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ESSAYS ON THE ECONOMICS OF IMMIGRATION

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CONTENTS

OUTLINE OF THE THESIS

The Thesis is organized as follows. First, we review the literature concerned with the economics of immigration[1] and the relevant empirical literature in chapters 1 and 2 (Part A). Part B, consists of three empirical chapters. Finally, there is also a short chapter that offers some conclusions and policy implications.

In chapter 1, we show the two basic approaches, which are used to analyze the impact of immigration on the destination country. More precisely, we concentrate on the Labor market versus the Trade theoretic approach. The main difference between these two methodologies is that the former builds on a single output - host economy, while the latter on an economy that produces two (or more) goods. We further distinguish between competitive labor markets and labor markets with rigidities. The aim of this chapter is to present the economic theory of immigration and also support the regression models in the following chapters.

In chapter 2, we show the five empirical methods which are used to analyze the impact of immigrants on the labor market outcomes of natives. We also discuss the limitations of each estimation methodology and the generated results. Beginning with Grosmann's (1982) production function approach, most papers fail to detect significant adverse effects of immigration on natives' wages or unemployment. Nevertheless, there are some native groups -young and less-skilled natives- whose employment opportunities deteriorate as a result of immigration.

Chapter 3 examines the impact of immigration on the labor market opportunities of natives. First, using panel data techniques and Instrumental Variables (IV)

[1] This study concentrates on the effects of legal immigration on the welfare and the employment opportunities of natives. We do not cover either the part of the literature, which focus on the welfare effects of illegal immigration (see e.g. Ethier, 1986; Palivos and Yip, 2010) or the part of the literature which examines the impact of immigrants on the fiscal policy of the host country (see e.g Storesletten, 2000).

regressions, we analyze the effect of immigration on the unemployment rate of three different education groups of natives, namely skilled, medium-skilled and unskilled workers. The OLS results imply that immigration is associated with lower unemployment rate. However, when we control for unobserved heterogeneity and common year effects, immigration switches sign and is no longer significant. Combining First-Differences and IV, we also fail to detect significant adverse effects. Second, we estimate the impact of immigrants on two alternative aspects of unemployment: a) the displacement risk, defined as the probability of moving from employment to unemployment (within one year), b) the job-search effectiveness, defined as the probability of finding a job (within one year). Our findings indicate some weak substitutability between immigrants and unemployed natives (*outsiders*). Finally, exploiting occupational information from the Greek Labor Survey, we estimate the effect of immigration on national wages. The results are in general not statistically different from zero. However, it is worth noting that the negative bias of the OLS results is the opposite of the positive bias found by the empirical papers that were based on the spatial correlation approach. The negative bias results because immigrants tend toward high-wage regions, but low-paid jobs, provided that that they can move freely within the country but not within occupations.

Chapter 4 estimates the long-run relationship between immigration and two macroeconomic variables: GDP per capita and unemployment. The dataset is annual at the national level. Immigrants do not only affect the host country economy, but also take into consideration the employment opportunities in their decision to migrate. Hence, it is interesting to investigate the causal relationship between the variables under consideration. To avoid spurious regression, we employ two alternative cointegration methodologies: The Johansen and Juselius (1990) approach and the

Autoregressive Distributed Lag (ARDL) bounds testing approach suggested by Pesaran et al (2001). Both approaches suggest that there is a stable long-run relationship running from immigration to per capita GDP. The results from the Granger non-causality tests imply that per capita GDP causes immigration in Granger's sense. Moreover, there is evidence of short-run causality running from unemployment to immigration. Hence, we can argue that immigrants contribute to per capita GDP. On the other hand, the results reported in chapter 4 do not support the argument that immigrants displace Greeks from jobs.

Chapter 5 studies the employment and wage differentials between natives and immigrants in the Greek labor market. More precisely, we decompose the mean wage gap between the groups under consideration, into a part explained by differences in the average characteristics, and a residual part that is usually referred as discrimination. The same analysis is carried out for the differences in the average probabilities of employment between immigrants and natives. Moreover, we examine the importance of distinguishing between immigrants originating from E.U. countries and immigrants originating from countries outside E.U. The results suggest that the -39% of the mean wage gap and the 31 % of the mean employment gap - between natives and immigrants can be attributed to discrimination. Nevertheless, the most important message is that the actual discrimination is masked because the E.U. immigrants are paid more than equally productive natives.

PART A

Chapter1

The Economics of Immigration: Theory

1. Introduction

By the late 1980's Greece experienced a massive influx of immigrants, whose number continuously increases over the following decades, reaching 767.000 by 2001[2]. The rising number of immigrants has made immigration one of the most controversial issues in politics. Domestic residents and anti-immigration parties often express fears that immigrants displace native workers, increase native unemployment and reduce wages (see e.g. Fakiolas, 1999). On the other hand, it is often argued that immigrants are employed in low-paid, low-status jobs, forsaken by natives, and hence leave native unemployment and wages unaffected. Furthermore, immigration may help declining sectors of the economy that otherwise could not survive, and thus prevents job loss of natives working in these sectors (see e.g. Lianos et al, 1996).

The economic effects of migration have also generated a sizable academic literature. The theoretical literature does not provide clear cut results. It seems that immigration can be beneficial, harmful or can even have no effects on the labor market opportunities of natives, depending upon the assumptions used in each model. On the other hand, most of the empirical studies agree that the effect of immigration on the labor market opportunities of natives is small or no statistically significant[3][4].

We will concentrate in this chapter on two different theoretical approaches: Labor versus Trade theoretic models. Furthermore, we distinguish two kinds of the Labor

[2] Census of Population, 2001
[3] See among others the excellent reviews of the literature by Borjas (1994), Friedberg and Hunt (1995), Gaston and Nelson (2008), Okkerse (2008), Bodvarsson and Van den Berg, 2009.
[4] A notable exception, of large adverse effects of immigration on natives' wages, can be found in Borjas (2003).

market approach, namely models with competitive labor markets and models with rigid labor markets.

Competitive labor market models typically capture the supply effect of immigration. The standard neoclassical supply and demand model of the labor market is the simplest way to analyze the impact of migrants on the labor market prospects of natives. Assuming homogeneous labor, immigration will generate excess supply of labor, which will lower the price of labor and the number of employed natives[5]. If labor is heterogeneous, Friedberg and Hunt (1995) generalize the implications of the labor market model arguing that: "immigrants will deteriorate the employment opportunities of natives with which they are perfect substitutes, improve the employment opportunities of natives with which they are complements and have an ambiguous effect on natives with which they are imperfect substitutes"[6].

Moreover, the interpretation of the small sized effects of the labor supply shock, found by the empirical literature, has also been the subject of a large part of this strand of the theoretical literature. Factors such as - native internal migration, inter-regional trade, endogenous skill upgrading, capital and product market responses – have been identified as factors that mitigate any negative effect of immigration[7].

Furthermore, the difference of labor market institutions, such as minimum wages or collective wage bargaining by unions plays important role in determining the labor market effects of immigration. In an environment of a rigid labor market (a feature that characterizes most European countries) the employment and/or unemployment

[5] Employment effects arise if and only if that the labor supply of natives is somewhat elastic. In this case, native workers whose reservation wage is below the post-immigration equilibrium wage will quit the labor force (Dustmann and Glitz, 2005).
[6] The degree of substitution between immigrants and natives is likely to vary over time. In skilled jobs, the need for language proficiency makes it difficult for employers to substitute immigrants for natives (Orrenius and Zavodny (2007).
[7] It is useful to think the supply effect of immigration as a partial, short-run effect. On the other hand, this set of factors can be seen as a set of secondary, long-run adjustments of the economy (Bodvarsson and Van den Berg, 2009). These factors are discusses in more detail in the next section.

effect of immigration is expected to be larger than in an environment with flexible wages (i.e the US economy)[8].

On the other hand, trade economists often analyze the effects of immigration using the most commonly employed trade model, the Hecksher-Ohlin model. This approach generates quite different implications from the standard textbook model of the labor market. The adjustment of the host economy becomes through changes in output mix, rather than changes in wages and aggregate employment. However, as explained in the next section, different outcomes are produced when more realistic models of trade are considered (i.e. a model of trade without factor price equalization).

This chapter is organized as follows: In section 2 we provide an overview of the theoretical labor market models concerned with the effects of immigration on the labor market opportunities of natives. In section 3 we illustrate the predictions of trade theoretic approaches, namely the one cone, the multi cone, the Ricardian and the specific factors model. Finally, section 4 offers some conclusions.

2. Labor market approach

Theoretically, there is a widespread agreement that the impact of immigration is ambiguous and depends on the type of the model used. According to Gaston and Nelson (2000), there are primarily two frameworks for analyzing the impact of immigration: labor market models and trade models. Under perfectly competitive markets they argue:

[8] See Friedberg and Hunt (1995).

'the sole difference between the basic labor model and the basic trade model is dimensionality: labor economists prefer a one final good model for the strong structure it offers for empirical work and trade economists prefer a model with multiple final goods'.

Further, Dustmann et al. (2005) argue tthat he existence of at least one further sector is important, since it allows the economy to adjust through changes in output mix rather than changes in wages or employment of natives.

In this section we will start with the labor market approach, where we constantly assume that the economy produces a single output using skilled and unskilled labor (more factors than goods). Moreover, we always examine the effects of unskilled immigration[9]. In section 2.1 we show the distributional effects of immigration on the wages of the domestic workers. In section 2.2, we discuss the welfare gain of the economy, the so-called *immigration surplus*. We then continue with a more elaborate theoretical discussion of the distributional effects of immigration. In section 2.3, we show that the effect of immigration on natives' wages and employment depends upon the elasticities of labor demand and supply (Johnson, 1980). In section 2.4, we show that – when skill diversity within the group of immigrants is assumed – the effect of immigration depends upon whether immigrants change the balance of skills in the economy (see e.gAltonji and Card, 1991; Dustmann et al, 2005).

The above analyses implicitly assume a third factor, capital, whose stock is supposed to be fixed. We relax this assumption on section 2.5. In section 2.6, we discuss the effect of immigrants on the demand for the local output and its implications for the effects of immigration on the wages of the domestic workers (see e.g. Bodvarsson et al, 2008). Finally, in section 2.7, we review the welfare effect of

[9] Skill diversity within the immigrant group is assumed in section 2.4.

immigration on models which introduce rigidities on the labor market. It is shown, that, contrary to competitive labor markets, the overall effect of immigration is ambiguous (see e.g. Schmidt et al, 1994). It depends, among others, upon the degree of substitutability between skilled and unskilled labor, the elasticity of labor demand, and the endogenous skill formation of natives.

2.1 One sector model- the distributional effects of immigration

Our starting point will be the simple one sector model where two factors, skilled and unskilled labor, are used to produce a single output. Furthermore, in this section and for most of this chapter, the theoretical models are characterized by perfectly competitive labor markets. In addition we assume that the host country is a small open economy[10]. The assumption of the small open economy implies that the price of the output is fixed and determined over the world market, that is, the host country is price taker. Initially, we suppose that the economy is closed as regard to factor movements from abroad. Thus, factor prices are determined locally and there is no space for factor price equalization across countries. Technology is characterized by the standard neoclassical production function[11]:

[10] Borjas (1999) argues that we get the same results if we assume a closed economy.

[11] We say that a production function, F(S,L), is neoclassical if the following properties are satisfied:

1) The function F exhibits constant returns to scale: $F(\lambda S, \lambda L) = \lambda F(S, L)$ for all $\lambda > 0$

2) For all $S > 0$ and $L > 0$, F exhibits positive and diminishing marginal products with respect to each input:

$$\frac{\partial F}{\partial S} > 0, \frac{\partial^2 F}{\partial S^2} < 0$$

$$\frac{\partial F}{\partial L} > 0, \frac{\partial^2 F}{\partial L^2} < 0$$

$$Y = f(\mathbf{z}) \tag{1.1}$$

Y denotes the amount of the output produced and **z** is a vector of inputs, for instance, skilled (S) and low skilled (L) labor. The locus of input combinations that yield one monetary unit of output can be represented by the unit value isoquant (*1/P*). Given perfect competition, full employment and cost minimization by firms, the relative wage $\omega = -w_S / w_L$ is determined by the slope of the isocost[12] (AA) tangent to the unit value isoquant (Figure 1.1). Now suppose that an inflow of unskilled immigrants decreases the relative endowment of skilled labor. At the new endowment, the isocost is given by the dashed line (BB). This produces a fall in relative wage ω. Furthermore, if we assume that the price of output is fixed, immigration induces a real decrease in the wage of low skilled and a real increase in the wage of skilled labor.

On the other hand, if immigrants have the same skill distribution as natives, the economy just moves to a higher level of output, while at the same time the relative wage of skilled to low skilled labor remain at the pre-immigration level[13].

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3) Inada Conditions. The marginal product of capital (labor) approaches infinity as capital (labor) goes to 0 and approaches 0 as capital (labor) goes to infinity:

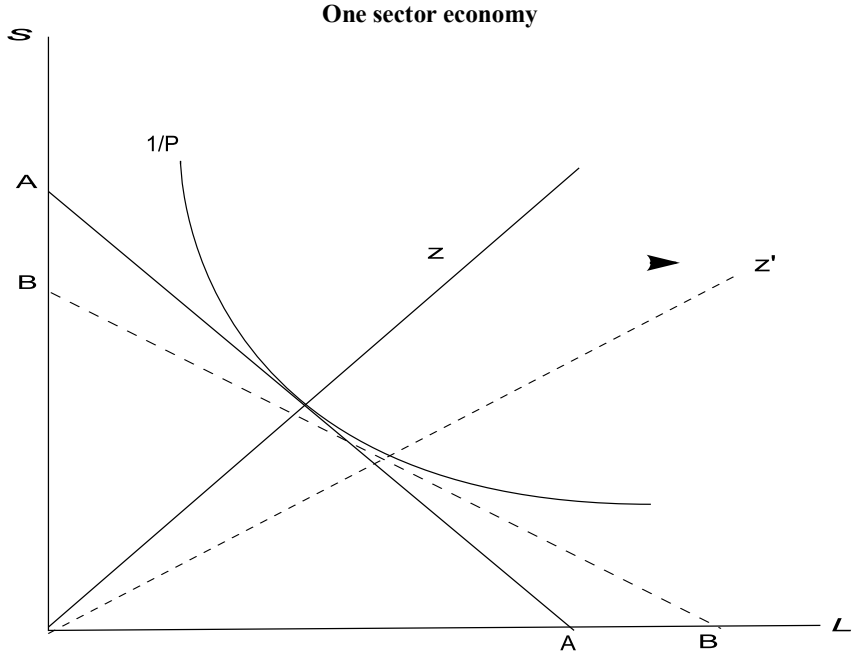
$$\lim_{S\to 0} \frac{\partial F}{\partial S} = \lim_{L\to 0} \frac{\partial F}{\partial L} = \infty$$

$$\lim_{S\to \infty} \frac{\partial F}{\partial S} = \lim_{L\to \infty} \frac{\partial F}{\partial L} = 0$$

[12] The isocost line tangent the unit isoquant has the equation $\$1 = w_s S + w_L L$. Thus, the S intercept shows $1/w_S$ and the L intercept shows $1/w_L$. At the new endowment, the isocost is BB. Hence, if P is unchanged, w_S has risen and w_L has fallen

[13] Altonji and Card (1991) and Dustmann et al. (2005) derive some theoretical microfoundations supporting the view that immigrants need not always have adverse effects on native labor market opportunities. If immigrants' skill distribution is identical to the skill distribution of natives, these models predict no negative effects on natives labor market outcomes.

Figure 1.1
One sector economy



2.2 One sector model- the aggregate effect of immigration

The neoclassical supply and demand model of the labor market (Borjas, 1995) predicts that immigration generates an overall gain for the native born population, but the benefits are unequal distributed over the native population. Let us suppose that wages are flexible whereas supplies of skilled and low skilled labor are perfectly inelastic[14]. Technology is described by a Constant Returns to Scale production function. Total output, Q, is produced by two inputs, skilled (S) and low skilled labor (L) such that $Q = f(S, L)$. Assuming perfect competition on the labor market, the price of factors equals their marginal productivities. National Income before the entry of immigrants is given by:

$$Q_N = w_S S + w_L L \tag{1.2}$$

Equilibrium in Figure 1.2 is given at point A where the inelastic supply curve intersects the curve of marginal product of labor. National income is represented by

[14] Alternatively we can assume that there are fixed supplies of skilled and low skilled labor.

the area *ABN0*. Skilled laborers earn the area ABw_L and low skilled workers the area w_LBN0. If low skilled immigration takes place, the supply curve shifts rightwards and the price of low skilled labor becomes w_L'. National income will increase by the triangle BCD and is now given by the area ACL0. Skilled workers will gain the area w_LBDw_L' plus the triangle BCD whereas low skilled laborers will lose the area w_LBDw_L'. Finally, immigrants earn income equal to w_1M. The triangle BCD is referred by Borjas (1995) as the *immigration surplus*[15][16].

The paradox from the above analysis is that natives gain as a whole if the increase in the unskilled labor supply reduces the wage. On the other hand, If the price of labor is insensitive to changes in labor supply the immigration surplus is zero (Borjas, 1995)[17].

