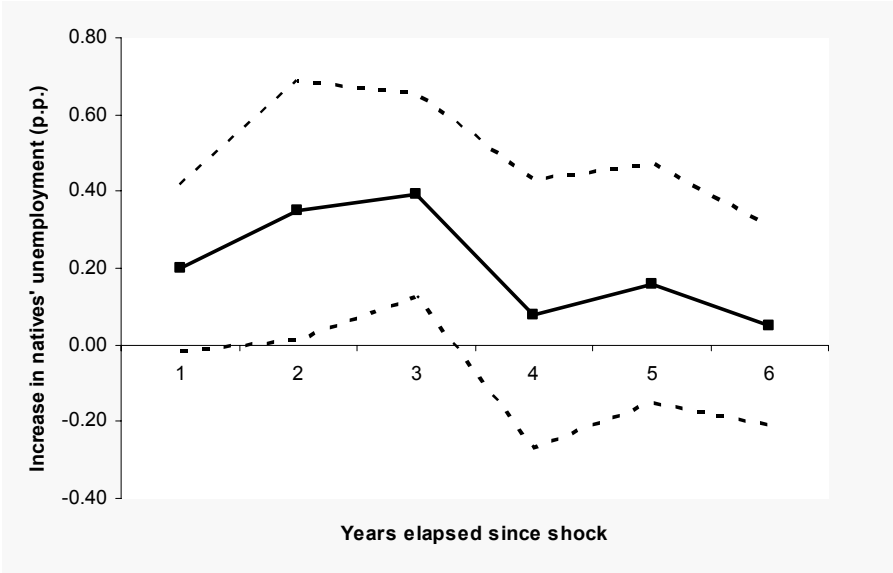
Note: (4) and (6) are carried out using system-GMM estimators, whereas (2) uses feasible GLS. Estimations in columns (1) and (2) are weighted using the native labour force. Estimations in columns (5) and (6) are restricted to data on European countries, and only concern immigrants from non-EU countries. Robust t-statistics are reported in parenthesis. * means significant at 10%; ** at 5%; *** at 1%. I(t) refers to the share of immigrants in the labour force at year t. Each equation includes a set of dummies, as described in equations (1) and (2). In order to save space, only the coefficients of direct interest are reported. AR(1) and AR(2) are the p-values of Lagrange-multiplier (LM) tests of serial autocorrelation of order 1 and 2, under the null of no autocorrelation. The Sargan test is a test of overidentifying restrictions for the validity of instruments. It is asymptotically distributed as a Chi-square under the null that the instruments are uncorrelated to the residuals. A p-value close to one indicates that the null of valid instruments cannot be rejected.

Figure 3. Estimated direct impact of a permanent 1% increase in the share of immigrants in the labour force on natives' unemployment (with 95% confidence bands)

Panel A. Disaggregated impact (on one skill cell with respect to others)



Panel B. Aggregate impact



Source: based on Table 1, column (2) for Panel A, column (4) for Panel B.

29. Only *changes* in the share of immigrants in the labour force significantly influence natives' unemployment, and their impact is temporary. The estimated impact is significant but very weak at the disaggregated level; it is stronger at the aggregate level. Indeed, the estimated initial responses must be compounded by the persistence of unemployment shocks, measured here through the auto-regressive term. Hence, the fact that the impulse is insignificant beyond three years after the shock does not mean that the impact on unemployment is not felt afterwards, as illustrated by the response function to a permanent 1% increase in the share of immigrants in active population (Figure 3). The persistence of unemployment is thus a crucial determinant of the potential unemployment consequences of immigration shocks.

