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Meta-Analysis of Empirical Evidence on the Labour Market Impacts of Immigration

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Meta-Analysis of Empirical Evidence on the Labour Market Impacts of Immigration

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Abstract
The increasing proportion of immigrants in the population of many countries has raised concerns about the 'absorption capacity' of the labour market, and fuelled extensive empirical research in countries that attract migrants. In previous papers we synthesized the conclusions of this empirical literature by means of meta-analyses of the impact of immigration on wages and employment of native-born workers. While we have shown that the labour market impacts in terms of wages and employment are rather small, the sample of studies available to generate comparable effect sizes was severely limited by the heterogeneity in study approaches. In the present paper, we take an encompassing approach and consider a broad range of labour market outcomes: wages, employment, unemployment and labour force participation. We compare 45 primary studies published between 1982 and 2007 for a total of 1,572 effect sizes. We trichotomise the various labour market outcomes as benefiting, harming or not affecting the native born, and use an ordered probit model to assess the relationship between this observed impact and key study characteristics such as type of country, methodology, period of investigation and type of migrant.

Keywords: Immigration, labour market, factor substitution, comparative research, meta-analysis

JEL Classification: C51, F22, J31, J61

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1. Introduction

Economic theory alone cannot give a decisive answer about the expected impact of immigration on the labour market. Careful empirical research is needed because an influx of migrants triggers a range of responses from local employers, housing and other markets, native-born and earlier-immigrant households, investors, the public sector, etc. The answer matters because migration continues to grow globally. While the total number of people living outside their country of birth is still no more than about 3 percent of the world population, in many developed countries immigrants account for more than ten percent of the population and in, for example, the 'New World' countries Canada, Australia and New Zealand immigrants are more than one fifth of the population (e.g. World Bank, 2006).

During the last two decades there have been many empirical studies of the economic impact of immigration but it is not easy to make meaningful comparisons between such studies because of major differences in data and study design. Meta-analysis provides a scientific way of synthesising empirical studies to detect whether consensus conclusions are emerging in the literature and whether differences in results across studies can be explained (e.g., Cooper and Hedges, 1994).

In two earlier papers, we used meta-analysis to summarise previous studies of the impact of immigration on the labour market. In Longhi et al. (2005a) we analysed 18 papers that provided 348 estimates of the effect of immigration on wages of the native-born population. We found that a one percentage point increase in the share of immigrants in the population would lower wages of the native-born population by about 0.1 percent on average across studies. When migrants are about one tenth of the population this translates into a very small elasticity of a 0.01 percent decline in the average wage for a 1 percent increase in the number of immigrants. In Longhi et al. (2005b) we compared nine recent studies that yielded 165 estimates of the impact of immigration on job displacement among native workers and found, similarly, that on average a one percent increase in the immigration population would leave the native born virtually unaffected: their employment would decline by a mere 0.02 percent.

While at face value the number of estimates used to derive these meta-analytic averages is reasonably high, they are sourced from a relatively small number of primary studies, and multiple estimates from any one study are clearly not independent estimates. However, empirical research in economics is driven by a 'competition of ideas' and replication in order to derive precise estimates is much less valued in general than designing a new econometric model that is innovative and unique in some respects. It is clear that from the perspective of policy formulation, both features of research are desirable.[1] It is useful to obtain relatively precise estimates but it is also useful to obtain a measure of the extent of variability of estimates under a wide range of different specifications. Meta-analysis can serve both purposes. On the one hand it can generate more precise estimates by pooling study results, while on the other it can attribute part of the variance across studies to known study characteristics.

However, estimates are only quantitatively comparable when there is a common metric, such as an elasticity (which is dimensionless). Sometimes elasticities can be derived from results that are reported in level form, but in many cases the available information is insufficient to obtain directly comparable quantities. To improve comparability we focus in this paper on the statistical significance of the empirical results. Study results are translated into whether the impact of immigration

[1] See Hamermesh (2007) for the benefits of, and greater need for, replication in economics.

on a local labour market is shown to be 'harming' the native born, 'benefiting' the native born, or leaving them unaffected. The latter applies to all cases in which the impact of immigration on a labour market outcome is statistically insignificant. It is clear that the present study draws no conclusions as to the magnitude of 'harm' or 'benefit', but is nonetheless able to identify on which dimension of labour market impact past empirical findings are more conclusive and the extent to which this is linked to study characteristics.

The labour market outcomes that are considered in this meta-analysis are wages, employment, labour force participation, and unemployment. The next section describes how the primary studies were selected and how the study results have been transformed into so-called 'effect sizes'. This is followed by a descriptive summary of the effect sizes across studies.

An important issue in meta-analysis is the extent to which published estimates are a biased sample of all research conducted. This can happen when statistically insignificant results are less likely to be submitted for publication or are more likely to be rejected in the refereeing process. This issue is addressed in Section 3.

In the penultimate section we assess the extent to which primary study conclusions are linked to particular study characteristics by means of multivariate analysis. We first estimate probit models in which study outcomes are coded as confirming that immigrants have a negative impact on labour market outcomes of natives, finding that the impact is positive, or generating inconclusive results. The robustness analysis is based on WLS regression models of Fisher's Z^r statistics, which are a transformation of partial correlation coefficients of primary studies. The final section offers a retrospective view.

2. The Primary Studies and their Effect Sizes

2.1. The Selection of the Primary Studies

There are presently hundreds of empirical studies on the impacts of immigration on labour markets of host countries. These vary widely in terms of methodology used and the nature of the data on which estimates are based. In study selection, there is a trade-off between comprehensiveness and size of the meta-sample on the one hand (which improves the extent to which the meta-sample is representative of all earlier research) and relative homogeneity of the study objects on the other (which facilitates the calculation of a summary measure).

For this paper, we have selected only primary studies that estimate the impact of immigration using a multivariate regression framework. By far, the majority of labour market impact studies use this framework. Secondly, immigration must be quantified in the primary study by either the stock of immigrants, or the share of immigrants in the population, or a change in one of these two variables (i.e. immigration flows). Moreover, studies were only selected when the dependent variable in the regression model refers to either: wages, employment, unemployment, or labour force participation of the native born or of earlier immigrants, or a change in one of these four variables. Hence, primary study regressions have the specification:

$$y_j = \beta m_j + \mathbf{x_j}\boldsymbol{\alpha} + \varepsilon_j \qquad (1)$$

in which y_j is the labour market variable analysed in the primary study, and m_j is the corresponding measure of immigration (with observations $j = 1, 2, \ldots, n$; n coinciding with the number of available observations in the primary study). The row vector $\mathbf{x_j}$ consists of the values of the covariates (with column coefficient vector $\boldsymbol{\alpha}$); and ε_j is the stochastic error term. The parameter β is the estimate of the impact of immigration on the labour market, and is the parameter of interest in our meta-analysis.

Often meta-analyses aim at computing a weighted average of estimated β coefficients, which in that context are referred to as *effect sizes*. Besides obtaining an average effect size, the objective of meta-analysis is also to explain the variability of the effect sizes across studies. However, it is clear that this is only meaningful when the estimates are either dimensionless (as in the case of elasticities) or when the measurement units of both the dependent variable and of the level of immigration are the same across studies, or can be converted to the same units. The presence of different units of measurement severely limits the quantitative comparability across studies.

To exploit the availability of a large sample of studies, a different approach is adopted here that focuses on the sign and statistical significance of the estimated β coefficients, as measured by their observed t statistics. Using t statistics, the requisites of comparability across primary studies are less stringent and allow the inclusion of a larger number of studies in the meta-analysis. The trade-off that we are facing is that the focus on statistical significance increases the number of observations of the meta-analysis but does not inform on the quantitative impact. Our previous studies of the quantitative impacts (Longhi et al. 2005a; 2005b) suggested wages and employment of natives were largely unaffected by immigration. If the meta samples of those earlier studies could be enlarged, we do not expect that this broad conclusion would be overturned (as it is in a qualitative sense the consensus of the vast majority of studies), but a larger meta-sample might provide a more efficient means of estimating the impact of study characteristics on study outcomes. Moreover, we can assess for which *type* of labour market impact the results are relatively more conclusive. These are the objectives of the present paper.

The standard neoclassical partial labour market model suggests that the impact of an exogenous increase in immigration depends on the extent to which immigrants and the native born are substitutes. In the simplest model of immigrants and natives being perfect substitutes, an increase in immigration is expected to lower the wage paid to the native born and therefore also their labour force participation (assuming no backward bending aggregate labour supply curve). Given that some displacement will take place, employment of the native born is expected to decrease and unemployment to increase. A meta-analysis is able to detect whether the empirical evidence is able to confirm or reject these predictions of the standard partial labour market model, and whether this evidence is statistically strong or weak.