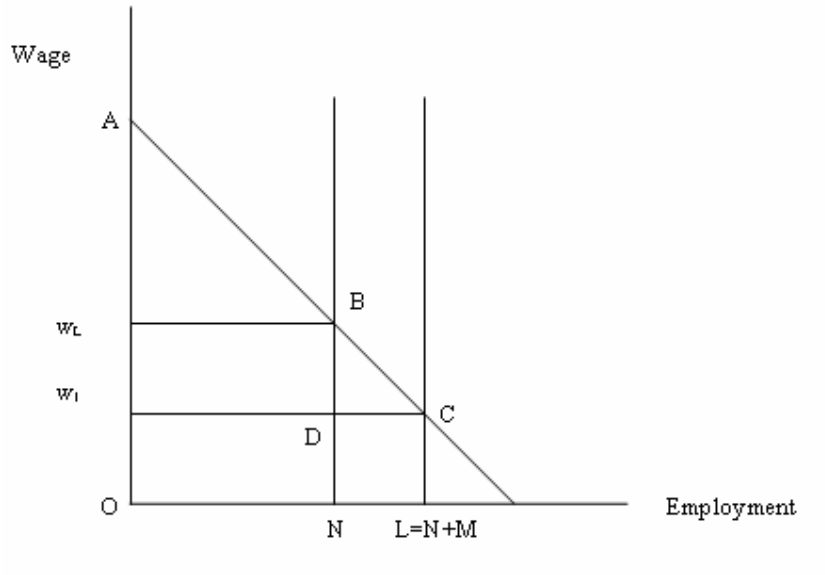
The analysis of the immigration surplus involves however a strong assumption that labor supply is perfectly inelastic, that is, workers supply labor whatever the wage. If we relax this assumption and assume that labor supply is somewhat elastic, some workers will now choose not to work if wages fall and thus immigration might cause (voluntary) unemployment among those natives workers whose wages fall (Dustmann et al., 2005).

[15] The immigration surplus as a percentage of GDP is calculated by the following formula: $\Delta Q_N/Q=-0.5sem^2$, where s is the share of low skilled income on total income, e is the wage elasticity with respect to the employment and m is the ratio of immigrant population to total employment. The change in the national income is calculated as: $N\Delta w_L/Q=-sem(1-m)$

[16] Given that the share of labor income in the US is approximately 70%, that immigrants constitute 10% of total population and according to Hamermesh (1993) that the elasticity of the price of labor to the labor force is about -0.3, Borjas calculates that the immigration surplus is about 0.1 percent of GDP or about $7 billions annually.

[17] The same results hold if we substitute skilled labor for capital and assume complementarity between unskilled labor and capital. However, as shown by Borjas (1999), if we assume perfect capital mobility across countries, the impact of immigration on wages and the immigration surplus is nullified.

Figure 1.2
The immigration surplus



2.3 The effects of low-skill immigration

Johnson (1980) focuses on the impact of low-skill immigrants on the wage and employment natives and shows that the labor market effects of immigration depend upon the elasticities of labor demand and supply. To illustrate the implications of this model more formally, suppose that immigrants and unskilled natives are perfect substitutes in production, they get the same wage and that immigrants don't buy anything from the product market of the host country[18]. Furthermore, define the total employment of low-skilled labor, E_1, as:

$$E_1 = E_{1d} + E_{1m} \tag{1.6}$$

where E_{1d} and E_{1m} are native and immigrant employment respectively. Johnson's comparative statics analysis shows how an increase in E_{1m} affects the wage w_1 and the

[18] This assumption means that the model abstracts from the demand effects of immigration.

employment E_{1d} of low-skilled labor. In equilibrium labor demand must equal labor supply, that is:

$$D(w_1) = E_{1d} + E_{1m} \tag{1.7}$$

Let the labor supply of immigrants be perfectly inelastic, and the labor supply of natives given by:

$$E_{1d} = h(w_1) \tag{1.8}$$

Further define the fraction of immigrants to total population as:

$$f = \frac{E_{1m}}{E_1} \tag{1.9}$$

and the elasticity of labor supply of natives, ε and the elasticity of labor demand for unskilled labor, n as:

$$\varepsilon = \frac{d\log E_{1d}}{d\log w_1} = \frac{w_1}{E_{1d}}\frac{dE_{1d}}{dw_1} = \frac{w_1 h'(w_1)}{E_{1d}} \tag{1.10}$$

$$n = -\frac{d\log D(w_1)}{d\log w_1} = -\frac{w_1}{D(w_1)}\frac{dD(w_1)}{dw_1} = -\frac{w_1 D'(w_1)}{D(w_1)} \tag{1.11}$$

Totally differentiating the equilibrium condition we obtain:

$$\frac{d\log w_1}{dE_{1m}} = -\frac{f}{(n+\varepsilon(1-f))} \prec 0 \tag{1.12}$$

Equation (1.12) has two important implications: First, the more elastic is the labor demand the less will change the wage for unskilled labor. Second, the more elastic is the labor supply the less will change the wage.

Finally, the impact of immigration on natives employment is calculated as follows:

$$\frac{dE_{1d}}{dE_{1m}} = \frac{-\varepsilon(1-f)}{(n+\varepsilon(1-f))} \tag{1.13}$$

Equation (1.13) implies that there is no displacement if the labor demand for unskilled labor is perfectly elastic. Firms use all new immigrants plus all old natives. If the labor demand is perfectly inelastic, then there is perfect displacement because immigrants have inelastic labor supply and are willing to work at any wage. Wage adjusts downwards as dE_{1m} are used to replace natives. Perfect displacement also occurs if the labor supply of native unskilled workers is perfectly elastic. Natives respond to any change in wage by a big fall in employment.

2.4 Skill diversity within the foreign workers

Altonji and Card (1991) extend Johnson's analysis by assuming skill diversity within the foreign labor force. Moreover, in contrast to Johnson's model, which is of a national economy, Altonji and Card's model is of a city model[19]. To illustrate the implications of this model, let us consider a closed economy which produces Q units of a single output with Constant Returns to Scale technology and two inputs, skilled and unskilled labor which earn wages w_s and w_u respectively. The cost function is summarized by Qc (w_s, w_u) and then unit cost function is given by c (w_s, w_u). Under perfect competition on product market the price of output equals the unit cost function: p= c (w_s, w_u). Each type of worker has an output demand function given by: $D_s(w_s, p)$ and $D_u(w_u, p)$. If the economy consists of N_s skilled workers and N_u unskilled workers, then product market equilibrium must satisfy the following equation:

$$Q = N_s D_s(w_s, p) + N_u D_u(w_u, p) \tag{1.14}$$

The model closes with the following labor market equilibria:

[19] The model developed by Altonji and Card (1991) provides theoretical support for most empirical studies in the spatial correlation approach (Okkerse, 2008).

$$N_s L_s(w_s, p) = Qc_s(w_s, w_u)$$
$$N_u L_u(w_u, p) = Qc_u(w_s, w_u) \tag{1.15}$$

where $L_s(w_s, p)$ and $L_u(w_u, p)$ are the labor supply functions of skilled and unskilled laborers. Supposing that an inflow ΔN of immigrants enter the labor market, a proportion β of whom are unskilled whereas the respective proportion of natives is b, the impact of immigration is summarized by the following pair of equations:

$$\Delta \log w_s = \frac{\lambda}{\varepsilon_\varsigma - \delta_\varsigma} \frac{\beta - b}{b(1-b)} \frac{\Delta \mathrm{N}}{\mathrm{N}} \tag{1.16}$$

$$\Delta \log w_u = \frac{1-\lambda}{\varepsilon_u - \delta_u} \frac{b - \beta}{b(1-b)} \frac{\Delta \mathrm{N}}{\mathrm{N}} \tag{1.17}$$

where $\lambda = N_u D_u(w_u, p)/Q$, ε_i is the labor supply elasticity and δ_i is the labor demand elasticity.

Equations (1.16) and (1.17) imply that if the fraction of unskilled workers on the immigrant flow is equal to the fraction of unskilled natives, skilled and unskilled wages remain unaffected due to linear homogeneous production function. On the other hand, if $\beta > b$, then immigration increases skilled wage and decreases unskilled wage whereas if $\beta < b$, immigration decreases skilled wage and increases unskilled wage.

2.5 Immigration and capital responses

Borjas (2003) argues that the small effects of immigration found in the empirical literature[20] are inconsistent with the laws of demand and supply, provided that the labor demand curve is not perfectly elastic[21]. Hence, Borjas (2003) advocates that the shift in the supply should lower the wage of competing workers, and reduce the

[20] The results of the empirical literature are analytically presented in chapter 2. The results reported in Borjas (2003) are amongst the most negative in the literature.
[21] See Hamermesh (1993).

amount of labor supplied by native workers, as long as the native supply curve is upward sloping.

On the other hand, Ottaviano and Perri (2005, 2006, and 2008) criticize most of the literature that represents immigration as an increase in the labor supply for a given capital stock. Moreover, they argue that immigration is not an unexpected and instantaneous shock; instead it is a predictable and rather slow event. Hence, the investors respond continuously to inflows of labor and to the consequent increase in the marginal productivity of capital.

Hence, they build a theoretical model that assumes international capital mobility and capital accumulation, such that the economy operates at a balanced growth path (Ramsey, 1928; Solow, 1956). In this case, the capital-labor ratio is growing at a constant rate equal to the growth rate of technology. Assuming that the technological process is exogenous to immigration, they express the percentage change in average wages due to immigration as a function of the percentage response of capital-labor ratio. Hence, with full capital adjustment and the economy in balanced growth path, they show that the percentage change of capital-labor ratio and the impact of immigration is zero in the long run. To put it differently, the Ottaviano and Peri's model permits a reduction of the capital-labor ratio due to an immigration shock only in the short run. This reduction reduces labor productivity and the average wage[22]. In the long run, the capital-labor ratio returns to its balanced growth path, boosts labor productivity and the wage returns to its pre-immigration level.

[22] The authors show that, even in the short-run, the negative effect of immigration on the real wages is reduced when they control for the speed of adjustment of capital. They calculated that the speed of adjustment is about 10% each year.

2.6 Demand effects of Immigration

The labor market model illustrated above examines the *'ceteris paribus'* impact of an exogenous labor supply shock. However, immigrants do not only add to stock of labor, but the also, as consumers, increase the demand for locally produced goods. Increased demand for goods induces an increase in the demand for labor, shifting the labor demand curve rightwards, partially offsetting the initial negative effects of immigration on the employment opportunities of natives.

The importance of the demand effects of immigration have already been mentioned by Altonji and Card (1991), and Greenwood and McDowell (1995). The former study, although theoretically discusses the importance of the effects of migration on the labor demand, did not incorporate it in the empirical specification. The latter, argues that the demand is one of many channels through which immigration can affect the employment and the wages of native population.

Hercowitz and Yashiv (2002), is one of the few studies[23] that explicitly incorporated the product market and the demand effects of immigration in their general equilibrium model. This model implies that immigrants increase the price of domestic goods because they boost demand. On the other hand, immigrants lower wages and hence production costs and product prices. The effect of immigration on price depends upon which of the two opposing effects dominates, the price elasticities and the extent to which immigrants participate in the goods market relative to the labor market.

Bodvarsson et al., (2008) develop a model where immigrants and natives compete for jobs in the labor market while at the same time consume the locally produced good. They found that immigration induces two different effects on wages: an input

[23] In addition, Saiz (2007) and Cortes (2008) analyze the impact of immigration on housing market and domestic prices, respectively, without seeking to generate predictions about how these effects influence native labor market outcomes.

substitution effect and a consumer demand effect. The first effect is the standard supply effect of immigration, that is, immigrants displace some native workers. The second effect, decomposed in four distinct effects – lower wages of natives, lower wages of immigrants, out migration of natives and more consumers – could raise or lower the native wage depending on whether the first three effects dominate the fourth or not. The net effect of immigration on the native wage is the sum of the input substitution and the consumer demand effect. In this framework, native wage can rise if the consumer demand effect dominates.

2.7 Introducing wage rigidities

The analysis in the previous sections assumes competitive labor markets where wages are flexible. This section focuses on labor markets which are characterized by minimum wages, labor unions and unemployment. We will start with the analysis of Schmidt et al. (1994) who analyze the welfare effect of unskilled immigration in the destination country, where a nationwide monopoly union represents both skilled and unskilled workers. The union sets the unskilled wage unilaterally and then firms chose the level of employment at the given wage. On the other hand, skilled wage adjusts to equate labor supply and demand. The government taxes capital and labor income. Unskilled unemployed receive a tax-financed unemployment benefit. Immigrants influence the native's welfare through two channels. First, immigrants displace some unskilled native workers and raise the unemployment rate among the native population. Furthermore, as unemployed immigrants are eligible for unemployment benefits, they impose a fiscal burden. On the other hand, if skilled and unskilled labor are complements, they union may demand lower wages to offset the displacement

effect. This increases unskilled employment and skilled wages. Hence, the overall effect of immigration on native welfare is ambiguous.

Fuest and Thum (2000) analyze the impact of migration on the welfare of natives, in a small open economy, which consists of two sectors: a unionized sector and a competitive sector. The wage in the competitive sector is determined by the laws of supply and demand, while the wage in the unionized sector is determined by bargaining between unions and firms. The union sets the wage as a markup on the competitive wage. The main result is that the welfare effect of migration on native population can be decomposed into two different effects. First, because there is positive probability of immigrants to find a job in the unionized sector, their expected wage exceeds their marginal product. This constitutes a negative effect on native's welfare. Second, immigrants reduce the wage in the competitive sector. This reduces the reservation utility of the union. Consequently, the wage in the unionized sector also declines and the employment increases. This latter effect raises the welfare of natives. Finally, it is shown that the overall impact of immigrants on native's welfare depends on the wage elasticities of labor demand in the two sectors. A strictly positive effect on the welfare emerges if the elasticity of labor demand in the unionized sector is greater than the respective elasticity in the competitive sector. The intuition behind this result is that the increase of the employment in the unionized sector is stronger, the higher the elasticity in the unionized sector, and the lower the elasticity in the competitive sector.

In a similar model, Fuest and Thum (2001) examine the welfare effect of unskilled migration when the destination economy experiences a secondary mechanism of adjustment. This mechanism involves endogenous skill formation of natives in response to immigration. Hence, it shown that unskilled natives, who at the

first stage experience wage reduction, will react with increased skilled formation. This restores the balance of skilled versus unskilled labor in the economy to the pre-immigration level, so that immigration has no effect on domestic welfare.

Kemnitz (2003) examines the welfare impact of immigrants on a host country with a welfare state that supports the unemployed and the elderly. The unskilled wage is set by a monopoly union, while the skilled wage is determined competitively. Hence, the model generates some unemployment for the unskilled. This differs from the analyses of Fuest and Thum (2000; 2001), where despite the presence of labor unions, the allocation of labor is efficient, since those workers who do not find a job in the unionized sector are employed in the competitive sector. The government taxes unskilled workers to finance the unemployment benefits paid to jobless. The unemployment insurance scheme is balanced. This differs from the analysis of Schmidt et al. (1994), where the unemployment insurance scheme is assumed to run as a surplus that diminishes with unemployment. Thus, the economy displays wage flexibility despite the presence of the labor union. The unemployment benefit has to be adjusted in response to changing labor market conditions. Hence, it is shown that an influx of unskilled immigrants raises unemployment, decreases unskilled wages and benefits the high-skilled and the pensioners.

3. Trade theoretic approach

In this section, we outline that the theoretical results of immigration on the wages or employment of natives, depend on whether or not trade equalizes the factor prices world wide. In section 3.1, we start with the presentation of an economy where the number of goods and factors is the same, i.e. the Heckscher-Ohlin model. We will

show that immigration tends to have no wage and employment effects on natives. We continue with the (more realistic) uneven case of more goods than factors. More precisely, in section 3.2 we will show that the effect of immigration on natives' wages and aggregate employment depends on its relative magnitude. Finally, in sections 3.3 and 3.4 we will discuss the *immigration surplus* in two kinds of trade models; the Ricardian and the specific factors models. We will see that the former emerges a negative effect on the aggregate welfare of natives, while the later an overall gain in the host country.

3.1 The Heckscher-Ohlin model

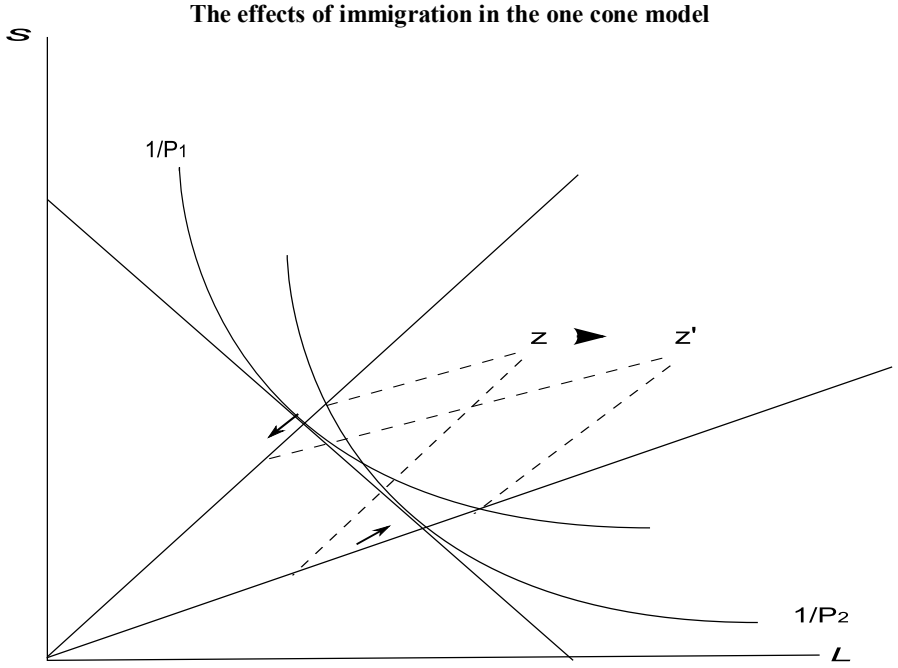
Now suppose that we add one more good and assume that good 1 is skilled labor intensive and good 2 is low skilled labor intensive. Further, assume that the unit isocost line is tangent to both unit value isoquants. As a result of free inter-sectoral factor mobility, the relative wage, ω, is common to both industries. By the assumption of the small open country, the economy is a price taker, and hence, the relative commodity price $(p = P_1 / P_2)$ is fixed. The rays r_1 and r_2 define the cone of diversification, where any endowment in the interior of the cone involves production of both goods at the given price. Thus, if two countries face the same final good prices and share the same technology, they have the same skilled and unskilled wages[24].