30. The estimated impact is less precisely identified when only non-EU immigrants are considered, but it is not markedly different (Table 2, last two columns). For all immigrants, weaker results at the disaggregate level than at the aggregate level presumably reflect the fact that immigrant workers do not compete only with native workers in the same skill segment: indeed over-qualification is widespread among immigrants (see *e.g.* OECD, 2005). Competition with workers in other segments is accounted for in the aggregate analysis, although after a few years it is compensated by the positive cross effects due to the capital and skill complementarities mentioned above. It is also noteworthy that the aggregate impact is lower and hardly significant during the first year. This confirms Hercowitz and Yashiv´s finding that the employment impact of immigration is delayed, presumably reflecting the slow entry of immigrants in the labour market.

31. Applying the same estimating framework to employment instead of unemployment rates delivers similar results, confirming our premise that the impacts measured are not substantially influenced by changes in the activity rate of men (see Annex, Table A.1). Replicating the above estimations for women, the direct average impact on unemployment is also found to be positive in the first three years following the change in the share of immigrants, but it is never significantly different from zero at conventional levels. The impact on native women's employment rate is even found positive at some lags, a finding difficult to interpret (see Annex, Table A.2). As already noted by Angrist and Kugler (2003), this may be related to the low employment rate among immigrant women. The activity behaviour of women, more sensitive to other factors, may also blur the analysis.

Results with policy interactions

32. Including interactions with (demeaned) policy variables does not significantly modify the estimated direct impact of immigration on unemployment at the disaggregated level (Table 3). Interaction effects are insignificant at conventional levels for EPL, and only the first term is significant for the replacement rate of unemployment benefits (corresponding to a weak dampening effect) and for product market regulation (suggesting that entry regulation may increase the impact of immigration on natives' unemployment).

Table 3. Estimated impact of immigrant share in the labour force on native men unemployment rate – disaggregated and aggregate estimations

	Disaggregated estimations			Aggregate estimations			By group of PMR stringency	
	Interacted policy variable:			Interacted policy variable:				
	EPL	PMR	ARR	EPL	PMR	ARR	Low PMR	High PMR
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	
Direct effect at sample mean								
I(t) - I(t-1)	0.04 ***	0.04 ***	0.04 ***	0.11	0.18	0.20	0.18	0.40
	(3.26)	(2.89)	(2.78)	(0.76)	(1.06)	(1.28)	(0.97)	(1.14)
I(t-1) - I(t-2)	0.03 *	0.02	0.02	0.24	0.09	0.18	0.14	0.43
	(1.75)	(1.61)	(1.50)	(0.92)	(0.47)	(0.66)	(0.52)	(1.17)
I(t-2) - I(t-3)	0.06 ***	0.06 ***	0.06 ***	0.35 **	0.33	0.25	-0.03	0.86 *
	(3.67)	(3.72)	(3.75)	(1.99)	(1.64)	(1.08)	(-0.15)	(1.89)
I(t-3) - I(t-4)	0.01	0.02	0.02	0.03	0.06	-0.11	-0.21	0.48
	(0.94)	(1.43)	(0.98)	(0.41)	(0.31)	(-0.45)	(-0.87)	(1.23)
I(t-4) - I(t-5)	0.02	0.01	0.01	-0.01	0.06	-0.07	-0.25	0.37
	(1.43)	(0.96)	(0.89)	(-0.12)	(0.45)	(-0.43)	(-0.81)	(1.34)
Lagged unemployment	0.07 ***	0.06 **	0.07 ***	0.66 ***	0.59 ***	0.73 ***	0.64 ***	0.68 ***
	(2.88)	(2.26)	(2.87)	(15.33)	(9.27)	(9.32)	(14.05)	(16.74)
Interaction with the policy variable								
I(t) - I(t-1)	0.02	0.05 ***	-0.01 ***	-0.29 *	0.34	0.01		
	(0.80)	(3.03)	(-2.98)	(-1.95)	(1.27)	(0.49)		
I(t-1) - I(t-2)	-0.02	-0.01	0.00	-0.07	0.28 **	0.02		
	(-1.62)	(-0.79)	(0.09)	(-0.45)	(2.34)	(0.95)		
I(t-2) - I(t-3)	0.02	-0.00	-0.00	0.11	0.41 **	0.04 *		
	(1.21)	(-0.13)	(-0.78)	(0.60)	(2.31)	(1.84)		
I(t-3) - I(t-4)	0.04 *	-0.01	-0.00	-0.05	0.28 **	0.04 **		
	(1.90)	(-0.37)	(-0.49)	(-0.33)	(2.15)	(2.41)		
I(t-4) - I(t-5)	0.03	0.03	0.00	0.06	0.25 **	0.02		
	(1.58)	(1.54)	(0.61)	(0.54)	(2.02)	(1.54)		
Lagged unemployment	-0.01	0.01	0.00	0.19 ***	0.23 ***	-0.00		
	(-0.34)	(0.70)	(0.63)	(2.86)	(3.73)	(-0.35)		
Observations	1743	1743	1743	160	159	159	159	
Log likelihood	6921	6944	6940					
Countries	18	18	18	16	16	16	16	
Sargan test (p-value)				1.00	1.00	1.00	1.00	
AR(1)				0.039	0.021	0.037	0.036	
AR(2)				0.603	0.408	0.276	0.167	