Of course, the theoretical predictions of the labour market impacts will depend on the assumed micro foundations of the response of the economy to an immigration shock and the implications of the adopted theory for the specification of the regression model. Moving away from the basic partial labour market model, different theoretical predictions may result. For example, Ottaviano and Peri (2006) argued that a correct interpretation cannot be made unless a general equilibrium perspective is adopted, in which the adjustment of the physical capital stock is taken into account. In addition, they assume that migrants are imperfect substitutes for natives, even at the level of narrowly defined education-experience groups. In such a framework, the expectation is that immigration may raise the wages of the native born, thus benefiting rather than harming natives.

We code the conclusions of regressions of the labour market impact on the level of immigration in a qualitative way. The labour market impact is considered to be *harmful* to natives when the *t* statistic on the immigration variable is negative and statistically significant (at a preset significance level). The labour market impact is considered to be *beneficial* to natives when the *t* statistic on the immigration variable is positive and statistically significant. When the *t* statistic is statistically insignificant, this is interpreted as immigration leaving the native born *unaffected*.[2] An ordered probit model is used to investigate the relationship between the conclusions of the regression models and their specifications. We also transform the observed *t* statistics into Fisher's Z^r statistics and use a weighted least squares (WLS) regression model as an alternative means of linking study conclusions to study characteristics.

2.2. The Primary Studies: Descriptive Statistics

In this meta-analysis we include 45 primary studies, from which we have collected 1572 effect sizes in the form of *t* statistics: 854 *t* statistics on the impact of immigration on wages; 500 on employment, 185 on unemployment, and 33 on labour force participation (see Table 1). Of the 1572 effect sizes, 905 originate from studies using US data; 40 of these *t* statistics refer to the impact on the labour market of the state of California only (Peri, 2007), while 14 refer to evidence for New York City only (Howell and Mueller, 1997). Our meta-analysis also includes 422 effect sizes generated by studies of eight European countries (Austria, France, Germany, Netherlands, Norway, Portugal, Spain, and the UK); 50 estimates computed by considering the immigration impact across 15 EU countries (Angrist and Kugler, 2003; Jean and Jimenez, 2007); and 18 estimates computed from regressions with data from 19 OECD countries (Jean and Jimenez, 2007). The remaining 177 *t* statistics refer to the labour market impact in three other countries: Australia, Canada, and Israel.

By taking absolute values of the 1572 *t* statistics, we find that studies on wages and employment yield averages of 2.565 and 2.105, i.e. the 'average' regression is 'conclusive' at the 5 percent level, taking into account the number of observations in each of the considered studies. For unemployment and labour force participation, the averages are 1.383 and 1.568 respectively. Hence the evidence regarding these labour market impacts is inconclusive in the 'average' regression. [3]

[2] High wages, employment and labour force participation are all considered to be beneficial to natives. For unemployment, we reverse the sign of the *t* statistic so that a statistically significant positive *t* statistic is again evidence of a positive impact on natives.

[3] Since 86 of the 185 observations for the impact of immigration on unemployment are collected from the same study and because of the small number of observations on the impact of immigration on labour force participation, the results of the analysis focusing on these two variables should be interpreted with caution.

Table 1: The Primary Studies

	Study	Country	Effect on (No. Observations):				Total
			Wages	Employment	Unemployment	Labour Force	
1	Grossman, 1982	US	3				3
2	Borjas, 1987	US	48				48
3	Altonji and Card, 1991	US	28	39		21	88
4	Winegarden and Khor, 1991	US			4		4
5	Akbari and Devoretz, 1992	Canada		6			6
6	Hunt, 1992	France	5		4		9
7	Pope and Withers, 1993	Australia	4		4		8
8	De New and Zimmermann, 1994	Germany	8				8
9	Enchautegui, 1995	US	16				16
10	Borjas et al., 1996	US	20				20
11	Carrington and de Lima, 1996	Portugal	5	5	5		15
12	Dolado et al., 1996	Spain	6	6			12
13	Winter-Ebmer and Zweimuller, 1996	Austria	23				23
14	Borjas et al., 1997	US	28	14			42
15	Enchautegui, 1997	US		8			8
16	Greenwood et al., 1997	US	32	32			64
17	Howell and Mueller, 1997	NY City	14				14
18	Pischke and Velling, 1997	Germany		12	18		30
19	Bauer, 1998	Germany	18				18
20	Pedace, 1998	US	12	12			24
21	Winter-Ebmer and Zimmermann, 1999	Austria	4	8			12
		Germany	4	8			12
22	Pedace, 2000	US	24				24
23	Card, 2001	US	28	28			56
24	Friedberg, 2001	Israel	15	2			17
25	Addison and Worswick, 2002	Australia	23				23
26	Gross, 2002	France	5				5
27	Angrist and Kugler, 2003	Europe		48			48

28	Borjas, 2003	US	50	19			69
29	Hofer and Huber, 2003	Austria	8				8
30	Johannsson and Shulman, 2003	US			2	2	4
31	Cohen-Goldner and Paserman, 2004	Israel	58	40			98
32	Gross, 2004	British Columbia	1		1		2
33	Johannsson and Weiler, 2004	US			4	4	8
34	Bonin, 2005	Germany	52		31		83
35	Dustmann et al., 2005	UK	6	6	6	6	24
36	Ottaviano and Peri, 2005	US	12				12
37	Zorlu and Hartog, 2005	Norway	6				6
		Netherlands	10				10
38	Aydemir and Borjas, 2006	Canada	22	1			23
		US	22	1			23
39	Borjas, 2006	US	20				20
40	Carrasco et al., 2006	Spain	12	49			61
41	Gilpin et al., 2006	UK			86		86
42	Kugler and Yuksel, 2006	US	132	132			264
43	Orrenius and Zavodny, 2006	US	54				54
44	Jean and Jimenez, 2007	OECD			18		
		EU			2		
45	Peri, 2007	California	16	24			40
	Observations		854	500	185	33	1572
	Average (absolute) *t* statistic		2.565	2.105	1.383	1.568	

The distribution of the effect sizes is shown in Table 2. Although about half of the effect sizes (815) are not statistically significant at the 10 percent level, the number of *t* statistics that suggest a conclusively negative impact (447) is larger than the number of *t* statistics that suggest a conclusively positive impact (310). Average *t* statistics are shown at the bottom of Table 2. Despite the relatively large number of statistically insignificant effect sizes, the average of the positive *t* statistics for wages is 2.248 (just below the threshold of statistical significance at one percent level), while the average of the negative ones is -2.882. This clearly suggests a lack of consensus in the empirical literature as to whether immigration has a positive or negative (statistically significant) impact on wages in general. For employment the non-negative *t* statistics average to 1.846 – corresponding to a level of statistical significance of ten percent – while the negative ones average to -2.316, corresponding to a level of statistical significance of five percent. For unemployment and labour force participation, 78.9 percent and 60.6 percent of *t* statistics are statistically insignificant at the 10 percent level. It is worth noting, however, that despite the lack of a general consensus, the evidence that immigration has a negative impact on labour natives outcomes of natives is slightly stronger than the evidence in favour of a positive impact across all four dimensions: wages, employment, unemployment and labour force participation.