[24] The assumption of perfect competition implies that there are zero profits in equilibrium, so the unit cost is equal to price in each sector: Hence, $\begin{aligned} a_{S1}w_S + a_{L1}w_L &= P_1 \\ a_{S2}w_S + a_{L2}w_L &= P_2 \end{aligned}$

a_S and a_S denote the quantity of skilled/low skilled labor required to produce one unit of output. Solving the system one obtains: $\begin{matrix} w_S(a_{S1}, a_{L1}, a_{S2}, a_{L2}, P_1, P_2) \\ w_L(a_{S1}, a_{L1}, a_{S2}, a_{L2}, P_1, P_2) \end{matrix}$. Hence, if technologies are identical across countries and free trade equalizes prices, factor prices are equalized too.

This is the Samuelson, factor price equalization theorem[25]. In this framework, a *restricted* inflow of low skilled immigrants cannot change the location of the unit value isoquants and the equilibrium isocost line and hence the relative wage ω[26]. The only way this economy can respond to a change in the endowment of low skilled labor, is to change the output mix, by increasing the low skilled labor intensive output, and decreasing output in the other sector (Rybzinski effect)[27].

Figure 1.3
The effects of immigration in the one cone model



[25] Notice that if price equalization occurs, there is no economic incentive for migration. An explanation for migration from rich to poor countries in this model could be that rich countries have tariffs on low skilled intensive goods, in an attempt to raise the low skilled wage above the world level (Friedberg and Hunt, 1995).

[26] This is called by Leamer (1995) the factor price insensitivity theorem.

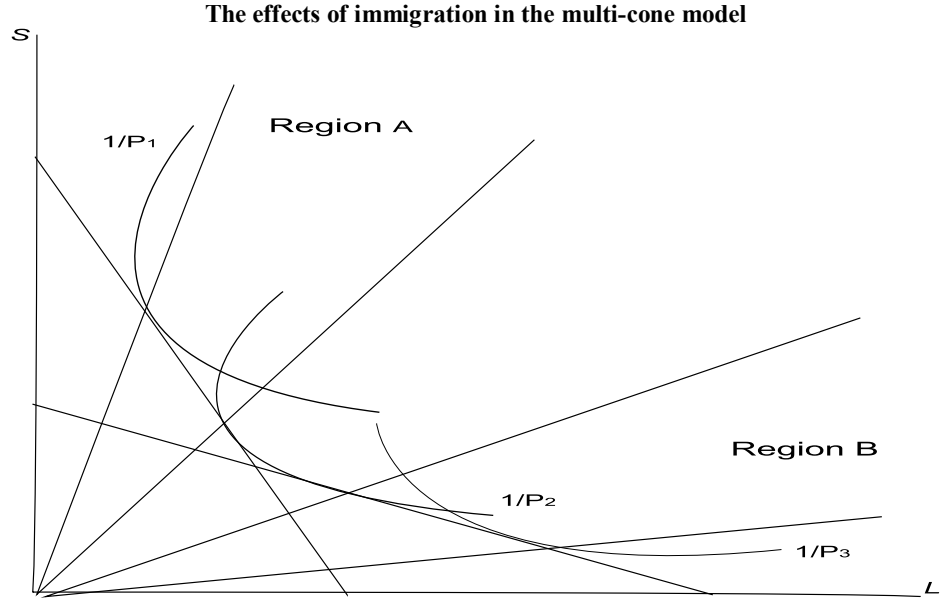
[27] See also Rivera-Batiz (1983). See Dustmann et al (2005) for a formal theoretical model of immigration within a Heckscher- Ohlin setup. Hansen and Slaughter (2002) and Lewis (2004) find some empirical support that industries adjust their technology is response to changing labor market conditions.

3.2 The multi-cone model

A more realistic model of trade is one in which countries have very different endowments of factors, and factor price equalization might not occur even with free trade (Friedberg and Hunt, 1995; Lee, 2007). In this case, countries with a large skilled labor endowment will produce a more skilled labor intensive mix of goods, whereas countries with a large low skilled labor endowment will produce a more low skilled labor intensive mix of goods.

Suppose that country A has an initial endowment of skilled and low skilled labor given by z_A and country B given by z_B and good 1 is skilled labor intensive, good 2 is an intermediate good and good 3 is low skilled labor intensive. Given the initial endowments in both countries, region A produces good 1 and the intermediate, and region B good 3 and the intermediate. It is easy to show that the relative wage of skilled labor is lower in region A, which is skilled labor abundant. The resulting cross country differences in wages could then generate migration. Assume for instance that low skilled workers migrate from region B to region A. In this case, the impact depends upon its size: A small inflow will not affect wages, as long as the endowment of region A remains in its diversification cone. However, if region A accumulates enough low-skilled labor, it wall pass out of its diversification cone. Hence, the host country will be forced to produce a more low skilled labor intensive mix of products, which will lower the low skilled wage and increase the wage of high skilled workers.

Figure 1.4
The effects of immigration in the multi-cone model



3.3 Immigration in a Ricardian model

Trefler (1997) analyze the impact of immigration in a Ricardian model of trade. Assume that three commodities are produced from a single factor, labor. Unit labor requirements are represented by α_i, (i=1,2,3). In equilibrium, the price of good i must be equal to the cost of producing one unit of good i, $w/p_i = 1/\alpha_i$. The commodities are indexed such that the unit labor requirements are ranked in order of diminishing home country comparative advantage:

$\alpha_1/\alpha^*_1 < \alpha_2/\alpha^*_2 < \alpha_3/\alpha^*_3$, where an asterisk denotes the foreign country. For simplicity, let us assume that the host country produces only commodity one.

Consider now the case where some workers from the foreign country immigrate to the home country. The immigrants will be employed to produce good one, creating an excess supply of the first good at the prevailing prices. The resulting home trade deficit drives down the home wage until $w/p_2=1/a_2$. The wage in the home country falls until it can produce the second good. Likewise, the foreign country wage rises

until industry 2 shuts down. Since home country always produce the first good, $w/p_1=1/a_1$ is unchanged by immigration. w/p_2 has fallen to $1/a_2$. Since w^* has risen and $w^*/p_3=1/a_3$ is unchanged, p_3 has risen. Hence, w/p_3 has fallen. These changes induce a decline in per capita native utility, meaning that Borjas' *immigration surplus* is negative.

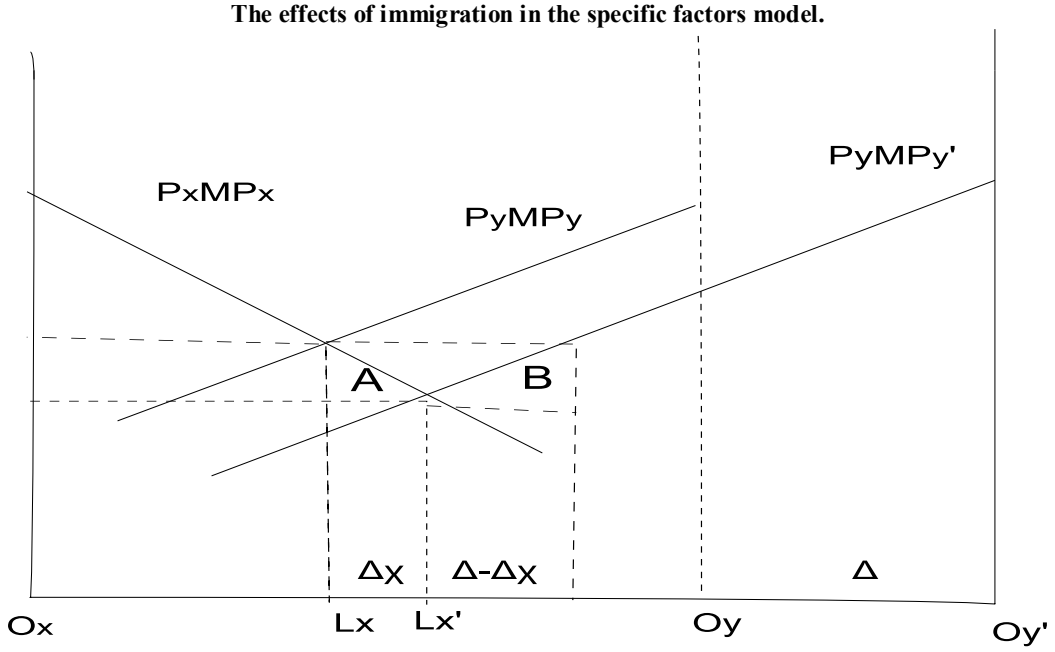
3.4 Immigration in the specific factors model

Trefler (1997) analyzes the hypothesis of the *immigration surplus* in the specific factors model. Assume that there are two industries, x and y, each one has a stock of industry specific capital, K_x and K_y. On the other hand, we assume that labor is mobile between the sectors. Hence, the price of capital will not be the same across the sectors. Labor demand in both industries is determined from the value marginal product of labor, $p_xMP_x(K_x, L_x)$ and $p_yMPy_y(K_y, L_y)$. Equilibrium wage, w, is found at the point where the labor supply equals the industry labor demand.

Let Δ immigrants arrive. Industry y labor demand shifts right by Δ from p_yMPy_y to p_yMPy_y' so that it is unchanged relative to its new origin O_y'. Δ_x immigrants find employment in industry x and $\Delta-\Delta_x$ find employment in industry y[28]. Competition between natives and immigrants drives down the wage to w', thus transferring income $(w-w')L$ to the specific factors. The shaded areas in figure 4 are the Borjas's *immigration surplus* generalized to two industries.

[28] Note that the Rybczynski theorem does not hold. Immigration expands both sectors.

Figure 1.5
The effects of immigration in the specific factors model.



4. Conclusions

In this chapter we show how different theoretical models analyze the impact of immigrants on the host economy, focusing on labor and trade economics approaches. As emphasized by Gaston and Nelson (2000), labor economists build on one sector models, while trade economists base their analyses on multiple sector models. In competitive labor markets, immigration generates an aggregate gain, which is called *immigration surplus*. However, concerning the distributional effects of immigration, it is shown that immigrants have adverse effects on the employment opportunities of natives with which they are substitutes and raise the employment opportunities of natives with which they are complements. On the other hand, the existence of multiple sector models, allows the host country to adjust through changes in output mix, rather than through changes in wages and employment.

Moreover, the labor market models are criticized for capturing the partial effect of immigration (see e.g. Ottaviano and Peri, 2005; Bodvarsson et al, 2008) and not being informative on the overall effect of immigrants. Hence, we can argue that it is important to distinguish between the short-run and the long-run effects of immigration. Immigrants do not only increase the supply of labor, but they also cause a set of secondary (long-run) adjustments in the host countries. Capital responses, endogenous skill upgrading, internal migration, changes in output mix, technological and product market responses, are considered as the most important second-round effects of immigration.

Further, in unionized labor markets, the effect of immigration depends on the reactions of the union to the increased labor supply, and the degree of complementarity between different types of labor (see e.g. Schmidt et al, 1994). On the other hand, an exogenous set minimum wage leads to increased unemployment.

To sum up, the main message of this chapter is that, although the basic laws of supply and demand suggest that immigration could reduce the employment opportunities of competing factors, in reality the economy responds in such a way, that the actual impact of immigration is likely to be small, especially in the long-run.

Finally, the mixed theoretical results do not suggest a certain immigration policy, that is, a government should close its borders, impose restrictions on immigration, or follow a laissez-faire policy towards immigration. There are also important issues that a government should take into consideration, which are not considered in this survey. For example, illegal immigrants could generate different effects on natives' welfare (see. E.g Ethier, 1986; Palivos and Yip, 2010). A further important issue (see e.g. Storesletten, 2000; Kemnitz, 2008) is the association between immigrants and fiscal policy (i.e. taxes, pensions, ageing of population).

Chapter 2

The Impact of Immigration on the Host Economy: Methods and Empirical Evidence

1. Introduction

This chapter provides a survey of the empirical literature, highlighting the different approaches used to estimate the impact of immigration on the labor market outcomes of natives. This literature typically begins in 1982 with the seminal paper of Grossmann. Taking the stock of the existing evidence, we can argue that the predictions of the simple textbook labor market model - that immigration has an adverse effect on the employment opportunities of competing native workers - do not seem to be confirmed.

In a well cited paper, Friedberg and Hunt (1995) conclude: "Despite the popular belief that immigrants have a large adverse impact on the wages and employment opportunities of native born population, the literature on this question does not provide much support for this conclusion. Moreover, Longhi et al. (2005) applying meta-analytic techniques to a sample of 18 papers, which generated 348 estimates, found that the percentage change in the wage of a native worker with respect to a one percentage point increase in the ratio of immigrants over native workers is only -0.119 percent. As the authors point out: "The broad conclusion since Grossman' (1982) is that the impact of immigration on wages is statistically significant but quantitatively small". More recently, Okkerse (2008) concludes that immigrants affect the labor market position of natives slightly. However, she points out that the less-skilled

natives and previous immigrants are vulnerable to increased competition from foreigners[29].

In this chapter, we break the empirical studies into five parts, namely the production function approach, spatial correlations, the skill cell approach, the factor proportions approach and the time-series analyses.

The production function approach (see e.g. Grosmann, 1982; Borjas, 1987) uses the concept of a neoclassical production function, where natives and immigrants are considered as different inputs. The key objective of this method is to examine the substitutability between immigrants and natives. These studies measure the effect of immigration on native wages by using cross-sectional data (population Censuses) from countries.

The spatial correlations approach (see e.g. Altonji and Card, 1991; Pischke and Velling, 1997; Dustmann et al, 2005) estimates the impact of immigration on the labor market opportunities of natives by using longitudinal (or cross-sectional) data from local labor markets (i.e. cities, regions)[30]. Immigrants are not equally allocated across the regions of the receiving country. Some regions receive large numbers of immigrants, while other receive low or none immigration. Hence, these studies regress a measure of the labor market performance of natives (i.e. wages, employment, unemployment, participation) on the fraction of immigrants in these particular labor markets. Nevertheless, despite its popularity, the spatial correlations approach is often criticized (Borjas, 2003) of being fraught with biases, from a

[29] A notable exception can be found in Borjas (2003). This study reports large adverse effects on the wages of natives. On the other hand, in a series of papers, Ottaviano and Perri (2005, 2006, 2008) report evidence in favor of complementarity between natives and immigrants.

[30] There are also some studies that utilize longitudinal data from countries (see i.e. Angrist and Kugler, 2003; Jean et al, 2007).

number of sources, such as endogenous allocation of immigrants across local labor markets and internal migration of natives as a response to immigration from abroad.

The skill-cell approach (see e.g. Friedberg, 2001; Borjas, 2003) is considered more robust, because it examines the effect of immigration on the natives' wages and unemployment by dividing the host country's labor market by skill groups rather than geographic areas. The rationale is that the mobility within occupations (or education/experience cells) is more restricted than it is across regions.

Time series analyses (see e.g. Morley, 2006) examine the relationship between immigration and some macroeconomic indicators (usually unemployment and GDP) by means of cointegration and causality tests. Since immigrants consider the economic conditions in the destination country, these studies help to identify the direction of causality between the variables under consideration.

Finally, the factor proportions approach (see e.g. Borjas et al, 1997) involves simulation of the impact of immigration on the labor supply and the consequences for wages and employment.

This chapter is structured as follows: Sections 2 to 6 illustrate the empirical methods used to quantify the labor market effects of immigration and discuss the reported evidence. Further, the main advantages and disadvantages of these methods are also discussed.

2. Production Function Approach

This strand of the empirical literature is guided by the neoclassical input demand theory. Such studies estimate a production function, where different labor inputs and capital are considered. The estimated parameters show if the inputs are substitutes or

complements. Using this information, one can then assess the effects from a change on the relative supply of these factors.