Source: Authors' estimations based on equation (1) for results presented in columns (1) to (3), and based on equation (2) for results in columns (4) to (7). Data sources are described in the text.

Note: Regressions in columns (1) to (3) are estimated using feasible GLS, whereas results in columns (4) to (7) use system-GMM estimators. Estimations (1) to (3) are weighted using the native labour force. In regression (7), the coefficients of changes in the immigration share are different for the two groups, including respectively those country-years with below-median and above-median level of PMR stringency. Robust t-statistics are reported in parenthesis. * significant at 10%; ** at 5%; *** at 1%. I(t) refers to the share of immigrants in the labour force at year t. Each equation includes a set of dummies, as described in equations (1) and (2). In order to save space, only the coefficients of direct interest are reported. AR(1) and AR(2) are the p-values of Lagrange-multiplier (LM) tests of serial autocorrelation of order 1 and 2, under the null of no autocorrelation. The Sargan test is a test of overidentifying restrictions for the validity of instruments. It is asymptotically distributed as a Chi-square under the null that the instruments are uncorrelated to the residuals. A p-value close to one indicates that the null of valid instruments cannot be rejected.

33. At the aggregate level, the interaction with EPL is significantly negative in the first year following immigration changes, presumably reflecting the protective role of EPL for native jobs (Table 4).[17] However, higher EPL also significantly increases the coefficient of the autoregressive term. In line with Duval *et al.* (2007), these results suggest an ambiguous effect of EPL, whereby the initial dampening of the immigration shock provided by employment protection comes at the cost of higher persistence of the related unemployment consequences in subsequent years. The interaction with a higher replacement rate of unemployment benefits is found to increase the impact of immigration on unemployment three to four years after entry. This effect may reflect the relative increased cost of native

17. However, when the focus is on non-EU immigrants, the interaction is also found to be positive as from the second lagged change, significantly so in two cases, reproducing the results obtained at the disaggregate level.

labour implied by such policies, as well as the differential impact of unemployment benefits on the reservation wages of immigrants and natives.

34. The most robust interaction at the aggregate level is found for the indicator of product market regulation, which significantly magnifies the unemployment impact of immigration, between two and five years after entry: the unemployment impact of immigration is thus both stronger and more durable under more stringent anti-competitive regulation in the product market. This influence is even stronger when focusing on non-EU immigrants.[18] In addition to magnifying the direct impact of changes in the share of immigrants on natives' unemployment, barriers to competition also significantly increase the persistence of unemployment shocks. Therefore, the overall magnitude of the unemployment impact of immigration strongly depends on the stringency of product market regulation: the supply response, in particular through firm creation,[19] is key to the adjustment of the economy, and it is hampered by excessive anti-competitive regulations. This result is consistent with Angrist and Kugler's (2003) findings for European countries in a static framework. Since product market regulation affects fairly equally different labour categories, it is not surprising that this effect does not show up strongly at the disaggregated level. Splitting the sample into two sub-samples according to the level of regulation in comparison to the sample's median confirms this finding, although estimates are imprecise in that case: the estimated unemployment impact of immigration is higher for observations corresponding to higher-than-median product market regulation than for other observations. The estimated persistence of unemployment shocks is also found to be slightly higher under relatively stringent product market regulation.