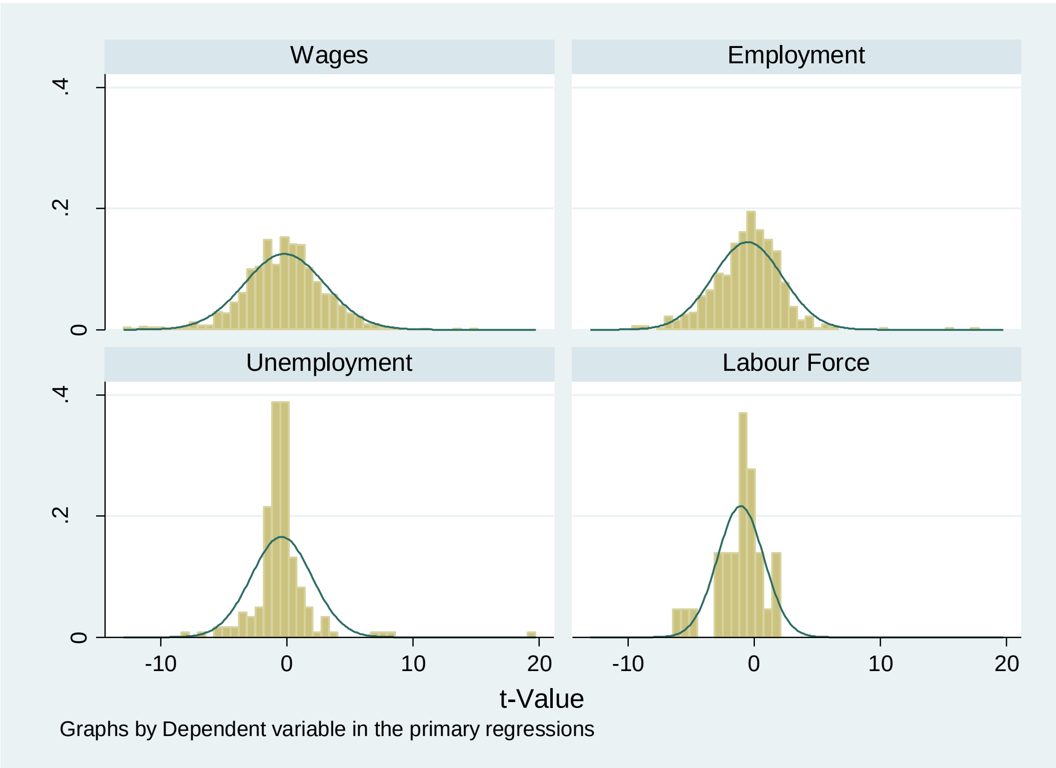

Figure 1: Distribution of *t* statistics by labour market variable of interest

Figure 1 shows the distribution of the *t* statistics separately for wage, employment, unemployment and the labour force participation.[4]

[4] For ease of representation three extremely high *t* statistics (from regressions in Grossman, 1982; Borjas, 2006; and Kugler and Yuksel, 2006) have been excluded from Figures 1 and 2, although we do include them in the meta regression models.

Table 2: Distribution of the Effect Sizes

	t statistic	Effect on (No. Observations):				Total
		Wages	Employment	Unemployment	Labour Force Participation	
	$t \leq -2.576$	174	102	17	4	297
	$-2.576 < t \leq -1.960$	55	28	6	5	94
	$-1.960 < t \leq -1.645$	34	17	4	1	56
Total negative and significant (10% level)		**263**	**147**	**27**	**10**	**447**
	$-1.645 < t \leq -0.001$	175	126	106	16	423
	$-0.001 < t \leq 0.001$	3	6	5	0	14
	$0.001 < t \leq 1.645$	203	136	35	4	378
Total insignificant		**381**	**268**	**146**	**20**	**815**
	$1.645 < t \leq 1.960$	24	16	1	1	42
	$1.960 < t \leq 2.576$	41	26	2	2	71
	$t > 2.576$	145	43	9	0	197
Total positive and significant (10% level)		**210**	**85**	**12**	**3**	**310**
	Total	**854**	**500**	**185**	**33**	**1572**
Of which statistically insignificant at 10% level (%)		44.6	53.6	78.9	60.6	
Average *t* statistic of negative effect sizes		-2.882	-2.316	-1.273	-1.684	
Average *t* statistic of positive effect sizes		2.248	1.846	1.844	1.137	

Note: signs of *t* statistics of immigration variables in unemployment regressions are reversed. A statistically significant positive *t* statistic in the unemployment column of this table refers to immigration conclusively reducing unemployment of the native born.

While for wages and employment, the distributions of the *t* statistics appear close to a normal distribution centred on zero, for unemployment and labour force participation a large number of very small effect sizes make the distribution rather different from normal with too little density in the tails.

2.3. Moderator Variables and Descriptive Statistics

Because *t* statistics for any given data generating process are increasing at the rate of the square root of the sample size, a common alternative effect size measure that controls for sample size variation is the Fisher Z^r statistic. This is based on the partial correlation coefficient r_i derived from the primary regression that generated effect size *i*:

$$r_i = \frac{t_i}{\sqrt{t_i^{\ 2} + df_i}} \tag{2}$$

in which t_i is the *t* statistic and df_i the degrees of freedom associated with the *i* th regression. As noted earlier, when a primary study estimates the impact of immigration on unemployment, the sign of the *t* statistic has been inverted, so that a positive correlation coincides with immigration being beneficial to labour market outcomes of natives. Since for some studies the number of degrees of freedom of the regression is not reported and not easily derived (for example, because some dummy variables or covariates are not explicitly listed), the computation of the Z^r statistics is in practice based on the sample size N_i rather than the degrees of freedom. Because most studies are based on relatively large samples, the difference is negligible.

The Fisher Z^r statistic is then calculated as:

$$Z_i^{\ r} = \frac{1}{2}\ln\left(\frac{1+r_i}{1-r_i}\right) \tag{3}$$

The asymptotic standard error of the Z^r statistic is given by:

$$se\left(Z_i^r\right) = \sqrt{\frac{1}{N_i - 3}} \tag{4}$$

Frequency distributions of the *t* statistics across study characteristics are reported in Table 3a, while Table 3b provides a descriptive summary of the Z^r statistics across the same characteristics. Column (1) of Table 3a shows the percentage of effect sizes that correspond to a significantly negative impact of immigration on native labour market outcomes (at the 5 percent level). Column (2) shows the percentage of regressions that yield statistically insignificant impacts on the native born. Finally, column (3) shows the percentage of *t* statistics that correspond to a positive and statistically significant effect of immigration on labour market outcomes of the native born. While the figures in the first row of Table 3a refer to the whole sample, the remaining rows refer to sub-samples of the dataset. These sub-samples are defined on the basis of the characteristics of the primary studies that we expect to have an influence on the primary regression models. The variables recording these study characteristics of the primary studies are called *moderator* variables in meta-analysis. They are usually representing qualitative information that is coded in the form of dummy variables.

Using the 5 percent significance level, Table 3a shows that 24.9 percent of the effect sizes confirm a negative impact, 17.0 percent confirm a positive impact (19.7 percent) and 58.1 percent are inconclusive.

Table 3a: Number of Observations by Sub-Group

Study Characteristic		Labour Market Effect: (1) Percent $t \leq -1.96$	(2) Percent $-1.96 < t < 1.96$	(3) Percent $t \geq 1.96$	Total
	All	24.9	58.1	17.0	1572
Type of Publication	Journal	29.6	52.6	17.8	652
	Book	17.0	65.2	17.9	112
	Working Paper	22.2	61.5	16.3	808
Year of Publication	1980s	33.3	47.1	19.6	51
	1990s	18.7	59.1	22.2	433
	2000s	26.9	58.2	14.9	1088
Labour Market Impact	Wages	26.8	51.4	21.8	854
	Employment	26.0	60.2	13.8	500
	Unemployment	12.4	81.6	5.9	185
	Labour Force Participation	27.3	66.7	6.1	33
Country	US	23.8	54.6	21.6	923
	EU	20.8	67.8	11.4	490
	Others	40.5	52.8	6.7	195
Size of the Area	Big	26.8	59.2	14.0	893
	Small	15.8	74.7	9.5	95
	Very Small	23.5	53.6	22.9	584
Approach	Data Driven	27.1	56.3	16.7	942
	Economic	19.0	59.2	21.8	179
	Natural Experiment	22.6	61.4	16.0	451
Impact on	Everybody	16.7	65.3	18.1	72
	Natives	27.0	57.0	16.0	1244
	Immigrants	16.8	61.3	21.9	256
Natives' Skills	Everybody	31.7	55.9	12.4	914
	High	12.9	60.7	26.4	326
	Low	17.8	61.4	20.8	332
Kind of Data	Cross Section	33.6	49.0	17.4	822
	Pooled	15.3	68.0	16.7	750

These proportions vary somewhat depending on the specific aspect of the labour market analysed: the proportion of inconclusive effect sizes is the highest for unemployment (81.6 percent) and the lowest for wages (51.4 percent).

Descriptive statistics of 1513 Z^r statistics are shown in Table 3b.[5] The first row shows the unweighted mean, standard deviation, minimum and maximum value for the whole dataset. The Z^r statistics range from a minimum of −0.818 to a maximum of 1.136, with a mean of only −0.022 and a standard deviation of 0.153.