Grossman (1982), estimating a translog production function, calculates the partial elasticity of complementarity and factor price elasticity to find out whether natives, second generation natives, immigrants and capital are substitutes or complements.. The Translog production function as given by:

$$\ln Y = \ln a_0 + \sum_i a_i \ln x_i + \frac{1}{2}\sum_i \sum_j \gamma_{ij} \ln x_i \ln x_j \tag{2.1}$$

Under the condition of perfect competition in factor markets, the cost-minimizing behavior of firms implies that:

$$\frac{\partial \ln Y}{\partial \ln X_i} = \frac{\partial Y}{\partial X_i}\frac{Y}{X_i} = \frac{w_i X_i}{Y} = s_i \tag{2.2}$$

where w_i is the price of factor X_i, and s_i is its share on total income. The respective share equations are given by (Hamermesh, 1986):

$$s_i = a_\iota + \sum_j \gamma_{ij} \ln x_i \tag{2.3}$$

Economic theory requires symmetry, such that $\gamma_{ij} = \gamma_{ji}$. Furthermore homogeneity is imposed, that is $\sum_i a_i = 1$ Estimates of technological parameters γ_{ij} are used to calculate two elasticities which measure the impact of foreign labor on the wages of native workers. The first is the partial elasticity of complementarity, C_{ij}, defined as (Hamermesh, 1986):

$$C_{ij} = \frac{YY_{ij}}{Y_i Y_j} \tag{2.4}$$

where $Y_i = \partial Y / \partial X_i$ and $Y_{ij} = \partial^2 Y / \partial X_i \partial X_j$. The partial elasticity of complementarity C_{ij} gives the percentage change in relative price w_i / w_j of inputs i

and j to proportional change in their relative quantity X_i / X_j, holding marginal cost and other input quantities constant. In terms of the Translog production function the partial elasticity of complementarity is given by (Hamermesh, 1986):

$$C_{ij} = \frac{\gamma_{ij} + s_i s_j}{s_i s_j} \qquad \text{for i} \neq \text{j} \tag{2.5}$$

$$C_{ij} = \frac{\gamma_{ij} + s_i^{\,2} - s_i}{s_i^{\,2}} \qquad \text{for i=j} \tag{2.6}$$

If $C_{ij} > 0$, X_i and X_j are q-complements. On the other hand, the inputs are and q-substitutes if $C_{ij} < 0$.

The second elasticity often used is the elasticity, ε_{ij}, of factor price w_i with respect to a change in the quantity of X_j, defined as:

$$\varepsilon_{ij} = s_j C_{ij} \tag{2.7}$$

If $\varepsilon_{ij} > 0$ inputs X_i and X_j are called complements. On the other hand, if $\varepsilon_{ij} < 0$, inputs X_i and X_j are called substitutes.

Grossman (1982) estimates aggregate production relationships utilizing US Census data (1970). Her findings indicate that second generation workers and immigrants substitute for native workers in production. Furthermore, capital is found to be complementary with all types of labor. With regard to the effects of immigration on native wages, the evidence indicates a very small effect. The resulting price elasticities imply that the wages of natives fall only 0.02% and the wages of second generation workers fall only 0.03%, when the supply of immigrants increases 1%.

Bauer (1998), using a cross-section of the German Labor Force Survey from 1990, calculates the Hicksian elasticities of complementarity and the elasticities of factor price for the following six subgroups: native and foreign low-skilled blue collar

workers, native and foreign high-skilled blue collar workers and native and foreign white collar workers. The calculated elasticities show that the impact of immigrants on the wages of natives is negligible. The most negative effect of immigration (0.021) is found for the wages of low-skilled native blue collar workers. The highest positive effect (0.02) is found for the earnings of white collar natives with respect to the quantity of low-skilled blue collar immigrants.

Akbari and Devoretz (1992) estimate the production relationship among Canadian workers, immigrants that entry Canada before 1971, immigrants that immigrated to Canada during 1971 to 1980 and capital, using 1980 data for 125 Canadian manufacturing and non-manufacturing industries. The calculated elasticities and the respective t-ratios suggest insignificant negative elasticities among native workers and both types of immigrant workers. Furthermore, both earlier and recent immigrants affect the employment of natives to the same extent, as the insignificant elasticities are identical. Finally, the insignificant elasticity between earlier and recent immigrants indicates that recent immigrants appear to be complements to earlier immigrants in Canada. However, when the analysis is restricted to those industries with a high concentration of immigrants, the elasticities of complementarity differ significantly. Both recent and earlier immigrants are found to be significant substitutes for the native born workers (elasticity -0.67).

Borjas (1987) uses data from the 1980 US Census of Population to analyze production relationships among white native males, black native males, Hispanic native males, Asian native males, white immigrant males, black immigrant males, Hispanic immigrant males, Asian immigrant males and females. He also uses a

different production functional form, the Generalized Leontief Production Function[31]. The calculated elasticities of factor price are small in magnitude, indicating that immigrants' impact on native earnings is minor. In general, foreign workers appear to be substitutes for white native men and complements for black native men. Finally, it seems that other immigrants are the main competitors of immigrants in the US labor market

Gang and Rivera-Batiz (1994), in contrast to previous studies, use a different strategy to identify production relationships between native and immigrant workers. Instead of considering immigrants and natives as separate inputs in production, they distinguish human capital variables, namely, unskilled labor, experience and education. Workers are paid for the amounts of unskilled labor, education and experience that they provide to their employers. In this framework, an inflow of immigrants affects natives by altering the returns to these human capital variables. The empirical analysis is based on the estimation of a Translog production function, using the 1980 US Census of Population and Euro-barometer data. Evidence from these estimations implies that both in the United States and in Europe, unskilled labor, experience and education are complementary inputs. Concerning the effects of immigration on natives' wages, the largest negative effect is found for Asian immigration in France. French income falls by 0.108% in response to a 1% Asian inflow. More generally, it appears that domestic groups with human capital endowments different from those of the immigrants experience wage increases, whereas domestic groups with similar human capital endowments to those of the

[31] The Generalized Leontief Production Function has the following form: $Q = \Sigma_i \Sigma_j \gamma_{ij} (\mathrm{X}_i \mathrm{X}_j)^{1/2}$. The factor share equations are given by: $r_i = \gamma_{ij} + \sum_{i \neq j} \gamma_{ij} (X_j / X_i)^{1/2}$. Partial elasticities of complementarity are calculated as: $C_{ij} = \frac{\gamma_{ij}}{2(s_i s_j r_i r_j)^{1/2}}$ and $C_{ii} = \frac{\gamma_{ij} - r_i}{2(s_i r_i)}$.

immigrants experience wage reductions. Nevertheless, the authors conclude that employed US and European workers have very little to fear from immigration.

3. Spatial Correlations - Area Analysis

The most commonly employed estimation method of the impact of immigration in the host economy is the so-called spatial correlations (see e.g. Borjas, 1999). This method relates employment opportunities or wages of natives on regional labor markets to the fraction of immigrants in these particular labor markets. To understand the intuition behind the spatial correlations, consider that the destination country consists of two regions, A and B, which have identical labor markets. Furthermore, assume that only region A receives immigrants. Then, using data from both regions, with region B considered as the control region, the spatial correlation allows the researcher to test whether immigration explains the difference in the labor market outcomes of natives. If wages or employment in the region A are lower than in the region B, then one should conclude that immigrants depress the labor market opportunities of natives (Bodvarsson and Van den Berg, 2009)

The majority of the empirical studies in this field estimate a regression model of the following form[32]:

$$Y_{it} = \beta M_{it} + \alpha Z_{it} + u_{it} \tag{2.9}$$

where Y_{it} is a measure of the labor market performance of natives in area *i*, during period *t*, such as wages, unemployment, employment, participation rates, M is the fraction of immigrants in the total population of region *i* during *t*, Z is a vector of

[32] More frequently a first differenced version of equation (2.9) is estimated in (i.e. Altonji and Card, 1991; Pischke and Velling, 1997. First-differencing prevents spurious correlation, since it eliminates location-specific effects that do not vary over time (Friedberg and Hunt, 1995).

other control variables such as population density, share of female workers, share of advanced workers, share of unqualified workers and so on, and u_{it} is the idiosyncratic error term.

Equation (2.9) yields unbiased estimates, if and only if the allocation of immigrants across regions is random. However, this is quite unlikely if immigration is endogenous to local economic conditions, that is, if immigrants settle in areas with favorable economic conditions. This endogeneity problem creates bidirectional causality between the two variables. Hence, the economic conditions influence immigration, while at the same time immigration influences the economic conditions. Hence, the OLS estimations that don't account for such endogeneity tend to report biased estimates of β.

One way to solve endogeneity bias is to use an instrumental variables (IV) approach. In econometrics, a sensible instrumental variable is one which is not correlated with the dependent variable but is correlated is correlated with the suspected endogenous variable. In the literature of immigration, the most commonly employed instrument is the immigrants share with an adequate time lag (i.e. Altonji and Card; Dustmann et al, 2005). The intuition behind this strategy is that immigrants often locate in areas where previous immigrants already live (Bartel, 1989). These previous immigrant networks may provide support to new immigrants and help them to find employment. If this is true, then previous foreign share constitutes a satisfactory instrument for new immigrants.

In one of the most influential studies, Altonji and Card (1991) use the spatial correlation approach to estimate the impact of immigration across 120 Statistical Metropolitan Areas (SMSAs) on the labor market opportunities of less-skilled natives. The estimations are based on US Census data for 1970 and 1980. To control for

endogeneity, they use the stock of immigrants in 1970 as an instrument. In general, the estimated effects of immigration on native employment are modest and ambiguous, while there is some evidence of negative effects on wages. The results indicate, that a 1 percentage point increase in the fraction of immigrants over native population decreases the wage of less skilled natives by at most 1.2 percent

Lalonde and Topel (1991), using data from 119 SMSAs in the US between 1970-1980, examine the wage effects of newly arriving immigrants on natives and previous cohorts of immigrants. The distinctive feature of this study is that different cohorts of immigrants are considered as different inputs in production. The results imply no significant effects on native earnings, while negative effects appear on the earnings of other new immigrants. Furthermore, the impact on the earnings of other immigrants disappears with older immigrant cohorts.

Butcher and Card (1991) analyze the impact of immigrants on earnings of less-skilled workers in the US, using data from the Current Population Survey (CPS) for the years 1979-1980, 1988-1999 and the US Census of Population (1980). The evidence implies no significant effects in the lower tail of the wage distribution, particularly the 10^{th} percentile of wages.

De New and Zimmermann (1994) estimate wage functions for four subcategories of German workers, using data from the 1984-1989 West German Socio-Economic Panel. They distinguish workers between white-collars and blue-collars. The key explanatory variable is the share of foreign labor across industries. Empirical evidence indicates that a 1 percentage point increase in the overall share of foreign labor induces a 4.1 percent reduction in the hourly wage of German workers. When the analysis is carried out to specific native groups the results imply that the wages of blue-collar workers would decline for about 5.9%, whereas the wages of white-collar

workers would increase by about 3.5%. A weighted average of the last results indicates that the overall reduction is about 3.3%, which is somewhat lower than the findings from the complete sample.

Pischke and Velling (1997) examine the impact of immigration on the employment opportunities of natives, in 176 German regions, between 1985 and 1989. Given that the unemployment rate in Germany does not follow a random walk, but it is mean reverting over the period under consideration, the authors conclude the stock of immigrants in 1985 is not a suitable instrumental variable for the German case. Instead, they use previous labor market outcomes as instruments. Their results indicate no significant effects on the unemployment rate of natives.

Winter-Ebmer and Zweimuller (1996) estimate the impact of immigration on the earnings of young male blue-collar workers, using data from the Austrian social Security Records (1988-1991). The endogenous immigrant share is instrumented with the lagged foreign share, the average wage among immigrants, the share of females and the share of blue-collar workers. The results indicate that a one percentage point increase in the immigrant share increases the (log monthly) earnings of young male blue-collar workers by 2.1-3.7 percent. In the second part of their paper, the authors develop a simple bargaining model which is consistent with their empirical findings. In an insider-outsider model, the employment of more immigrants at lower wage creates additional rent which can be shared between the insiders and their employers.

In a second paper few years later, Winter-Ebmer and Zweimuller (1999) analyze the impact of migration on the unemployment probability of native workers, called by the authors as ‘displacement risk’. This study focuses on young native workers below the age of 35 in Austria, using data for the period 1988-1991. They regress, using a probit model, the incidence of unemployment within one year on the immigrant share

in 76 regions or 46 industries of Austria. On the regional level, a one percentage point increase on the foreign share increases the probability of unemployment entry by 0.17 percent. When the analysis is carried out on the industry level, it is found that seasonal and less-skilled workers are vulnerable to increased competition from immigration.

Dustmann et al. (2005) using data from the British Labor Force Survey (1992-2000) investigate the impact of immigration on the labor market opportunities of natives. They estimate their equations using OLS, first differences and Instrumental variables in first differences. The OLS results show a slight positive and significant relationship between employment and the immigrants to total population ratio. First differences and Instrumental Variables estimations switch the sign of the relationship but there is no evidence of significant adverse effect. When the analysis is carried out for different education sub-groups, a modest negative effect is found for native medium-skilled workers.

3.1. Natural Experiments

A second way to address endogeneity is to look at 'natural experiments', that is, immigrant inflows which are exogenous to economic conditions. These migration flows are mainly influenced by political factors on the country of origin or natural disasters. Some examples are the 'Mariel Boatlift' of Cuban refugees to Miami (Card, 1990), the arrival in France of approximately 900,000 people from Algeria (Hunt, 1992) the repatriation of roughly 600,000 Portuguese from Angola and Mozambique, following the independence of those two former colonies in the 1970's, and the large influx of Central American immigrants towards US Southern ports after Hurricane Mitch in the 1980's (Kugler and Yuksel, 2008).

Between May and September of 1980 about 125,000 Cuban immigrants arrived in the Miami after the Cuban President Fidel Castro allowed the emigration of Cubans who wished to do so. This mass influx increased the labor force of Miami by seven percent. Card (1990) analyzed the effects of these Cuban immigrants on the wages and the unemployment rates of less-skilled non-Cuban workers. Surprisingly, the results show no significant effects of immigration either on wages or on unemployment rates of the non-Cuban population. Card argues that the labor market of Miami rapidly absorbed the Cuban immigration without significant effects because its industry was suitable to incorporate the immigrants. In addition, Bodvarsson's et al. (2008) estimations further contribute on understanding why the Boatlift's effects on native wages were benign: The increased demand for local output increased the demand for labor; hence, leaving the wages in Miami unaffected.

In Hunt's (1992) study, the repatriation of Algerians to France increased the French Labor Force by 1.6 percent. Using Census data for 1962 and 1968, she examines the labor market effects of the repatriates on the other population. The empirical results imply that a one percentage point increase in the immigrant share induces a fall in the wage by at most 0.8 percent and a raise in unemployment by 0.2 percent.

In a similar study, Carrington and De Lima (1996) study the labor market effects of the influx of the repatriates from Angola and Mozambique which increased Portugal's labor force by roughly 10 percent. Overall, they found that the repatriates caused some short run unemployment, but in the long run it seems that they had little effect on unemployment.

Finally, Kugler and Yuksel (2008) studied the impact of immigration on the earnings and employment of US native workers and earlier Latin American

immigrants. The authors deal endogeneity exploiting the influx of Central American immigrants after Hurricane Mitch. The results indicate no significant effects on natives, while less-skilled employment of previous Latin American immigrants falls, indicating that recent Latin American immigrants substitute for previous immigrants from this region.

3.2 Native Internal Migration

A second problem of the spatial correlation approach is that natives may respond to the arrival of immigrants by moving in other areas. If natives are indeed mobile, they partly offset the labor supply shock and disperse the impact of immigration through the national economy. Friedberg and Hunt (1995) compare the effects immigration across local labor markets to the water poured in a pool:

"If a bucket of water is poured into the pool, the water level at that particular spot will not be higher than the water level in the rest of the pool. Using a geographic, or cross-sectional, approach would lead to the conclusion that pouring water into a pool does not affect the amount of water it contains. This approach would miss the fact that the overall water level of the pool had risen".

The empirical literature on these native outflows yields conflicting results. For the period 1975-1980, Filer (1992) examines whether immigration in the US induces native internal migration. Using US Census data, he finds that immigration reduced native in-migration while at the same time increased native out-migration. Similarly, Frey (1995) finds increased native out-migration away from California as a response to the arrival of immigrants from abroad. Evidence for native out-migration is also found by Hatton and Tani (2003) in 12 UK regions and Borjas (2005) in the US.

On the other hand, Card and DiNardo (2000) using data on population changes from 1970 to 1990 for 119 US MSAs find no evidence for out-migration of natives. Instead, their results suggest that natives and immigrants are attracted by the same cities. Butcher and Card (1991) analyze the impact of immigrants on the migratory pattern of natives. Their sample includes 24 MSAs. Overall they find that natives do not migrate in other areas as a response to immigration from abroad. However, when New York, Los Angeles and Miami are excluded from the sample, the results indicate that native in-migration is positively correlated with foreign migration. Wright et al**.** (1997) reexamine Frey's specifications and conclude that native outflows from large metropolitan areas are unrelated to immigration from abroad. Similarly, Pischke and Velling (1997) find no evidence of native out-migration in Germany.

4. Skill-cell approach

To avoid the problem of compensating native out-migration, some researchers change the unit of analysis from region to education-experience group or occupation. The rationale behind this strategy is that it is harder for natives to change occupation than to change region in order to avoid increased competition on the labor market. Second, immigrants tend toward high-wage regions, but low-paid jobs, provided that that they can move freely within the country but not within occupations.

One of the first examples of the occupation-level analysis dates back to Friedberg's (2001) study of the impact of Russian immigrants on the Israeli labor market. Using data for the years 1989 to 1994, she estimated her regression model using both OLS and an Instrumental Variables first differenced version. The latter specification exploits information on immigrants' former occupational distribution in

Russia to control for the possible endogeneity. Her OLS regression implies that a one percentage point increase in the foreign share in each occupation group yields a 0.324 percent reduction in the native wage. However, the Instrumental variables regression yielded a negative and statistically insignificant coefficient. It should be also noted that Friedberg used a novel instrumental variable. The classification of immigrants across occupations was based on immigrants' former occupations in Russia.