35. Estimates that jointly include several policy interactions are very imprecise, most likely due to multicollinearity. Policy variables are not fully independent from each other and the limited variance in the sample does not allow their respective impact to be properly identified when they are considered together.[20]

36. Splitting the sample into age groups unveils contrasting impacts of immigration.[21] For natives under 40 years of age, the average impact is significant and comparable to that found for all workers, but interactions with policies are insignificant except for one term for PMR and another for the average replacement rate. By contrast, the average impact is insignificant for natives above the age of 40, but it is found to depend significantly on policy settings, in line with the general effects described above. The particular relevance of EPL and unemployment benefits replacement rate for older workers does not come as a surprise, since these workers are more likely to hold a permanent job (thus fully benefiting from EPL) and to be eligible for unemployment benefits.

18. Using the economy-wide indicator for year 1998 gives similar results.

19. Firm creation is actually important not only to match the additional demand emanating from immigrants, it is also in itself an important modality of integration of immigrants (Zimmermann, 2004).

20. These estimates are not reported, but are available from the authors upon request.

21. Splitting the sample by educational categories would also be interesting, but information by education category is not available before 1994, thus leaving too few observations in order to conduct reliable aggregate analysis.

Table 4. Impact of immigrant share in the labour force on unemployment rate, and its interaction with product and labour market policies, by age group – aggregate estimations

	Average effect		Interacted policy variable:					
			EPL		PMR		ARR	
	Under 40	Over 40	Under 40	Over 40	Under 40	Over 40	Under 40	Over 40
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Direct effect at sample mean								
l(t) - l(t-1)	0.19 *	-0.02	0.16	-0.04	0.19	0.01	0.24 **	-0.05
	(1.83)	(-0.17)	(1.11)	(-0.36)	(1.03)	(0.07)	(1.99)	(-0.42)
l(t-1) - l(t-2)	0.33 *	0.05	0.23	-0.04	0.10	-0.10	0.35	-0.12
	(1.89)	(0.39)	(1.04)	(-0.16)	(0.40)	(-0.54)	(1.52)	(-0.53)
l(t-2) - l(t-3)	0.35 ***	0.21	0.41 ***	0.07	0.31	0.06	0.29	-0.02
	(3.16)	(1.05)	(2.71)	(0.38)	(1.45)	(0.37)	(1.48)	(-0.11)
l(t-3) - l(t-4)	0.12	0.02	0.15 **	-0.08	0.23	-0.15	0.02	-0.17
	(0.93)	(0.07)	(2.18)	(-0.68)	(1.01)	(-0.89)	(0.11)	(-0.68)
l(t-4) - l(t-5)	0.05	0.03	0.02	-0.16	0.07	-0.17	0.03	-0.20
	(0.31)	(0.10)	(0.12)	(-1.62)	(0.57)	(-1.33)	(0.14)	(-1.41)
l(t-5)	-0.15	0.15						
	(-0.95)	(0.66)						
Lagged unemployment	0.73 ***	0.63 ***	0.65 ***	0.55 ***	0.61 ***	0.51 ***	0.77 ***	0.58 ***
	(14.02)	(11.56)	(18.99)	(12.95)	(8.77)	(10.19)	(10.09)	(6.27)
Interaction with the policy variable								
l(t) - l(t-1)			-0.24	-0.22 **	0.27	0.27 *	-0.01	0.01
			(-1.35)	(-1.99)	(1.12)	(1.96)	(-0.89)	(1.46)
l(t-1) - l(t-2)			-0.20	-0.00	0.15	0.30 *	-0.02	0.03 *
			(-1.23)	(-0.02)	(1.32)	(1.89)	(-0.84)	(1.76)
l(t-2) - l(t-3)			-0.06	0.20	0.29 *	0.36 ***	0.02	0.03 *
			(-0.31)	(1.37)	(1.79)	(2.94)	(1.33)	(1.83)
l(t-3) - l(t-4)			-0.14	0.04	0.25	0.23 **	0.03 ***	0.05 **
			(-1.02)	(0.26)	(1.53)	(2.09)	(2.62)	(2.08)
l(t-4) - l(t-5)			-0.09	0.22 **	0.17	0.29 **	-0.00	0.03 ***
			(-0.62)	(2.28)	(1.16)	(2.53)	(-0.30)	(3.34)
Lagged unemployment			0.21 ***	0.19 ***	0.22 ***	0.21 ***	-0.00	-0.00
			(2.91)	(3.59)	(3.07)	(4.33)	(-0.48)	(-0.18)
Observations	178	178	160	160	159	159	159	159
Countries	16	16	16	16	16	16	16	16
Sargan test (p-value)	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00
AR(1)	0.048	0.018	0.078	0.014	0.024	0.014	0.055	0.029
AR(2)	0.034	0.821	0.107	0.672	0.141	0.853	0.258	0.639