Table 3b: Descriptive Statistics on Z^r

Study Characteristic		Obs.	Mean	St. Dev.	Min	Max
	All	1513[#]	-0.022	0.153	-0.818	1.136
Type of Publication	Journal	652	-0.035	0.176	-0.818	0.773
	Book	112	-0.033	0.185	-0.550	0.419
	Working Paper	749	-0.010	0.121	-0.631	1.136
Year of Publication	1980s	51	-0.005	0.048	-0.139	0.127
	1990s	433	-0.001	0.185	-0.631	0.773
	2000s	1029	-0.032	0.139	-0.818	1.136
Labour Market Impact	Wages	800	-0.025	0.158	-0.818	0.760
	Employment	495	-0.016	0.142	-0.550	0.773
	Unemployment	185	-0.020	0.158	-0.422	1.136
	Labour Force Participation	33	-0.075	0.119	-0.382	0.181
Country	US	864	-0.017	0.155	-0.818	0.773
	EU	490	-0.031	0.150	-0.631	1.136
	Others	195	-0.033	0.137	-0.618	0.557
Size of the Area	Big	888	-0.026	0.166	-0.818	1.136
	Small	95	-0.027	0.145	-0.398	0.416
	Very Small	530	-0.015	0.128	-0.462	0.773
Approach	Data Driven	888	-0.037	0.174	-0.818	1.136
	Economic	179	0.036	0.149	-0.631	0.496
	Natural Experiment	446	-0.016	0.088	-0.618	0.320
Impact on	Everybody	72	0.003	0.233	-0.385	0.773
	Natives	1190	-0.023	0.157	-0.818	1.136
	Immigrants	251	-0.027	0.091	-0.631	0.173
Natives' Skills	Everybody	914	-0.037	0.166	-0.733	1.136
	High	286	-0.002	0.108	-0.631	0.400
	Low	313	0.001	0.141	-0.818	0.515
Kind of Data	Cross Section	768	-0.040	0.160	-0.818	1.136
	Pooled	745	-0.004	0.143	-0.733	0.760

[#] Five meta-observations were dropped because the standard errors were zero up to the smallest reported digit after the decimal point, while another 54 observations were dropped because the number of observations of the primary study regression could not be found.

The remaining rows of Table 3b show descriptive statistics for sub-samples of the dataset. The categories used are the same as in Table 3a.

Using the information in Tables 3a and 3b, we can assess the extent to which the distribution of effect sizes is affected by study characteristics. Here we consider

[5] Five observations were dropped because the standard errors were zero up to the smallest reported digit after the decimal point, while another 54 observations were dropped because the number of observations of the primary study regression could not be found.

these only one by one descriptively. In Section 4 we adopt a multivariate analysis that takes account of correlations between study characteristics as well.

Of the 1572 effect sizes, 652 are published in academic journals; 112 are published in books; and 808 have been collected from working papers or unpublished papers. Effect sizes collected from studies published in academic journals might be of higher quality (due to the refereeing process). On the other hand, these might be more affected by the problem of publication bias (Begg, 1994; Florax, 2002). Dummies for the kind of publication in our meta-analysis will enable us to test whether primary studies published in academic journals tend to draw conclusions that are systematically different than those of primary studies published in books or as working papers. More than 60 percent of effect sizes published in books or as working papers are inconclusive. This proportion decreases to 52.6 percent for those effect sizes published in academic journals. The mean Z^r statistic for those effect sizes published in academic journals is, however, very similar to the mean Z^r statistic of those effect sizes published in books, while it is much closer to zero for those effect sizes published in working papers. In Section 3 we will assess to what extent this finding is related to publication bias.

If more recent studies use better datasets and econometric techniques, we might expect these to give a more precise picture of the impact of immigration on the labour market. We therefore classify the primary studies on the basis of the decade in which the most recent version of the paper has been published: 1980s, 1990s and in 2000s. It is clear from Table 3 that, following the two 1980s contributions by Grossman (1982) and Borjas (1987), this literature has been growing rapidly during the 1990s and 2000s. We collected 51 effect sizes from the two primary studies published in the 1980s; 433 from the 19 primary studies published in the 1990s; and 1088 effect sizes from the 24 primary studies published in the 2000s. Grossman (1982) and Borjas (1987) were rather more conclusive (in the sense of confirming a negative impact of wages of the native born) than the subsequent studies on average. As expected, being based on only two primary studies, the distribution of Z^r statistics from the 1980s has the smallest standard deviation.

With respect to impacts across the four labour market outcomes (wages, employment, unemployment and labour force participation), Table 3 suggests that the evidence of a decline in labour force participation of the native born is relatively stronger than evidence of detrimental effects on the other labour market outcomes. Large adjustments in the labour force participation might explain small adjustments in wages and/or (un-)employment in response to immigration (see, e.g., Johannsson and Shulman, 2003; Johannsson and Weiler, 2004).

Most of the literature estimates the impact of immigration on wages. In our sample 854 effect sizes compute the impact of immigration on wages, against 500 computed on employment. Of the 185 effect sizes estimating the impact of immigration on unemployment, 86 were sourced from the study by Gilpin et al. (2006). So far, only 33 effect sizes of the impact of immigration on labour force participation were obtained. Table 3a and Table 3b show that the frequencies of negative and statistically significant t values and negative Z^r values respectively is greater for labour force participation than the other impacts.

In Longhi et al. (2005a) we found that immigration has a bigger negative impact on wages in the US while in Longhi et al. (2005b) we found the negative employment effect on the native born was greater in the non-US, predominantly European, countries. This conclusion is plausible given that wage effects may be expected to be greater in the more flexible labour market (the US) while employment effects may be greater in the less flexible labour market (such as in some European countries). Table 3 aggregates the *t* values and Z^r values across the four types of labour market impact for studies on the US, the EU, and other countries. Table 3a shows that the measured impact of immigration is more often significantly negative in the US than in Europe. However, the impact is much more often significantly negative in regressions run for 'other' countries.[6] Similarly, the mean Z^r statistic is the most negative for the 'other' countries.

We found in earlier research that elasticities that are computed using geographically narrower definitions of the labour market tend to find much smaller impacts of immigration. When focussing on statistical significance, Table 3a shows that significantly negative *t* statistics are relatively more frequent for studies using large geographical areas (such as nations), while in Table 3b the least negative mean Z^r statistic is found for the very small regions. Taken together these results reconfirm that labour market impacts of immigration are less detectable in the smaller geographical areas, which are more open to various adjustment mechanisms such as trade, internal migration and capital mobility.

There are different conceptual frameworks to estimate the impact of immigration on the labour market, even when limiting the focus to regression models only. The most common are the 'area' approach and the 'factor proportions' approach. The area approach exploits the fact that immigration is spatially highly concentrated, so that a negative spatial correlation may be expected between the proportion of the labour force in local labour markets that are immigrants and the wages of natives who they can substitute for. We label this approach 'data driven'. The factor proportions approach has a much stronger theoretical basis in that it analyses the wage effect of immigration by considering native and immigrant workers as separate production inputs. After assuming a certain elasticity of substitution between skilled and unskilled workers – usually derived from other studies – and accounting for the distribution of immigrants across skill categories (in many countries immigrants have significantly lower skills than natives on average), the elasticities of substitution between native and immigrant workers are estimated. We label this approach 'economic'. Although it has been suggested in the literature that studies applying the factor proportions approach tend to find a larger effect of immigration on natives than those applying the area approach (e.g., Borjas et al., 1996 and Friedberg, 2001), Longhi et al. (2005a) found that the economic approach tended to generate effect sizes that were on average closer to zero. We test here whether these different approaches systematically lead to different results in terms of statistical significance. We also distinguish effect sizes that can be interpreted as derived from 'natural experiments', although they were estimated by means of regression equations in the form of equation (1). These studies are Hunt (1992); Carrington and de Lima (1996); Friedberg (2001); and Angrist and Kugler (2003). Table 3a suggests that 'natural experiments' and 'economic approaches' are more likely to find insignificant effects than the 'data driven' approach. The most negative mean Z^r statistic is also found for the latter approach.

One robust finding from the literature, confirmed by previous meta-analyses (Longhi et al. 2005a, 2005b), is that previous immigrants have more to fear from further immigration that the native born, primarily because the former are closer substitutes to new inflows than the latter. With respect to statistical significance, this conclusion is reinforced by Table 3b (in which the mean Z^r statistic is the most

[6] We include those effect sizes estimating the impact of immigration by pooling OECD countries (Jean and Jimenez, 2007) in all three groups: US, EU, and Other countries.

negative for immigrants), but –somewhat surprisingly – in Table 3a 27.0 percent of the *t* statistics associated with regression coefficients measuring the impact on natives is less than -1.96, whereas this is the case for only 16.8 percent of *t* statistics of coefficients measuring the impact on immigrants. The distribution of *t* statistics for studies that measure the impact on 'everybody' is not a weighted average of the distributions of the impact on natives and immigrants. The former has been obtained from regressions using different data sources and specifications. They have the largest percentage of inconclusive results (Table 3a) and the greatest standard deviation of Z^r statistics (Table 3b).