Card (2001) analyzed the impact of immigrants on the labor market outcomes of natives using an occupation/region based approach. He distinguishes six occupation groups across 175 large U.S. cities. His dataset is a cross-section drawn from the 1990 U.S. Census. The evidence implies that a one percentage point increase in the share of immigrants within an occupation decreases native employment by 0.2 percent at most.

Borjas (2003) suggested the use of nationwide data and defined the labor market as a group of workers with the same level of education and work experience. His data are drawn from the U.S. Censuses of Population from 1960 through 2000 for men aged 18-64. He distinguished male workers into four schooling groups (high school dropouts, high school graduates, those with some college, and those with at least one university degree) and eight experience groups, ending with 32 education/experience skill cells. The evidence from this study indicates that a one percentage point increase in immigration reduces weekly earnings by 0.4 percent.

Orrenius and Zavodny (2007) analyze the impact of immigrants on US wages across occupation defined labor markets using data fro m the Current Population Survey for the period 1994 to 2000. The analysis focus on three occupation groups: professional workers (teachers/doctors), service related workers (sales/service workers) and manual laborers. The use of occupation groups has the advantage over spatially defined markets, that it is less possible for natives to change occupation in

response to immigration. Thus, it is expected that the bias arising from internal migration is not as important as is in the case of labor markets defined by local areas. In order to correct for endogeneity, Orrenius and Zavodny (2007) use a novel instrumental variable, those immigrants married to a US citizen who are either new arrivals in the US or adjusting from a status in which they were not eligible to work legally in the US. These foreign born spouses immigrate for family reunification reasons and settle where their citizen spouse lives. Thus, their location decision is less affected by the wage growth in their reported occupation. Evidence from this study implies that wages in low skilled, blue collar occupations are about 0.8% lower as a result of an 1% increase in the share of foreign workers. In addition, the results suggest that wage effects on the other two, more skilled occupation groups are essentially zero.

5. The Factor Proportions Approach

Because of endogeneity bias and native response to immigration in spatial correlations, Borjas et al. (1992) propose an alternative strategy to identify the labor market effects of immigration, the Factor Proportions Approach. Borjas (1999) summarizes this approach: "The factor proportions approach compares a nation's actual supplies of workers in particular skill groups to those it would had had in the absence of immigration, and then uses outside information on the elasticity of substitution among skill groups to compute the relative wage consequences of the supply shock."

We will present this approach following Borjas (1999). Initially, suppose a linear homogeneous CES production function with two inputs, skilled labor (L_s) and unskilled labor (L_u):

$$Q_t = A_t[aL^{\rho}{}_s + (1-a)L^{\rho}{}_u]^{1/\rho} \tag{2.44}$$

where $\sigma = 1/(1-\rho)$ is the elasticity of substitution between skilled and unskilled labor. Additionally, suppose that the labor supply is perfectly inelastic and the relative wage is determined by the intersection of the labor supply with a downward sloping demand curve:

$$\log(w_{st}/w_{ut}) = D_t - \frac{1}{\sigma}\log(L_{st} - L_{ut}) \tag{2.45}$$

where D_t is a relative demand shifter. The aggregate supply of skill group j at time t is composed of native workers (N_{jt}) and immigrant workers (M_{jt}):

$$L_{jt} = N_{jt} + M_{jt} = N_{jt}(1+m_{jt}) \tag{2.46}$$

with $m_{jt} = M_{jt}/N_{jt}$. Equation 2.45 can be rewritten as:

$$\log(w_{st}/w_{ut}) = D_t - \frac{1}{\sigma}\log(N_{st} - N_{ut}) - \frac{1}{\sigma}[\log(1+m_{st}) - \log(1+m_{ut})] \tag{2.47}$$

If there is an estimation of the relative wage elasticity, the impact of a labor supply shock induced by immigration on the relative wage of skilled and unskilled labor is given by:

$$\Delta\log(w_{st}/w_{ut}) = -\frac{1}{\sigma}[\Delta\log(1+m_{st}) - \Delta\log(1+m_{ut})] \tag{2.48}$$

Borjas et al. (1997) calculate the impact of immigration on the relative wages between 1980 and 1995. Treating all persons of 1979 residing in the USA as natives, the log gap in brackets of equation 2.18 is 0.149. According to Borjas et al. (1992) the relative wage elasticity for skilled and unskilled labor is -0.322. By equation 2.18 it is

then computed that immigration reduces by 4.8 percentage points the relative wage of unskilled natives.

6. Time Series Analyses

Withers and Pope (1985) analyze the causal relationship between immigration and unemployment in Australia, using quarterly time series data for the period 1964:2-1982:1. The causality analysis in this paper was unable to find any association running from immigration to unemployment. Instead, there was strong evidence of a significant effect of unemployment on migration. According to the authors, these results imply that immigrants created at least as many jobs as they filled.

Similarly Pope and Withers (1993) using data for the years 1861-1991 find no evidence of any association between immigrants and native unemployment in Australia.

Marr and Siklos (1994), test for causality between migration and unemployment in Canada, using quarterly time-series data for the period 1962-1990. The results of this study imply that current increases in the unemployment rate reduced future immigration rates before 1978. However, after 1978 they find a positive association between past immigration and current unemployment.

Shan et al (1999) used the Granger non causality procedure to investigate whether there is a causal linkage between immigration and unemployment in Australia and New Zealand. Their dataset is quarterly time series for the years 1983:3 and 1995:4. The evidence suggests no Granger causality between the variables under consideration. Hence, the authors conclude that their results do not support the argument that immigrants displace Australians and New Zealanders from jobs.

Gross (2002) investigates the effects of immigration on the unemployment rate in France. Using time-series data for the years 1975-1994 and a system of four equations for unemployment, migration, prices and real wage, it is shown that in the short-run the arrival of immigrants increases the unemployment slightly. However, in the long-run immigrants lower the unemployment permanently, meaning that the number of jobs created by additional demand from immigrants is greater than those they occupy.

Similarly, Gross (2004) analyzes the impact of immigration in British Columbia, one of the most attractive regions of Canada for most of immigrants. The results show that the arrival of immigrants increases unemployment in the short-run. Nevertheless, it is found that in the long-run immigrants contribute to lower unemployment rates.

Feridun (2004) using data for the period 1982-2002 analyze the causal relationship among immigration, unemployment and GDP per capita in Finland. Evidence from the Johansen cointegration test indicates that there exists a stable long run relationship between the variables under consideration. The results of Granger causality tests show that immigration granger causes per capita income and unemployment at 5% significant level. On the other hand, results show no evidence for reverse causality.

Feridun (2007) investigates the causal relationship between immigration and two macroeconomic indicators, GDP per capita and unemployment, in Sweden using the ARDL testing procedure, proposed by Pesaran et al. (2001), and the Granger causality test, based on annual data over the period 1980-2004. Evidence from the ARDL cointegration technique, suggests the existence of a long run relationship among the variables under consideration. Results from the Granger causality tests support the existence of long run bidirectional causality between immigration and GDP per

capita. On the other hand, evidence suggests that unemployment causes immigration but not vice versa.

Morley (2006) investigates the causal relationship between immigration and per capita GDP for Australia, Canada and the United States using annual data for the period 1930 to 2002. Results from the ARDL bounds testing approach suggest that there is a stable long run relationship that runs from GDP to immigration but not vice versa. Thus, Granger non-causality tests are carried out only for the case where causality runs from per capita GDP to immigration. For all three countries, the Granger test indicates a long run causality running from GDP to immigration. According to the author, these results offer little support to the view that that immigration has an important causal effect on per capita economic growth, as suggested in the Solow-Swan model. On the other hand, evidence suggests that immigrants are attracted to the host country by the prospect of higher wages produced by the greater economic growth.

Boubtane et al (2011) using annual data over the period 1980-2005 for 22 OECD countries found that the interaction between immigration and economic activity depends on the host country. More precisely, they found that in six countries (Australia, Denmark, Greece, Portugal, Netherlands and Spain) unemployment negatively Granger causes migration, while in any country, migration does not Granger cause unemployment. On the other hand the results imply that in three countries (Iceland, Norway and United Kingdom) per capita income positively Granger causes migration, while no evidence of reverse causality is found.

Finally, Gonzalez-Gomez and Giraldez (2011) found bidirectional causality between immigration and per capita GDP in Germany. On the other hand, no evidence of long-run relationship is found for Switzerland. According to the authors,

the difference in the results is indicative that the Swiss immigration was more restrictive.

7. Conclusions

In this chapter we surveyed the empirical methods which are used to estimate the labor market effects of immigration on the destination country. The empirical literature begins with Grosmann's seminal – production function approach – in 1982. Nevertheless, the most commonly employed method is the so-called spatial correlation method. Despite its popularity among the researchers, the spatial correlation approach yields biased results if immigrants endogenously settle across local labor markets or if natives move away in response to the arrival of immigrants. Most studies control for endogeneity using an instrumental variables approach. Another solution is to look at natural experiments, i.e. immigrants motivated by political rather than economic factors.

The last few years, the so-called skill cell approach has been increasingly applied by many researchers. It is widely believed that this method yields more robust results. The rationale behind this belief is that it is harder for natives to change occupation than to change region, in order to avoid increased competition on the labor market. Second, immigrants tend toward high-wage regions, but low-paid jobs, provided that that they can move freely within the country but not within occupations.

Taking the stock of the existing evidence, we can argue that the widely held view that immigration has large adverse effects on native born does not seem to be confirmed. A notable exception is a recent study by Borjas (2003) which reports large adverse effects on the wages of less-skilled natives.

Appendix

Table 2.1 Summary of the results from the empirical literature

Study	**Country**	**Methodology**	**Impact of immigration on:**	**Main Results**
Altonji and Card (1991)	USA	Cross-Sections, First-Differences with IV (1970-1980)	Employment, Participation and weekly earnings of less skilled natives	Insignificant effects on employment and participation. Wages:-1.2%
LaLonde and Topel (1991)	USA	First-Differences (1970-1980)	Wages of natives and previous immigrants	No effects for natives. Negative effects for previous immigrants
De New and Zimmermann (1994)	Germany	Random effects with IV (1984-1989)	Hourly wages of blue and white collar native workers	Wages of blue collar workers:-5.9% Wages of white collar workers: +3.5%
Borjas et al. (1996)	USA	Cross-Sections, First-Differences (1980-1990)	Weekly earnings of natives	Mixed results.
Winter Ebmer and Zweimuller (1996)	Austria	First-Differences (1988-1991)	Monthly earnings of native blue collar workers	Negative effects for immobile workers
Schoeni (1997)	USA	Cross-Sections, First-Differences with IV (1970-1990)	Employment, participation and annual earnings of native workers	More negative effects on less skilled natives
Pischke and Velling (1997)	Germany	First-Differences with IV (1985-1989)	Employment, Unemployment of native workers	Insignificant effects on employment. Unemployment: +1.98%
Camarota (1998)	USA	Cross-Section (1991)	Wages of native workers	Wage:-0.5%
Winter Ebmer and Zweimuller	Austria	Random effects panel probit model (1988-	Unemployment entry of young native male	Greater effects for seasonal workers

(1999)		1991)	workers	
Card (2001)	USA	Cross-Section (1990)	Employment and wages of natives	Employment:-1%. Wage:-1%
Friedberg (2001)	Israel	Pooled cross-sections, 2SLS with IV (1989-1994)	Hourly wage of natives by skill groups	Positive but insignificant effect on low-skilled. Positive and significant effect on high-skilled
Addison and Worswick (2002)	Australia	Panel Data, IV (1982-1996)	Real wages of natives	Insignificant effects
Venturini and Villosio (2002)	Italy	Pooled cross-sections probit model (1993-1997)	Probability of unemployment entry	Insignificant effects
Borjas (2003)	USA	Panel Data, Fixed effects (1960-2000)	Weekly and annual earnings of native workers	Annual earnings:-0.9% Weekly earnings:-0.5%
Hofer and Huber (2003)	Austria	Multinomial logit, First-Differences (1991-1994)	Wages, probability of unemployment entry	Wages:-0.2% Immigration increases the probability of unemployment entry for blue collar workers
Angrist and Kugler (2003)	EU	Panel Data, Fixed effects, IV (1983-1999)	Employment rate of native workers	Estimations range from -0.02 to -0.07 percent
Lianos (2003)	Greece	Panel Data, 2SLS (1998-2001)	Participation and unemployment by sex groups	Insignificant effects for male workers. Positive and significant impact on female participation
Kung (2005)	Swiss	Fixed effects, 2SLS Panel Data model (1993-2000)	Annual gross earnings of natives	Insignificant impact
Johansson and Weiler (2005)	USA	First-Differences (1994-1999)	Wage inequality between skilled and	Positive and significant impact

			unskilled native workers	
Bonin (2005)	Germany	Panel Data Fixed effects (1975-1997)	Gross daily wages and native unemployment	Wage:-0.15% Stronger effects for less qualified and older workers. Insignificant effects on unemployment
Dustmann et al. (2005)	UK	Panel Data, First-Differences and IV (1983-2000)	Employment, unemployment, participation and hourly wages of natives	Overall insignificant effects. Evidence for substitutability between immigrants and medium skilled natives
Orrenius and Zavodny (2007)	USA	Fixed effects with IV (1994-2000)	Wages by occupation group	Wage of manual workers:-0.03% No significant effects for service and professional laborers
Jean et al (2007)	OECD	Panel Data, Fixed Effects, GMM (1984-2003)	Unemployment	No significant long run impact. Immigration only temporary raises unemployment. Anticompetitive product market regulations, higher unemployment benefits and more stringent employment protection increase this impact
Galloway and Jozelowicz (2008)	Netherlands	Panel Data, First-Differences (1996-2003)	Natives' unemployment	Unemployment:+0.04%
Carrasco et al. (2008)	Spain	Panel Data, Fixed effects with IV (1991-2001) Cross-section (2002)	Natives' employment and hourly wages	At most -0.2%
Nickell and Saleheen (2008)	UK	Panel Data, Fixed effects (1992-2006)	Real wages of natives across occupational groups	Small effects for most categories. Stronger effects for Semi/unskilled sectors
Kifle (2009)	Australia	Cross-section (2001)	Weekly earnings of natives	Wages:+0.15%
Staffolani and Valentini (2009)	Italy	Fixed effects (1994-2004)	Daily wages of natives	Positive impact for high skilled. Mixed results for low skilled

PART B

Chapter 3

Are immigrants competing with natives in the Greek labor market?

1. Introduction

Do immigrants and natives compete for the same jobs into the labor market? This issue has become one of the most heatedly and publicly debated issues. Today immigration flows are towards the Southern European Countries, like Greece. These countries became an immigrant destination. Since the collapse of the former communist regimes in the 1990s, Greece has experienced a continuously increasing influx of immigrants, mainly from the neighboring Balkan countries and especially from Albania. According to the Census of Population (2001), foreign population is estimated at 797,000 or about 7% of total population. Today, the immigrants' share on native population is estimated at about 10%. Greece was unprepared to accept this enormous increase of labor supply and the question about the effects of immigration on natives' labor market outcomes is crucial.

As far as the country of origin is concerned, more than half of immigrants (57%) come from the neighboring country, Albania[33]. More than 80% of immigrants are either unskilled or medium skilled and they are generally employed in non-qualified jobs. Most of immigrants are concentrated in Attiki (54%), which is characterized by the high concentration of economic activity and low unemployment rates[34]. Hence, it seems that immigrants' settlement decision is driven by the prospect of higher

[33] Census of Population (2001).
[34] In 2008 the unemployment rate in Attiki (6.2%) was below the national average (7.9%) by 1.5 percentage points.

employment opportunities. The lowest concentration of foreigners is observed in Northern Aegean (0.8%) and Western Macedonia (0.7%).

Table 3.1 Foreign share and regional unemployment rates

Region	Immigrants (In thousands)	%	Foreign share %	Unemployment rate, %
Attica	284,368	53.6	10.6	6.2
Central Macedonia	72,057	13.6	5.7	8.4
Sterea & Evoia	29,937	5.6	8.4	8.7
Crete	26,406	5.0	6.9	5.3
Peloponnesus	25,810	4.9	6.9	7.4
Thessaly	21,402	4.0	4.5	7.4
Western Greece	17,074	3.2	3.6	9.6
Eastern Macedonia	14,758	2.8	3.9	8.5
Ionia	11,915	2.2	8.3	9.1
Southern Aegean	9,651	1.8	4.9	7.1
Epirus	8,845	1.7	4.0	9.2
Northern Aegean	4,507	0.8	3.7	3.6
Western Macedonia	3,536	0.7	1.9	12.4

Source: Own calculations, Greek Labor Force Survey 2008.

While there is a large number of empirical studies concerning the labor market effects of immigration for the US and other European countries, most of the literature for Greece is either descriptive or simulation based[35]. Concerning the impact of immigration on the unemployment of Greeks, most of the researchers support that immigration doesn't increase the unemployment rate of the native population. Moreover, they argue that immigrants are employed in jobs which are not preferred by the Greeks[36].

Lianos et al (1996) using data from four prefectures of Northen Greece, found that there is a small substitution of native workers by immigrants. According to the authors, the fact that immigrants' wages are lower than those of equally productive natives is the most important reason why employers seem to prefer immigrants to

[35] See Cholezas and Tsakloglou (2008) for a survey of the literature dealing with immigration in Greece.