Source: Authors' estimations based on equation (2). Data sources are described in the text.
Note: System-GMM estimators are used in all regressions. Robust t-statistics are reported in parenthesis. * means significant at 10%percent; ** at 5%; *** at 1%. l(t) refers to the share of immigrants in the labour force at year t. "ARR" refers to the average replacement rate of unemployment benefits (see text for definition). Each equation includes a set of dummies, as described in equation (2). In order to save space, only the coefficients of direct interest are reported. AR(1) and AR(2) are the p-values of Lagrange-multiplier (LM) tests of serial autocorrelation of order 1 and 2, under the null of no autocorrelation. The Sargan test is a test of overidentifying restrictions for the validity of instruments. It is asymptotically distributed as a Chi-square under the null that the instruments are uncorrelated to the residuals. A p-value close to one indicates that the null of valid instruments cannot be rejected.

6. Conclusion

37. This paper reassesses the unemployment effect of immigration in OECD countries, with a focus on the time profile of these effects and on their interaction with product and labour market policies. Our estimates do not find any permanent effect of immigration, measured as the share of immigrants in the labour force, upon natives' unemployment. An immigration inflow leaving unchanged the share of immigrants in the labour force does not even influence unemployment in the short run. Still, we find significant evidence of a transitory and delayed impact on unemployment of changes in the share of immigrants. The impact is weak when measured at the skill level: natives with skills most similar to those of immigrants do not suffer from a strong rise in their unemployment rate relative to other categories of natives. At the aggregate level, however, the transitory impact may be substantial; its magnitude and duration largely depends on the persistence of unemployment shocks, and it may last between five and ten years.

38. The extent and duration of the unemployment impact of immigration partly is shown to depend on framework policies. In particular, anticompetitive product market regulation is found to increase both

the magnitude and persistence of the impact of a change in the share of immigrants in the labour force on native male unemployment. This finding underlines the importance of the supply response in the adjustment to an immigration shock, and of the potentially damaging role played by excessive regulation of product markets. In addition, the results suggest that EPL increases the persistence of the unemployment impact of immigration, while the generosity of unemployment benefits increases its magnitude.

39. Data limitations make it difficult to accurately identify these effects. However, these findings are consistent with previous results on the interaction with policies by Angrist and Kugler (2003), and on the dynamic employment impact of immigration by Hercowitz and Yashiv (2002). They are also consistent with recent analyses, in a more general context, of how policies influence the adjustment capacity of an economy to macroeconomic shocks (OECD, 2006; Duval *et al.*, 2007). Policies that enhance the adaptability of labour and product markets to immigration shocks should help limit the impact of these shocks, while at the same time helping the labour market to quickly revert to a new equilibrium. In sum, immigration *per se* is not a problem for natives' unemployment. However, changes in immigration flows may require adjustments that are costly for the native population, and well-suited framework policies can be important in minimising these costs.