It has been suggested that substitutability between natives and immigrants – and therefore the impact of immigration on natives – is likely to differ across education groups (e.g. Ottaviano and Peri, 2005). A large number of primary studies estimate the impact of an increase in the proportion of immigrants on high- or on low-skill natives. In such regressions, there is often no differentiation of immigrants by skill group. Instead, other primary studies compute the proportion of immigrants by skill groups to estimate its impact on natives of that specific group. However, when all groups are estimated in the same regression, the resulting effect size averages out the skill-group-specific impacts. Although it is only a rough indicator, we include in our analysis a dummy for whether the effect sizes focus on high-skill natives, low-skill natives, or make no distinction across skill groups. The descriptive statistics in Table 3a suggest that *t* statistics coming from regressions that measure the impact on high skill workers find the least support for a statistically significant negative impact of immigration.

While 822 effect sizes estimate the impact of immigration using data for only one year; 750 are based on pooled cross-sections. The effect sizes estimated using cross-section data might underestimate the impact of immigration: first-differences should be used to capture the short-run effects of immigration, since they would be less affected by city-specific unobserved characteristics that might influence immigrant density and/or natives' outcomes (e.g., Friedberg and Hunt, 1995; Altonji and Card, 1991). However, most studies – especially for the US – use census data, thus computing first-differences over rather long periods. In that case, the assumption of time-invariant location effects is less tenable. In our database the time span between the first and the last year used in the primary estimations ranges from one year – for those estimations computed using cross-section data – to 40 years for those estimations computed using five censuses (from 1960 to 2000). It is clear from Table 3a that those effect sizes estimated using pooled data tend to find a statistically insignificant impact of immigration more often than effect sizes estimated using cross-section data. In addition, the mean Z^r statistic is indeed more negative for the latter.

In summary, the most statistically significant negative impacts are found for cross-sectional data, studies based on the area approach (data driven), in relatively large geographical areas, and in studied countries other than the US and Europe. Further, both Table 3a and Table 3b suggest more conclusively negative impacts reported in journal articles. With respect to the type of labour market impact, both tables suggest more frequent statistically negative results on labour force participation, followed by wages, employment and unemployment. Also, both tables suggest that those effect sizes focusing specifically on low-skilled natives tend to find a negative impact of immigration less frequently than those computing elasticities that are averaged across the skill distribution.

These results may be affected by the extent to which estimates are less likely to be reported when they are inconclusive. Referees of journal are more likely to reject studies with weak or inconclusive results than those that claim a high level of statistical significance. The former studies are more likely to be 'parked' in working paper series or in book chapters. This can be seen from Table 3a, which shows that the percentage of inconclusive effect sizes is 52.6 percent for journal articles, but more than 60 percent for books and working papers. The next section reports on methods to detect publication bias resulting from selective reporting of results in the available literature.

3. Publication Bias

Because of the tendency of authors, referees and editors to favour the publication of statistically significant results, the sample of available studies and, to a lesser extent of effect sizes, is likely to be biased toward more (statistically) significant results (e.g. Stanley et al., 2004; Glaeser, 2006). We reduce the impact of publication bias by including both published and unpublished studies, and by sampling all estimates published in each primary study (see also Longhi et al., 2005a).

If primary studies finding statistically significant results are more likely to be published, we would expect small *t* statistics to be underrepresented. As shown in Figure 1, however, the distribution of the *t* statistics is not only very close to normality, at least for wage and employment impacts, but since it is centred on values very close to zero, this clearly shows that small *t* statistics are not underrepresented in our sample of primary effect sizes. The finding, that immigration has no (statistically) significant (negative) impact on the labour market, is likely to be considered an interesting result by authors, referees and editors – worthy of publication. Hence, in this specific subject, publication bias is less likely to be a problem even when it is present.

The heterogeneity of our effect sizes, and the need for moderator variables makes the formal 'FAT' test for publication bias (Stanley, 2005) inappropriate. The 'MST' test for meta-significance, however, can give us further – indirect – insights into publication bias. We regress the natural logarithm of the absolute value of the *t* statistics on the log of the square root of the sample size collected from the primary studies, as suggested by Card and Krueger (1995) and by Stanley (2005):

$$\ln|t_i| = \delta + \omega_p \ln\left(\sqrt{N_i}\right) + \mathbf{s_i}\boldsymbol{\gamma} + \xi_i \qquad (5)$$

To partially correct for the heterogeneity of the effect sizes, the row vector $\mathbf{s_i}$ includes the study characteristics with column coefficient vector $\boldsymbol{\gamma}$. Sampling theory predicts that if there is a genuine effect of immigration on the labour market and there is no publication bias, the hypothesis test that $\omega_p = 1$ based on the estimate $\hat{\omega}_p$ from the above regression should not be rejected. However, if immigration has no impact on the local labour market, we should not find a relationship between *t* statistics and sample sizes. Instead, we should find that the hypothesis that $\omega_p = 0$ will not be rejected (Stanley, 2005). The presence of a genuine effect of immigration on the labour market, coinciding with a 95 percent confidence interval for the estimated $\hat{\omega}_p$ in between zero and one, might be due to publication bias, or to the fact that researchers might change their specification to enhance their results (e.g., Glaeser, 2006), or to changes over time in the impact that immigration has on the labour market (Card and Krueger, 1995). An estimated value of $\hat{\omega}_p$ that is significantly less than zero would indicate publication bias and no genuine effect (Stanley, 2005).

Table 4 shows the results of our meta-significance tests. The model in column (1) is computed on all effect sizes. Column (2) is based on the effect sizes estimating the impact of immigration on wages only, while column (3) reports the regression for those effect sizes estimating the impact of immigration on employment. The regression coefficients are all less than one. [7] The one in column (1) is significant at the 10 percent level and in column (3) at the 5 percent level. There is therefore some evidence of publication bias in the reporting of primary employment regressions. This also affects the MST regression involving all effect sizes. However, there is no evidence of publication bias influencing the wage regressions, but at the same time there is also no evidence from this regression that there is a real statistically significant effect.

The impact of publication bias on this literature is likely to relatively minor, as noted above. We saw from Table 3a that the percentage of regressions with statistically significant *t* statistics at the 5 percent level was 29.6 percent in the case of refereed journal articles and 22.2 percent in the case of the usually non-refereed working papers. Similarly, the mean Z^r statistic found for regressions from journal articles is -0.035 as compared with -0.010 for working papers (and the mean Z^r for books of -0.033 being rather similar to that for journal articles). Hence there are differences, but they are not huge. As shown in Figure 1, we find similar distributions of the *t* statistics for those effect sizes estimating the impact of immigration on wages, or on employment separately. In both cases the distribution is close to normal.

Table 4: Test for Publication Bias

Dep. Variable: ln|t|	(1) All	(2) Only on Wages	(3) Only on Employment
Ln √ sample size	0.066*	0.056	0.186**
	(0.037)	(0.046)	(0.074)
Adjusted R^2	0.105	0.128	0.115
Observations	1499	797	489

Robust standard errors in parenthesis; * Significant at 10%, ** Significant at 5%, *** Significant at 1%
Other explanatory variables: type of publication, where it applies (book or working paper); year of publication (1990s or 2000s); labour market impact, where it applies (employment, unemployment or labour force); country (EU or others); size of the area (big or small); approach (economic or natural experiment); natives' skills (everybody, high-skill natives, low-skill natives); impact on (everybody or immigrants); kind of data (pooled); data (1960s, 1970s, 1980s, 1990s, and 2000s).

Another technique to identify publication bias is the use of funnel plots. These are depicted in Figures 2a and 2b. Funnel plots are scatter plots of Z^r statistics against the square root of the primary study sample size. Publication bias can be detected by means of these plots if they are noticeably asymmetric. While there is a slight evidence of some 'missing' positive Z^r values at relatively small sample sizes, on the whole the funnel plots are rather symmetric. This reconfirms that publication bias does not appear to be a major issue in the present meta-analysis.

[7] These results are not affected by the outliers with very large *t* statistics that we dropped from the figures: the test for publication bias generate roughly the same results with and without such effect sizes.