[36] See Fakiolas and King, 1996; Iosifidis and King, 1998; Fakiolas, 1999; Labrianidis and Lyberaki, 2001; Chletsos et al, 2005.

Greeks. Lianos (2003), using longitudinal data over the period 1999-2003, found no significant effects of immigration on natives' unemployment rates. On the contrary, the reported evidence implies that immigration is associated with higher participation rates of native women. On the other hand, Sarris and Zografakis (1999) calculated that about 50,000 natives had lost their jobs because of incoming foreign labor.

As explained in chapter 1, the impact of immigrants on the employment opportunities of natives is ambiguous. There are multiple channels through which immigration affects the labor market of the destination country. The supply effect of immigration tends to reduce the employment outcomes of competing natives. On the other hand, migration benefits complement native factors of production. Nevertheless, there is a set of long-run adjustments – such as demand effects, capital mobility, native outflows, changes in output mix and technological adjustments - which mitigate the short-run adverse effects of migration. Furthermore, the impact of migration on the employment of natives depends on the degree of the labor market flexibility. The more flexible the wages, and the more inelastic the labor supply are, the less will be the change in the employment of natives.

The purpose of this chapter is to fill the gap concerning the empirical evidence of the effects of immigration on the labor market opportunities of natives in the Greek case. This chapter is structured as follows:

First, we analyze the impact of immigration on the unemployment of natives, using annual data for 13 Greek regions[37], over the period 1988-2008. The data are drawn from the Greek Labor Force Survey (LFS). The method used is the so-called spatial correlation approach (see Borjas, 1999)[38]. Since immigrants – in their majority – are unskilled, they compete most heavily with unskilled natives for jobs.

[37] Attiki, Central Macedonia, Sterea & Evoia, Crete, Peloponnesus, Thessaly, Western Greece, Eastern Macedonia, Ionia, Southern Aegean, Epirus, Northern Aegean, Western Macedonia.
[38] The spatial correlation approach is discussed in more detail in chapter 2.

Furthermore, immigrants are possible complements with high skilled native workers. For this reason, we investigate the impact of immigrants on the unemployment rate of low, medium and high skilled native workers.

Second, we analyze the effect of immigration on two alternative aspects of the native unemployment: a) displacement risk, measured by the probability of moving from employment to unemployment and b) job – search effectiveness measured by the probability of moving from unemployment to employment within one year. The data-set is a cross-section from the LFS (2009).

Finally, we exploit occupational information from the Greek LFS (2003-2008) to analyze the impact of immigration on natives' wages. Conclusions are discussed in the final section of the chapter.

2. The impact of immigration on unemployment: Data and Empirical Specification

The data used to analyze the impact of immigration on native unemployment rate are from the Greek Labor Force Survey (LFS) and the variables are measured at the regional level for the years 1988-2008. The benchmark regression equation is a typical equation used in spatial correlation approach:

$$Y_{it} = M_{it}\beta + \mathrm{X}_{it}\gamma + \lambda_i + v_i + u_{it} \qquad (3.1)$$

where Y_{it} denotes the unemployment rate of natives, M_{it} is the key explanatory variable, the ratio of immigrant to total population, and X_{it} is a vector of regional explanatory variables. Finally, equation (3.1) also includes region, λ_i, and time, v_i dummies to control for unobserved heterogeneity and common time effects.

Our empirical specification follows Pischke and Velling (1997). As potential determinants of the unemployment rate we employ the following four variables. First,

we use two native skill group variables: the share of low (*edul*) and medium (*edum*) skilled natives (between 18-64 years old), the female participation rate (*female*) and the fraction of the labor force over age 45 (*old*). Medium education level is equivalent to a high school or vocational school diploma, while low education level is equivalent to an elementary school diploma. The expected signs for the education variables (*edul, edum*) are ambiguous. Workers with low or medium education level may have more or less chances to find a job, and this depends on the relative demand for skills in the labor market. The sign of the variable *old* is also ambiguous. Although the unemployment rate among older workers is lower than it is for their younger counterparts, older persons who become unemployed spend more time searching for a job. Finally, the sign for *female* is also ambiguous and it depends on whether females have high or low unemployment rates. In addition, it is also uncertain whether or not females are substitutes or complements to males in the labor market.

As we explained in chapter 2, OLS estimation of equation (3.1) - i.e. without including for region dummies - yields biased results because of two reasons. First, because the regression omits to control for characteristics that are unique to the local labor market, or what it is called (region specific) fixed effects. Second, because immigrants tend to settle where labor markets are strong; hence immigration is affected by local economic conditions. This endogeneity creates the problem of simultaneity bias. Better employment opportunities influence immigration while at the same time immigration influences the employment.

The usual strategy in the literature of immigration is to first differencing the data. The differencing purges the equation of the fixed effect and any potential bias arising from it (see e.g. Altonji and Card, 1991; Dustmann et al 2005). Second, if immigrants choose their location based upon the level of unemployment but not on foreseen

changes in it, the endogeneity problem may be circumvented using differenced data (see Friedberg and Hunt, 1995). A more robust way to address endogeneity is to use a first difference strategy with instrumental variables (Dustmann et al, 2005). In addition, the vector of covariates X_{it} may also be endogenous. For example, the female labor force participation may depend on the unemployment rate. Hence, we choose to instrument the immigrant's share and the other right hand variables in equation (3.1) with two period lags. This latter estimator is calculated using the Blundell and Bond (1998) GMM method[39].

2.1 Results: The impact on native unemployment

Table 3.2 reports four different estimates of the effect of immigration on native unemployment. More precisely, we report results using the OLS estimator, a first-differenced estimator, a Random effects estimator and an Instrumental Variables estimator in differences. The second column of each specification includes a set of time effects. The use of an F-test implies the rejection of the null hypothesis of joint insignificance of the time dummies at the usual significance levels. Tests are also reported for first and second order autocorrelation of residuals and overidentifiying restrictions, for both IV estimates. As it is expected, there is evidence of first order serial correlation, while second order serial correlation is rejected. Finally, the Sargan test implies that the selected instruments are exogenous.

OLS regression shows a negative and significant effect of immigration on unemployment. Removing fixed effects by first differencing, the sign of the relationship is switched. Immigration is now associated with an increase in unemployment. However, the impact is far from being statistically different from

[39] The GMM estimator is calculated in STATA using xtabond2 (Rodman, 2009)

zero. Random effects suggest a negative association between immigration and unemployment. Nevertheless, the effect is no longer statistically significant when time dummies are included in the model. Combining first differences with instrumental variables, the GMM estimations in columns (7) and (8) imply that the hypothesis of no effect of immigration can not be rejected. Summarizing the results from Table 3.2 we can conclude that immigration does not significantly affect the natives' unemployment. Furthermore, even in the short-run - given that the first differenced estimations reflect the short-run effect of immigration - we fail to detect adverse effects on the employment opportunities of natives. These results are in line with the empirical evidence for other immigration countries (e.g. Altonji and Card, 1991; Pischke and Velling, 1997; Dustmann et al, 2005). Nevertheless, the results do not confirm the theoretical arguments, shown in chapter 1, that it is more likely that immigration will deteriorate the employment opportunities of natives in the short-run.

Focusing on the other explanatory variables, we observe that the fraction of unskilled natives has a negative sign, while the fraction of the intermediate group a positive sign. These findings indicate that the local labor demand keep up pace with unskilled labor supply, while at the same time increases of the medium skilled labor force are associated with higher unemployment rates. On the other hand, the variables *Old* and *Female* are in general not statistically different from zero.

Table 3.2: The impact of immigration on unemployment, LFS 1988-2008

	OLS		First-Differenced		Random Effects		First-Differenced (IV)	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Independent Variable								
IMM	-0.372***	-0.312***	0.067	0.098	-0.207***	-0.049	-0.115	-0.069
	(0.090)	(0.099)	(0.072)	(0.080)	(0.076)	(0.084)	(0.070)	(.071)
Edul	-0.737***	-0.371**	-0.679***	-0.445**	-0.699***	-0.484***	-0.183**	-0.193
	(0.089)	(0.163)	(0.171)	(0.182)	(0.067)	(0130)	(0.084)	(.128)
Edum	1.179***	0.103	1.572***	1.568***	1.882***	1.533***	0.433	0.309
	(0.427)	(0.608)	(0.509)	(0.564)	(0.364)	(0.545)	(0.349)	(0.462)
Old	0.030	-0.038	-0.250***	0.101**	0.008	-0.112**	0.003	-0.000
	(0.050)	(0.031)	(0.060)	(0.043)	(0.047)	(0.062)	(0.038)	(0.024)
Female	0.011	-0.040	0.083***	-0.356***	0.073	0.093**	-0.009	0.032
	(0.024)	(0.065)	(0.025)	(0.094)	(0.025)	(0.039)	(0.018)	(0.049)
Time effects	No	Yes	No	Yes	No	Yes	No	Yes
Sample Size	273	273	260	260	273	273	247	247
R^2	0.287	0.366		0.268	0.240			
F		1.60*		1.79**		30.25***		33.70**
S							0.831	0.555
LM(1)							0.000	0.000
LM(2)							0.379	0.160

Notes: ***,**,* denote statistical significance at 1%,5%,10% significant levels. White Standard Errors are in parentheses. F is an F-test for the inclusion of the time dummies. S is the probability of the Sargan test for overidentifying restrictions. LM(1) is a first order serial correlation test. LM(2) is a second order serial correlation test. Two period lagged values of all right-hand side variables in eq. (3.2) are used as instruments in columns (7) and (8). The Hausman test indicates that the Random effects estimator dominates the Fixed effects estimator.

Table 3.3 reports results for native workers in different education groups. The reported results are obtained from the IV estimator. The F-test rejects the null hypothesis of no year effects, so the second column is considered more reliable. The impact of immigration on the unemployment rate of unskilled natives is not significant either in column (1) or in column (2). for the unskilled and negative for the medium and high skilled. The estimated coefficients are not statistically different from zero at the conventional significant levels. Regarding the impact of immigration on the unemployment rate of medium and high-skilled natives, we observe that the specifications without time dummies imply significant and complementary effects of immigration. Nevertheless, the coefficient of immigration is no longer significant when we control for year effects.

Table 3.3: The impact of immigration on unemployment by education group, LFS 1988-2008

	Unskilled		Medium-skilled		Skilled	
Independent Variable	(1)	(2)	(3)	(4)	(5)	(6)
IMM	-0.024	0.013	-0.258**	-0.159	-0.195*	-0.100
	(0.081)	(0.070)	(0.129)	(0.121)	(0.105)	(0.098)
Edul	-0.213**	-0.210	-0.032	-0.008	-0.329***	-0.123
	(0.081)	(0.131)	(0.134)	(0.214)	(0.117)	(0.175)
Edum	0.493	0.342	0.311	-0.428	0.790	0.088
	(0.353)	(0.469)	(0.622)	(0.776)	(0.518)	(0.637)
Old	-0.013	-0.009	0.096	0.051	0.160***	0.053
	(0.039)	(0.051)	(0.070)	(0.084)	(0.059)	(0.069)
Female	-0.012	0.000	-0.044	-0.006	-0.005	0.003
	(0.019)	(0.024)	(0.034)	(0.040)	(0.027)	(0.032)
Time effects	No	Yes	No	Yes	No	Yes
Sample Size	247	247	247	247	247	247
F		34.29**		77.46***		97.65***
S	0.898	0.698	0.760	0.646	0.324	0.302
LM(1)	0.000	0.000	0.000	0.000	0.000	0.000
LM(2)	0.762	0.169	0.351	0.748	0.709	0.213

Notes: ***,**,* denote statistical significance at 1%,5%,10% significant levels.Standard Errors are in parentheses.F is an F-test for the inclusion of the time dummies. S is the probability of the Sargan test for overidentifying restrictions. LM(1) is a first order serial correlation test. LM(2) is a second order serial correlation test. Two period lagged values of all right-hand side variables in eq. (3.2) are used as instruments.

3. The impact of immigration on the probability of unemployment entry and job search effectiveness: Data and Empirical Specification

As far as the impact of immigration on displacement risk is concerned, we use a cross-sectional[40] data from the Greek LFS (2009). A key question contained in this survey, is about whether each individual was employed in the previous year. The answer to this question is used to quantify native movements from employment to unemployment and vice versa. Displacement risk occurs to employed workers who can be displaced by foreign workers. Job search can also be affected by immigration, because immigration may reduce the probability of natives to find a job (Winter-Ebmer and Zweimuller, 1999; Venturini and Villosio, 2002).

As an indicator of displacement risk, we use the probability of moving from employment (E) to unemployment (U) within one year (December 2008 until December 2009). Similarly, as an indicator of job-search effectiveness, we use the probability of moving from unemployment (U) to employment (E) within one year. These indicators give a picture of first-round effects of immigration on employment stability. In the long-run, the employment effects should be smaller, provided that there is some flexibility on wages or some regional mobility of workers (Winter-Ebmer and Zweimuller, 1999).

Since immigrants cannot compete with natives in the public sector and given that self-employed do not generally report their earnings, we omit these categories. Hence, the sample includes 17,500 individuals, 15,551 of whom were employed in 2008 and 1,949 were unemployed. On December (2009) 534 individuals from the pool of

[40] A panel data analysis requires at least two observations per individual. Unfortunately, there is no information indicating that an individual was also included in previous surveys. In addition, panel data analysis implies a selectivity problem, since it requires individuals with more stable employment career (Winter-Ebmer and Zweimuller, 1999).

unemployed (on 2008) answered that they lost their work, while 491 unemployed individuals (on December, 2008) found a new job.

The empirical model can be written as follows:

$$Y^*_{ir} = X_i a + M_r + u_{ir} \tag{3.2}$$

$Y_{ir} = 1$ if $Y^*_{ir} \geq 0 \leftrightarrow$ Transition from E (U) to U (E)

$Y_{ir} = 0$ if $Y^*_{ir} \prec 0$

Y indicates the transition probabilities from employment to unemployment of the individual i in region r. Y^* is a latent variable which is not observed whereas its sign is. X_i is a vector of individual characteristics such as age, age squared, level of education, gender and marital status. Finally, M is a vector denoting the share of immigrants in $i's$ region. Assuming that the error term u_{ir} is standard-normally distributed, equation (3.2) specifies a probit model[41]. The analysis is carried out for seven different sub-groups of natives, namely, men, women, skilled, medium-skilled, unskilled, young and old workers[42].

As mentioned earlier in the chapter, estimation of equation (3.2) yields biased results if the foreign labor supply is driven by the labor market conditions of an area. We test for endogeneity following Blundell and Smith (1986) methodology for probit regressions. At the first stage, we regress the foreign share on two variables which are chosen to instrument it, the lagged immigration share and the average wage of immigrants. Then the residual series from this estimation is included in the probit equation (3.4)

[41] Since there is not any theoretical model which dictates the use of probit or the logit model, we report the results based on the former model as Winter-Ebmer and Zweimuller (1999) and Venturini and Villosio (2002). Nevertheless, estimations assuming a logistic distribution of the error term in equation (3.2) provide quite similar results.

[42] Foloowing Venturini and Villosio (2002) young workers are considered those aged below 35 and old those above 35.

$$M_{ir} = \gamma z_r + e_r \tag{3.3}$$

$$Y^*_{ir} = \mathrm{X}_i \alpha + e_r \phi + u_{ir} \tag{3.4}$$

where e_r are the error terms from equation (3.3). The null hypothesis of exogeneity is that the coefficient ϕ of the residual series is statistically equal to zero.

3.1 The impact on natives' unemployment entry

The estimates of equation (3.2) are summarized in Table 3.4[43]. The first column refers to a probit analysis without regional dummies. The second column controls for regional fixed effects by including 12 regional dummies. The likelihood ratio test (see appendix) rejects the hypothesis of no regional effects for the sub-samples of the groups *All*, *Women*, *Skilled* and *Old*, so the second column is considered more reliable. On the other hand, for the remaining groups, *Men*, *Unskilled*, *Medium-skilled* and *Young*, the first column is considered more reliable. In addition, the results of the Blundell and Smith (1986) test suggest that there is no evidence of endogeneity[44]. Before discussing the effect of immigration, it is interesting to discuss the sign of the other exogenous covariates. Generally, the likelihood of losing a job is lower for men, married, men with tertiary education and it fails with experience. On the other hand, the probability of unemployment has no significant correlation with education of women and the experience of skilled natives.

As far as the impact of immigration is concerned, the estimated coefficient – for the whole sample of natives - indicates a weak (but significant) negative effect of the immigrant share. The marginal impact of a 1% percent increase in the immigrant share decreases the probability of unemployment entry by 0.002%. As far as the

[43] In this section we focus on the effects of immigration. The full set of results is reported in the appendix.
[44] See Panel A of Table 3.10 in the Appendix.

impact of immigration on different education and demographic groups is concerned, the picture remains the same. Except for the Medium-skilled and the Young, the immigrant share is negative and significant, indicating that immigrants are complement with most native groups. Nevertheless, the estimated marginal effects are small in magnitude.