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ANNEX: DATA AND METHODOLOGICAL ISSUES

Data

Data sources and countries covered

40. The main data source for the empirical analysis of the labour market impact of immigration is the labour force survey (LFS) of various countries. Data for policy indicators and macroeconomic shocks are the same as those used in the most recent version of the Jobs Study (Bassanini and Duval, 2006) and come from various OECD sources.

41. For European countries, the European Labour Force Survey (ELFS) is used. Data for these countries are available for varying time periods: since the early 1980s for early members of the Union, the mid-1980s for Spain and Portugal, and since 1995 for ex-members of the European Economic Area. Italy is excluded from the aggregate estimations as it does not allow the publication of data on nationality. Recent accession countries have not been included in the analysis due to data limitations. Norway, Iceland and Switzerland are also covered by the ELFS, despite not being EU members, although the latter two have not been covered due to the lack of detail on nationality. For the United States, New Zealand and Australia, LFS data have also been used; however, Australia is only included in the aggregate analysis since information on the level of education is not available. Canada is not considered because LFS data do not provide statistics on nationality or country of origin; finally Japan, Korea, Turkey and Mexico are excluded from the analysis due to data limitations.

Variables

Labour market variables

42. The main labour market variables used in the analysis are the unemployment rates and the share of immigration for specific categories of workers. These categories are defined by sex, education level and experience (which in turn is directly derived from age).

Immigrant status

43. As pointed out in the main text, the status of immigrants can be determined by nationality or the country of birth. For the LFS both variables are available, although the country of birth is registered only since 1992, not allowing to use this concept in the aggregate analysis due to the lack of sufficient points in time. For the other three countries included in the analysis (Australia, New Zealand and United States), immigration is usually defined by country of birth. Nationality is only available for the United States.

44. The immigration shock has been restricted to individuals coming from countries which are not similar to the host country in terms of per capita income, language and culture. Data availability has also played a role in defining this restriction. For European countries, these are immigrants from outside the European Union (and Iceland, Norway and Switzerland). For the United States, they are immigrants from outside Canada, United Kingdom and Australia; for New Zealand, those who are not born in the United Kingdom, Australia or the Netherlands; for Australia, all immigrants are considered, due to lack of information on area of origin.

Labour market status

45. This is defined in the standard way, using the concepts determined by the International Labour Organization and incorporated in national labour force surveys.

Education

46. The level of education is defined at one digit (ISCED1), which corresponds to a classification of workers in three categories: low-skilled (those who have completed at most compulsory secondary education); medium-skilled (upper secondary education) and highly skilled (beyond secondary education).

Experience

47. This variable is defined as the age minus a standard age that depends on the education level of the individual, and corresponds approximately to the age of leaving education for that level: 15 for low-skilled workers, 18 for medium-skilled workers, and 21 for highly-skilled workers. Due to lack of information, no consideration is given to the time of inactivity or unemployment spent working after those ages while, for immigrants, experience cumulated in the origin country is not distinguished from that acquired in the host country.

Data adjustments

48. Data for Germany, Finland and Sweden have been split in two periods: before and after 1991. In practice, each of them is considered as two separate pseudo-countries (each with data for two different periods). This adjustment, which was also carried out in the most recent version of the Jobs Study, addresses the problem of the statistical break in Germany in that year (due to reunification) and the economic break in Finland and Sweden at the beginning of the 1990s, which was followed by a deep recession in both countries.

49. Spain is dropped from the sample in the aggregate analysis. The massive inflows of immigrants in the second half of the 1990s coincides in that country with a very large drop in the unemployment rate that cannot be explained by the model used here. In addition to this incidental correlation, a large number of immigrants were occupying undeclared jobs, thus blurring further the statistics used for the regression.