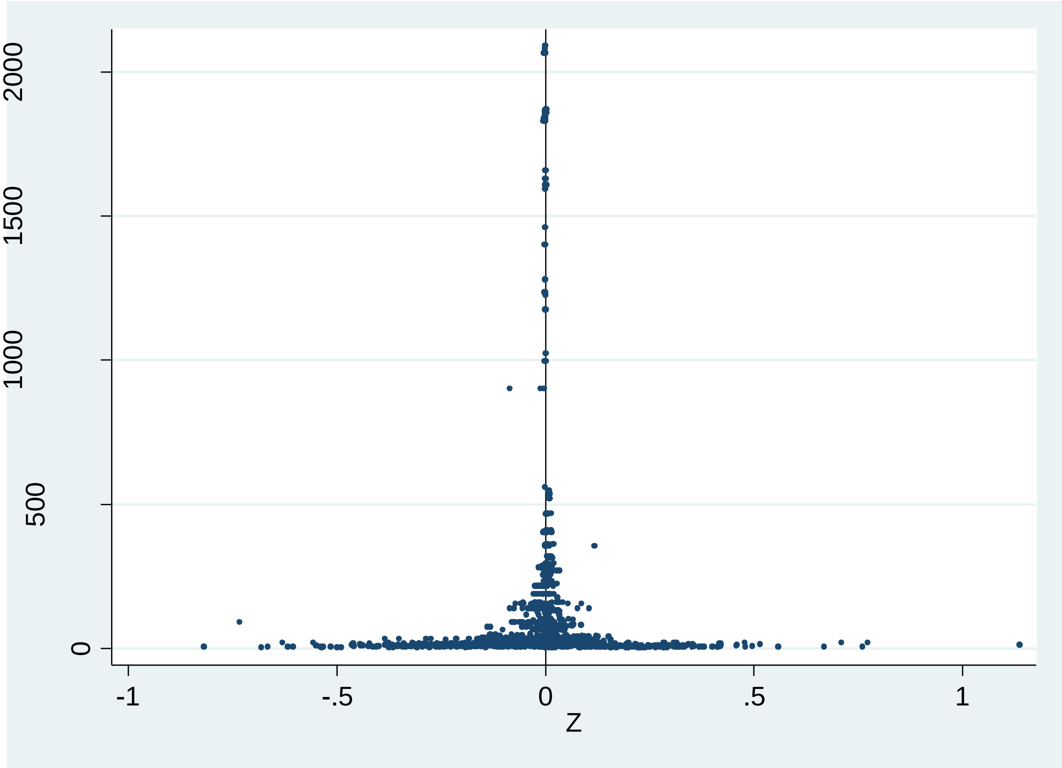

Figure 2a: Funnel plot on all Z^r effect sizes

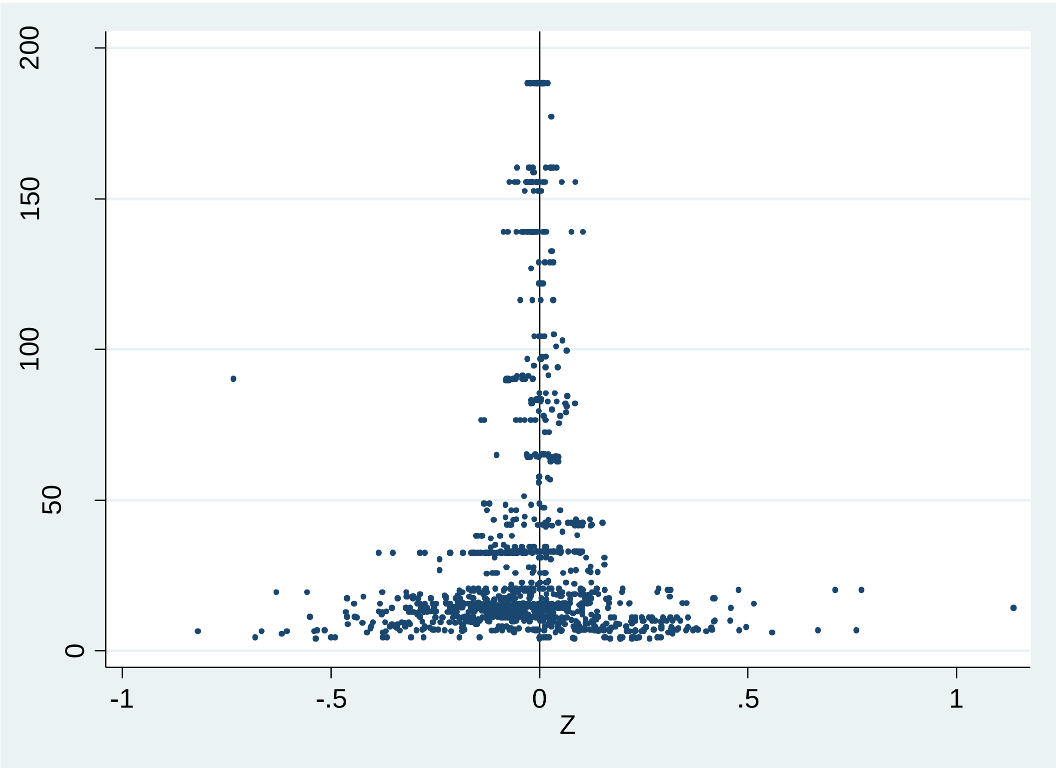

Figure 2b: Funnel plot of only those Z^r effect sizes for which the square root of the sample size is smaller than 200

4. Multivariate Analysis

4.1. Probit Models

Because effect sizes are based on *t* statistics derived from a large sample of heterogeneous primary studies, it would not be meaningful to assess the impact of study characteristics on the observed effect sizes by means of a standard meta-regression model. Instead, we assume that the true impact of immigration on the labour market is a continuous but latent process (k^*) from which we observe only three possible outcomes related to the *t* statistic of each effect size. The *t* statistic is coded as $k = -1$ when the immigration variable has a negative coefficient in regressions of the labour market outcomes for natives and the coefficient is statistically significant; $k = +1$ when the primary study regression coefficient is positive and statistically significant; and $k = 0$ when the estimated coefficient is statistically insignificant.[8]

We also assume that the impact of immigration can be expressed as a linear function of the aforementioned characteristics of the primary studies ($\mathbf{s_i}$):

$$k_i^* = \mathbf{s_i}\boldsymbol{\lambda} + \zeta_i \qquad (6)$$

where ζ_i is assumed normally distributed. We observe $k = -1$ when the impact of immigration in the labour market is negative and statistically significant and this is assumed to coincide with $k_i^* \leq \mu_1$. Further, $k = +1$ when the impact of immigration on the labour market is positive and statistically significant ($k_i^* \geq \mu_2$); while $k = 0$ when the impact of immigration is positive or negative, but the *t* statistic is not statistically significant, which is assumed to be the case when $\mu_1 < k_i^* < \mu_2$. The parameters μ_1 and μ_2 have to be estimated within the probit model.

We have experimented with three different thresholds of statistical significance (10, 5 and 1 percent) and applied the same ordered probit model specification to each threshold. The results are very robust to these changes. We report in Table 5 only the results which use the threshold of the one percent level of statistical significance. Column (1) reports the results of the probit model for all effect sizes. Column (2) reports results for effect sizes on wage impacts only, while column (3) is concerned with employment impacts only. To facilitate the interpretation, the marginal effects of the probit analysis are reported in Table 6. Corresponding to the three models of Table 5, Table 6 consists of three blocks: one for all effect sizes, one for wage effects and one for employment effects. The marginal effects identify the change in the probability of each outcome (-1, 0 and 1) to changes in the moderator variables. The results of probit analysis that take account of correlations between study characteristics may yield results that differ somewhat from the descriptive bivariate analysis of Table 3.

Tables 3a and 3b suggested that a prior expectation (from the partial labour market model) of a negative impact is more likely to be confirmed for studies focussing on labour force participation. We see from Table 5 that the effect sizes that estimate the impact of immigration on labour force participation tend to confirm this prior more often than those estimating the impact of immigration on wages. Table 6

[8] It might be argued that using a probit model should be avoided since it leads to a loss of information compared with running a meta-regression on the *t* statistics. However, if authors and readers are interested in the sign and statistical significance of an effect size, they will pay attention to whether the *t* statistic passes a certain threshold of statistical significance, rather than be concerned with the specific value of the *t* statistic. The probit model thus trades such 'loss of information' for a higher clarity of the results.

also suggests that those effect sizes computed from the impact on labour force participation are more likely to accept – and less likely to reject – the prior of a negative impact of immigration on these labour market outcomes. However, Tables 5 and 6 show that the same is also true for employment relative to wages, a conclusion that could not be seen in the descriptive summary in Table 3. Together, these results suggest that the rather small impact that immigration has on wages might be due to relatively larger adjustments to labour force participation and to employment of natives.