Table 3.4: The impact of immigration on the probability of native workers losing their job, Marginal effects

	Without dummies	Including dummies
All	-0.001**	-0.002***
	(0.000)	(0.001)
Men	-0.001*	-0.001*
	(0.001)	(0.001)
Women	-0.002**	-0.003***
	(0.001)	(0.001)
Unskilled	-0.003*	-0.001
	(0.002)	(0.002)
Medium-skilled	-0.001	-0.003**
	(0.001)	(0.001)
High-skilled	-0.001	-0.002**
	(0.000)	(0.001)
Young	-0.001	-0.002
	(0.001)	(0.002)
Old	-0.001**	-0.002***
	(0.000)	(0.001)

Notes: Standard errors are show in the parentheses below the estimated marginal effects. High-skilled: University degree. Medium-skilled: Secondary level of education. Unskilled: Primary level of education. Young: below 35 years old. Old: 35 years old and above.

3.2 The impact on natives' job search

Similarly to the previous section, the probit regression is replicated for the unemployed who seek a job. Again, the full set of results is reported in the appendix. The likelihood ratio test rejects the null hypothesis of no regional effects in all specifications except for young natives. The Blundell and Smith (1986) test strongly rejects the existence of endogeneity[45]. Among the control variables included in

[45] See Panel B of table 3.10 in the Appendix.

equation (3.2), married, male, High-skilled and Medium-skilled natives have more probabilities to find a job. On the other hand, in most specifications, age and experience have no significant effects on the probability of finding a job.

Considering the impact of immigrant share, it is found that immigration lowers the probability of finding a job. The marginal impact of 1% point increase in the immigrant share decreases the likelihood of finding a job by 0.011% points. Looking for the effect of immigration on different native groups, the results suggest that there is competition between immigrants and Men, Unskilled and Old natives.

Surprisingly, it is also found that immigrants lower the likelihood of skilled unemployed to find a job. It is likely that the presence of unskilled immigrants favors the adoption of low skilled, labor intensive production methods that makes less possible for skilled unemployed to find a job. Moreover, immigration may also induce skill upgrading of natives (see e.g. Fuest and Thum, 2001). If natives become more educated and skilled with the expectation that they would avoid competing with unskilled immigrants in the labor market, it is likely – in the short-run - that the increase in the supply of skilled workers would not keep in pace with the demand for skilled labor.

Taking into consideration the estimations for both the employed and the unemployed, we observe that immigrants compete with most groups of the unemployed natives and complement with most groups of the employed natives. Hence, it seems that the group which is most at risk is the group of the unemployed natives (*outsiders*). On the other hand, the employment opportunities of native *insiders* to unemployment do not become worse because of immigration.

Table 3.5: The impact of immigration on the probability of the unemployed natives of finding a job

	Without dummies	Including dummies
All	-0.006*	-0.011**
	(0.003)	(0.005)
Men	-0.016***	-0.024***
	(0.006)	(0.009)
Women	0.000	-0.004
	(0.004)	(0.006)
Unskilled	-0.019***	-0.037***
	(0.006)	(0.009)
Medium-skilled	0.003	0.003
	(0.005)	(0.007)
High-skilled	-0.013**	-0.021**
	(0.006)	(0.010)
Young	-0.004	-0.009
	(0.005)	(0.008)
Old	-0.007	-0.012**
	(0.004)	(0.006)

Notes: As in Table 3.4

4. The impact of immigration on wages

In his influential study, Borjas (2003) quotes Paul Samuelson's (1964) assertion that:

"After World War I, laws were passed severely limiting immigration. Only a trickle of immigrants has been admitted since then … By keeping labor supply down, immigration policy tends to keep wages high".

Nevertheless, Borjas (2003) concludes that: "although the textbook model of the competitive labor market predicts that an immigrant influx should lower the wage of competing factors … the measured impact of immigration on the wage of natives fluctuates widely from study to study (and sometimes even within the study), but seems to cluster around zero".

Some researchers – one of them is Borjas – argue that the empirical literature does not detect large adverse effects of immigration on natives' earnings because it failed to account for endogeneity and native internal migration in response to the

arrival of immigrants in a particular city. In the last few years, some attempts have been made to identify the impact of immigration on the labor market of the destination country, using a new strategy, the so-called skill-cell approach. This method typically changes the unit of analysis from region to occupation or skill/experience groups. The rationale behind the skill-cell approach is that it is harder for natives and immigrants to move freely between occupations or skill-cells than it is between regions.

To the best of our knowledge, one of the first attempts dates back to Friedberg's (2001) occupational level analysis of the Russian migration on the labor market of Israel. Another example is Card's (2001) occupation-region based analysis for the US. Nevertheless, neither Friedberg nor Card managed to detect significant effects of immigration. Borjas (2003) suggested an analysis based on data at the national level and therefore robust to out-migration and other ways of adjustment of local labor markets. His results are amongst the most negative in the literature. More precisely, the evidence implies that a 10% increase in the immigrant share reduces the wages of native workers by 3-4%. Given that between 1980 and 2000 the actual immigration flow increased the labor supply of men by 11%, he calculates that the average native's wage reduced by 3.2% and the wage of high-school dropouts by 8.9%. Orrenius and Zavodny (2007) used an occupation-region based approach, distinguishing between three occupation groups. Her results imply that a 1% increase in the share of immigrants reduces the wage in blue-collar occupations by 0.8%. More recently, Kifle (2009) using employees' occupation and level of education as proxies for skill found that immigrants have a significant positive effect on earnings of natives.

The relevant literature in Greece is rather limited. To the best of our knowledge, there are only two simulation based approach studies[46] concerned with the effect of immigration on the natives' earnings. Sarris and Zografakis (1999) base their empirical analysis on a General Equilibrium Model of Greece. The evidence implies that immigration induces a decline in the earnings of two classes of households among the fifteen modeled, those headed by an unskilled person, that are poor and middle income. All the other households gain from immigration. However, those who lose make up 37% of the Greek population. Similarly, Kontis et al (2006) also found that the immigration benefits the more skilled and harms the less-skilled Greeks.

This section exploits occupational information from the Greek Labor Force Survey, to identify the impact of immigrants on natives' wages.

4.1 Data and Empirical Specification

The dataset used in this section is the Greek Labor Force Survey (LFS) for the years 2003-2008. We divide the 9 1-digit occupations into 3 broader occupation groups: high skilled (managers, professionals, associate professionals); medium skilled (clerks, service workers) and low to non-skilled (Skilled agricultural workers and below). Furthermore, we incorporate the occupational desegregation into regional data for 13 Greek regions[47], ending with 234[48] observations.

To estimate the effect of immigration on native wages we regress average monthly log earnings of natives in occupation *o*, area *r* and period *t* on the fraction of

[46] See also Lianos et al (1996) and Demoussis et al (2010). These studies do not seek to identify the impact of immigrants on natives' earnings; instead they analyze the earnings gap between natives and immigrants. Both conclude that immigrants earn about 40% percent less than equally productive natives.

[47] Attiki, Central Macedonia, Sterea & Evoia, Crete, Peloponnesus, Thessaly, Western Greece, Eastern Macedonia, Ionia, Southern Aegean, Epirus, Northern Aegean, Western Macedonia.

[48] 6 (years) * 3 (occupation groups) * 13 (regions) gives 234 observations.

immigrants in that occupation group and some other variables that are discussed below:

$$\ln w_{ort} = a`\beta M_{ort} + \gamma X_{ort} + \lambda_t + \mu_o + \sigma_r + u_{ort} \quad (3.5)$$

The variable M is the number of immigrants in each occupation group relative to total employment in that occupation group (aged between 18-64 years old). The vector X controls for the distribution of native workers across three of four age groups (19-24, 25-29, 30-44, 45-64) and two of three education groups (tertiary, secondary and primary education). Additionally, equation (3.5) includes a set of occupation (μ_o), area (σ_r) and year (λ_t) fixed effects in order to control for unobservable determinants of wages. Table 3.6 shows means of the variables and standard deviations.

We estimate equation (3.5) by pooling the data for all occupation categories, implicitly assuming that the impact of immigration on wages is identical across all occupations. Furthermore, we investigate the impact of foreign workers on native wages in each particular occupation group, that is, in high, medium and low skilled group.

Because immigration into an area may be influenced by local wages, we also address endogeneity bias utilizing an instrumental variables approach. This requires an instrument that is correlated with the inflow of immigrants into a given occupation and area but uncorrelated with unobserved factors that influence the local wages. We use one period lagged foreign share and the average immigrant (log monthly) wage into a given area and occupation. The idea behind this strategy is that immigrants tend to settle in areas where previous immigrants already live (Bartel, 1989). Additionally, average foreign wage serves as a good measure of the relative attractiveness of each occupation and region.

Table 3.6 Means of Variables

	Mean
Dependent variable	
$\ln w_{ort}$	6.88
	(0.12)
Independent variable	
Immigrant/native $_{ort}$	0.04
	(0.04)
Share of natives with:	
Tertiary education	0.36
	(0.33)
Secondary education	0.33
	(0.18)
Primary education	0.32
	(0.24)
Age groups:	
19-24	0.06
	(0.03)
25-29	0.12
	(0.04)
30-44	0.43
	(0.05)
45-64	0.36
	(0.08)

Note: standard deviations in parentheses below the sample means

Table 3.7 shows the distribution of natives and immigrants along nine occupation categories. As it is evident, most of immigrants are employed in low and medium skill occupations. About 37% of immigrants are employed as craft and related trade workers and 32.1% are employed in elementary occupations. The immigrants that employed as service workers and shop and market sale workers are about 14% of total employed immigrants. On the other hand, immigrants are underrepresented in high-skill occupations (managers, professionals and associate professionals) Hence, it seems that labor market competition between immigrants and natives is more likely in the medium and low skilled occupations.

Table 3.7 Employment by occupation and nationality

Occupation	Nationality	
	Greeks	Foreigners
Legislators, senior officials and managers	11.5	2.2
Professionals	14.5	2.2
Technicians and associate professionals	8.1	1.4
Clerks	11.5	2.1
Service workers and shop and market sale workers	14.0	13.6
Skilled agricultural and fishery workers	14.8	3.4
Craft and related trade workers	13.0	37.3
Plant and machine operators and assembler	7.6	5.8
Elementary Occupations	5.0	32.1
Total	100	100

4.2 Results

We start by testing the impact of immigrant shares on the average wage of natives. The results are reported in Table 3.8. As indicated in the Table 3.8, we report specifications with and without region and year fixed effects. The inclusion of the region dummies controls for time invariant region specific determinants of earnings, while the inclusion of time dummies controls for common time effects. The F statistic indicates that the null hypothesis that the region effects are jointly equal to zero have to be rejected. Moreover, the Hausman test indicates that we can not reject the null hypothesis that the region effects are not correlated with the exogenous variables (i.e. that we should use the Random effects estimator).

The least-squares estimation – without occupation and region fixed effects – indicates a very weak negative relationship between the presence of immigrants in an occupation and the wages of Greeks in that occupation. Nevertheless, the effect of immigration on native average wage is no longer significant when we control for occupation and region fixed effects or when the instrumental variables approach is used. The results are in line with Friedberg's (2001) findings. The difference between the OLS and IV results implies that the negative correlation between immigration and

native wages found by OLS is not due to an adverse impact of immigration on native wages, but due to the disproportional allocation of immigrants in low wage occupations[49].

Note also that the negative bias of the OLS results is the opposite of the positive bias found by the empirical papers that were based on the spatial correlation approach (see also Friedberg, 2001). The negative bias results because immigrants tend toward high-wage regions, but low-paid jobs, provided that that they can move freely within the country but not within occupations.

Table 3.8 The impact of immigration on wages across occupation groups

Independent Variable	OLS		2SLS	
Foreign share	-0.002*	-0.000	-0.002	-0.000
	(0.001)	(0.001)	(0.001)	(0.001)
Share of high-skilled	0.003***	0.003***	0.002***	0.003***
	(0.000)	(0.000)	(0.000)	(0.000)
Share of medium-skilled	0.001**	0.000	0.001	0.001
	(0.000)	(0.000)	(0.000)	(0.000)
Age-group-1	-0.012***	-0.007***	-0.014***	-0.005***
	(0.002)	(0.002)	(0.002)	(0.002)
Age-group-2	-0.003**	-0.003***	-0.002*	-0.005***
	(0.001)	(0.001)	(0.001)	(0.001)
Age-group-3	-0.004***	-0.003***	-0.002*	-0.003***
	(0.001)	(0.001)	(0.001)	(0.001)
Observations	234	234	195	195
R^2	0.72	0.86	0.76	0.91
Region fixed effects	No	Yes	No	Yes
Occupation fixed effects	No	Yes	No	Yes
Year fixed effects	No	Yes	No	Yes
F_r		12.98***		17.13***
F_o		10.56***		13.45***
F_t		8.34***		9.63***

Notes: Standard errors are shown in the parentheses below the estimated coefficients. ***,**,* denote statistical significance at 1%5%0% significant levels.

[49] See also Demoussis et al, 2008 for an empirical support of this argument.

Table 3.9 shows the effect of immigration on natives' wages across the three different occupation groups, defined in section 4.1. For each occupation group, we estimate equation (3.5) using either an OLS or an IV strategy. Moreover, the second columns of each specification include region and year fixed effects. The F statistic suggests that we have to reject the null hypothersis that the region dummies are jointly equal to zero. Hence, the second column of each specification is considered more reliable. In addition, the Hausman test indicates that the have to control for fixed rather than for random effects.

The results are generally not statically different from zero. Even the natives employed in the low skill occupations experience wage reductions as a result of immigration. We can also observe the negative bias between the OLS and IV results for the high and medium skill occupations. The negative least-squares coefficient of the foreign share (-0.008) in the high skill occupations becomes positive (0.001) when the IV approach is considered. Similarly, for the medium-skilled occupations, the foreign share coefficient increases from 0.009 (OLS) to 0.05 (IV). On the other hand, there is positive bias of the OLS results in the low-skill occupations as is the bias found by the empirical papers that were based on geographically defined labor markets.

Table 3.9 The impact of immigration on wages across occupation groups

	High-skilled				Medium-skilled				Unskilled			
	OLS		2SLS		OLS		2SLS		OLS		2SLS	
Foreign share	-0.008	-0.008	0.007	0.001	0.000	0.009	-0.002	0.050	0.002	-0.002	0.000	-0.013
	(0.010)	(0.009)	(0.016)	(0.011)	(0.004)	(0.006)	(0.006)	(0.128)	(0.002)	(0.004)	(0.002)	(0.017)
High-skilled	-0.000	-0.002	-0.000	0.001	0.002	0.002	0.001	0.004	-0.007	0.001	-0.003	0.006
	(0.001)	(0.001)	(0.002)	(0.002)	(0.001)	(0.002)	(0.001)	(0.005)	(0.005)	(0.004)	(0.005)	(0.004)
Medium-skilled	-0.001	-0.005[b]	0.002	-0.001	0.003[b]	0.001	0.003[b]	-0.000	0.003[c]	0.003[c]	0.004[b]	0.003[c]
	(0.003)	(0.002)	(0.004)	(0.003)	(0.001)	(0.002)	(0.001)	(0.003)	(0.002)	(0.002)	(0.002)	(0.002)
Age-group-1	-0.029[a]	-0.010[c]	-0.026[a]	-0.010	-0.009[a]	-0.006[b]	-0.010[a]	-0.008	-0.004	-0.008[b]	-0.005	-0.004
	(0.005)	(0.005)	(0.006)	(0.010)	(0.002)	(0.003)	(0.002)	(0.011)	(0.004)	(0.004)	(0.004)	(0.003)
Age-group-2	0.002[c]	-0.001	0.003[b]	-0.007[b]	-0.008[a]	-0.003	-0.008[a]	0.000	-0.010[b]	-0.008[c]	-0.011[b]	-0.004
	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)	(0.009)	(0.005)	(0.004)	(0.004)	(0.005)
Age-group-3	-0.001	-0.000	0.002	-0.002[c]	-0.009[a]	-0.005[a]	-0.008[a]	-0.005	-0.002	-0.002	-0.001	-0.001
	(0.002)	(0.002)	(0.002)	(0.001)	(0.002)	(0.002)	(0.002)	(0.003)	(0.002)	(0.002)	(0.002)	(0.002)
Area fixed effects	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Year fixed effects	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Observations	78	78	65	65	78	78	65	65	78	78	65	65
R^2	0.32	0.75	0.32	0.93	0.41	0.77	0.50	0.62	0.18	0.75	0.22	0.86
F_r		4.67[a]		26.02[a]		5.46[a]		3.02[a]		8.11[a]		13.82[a]

Notes: standard errors are shown in the parentheses below the estimated marginal effects. [a,b,c] denote statistical significance at 1%,5%,10% significant levels.

5. Conclusions

The empirical evidence regarding the effect of immigration in the Greek labor market is scarce. In this chapter we analyzed the impact of immigration on natives' unemployment rate using regional data for the years 1988-2008 from the Greek Labor Force Survey. The results seem to be in line with most previous studies (e.g Altonji and Card, 2001; Dustmann et al, 2005). More precisely, our findings suggest that immigration do not significantly affect the unemployment rate of native workers. As far as the impact of immigrants on the employment opportunities of different native education groups is concerned the results are again not statistically different from zero. In addition, we carried out a cross-sectional analysis (LFS, 2009) of the displacement risk (transition from employment to unemployment) and job search effectiveness (transition from unemployment to employment). Concerning displacement risk, the results suggest that there is a complementary effect between immigrants and Unskilled, Skilled and Old natives. Hence, it seems that immigrants are complements with native *insiders*. On the other hand, the job search effectiveness for the unemployed indicates a competitive effect. To put it differently, immigration seems to lower the chances of the native *outsiders* to find a job.