Table A.1. Estimated impact of immigrant share in the labour force on native men employment rate, and its interaction with product and labour market policies –aggregate estimations

	Average effect	Interacted policy variable: EPL	PMR	ARR
	(1)	(2)	(3)	(4)
Direct effect at sample mean				
I(t) - I(t-1)	-0.34 ***	-0.31 **	-0.33 ***	-0.36 ***
	(-3.78)	(-2.32)	(-3.20)	(-2.96)
I(t-1) - I(t-2)	-0.21	-0.11	-0.16	-0.12
	(-0.88)	(-0.38)	(-0.56)	(-0.40)
I(t-2) - I(t-3)	-0.12	-0.23	-0.27	-0.22
	(-0.57)	(-1.38)	(-1.14)	(-0.98)
I(t-3) - I(t-4)	-0.16	0.01	-0.19	0.02
	(-0.75)	(0.11)	(-1.05)	(0.09)
I(t-4) - I(t-5)	-0.11	0.06	-0.17	0.03
	(-0.53)	(0.40)	(-1.24)	(0.20)
I(t-5)	0.15			
	(0.90)			
Lagged unemployment	0.69 ***	0.71 ***	0.66 ***	0.76 ***
	(11.31)	(20.95)	(10.04)	(11.88)
Interaction with the policy variable				
I(t) - I(t-1)		0.19	-0.22	-0.02
		(1.30)	(-1.48)	(-1.36)
I(t-1) - I(t-2)		0.28	-0.36 **	-0.01
		(1.50)	(-2.04)	(-0.31)
I(t-2) - I(t-3)		0.08	-0.30 *	-0.03
		(0.50)	(-1.65)	(-1.42)
I(t-3) - I(t-4)		0.15	-0.26 **	-0.05 ***
		(0.76)	(-2.10)	(-4.25)
I(t-4) - I(t-5)		0.10	-0.30 **	-0.03 ***
		(0.65)	(-2.11)	(-3.01)
Lagged unemployment		0.11 *	0.20 ***	-0.00
		(1.77)	(3.57)	(-0.08)
Observations	178	160	159	159
Countries	16	16	16	16
Sargan test (p-value)	0.00	0.00	0.00	0.00
AR(1)	0.011	0.030	0.023	0.026
AR(2)	0.373	0.246	0.262	0.094

Source: Authors' estimations based on text's equation (2). Data sources are described in the text..

Note: System-GMM estimators used in all regressions Robust t-statistics are reported between parenthesis. * significant at 10%; ** at 5%; *** at 1%. I(t) refers to the share of immigrants in the labour force at year t. "ARR" refers to the average replacement rate of unemployment benefits (see text for definition). Each equation includes a set of dummies, as described in equation (2). To save space, only the coefficients of direct interest are reported. AR(1) and AR(2) are p-values Lagrange-multiplier (LM) tests of serial autocorrelations of order 1 and 2, under the null of no autocorrelation. The Sargan test is a test of overidentifying restrictions for the validity of instruments. It is asymptotically distributed as a Chi-suare under the null that the instruments are uncorrelated to the residuals. A p-value close to one indicates that we cannot reject the null of valid instruments.

Table A.2. Estimated impact of immigrant share in the labour force on unemployment rate among native <u>women</u>