Among the different approaches – economic, natural experiments or data driven – those effect sizes estimated using natural experiments and the economic approach seem to offer less support for the prior of a negative impact of immigration on the labour market, while they seem to be more likely to find a positive impact of immigration. Those effect sizes estimating the impact of immigration in 'big' or 'small' areas do seem to confirm the prior of a negative impact more often than those using 'very small' areas. Somewhat surprisingly, those effect sizes that estimate the impact of immigration averaging it by different natives' skill groups seem to find a negative impact of immigration more often than those focusing on high skill or low skill groups only.

As we saw earlier based on Table 3, Tables 5 and 6 suggest also that those effect sizes estimating the impact of immigration on 'other' countries tend to confirm the prior of a negative impact more often than those estimating the impact of immigration on the US or the EU. Those effect sizes estimating the impact of immigration on earlier immigrants tend to confirm the prior more often than those estimating the impact of immigration on natives, while the reverse happens for those studies that consider natives and immigrants together. Hence, earlier migrants are much more affected by further immigration than the native-born population, which reinforces often cited findings such as those by Ottaviano and Peri (2006) for the US. Finally, effect sizes estimated using pooled data seem to reject the prior of a negative impact more often than those estimated using cross-section data.

Given that large samples are more likely to yield statistical significance of primary regression coefficient, we include the natural logarithm of the sample size in the ordered probit regression. The coefficient of this variable is statistically significant and negative, thus pointing in the direction of a small bias towards accepting the prior of a negative impact of immigration on the labour market (as also noted in the previous section). Table 6 also suggests that those primary studies with large sample sizes are more likely to find support for the prior of a negative impact of immigration, and are not only less likely to find statistically insignificant results, but are also less likely to find results that reject the prior.

Given the relatively high number of effect sizes estimating the impact of immigration on wages or on employment, we have also estimated the probit model separately for these two sub-groups of effect sizes. The chosen threshold level to classify the *t* statistics is again the 1 percent level of statistical significance. The results are in the second and third column of Table 5, while the marginal effects are in the second and third panel of Table 6, as noted earlier.

Table 5: Ordered Probit Models for Wages and Employment

Dep. Variable: -1 if 0 if +1 if	$t \leq -2.576$ $-2.576 < t < +2.576$ $t \geq +2.576$	(1) All	(2) Only on Wages	(3) Only on Employment
Type of Publication	Book	-0.285*	-0.473**	-0.471
[Journal]		(0.155)	(0.230)	(0.290)
	Working Paper	0.134	-0.108	0.721***
		(0.090)	(0.123)	(0.175)
Year of Publication	1990s	0.212	0.512**	
[1980s]		(0.246)	(0.260)	
	2000s	0.052	0.625**	-1.176***
		(0.274)	(0.305)	(0.226)
Labour Market Impact	Employment	-0.250***		
[Wages]		(0.072)		
	Unemployment	0.040		
		(0.117)		
	Labour Force Participation	-0.421**		
		(0.184)		
Country	EU	-0.117	0.137	-0.222
[US]		(0.117)	(0.171)	(0.295)
	Others	-0.391***	-0.556***	-0.162
		(0.128)	(0.163)	(0.391)
Size of the Area	Big	-0.206*	-0.410***	0.024
[Very Small]		(0.108)	(0.139)	(0.287)
	Small	-0.282**	-0.665**	-0.207
		(0.130)	(0.270)	(0.477)
Approach	Economic	0.222*	0.431**	0.043
[Data Driven]		(0.133)	(0.205)	(0.195)
	Natural Experiment	0.180*	0.255*	0.531**
		(0.099)	(0.141)	(0.240)
Natives' Skills	Everybody	-0.472***	-0.283**	-0.704***
[Low-Skill Natives]		(0.102)	(0.128)	(0.244)
	High-Skill Natives	0.101	0.052	0.188
		(0.101)	(0.124)	(0.189)
Impact on	Everybody	0.402**	0.343	1.385***
[Natives]		(0.179)	(0.280)	(0.372)
	Immigrants	-0.213*	-0.322**	-0.065
		(0.113)	(0.145)	(0.196)
Kind of Data	Pooled	0.331***	0.351***	0.430**
[Cross Section]		(0.072)	(0.102)	(0.187)
Length of Data (years)		-0.005	-0.008	0.003
		(0.004)	(0.005)	(0.010)
ln(Sample size)		-0.018***	-0.000	-0.044***
		(0.005)	(0.007)	(0.010)
	μ_1	-1.266***	-0.791**	-1.548***
		(0.272)	(0.324)	(0.240)
	μ_2	0.941***	1.172***	1.273***
		(0.272)	(0.324)	(0.234)
Observations		1518	800	500

Robust standard errors in parenthesis; * Significant at 10%, ** Significant at 5%, *** Significant at 1%
Reference categories in brackets

Table 6: Marginal Effects

Marginal effects: (1) All Effect Sizes		P(k = -1)	P(k = 0)	P(k = 1)
Type of Publication	Book	0.081*	-0.037	-0.044**
	Working Paper	-0.034	0.010	0.024
Year of Publication	1990s	-0.052	0.011	0.041
	2000s	-0.013	0.004	0.009
Labour Market Impact	Employment	0.066***	-0.023***	-0.043***
	Unemployment	-0.010	0.003	0.007
	Labour Force Participation	0.126**	-0.068	-0.058***
Country	EU	0.030	-0.010	-0.021
	Others	0.113***	-0.054**	-0.059***
Size of the Area	Big	0.051*	-0.013**	-0.038*
	Small	0.080**	-0.036	-0.043**
Approach	Economic	-0.052*	0.007**	0.045
	Natural Experiment	-0.044*	0.010**	0.034*
Natives' Skills	Everybody	0.115***	-0.024***	-0.091***
	High-Skill Natives	-0.025	0.006	0.019
Impact on	Everybody	-0.085***	-0.005	0.090*
	Immigrants	0.058*	-0.023	-0.035**
Kind of Data	Pooled	-0.084***	0.024***	0.060***
Length of Data (years)		0.001	0.000	-0.001
ln(Sample size)		0.004***	-0.001***	-0.003***
Marginal effects: (2) Wages				
Type of Publication	Book	0.149*	-0.065	-0.084***
	Working Paper	0.029	-0.005	-0.024
Year of Publication	1990s	-0.123**	-0.006	0.129*
	2000s	-0.180*	0.052	0.128**
Country	EU	-0.035	0.003	0.032
	Others	0.172***	-0.071**	-0.101***
Size of the Area	Big	0.105***	-0.008	-0.097***
	Small	0.221**	-0.117	-0.104***
Approach	Economic	-0.099**	-0.014	0.113*
	Natural Experiment	-0.064*	0.003	0.061*
Natives' Skills	Everybody	0.074**	-0.008	-0.066**
	High-Skill Natives	-0.014	0.002	0.012
Impact on	Everybody	-0.078	-0.013	0.091
	Immigrants	0.094**	-0.029	-0.065**
Kind of Data	Pooled	-0.091***	0.009	0.082***
Length of Data (years)		0.002	0.000	-0.002
ln(Sample size)		0.000	0.000	0.000

Table 6 (cont.): Marginal Effects

Marginal effects: (3) Employment		P(*k* = -1)	P(*k* = 0)	P(*k* = 1)
Type of Publication	Book	0.127	-0.098	-0.029**
	Working Paper	-0.165***	0.101***	0.064***
Year of Publication	2000s	0.209***	-0.052*	-0.158***
Country	EU	0.053	-0.035	-0.017
	Others	0.039	-0.027	-0.012
Size of the Area	Big	-0.006	0.003	0.002
	Small	0.052	-0.037	-0.015
Approach	Economic	-0.010	0.006	0.004
	Natural Experiment	-0.117**	0.069**	0.048**
Natives' Skills	Everybody	0.158***	-0.094***	-0.064**
	High-Skill Natives	-0.040	0.023	0.017
Impact on	Everybody	-0.150***	-0.148	0.298**
	Immigrants	0.015	-0.010	-0.005
Kind of Data	Pooled	-0.100**	0.065**	0.036**
Length of Data (years)		-0.001	0.000	0.000
ln(Sample size)		0.010***	-0.006***	-0.004***

P(*k* = -1) is the probability that the effect size is negative and statistically significant at 1%; P(*k* = 0) is the probability that the effect size is not statistically significant at the 1% level; P(*k* = 1) is the probability that the effect size is positive and statistically significant at 1%.
Reference categories. Type of Publication: Journal; Year of Publication: 1980s; Labour Market Impact: Wages; Country: US; Size of the Area: Very Small; Approach: Data Driven; Natives' Skills: Low-Skill Natives; Impact on: Natives; Kind of Data: Cross Section

The results suggest that those effect sizes estimating the impact of immigration on wages or on employment that are published in books are less likely to find a positive impact of immigration than those published in academic journals. Those effect sizes estimating the impact of immigration on employment that are published in working papers are less likely to confirm, and more likely to reject, the prior of a negative impact than those published in academic journals. Studies published in academic journals, therefore, do not seem to be 'biased' against finding a negative impact of immigration; at least, not more than those studies appearing in books or still in their working paper form.