	Disaggregated estimations				Aggregate estimations			
	Average	Interacted policy variable:			Average	Interacted policy variable:		
	effect	EPL	PMR	ARR	effect	EPL	PMR	ARR
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Direct effect at sample mean								
l(t) - l(t-1)	0.02 *	0.02 *	0.02 *	0.02 **	0.10	0.28	0.25	0.33 ***
	(1.92)	(1.84)	(1.90)	(2.06)	(0.72)	(1.16)	(1.57)	(2.80)
l(t-1) - l(t-2)	0.00	0.01	0.01	-0.00	0.21	0.43 ***	0.21	0.35 ***
	(0.25)	(0.42)	(0.41)	(-0.05)	(1.24)	(2.73)	(0.19)	(2.81)
l(t-2) - l(t-3)	0.01	-0.00	0.01	-0.00	0.11	0.52 ***	0.25	0.26 **
	(0.68)	(-0.20)	(1.09)	(-0.26)	(0.90)	(4.75)	(0.85)	(2.20)
l(t-3) - l(t-4)	0.02	0.01	0.04 ***	0.01	-0.16	-0.00	-0.17	-0.22
	(0.74)	(1.25)	(3.17)	(1.35)	(-0.86)	(-0.00)	(-0.16)	(-1.34)
l(t-4) - l(t-5)	0.03	0.04 ***	0.02 **	0.02 *	-0.02	0.03	-0.01	-0.05
	(0.97)	(3.53)	(2.51)	(1.86)	(-0.15)	(0.11)	(-0.01)	(-0.35)
l(t-5)	-0.00				-0.07			
	(-0.04)				(-0.25)			
Lagged unemployment	0.02	0.01	0.02	0.02	0.76 ***	0.68 ***	0.52 **	0.77 ***
	(1.14)	(0.54)	(0.75)	(0.98)	(15.60)	(7.13)	(2.26)	(10.01)
Interaction with the policy variable								
l(t) - l(t-1)		0.03	0.08 ***	-0.01 ***		-0.14	0.25	0.01
		(1.32)	(5.12)	(-3.40)		(-0.55)	(1.50)	(0.48)
l(t-1) - l(t-2)		-0.02	-0.02	-0.00		-0.06	0.39 **	0.01
		(-1.04)	(-1.05)	(-0.79)		(-0.35)	(2.41)	(0.55)
l(t-2) - l(t-3)		-0.02	-0.00	-0.00		0.25	0.45	0.04 ***
		(-1.15)	(-0.10)	(-0.82)		(0.94)	(0.57)	(2.63)
l(t-3) - l(t-4)		-0.03 *	0.04 ***	-0.00 *		-0.10	0.13	0.00
		(-1.80)	(2.61)	(-1.83)		(-0.90)	(0.30)	(0.05)
l(t-4) - l(t-5)		0.03	0.05 ***	0.00		-0.33	-0.23	0.00
		(1.43)	(3.12)	(1.02)		(-1.57)	(-0.43)	(0.15)
Lagged unemployment		0.02 *	-0.00	-0.00		0.21 **	0.22 ***	0.00
		(1.72)	(-0.02)	(-0.08)		(2.38)	(3.54)	(0.49)
Observations	1948	1738	1738	1738	178	160	159	159
Countries	18	18	18	18	18	18	18	18
Log likelihood	7580	6816	6828	6832	17	17	17	17
Sargan test (p-value)	1035	938	938	938	1.00	1.00	0.00	1.00
AR(1)					0.093	0.103	0.037	0.091
AR(2)					0.179	0.107	0.386	0.194

Source: Authors' estimations based on text's equation (1) for estimations (1) to (4), and based on equation (2) for estimations (5) to (8). Data sources are described in the text..

Note: regressions (1) to (4) are estimated using uses feasible GLS, (5) to (8) using system-GMM estimators. Estimations (1) to (4) are weighted by the share in native labour force. Robust t-statistics are reported between parenthesis. * significant at 10%;** at 5%; *** at 1%. l(t) refers to the share of immigrants in the labour force at year t. Each equation includes a set of dummies, as described in equations (1) and (2). To save space, only the coefficients of direct interest are reported. AR(1) and AR(2) are p-values Lagrange-multiplier (LM) tests of serial autocorrelations of order 1 and 2, under the null of no autocorrelation. The Sargan test is a test of overidentifying restrictions for the validity of instruments. It is asymptotically distributed as a Chi-suare under the null that the instruments are uncorrelated to the residuals. A p-value close to one indicates that we cannot reject the null of valid instruments.

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