Those effect sizes estimating the impact of immigration on employment that were published recently are more likely to confirm the prior of a negative impact. With respect to wages, it is the opposite. Those estimating the impact of immigration on wages published during the 1990s and 2000s are less likely to confirm the prior, and more likely to find a positive impact of immigration. If we believe that more recent studies are – on average – of better quality, we might conclude that immigration is more likely to have a negative impact of on employment than previously thought; while the impact on wages seems nowadays less likely to be negative, and more likely to be positive.

Consistent with the idea that various forms of adjustments in an open labour market might lead to the underestimation of the impact of immigration, the results in Tables 5 and 6 show that those effect sizes estimating the impact of immigration on wages using relatively larger areas seem to confirm the prior more often than those computed using very small areas. This difference regarding the area of the observed labour markets does not seem to hold for those effect sizes estimating the impact on employment. Also, column (2) of Table 5 and the middle panel of Table 6 show once again that the negative wage impact is more likely to be confirmed when it concerns earlier immigrants rather than the native born, supporting the idea that immigrants and natives are at most imperfect substitutes. With respect to employment, we find – as would be theoretically expected – that overall employment following an immigration influx would grow. This is indicated by the positive coefficient on 'everybody' in column (3) of Table 5 being significant at the one percent level. Similarly, the third panel of Table 6 shows a lesser likelihood of employment decline for everybody and a greater likelihood of employment increase.

Those effect sizes estimated using pooled data are more likely to reject the prior of a negative impact than cross-section analyses. Studies focussing on the EU are as likely to find a negative impact on employment and wages as those focussing on the US; however, those studies estimating the impact of immigration on wages in 'other' countries seem to confirm the prior of a negative impact more often than those estimating the wage impact of immigration for the US. Consistently with the results in column (1) of Table 5, those studies estimating the impact of immigration as averages of different natives' skill groups seem to find negative impact of immigration more often than those focusing on one skill group only. Finally, the statistical significance of the log of the sample size suggests evidence of publication bias with respect to the employment impact, but not with respect to the wage impact.

4.2. Robustness Analysis

As a final sensitivity check, we also ran regression model on Fisher's Z^r statistics. These are models of the form:

$$Z_i^r = \mathbf{s}_i\boldsymbol{\theta} + \eta_i \qquad (7)$$

in which the row vector $\mathbf{s}_i$ again represents the characteristics of the study (moderator variables) that yielded effect size i. Because it is known that the variance of Z^r is inversely related to the number of observations in the primary study (see equation (4)), the regression model must be estimated by Weighted Least Squares, in which each regression observation is weighted by the inverse of the estimated standard error of the Z^r statistic of the study.

The results of the estimation of equation (7), not shown here but available on request, are consistent with those of the probit analysis. First, studies that used a natural experiment to gauge the impact of immigration on wage or employment are associated with higher Z^r values, i.e. less likely to yield a statistically significant negative impact.

The comparison between the EU and US (the reference group) is particularly interesting. The overall impact in EU studies is less negative, possibly due to the labour market adjustment in Europe being less following an immigration shock. However, when comparing the impact on wages with that on employment, we see that in Europe the impact seems to be slightly more positive in regression models that focus on wages, but more negative in regressions that focus on employment, although the coefficient is not statistically significant. This is a plausible result as it suggests that in the European labour market, which is more regulated than the US one, the response of the labour market to an immigration shock is to generate some displacement of native born workers, but little change in the wages of the native born. Hence employment adjustment in the European labour markets is stronger than wage adjustment. However, the impact does not appear to depend on the geographical area of the labour market in this meta-regression. Furthermore, estimating the impact of immigration averaging different natives' skill groups, or focusing on one skill group only, seem to produce similar results.

5. Conclusions

The number of people living outside their country of birth has more than doubled since 1960 (World Bank, 2006). The growth in international migration has fuelled an extensive and ever-increasing volume of research during the last two decades. The number of refereed journal articles on the topic of immigration recorded in *EconLit* is now close to 1200.[9] To those concerned with formulating policies that aim at increasing the wellbeing of both immigrants and the host country population such a bewildering array of research findings warrants an effective research synthesis. While narrative literature reviews may provide many relevant insights, they are likely to generate only a partial, and a – deliberately or subconsciously – biased summary of the literature. In this paper we adopted a meta-analytic approach to summarise this literature. This has provided a quantitative and transparent means of assessing the impact of immigration on the labour market.

The paper may be seen as the final part in a trilogy. In Longhi et al. (2005a) we carried out a meta-analysis of the impact of immigration on the wages of the native born population. This was followed by a study of the impact on employment (Longhi et al. 2005b). In the present paper we extended the analysis to the combined impact on wages, employment, unemployment and labour force participation.

The conclusion of this research synthesis is that the impact of immigration on the labour market of the native born population is quantitatively very small and estimated coefficients are more than half of the time statistically insignificant. This reinforces a consensus that has emerged in the literature on the macro level labour market impact. From the perspective of policy, however, this broad conclusion needs to be supplemented with more refined statements that concern the outcomes in specific labour markets for specific workers at specific times. It is fortunate that highly detailed administrative and survey data bases, often longitudinal, are now becoming available in host countries to carry out far more detailed analyses than have been hitherto possible.

Of particular importance is the extent to which immigrant workers are substitutes or complements to native-born workers in specific labour markets. While the present paper confirmed the neoclassical partial equilibrium model that, when migrants are substitutes for the native born and earlier immigrants, regressions of the labour market impact on these groups often yield negative but statistically insignificant coefficients, it was not possible to focus explicitly on specific types of immigrants and native-born workers. However, a strong result of the meta-analysis is a statistically significant downward effect of newcomers on the wages of earlier migrants, suggesting that in many cases the substitution elasticity between new arrivals and earlier immigrants will be relatively high.

By means of probit and regression analysis we found that the impact may be greater on labour force participation and on employment than on wages. Another robust conclusion is that the impact is greater the less locally born have the opportunity to 'escape' a potentially harmful impact through other adjustments, such as outward internal migration, capital inflows or additional local demand. Hence the impact on the nation or large regions is much greater than on local labour markets.

[9] Of course, these cover every aspect of the economics of immigration. The 45 studies that generated the data for our meta-analysis constitute most of the accessible papers that estimate the impact of immigration on the labour market by means of regression models.

It should be noted that the present paper has said nothing about the speed of adjustment of the labour market. The long-run impact, that also involves a change in the level of new investment, is likely to be quite different from the impact in the short run. The effect of immigration on gross fixed capital formation is presently still an under-researched topic, probably because micro level data on investment and capital stock at industry and regional level are often hard to obtain. Furthermore, we have also not considered the literature of the impact of immigration on prices. Saiz (2007) finds that immigration can lead to higher rents or higher house prices, but Lach (2007) finds that an influx of immigrants may lower prices of some goods and services. Consequently, a general equilibrium approach is desirable to distinguish wage impacts and impacts on real disposable incomes.

Finally we note that the indicators of the labour market impact that we considered in this paper has been limited to the primary indicators of labour market performance: employment, unemployment, wages and labour force participation. For example, the possibility of migrants affecting hours worked was not considered. In addition it would be particularly fruitful for future research to shift attention to *dynamic* aspects of the labour market. When there is concern for migrants displacing native born workers, this might be assessed by means of longitudinal data that measure layoffs, unemployment spells, changes of residence and occupational and industrial mobility. In addition, the impact of immigration on productivity-enhancing innovation of firms in the local labour market is one channel through which the labour market impact of immigration can be positive in the long-run. Such study of the ways in which the 'churning' in the labour market and the productivity of firms are influenced by changes in immigration levels offers much promise for new primary research, and eventually for additional meta-analyses.

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