In addition, using data from the Greek LFS (2003-2008), we analyzed the wage effects of immigration in the Greek labor market. To avoid the problems arising in a typical regional analysis of immigration, we estimated the effect of immigration on wages within occupational groups. We identify 3 broad occupation groups, high skilled, medium skilled and low to non-skilled and incorporated them into regional data for 13 Greek regions. In addition, we controlled for potential endogeneity using

an Instrumental Variables approach. Our results imply that immigrants do not adversely affect the wage rate of native workers in Greece.

Considering the economic situation of Greece and the structure of the Greek economy, we can assume that immigration was absorbed without large adverse effects on the labor market outcomes of natives for the following reasons: First of all, the last years of the period under consideration were years of high economic expansion and economic growth. In 2004 we had the organization of Olympic Games in Greece. Construction was a leader economic sector in that period creating continuously new jobs for skilled but basically for unskilled workers. Immigrants were working in construction, agriculture, tourism and in domestic services. We can also say that immigrants took jobs forsaken by natives (i.e. Lianos et al 1996; Fakiolas, 1999). Finally, it is likely that the firing restrictions policy, which was instituted in Greece in 1983 (Hatzinikolaou and Kammas, 2010), ensures the employment stability of native *insiders* and protects them from increased labor market competition due to immigration. On the other hand, firing restrictions may discourage firms to hire new workers in good times. Provided that immigrants also have lower wage expectations, tend to show more flexibility in performing different jobs and have higher degree of geographical mobility than natives (Fakiolas, 1999), it seems that the employment opportunities of native *outsiders* are reduced because of immigration.

Appendix A : Definition of the variables

Variables used in equation (3.1)

Unemployment Rate is defined as the number of unemployed natives (between 18 and 64 years old) divided by the native labor force (between 18 and 64 years old), where the labor force is the number of the unemployed persons plus the number of employed persons.

Foreign Share (*IMM)* is defined as the fraction of immigrants (between 18 and 64 years old) to the total population (between 18 and 64 years old).

Share of low-skilled *(Edul)* is the fraction of native labor force (between 18 and 64 years old) with primary education, to the total population of natives (between 18 and 64 years old).

Share of medium-skilled *(Edum)* is the fraction of native labor force (between 18 and 64 years old) with secondary education, to the total population of natives (between 18 and 64 years old).

Female participation (*Female)* is defined as the fraction of native women (between 18 and 64 years old) who work or seek to work, to the total female population (between 18 and 64 years old).

Share of labor force over age 45 (*Old*) is defined as the fraction of the native labor force (between 45 and 64 years old) to the total native labor force (between 18 and 64 years old).

Variables used in equation (3.2)

Foreign Share is defined as the fraction of immigrants (between 18 and 64 years old) to the total population (between 18 and 64 years old).

Age is the Age of the individual

Age^2 is the Age squared

Experience (*Exp)* Years of work experience

(Exp^2) Years of work experience squared

Tertiary (0,1) Dummy=1 if education = university degree or higher

Secondary (0,1) Dummy=1 if education = secondary level education

Male (0,1) Dummy=1 if gender = male

Married (0,1) Dummy=1 if married

Variables used in equation (3.5)

Foreign Share is defined as the fraction of employed immigrants (between 18 and 64 years old), to the number of employees within each occupation and region (between 18 and 64 years old).

Share of high-skilled *(Edul)* is the fraction of native employees (between 18 and 64 years old) with tertiary education, to the number of employed natives within each occupation and region (between 18 and 64 years old).

Share of medium-skilled *(Edum)* is the fraction of native employees (between 18 and 64 years old) with secondary education, to the number of employed natives within each occupation and region (between 18 and 64 years old).

Age group 1 is defined as the fraction of native employees between 19 and 24 years old, to the number of employed natives within each occupation and region (between 18 and 64 years old).

Age group 2 is defined as the fraction of native employees between 25 and 29 years old, to the number of employed natives within each occupation and region (between 18 and 64 years old).

Age group 2 is defined as the fraction of native employees between 30 and 44 years old, to the number of employed natives within each occupation and region (between 18 and 64 years old).

Appendix B : Results from the endogeneity Test and the full set of results from the probit regressions

The results of the Blundell and Smith endogeneity test for probit regressions are reported in tables 3.7 and 3.10 below. As can be seen from the tables, there is no evidence of endogeneity either for the employed or the unemployed looking for a job.

Table 3.10 Results from the endogeneity test

Panel A.	
Unemployment entry of natives	
ϕ	0.704 (0.401)
Unemployment entry of native males	
ϕ	0.290 (0.589)
Unemployment entry of native females	
ϕ	2.963 (0.085)
Unemployment entry of low-skilled natives	
ϕ	0.396 (0.528)
Unemployment entry of medium-skilled natives	
ϕ	2.284 (0.130)
Unemployment entry of high-skilled natives	
ϕ	0.391 (0.531)
Unemployment entry of old natives	
ϕ	0.145 (0.702)
Unemployment entry of young natives	
ϕ	0.343 (0.557)
Panel B.	
Job search effectiveness of natives	

ϕ	0.034 (0.851)
Job search effectiveness of native males	
ϕ	0.048 (0.824)
Job search effectiveness of native females	
ϕ	0.202 (0.653)
Job search effectiveness of low-skilled natives	
ϕ	0.585 (0.444)
Job search effectiveness of medium-skilled natives	
ϕ	1.951 (0.162)
Job search effectiveness of high-skilled natives	
ϕ	2.085 (0.148)
Job search effectiveness of old natives	
ϕ	0.008 (0.972)
Job search effectiveness of young natives	
ϕ	0.090 (0.763)

Notes: Panel A report the results from the endogeneity test for the unemployment entry. Panel B report report the results from the endogeneity test for the job search effectiveness. ϕ is the estimated coefficient in the probit equation, of the error term from the first stage. At the first stage the dependent variable is the foreign share. The right hand side variables are the lagged foreign share and the average wage among immigrants. P>chisq in parenthesis.

Table 3.11 Results from the probit regression on the probability of transition from employment to unemployment by age, education and demographic group, Marginal effects

	All		Males		Females		Unskilled		Medium-skilled		Skilled		Old		Young	
Foreign share	-0.001[b]	-0.002[a]	-0.001[c]	-0.001[c]	-0.002[b]	-0.003[a]	-0.003[c]	-0.001	-0.001	-0.003[b]	-0.001	-0.002[b]	-0.001[b]	-0.002[a]	-0.001	-0.002
	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)	(0.001)	(0.001)	(0.000)	(0.001)	(0.000)	(0.001)	(0.001)	(0.002)
Age	0.002	0.002	0.004[b]	0.004[b]	-0.003	-0.003	0.011	0.008	0.014[a]	0.014[a]	-0.000	-0.001	0.007[b]	0.007[b]	-0.004	-0.005
	(0.002)	(0.002)	(0.002)	(0.002)	(0.003)	(0.003)	(0.009)	(0.009)	(0.005)	(0.005)	(0.003)	(0.003)	(0.003)	(0.003)	(0.011)	(0.010)
Age^2	-0.000[a]	-0.000[a]	0.000[a]	0.000[a]	-0.000	-0.000	-0.000	-0.000	-0.000[a]	-0.000[a]	-0.000	-0.000	-0.000[a]	-0.000[a]	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Exp	-0.001	-0.001	-0.003[a]	-0.003[a]	0.004[a]	0.004[a]	-0.009	-0.007	-0.007[a]	-0.007[a]	0.001	0.001	-0.001	-0.001	0.000	0.000
	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)	(0.006)	(0.006)	(0.002)	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)	(0.003)	(0.003)
Exp^2	0.000[a]	0.000[a]	0.000[a]	0.000[a]	0.000	0.000	0.000	0.000	0.000[a]	0.000[a]	0.000	0.000	0.000[b]	0.000[b]	-0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Tertiary	-0.012	-0.012	-0.023[a]	-0.023[a]	0.013	0.011							-0.008	-0.008	-0.039[c]	-0.038[c]
	(0.008)	(0.008)	(0.008)	(0.008)	(0.015)	(0.014)							(0.008)	(0.008)	(0.020)	(0.020)
Secondary	-0.003	-0.003	-0.007	-0.007	0.005	0.004							0.002	0.002	-0.029[c]	-0.038[c]
	(0.006)	(0.006)	(0.006)	(0.006)	(0.011)	(0.011)							(0.006)	(0.005)	(0.015)	(0.020)
Male	0.012[a]	-0.012[a]					-0.022[b]	-0.023[b]	-0.014[a]	-0.014[a]	-0.007[b]	-0.007[b]	-0.008[a]	-0.008[a]	-0.018[a]	-0.017[a]
	(0.003)	(0.003)					(0.010)	(0.010)	(0.005)	(0.005)	(0.003)	(0.003)	(0.003)	(0.003)	(0.006)	(0.006)
Married	-0.015[a]	-0.015[a]	-0.016[a]	-0.016[a]	-0.018[a]	-0.017[a]	-0.009	-0.007	-0.018[a]	-0.018[a]	-0.013[a]	-0.013[a]	-0.013[a]	-0.013[a]	-0.016[b]	-0.016[b]
	(0.003)	(0.003)	(0.004)	(0.004)	(0.005)	(0.005)	(0.011)	(0.011)	(0.006)	(0.006)	(0.004)	(0.004)	(0.004)	(0.004)	(0.007)	(0.007)
Area Effects	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Sample size	15551	15551	8873	8873	6678	6678	2104	2104	6655	6655	6597	6597	9995	9995	5114	5114
LogL	-2217	-2206	-1134	-1127	-1069	-1058	-388	-383	1063	-1059	-736	-720	-1100	-1091	-1006	-1000
LRT	208.71[a]	231.42[a]	98.92[a]	113.68[a]	122.74[a]	144.61[a]	22.24[a]	31.51[b]	68.06[a]	76.83[a]	106.65[a]	131.13[a]	114.04[a]	131.98[a]	35.91[a]	48.29[a]
LRT (FE)		21.84[b]		14.14		20.75[b]		8.23		8.44		20.33[b]		16.32[c]		9.31

Notes: standard errors are shown in the parentheses below the estimated marginal effects. [a,b,c] denote statistical significance at 1%,5%,10% significant levels.

Table 3.12 Results from the probit regression on the probability of transition from unemployment to employment by age, education and demographic group, Marginal effects

	All		Males		Females		Unskilled		Medium-skilled		Skilled		Old		Young	
Foreign share	-0.006[c]	-0.011[b]	-0.016[a]	-0.024[a]	0.000	-0.004	-0.019[a]	-0.037[a]	0.003	0.003	-0.013[b]	-0.021[b]	-0.007	-0.012[b]	-0.004	-0.009
	(0.003)	(0.005)	(0.006)	(0.009)	(0.004)	(0.006)	(0.006)	(0.009)	(0.005)	(0.007)	(0.006)	(0.010)	(0.004)	(0.006)	(0.005)	(0.008)
Age	0.015	0.015	0.001	0.003	0.037[b]	0.037[b]	0.093	0.092	0.019	0.020	0.012	-0.006	0.006	-0.001	0.064	0.064
	(0.012)	(0.012)	(0.017)	(0.018)	(0.017)	(0.017)	(0.075)	(0.073)	(0.029)	(0.030)	(0.031)	(0.032)	(0.031)	(0.031)	(0.047)	(0.047)
Age^2	-0.000[b]	-0.000[b]	-0.000	-0.000	-0.001[b]	-0.001[a]	0.093	-0.001	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.001	-0.001
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.075)	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)
Exp	-0.008	-0.007	-0.002	-0.003	-0.015[c]	-0.012	-0.062	-0.052	-0.007	-0.007	-0.018	-0.009	0.006	0.008	-0.004	-0.005
	(0.006)	(0.006)	(0.010)	(0.010)	(0.008)	(0.008)	(0.054)	(0.052)	(0.015)	(0.016)	(0.013)	(0.014)	(0.011)	(0.011)	(0.014)	(0.014)
Exp^2	0.000[a]	0.000[a]	0.000	0.000	0.000[a]	0.001[a]	0.001	0.001	0.000	0.000	0.001	0.000	0.000	-0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)
Tertiary	0.212[a]	0.214[a]	0.126	0.119	0.263[a]	0.289[a]							0.152	0.148	0.203[c]	0.193[c]
	(0.069)	(0.069)	(0.111)	(0.112)	(0.091)	(0.092)							(0.099)	(0.099)	(0.106)	(0.108)
Secondary	0.101[b]	0.103[b]	0.060	0.062	0.145[b]	0.162[a]							0.049	0.049	0.115	0.115
	(0.043)	(0.044)	(0.065)	(0.066)	(0.062)	(0.062)							(0.049)	(0.049)	(0.077)	(0.079)
Male	0.107[a]	0.108[a]					0.176[a]	0.196[a]	0.120[a]	0.127[a]	0.028	0.033	0.113[a]	0.116[a]	0.086[a]	0.085[a]
	(0.022)	(0.022)					(0.043)	(0.043)	(0.030)	(0.030)	(0.043)	(0.044)	(0.029)	(0.029)	(0.032)	(0.032)
Married	0.044[c]	0.038	0.095[c]	0.087[c]	0.016	0.013	0.083[b]	0.070[c]	0.033	0.033	0.025	-0.004	0.086[a]	0.085[a]	-0.005	-0.017
	(0.026)	(0.026)	(0.049)	(0.050)	(0.030)	(0.029)	(0.041)	(0.040)	(0.035)	(0.036)	(0.052)	(0.053)	(0.026)	(0.026)	(0.044)	(0.044)
Area Effects	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Sample size	1949	1949	772	772	1177	1177		343		975	619	619	879	879	1015	1015
LogL	-1047	-1038	-455	-450	-583	-571	-136	-128	-517	-508	-378	-364	-392	-389	-615	-611
LRT	102.63[a]	120.53[a]	31.83[a]	41.73[b]	73.62[a]	96.92[a]	33.24[a]	48.99[b]	35.09[a]	53.35[a]	23.90[a]	52.87[a]	33.45[a]	39.67[a]	42.37 [a]	47.54[a]
LRT (FE)		17.36[b]		9.33		19.26b		11.55		17.02[b]		17.02[b]		6.24		17.87[c]

Notes: standard errors are shown in the parentheses below the estimated marginal effects. [a,b,c] denote statistical significance at 1%,5%,10% significant levels.

Chapter 4

The impact of Immigration on National Income and Unemployment: Evidence from Time-Series Analysis

1 Introduction

In line with the theoretical and empirical literature, presented in chapters 1 and 2, the present chapter, using annual time series data over the period 1960-2008, examines the causal relationship between immigration and two macroeconomic indicators, per capita GDP and unemployment. For robustness purposes we use both multivariate co-integration methodologies, namely the Johansen approach and the Autoregressive Distributed Lag model (ARDL) approach to cointegration. This study contributes on understanding not only how immigration affects per capita income and unemployment, but also whether immigration in Greece is driven by these factors. By establishing a long-run relationship running from GDP or unemployment to immigration, we can argue that immigration is not exogenous, but in part it is determined by the income or the employment opportunities within the economy.

As shown in chapter 1 the impact of immigration on natives' income and unemployment is ambiguous (Schmidt et al, 1994). The neoclassical labor demand model implies that the impact of immigration depends upon the degree of substitutability between natives and immigrants. Hence, immigrants tend to raise the income of factors with which they are complements and decrease the income of factors with which they are substitutes. In the simplest case where the economy

produces a single output with constant returns to scale technology and skilled and unskilled labor, unskilled immigration generates an aggregate gain (Borjas, 1995).

In addition, if natives' labor supply is somewhat elastic, migration can then generate some (voluntary) unemployment on native workers whose wages have fallen as a result of immigration (Dustmann et al. 2005; Dustmann and Glitz, 2005).

Nevertheless, there is a set of long-run adjustments, i.e. capital responses (Ottaviano and Peri, 2005), product market responses (Bodvarsson et al, 2008), changes in output mix (Friedberg and Hunt, 1995) and technological responses (Lewis, 2004) that allows the economy to absorb immigration with little or no adverse effects on natives' employment opportunities.

From the macroeconomic perspective, the neoclassical Solow-Swan model implies that migration induces a reduction in per capita capital, and moves the economy to a new steady state with lower per capita income (Jones, 1998; Barro and Sala-i-Martin, 2004). Similarly, Dolado et al (1994) use a Solow augmented model by human capital to analyze the impact of immigration. Their theoretical model implies that immigrants the more are educated the less will be the negative effects on per capita income. Using data from OECD economies during the period 1960-1985, they found that migrants have about the half negative impact of a comparable natural population increase. Moreover, according to Gonzalez-Gomez and Giraldez (2011), the admission of low skilled immigrants, who are eager to accept lower wages, impedes structural changes and technological development and contributes to slow growth rates. The rational is that due to the existence of immigrants, firms are not forced to invest in technology. Instead, they use their savings to hire cheap foreign labor force. Kemnitz (2001) using an AK model argues that immigration benefits an arbitrary native if immigrants possess on average more capital than natives.

Generally, most empirical papers based on the spatial correlation approach (Pischke and Velling, 1997; Dustmann et al, 2005) conclude that immigration do not adversely affect the employment opportunities of natives. Even studies looking at natural experiments (Card, 1990; Hunt, 1992), i.e. immigration that is caused by political rather than economic factors, fail to detect large adverse effects.

On the other hand, Immigrants also take into consideration the employment opportunities in their decision to migrate. Hence, some empirical papers examine whether immigration responds to host country economic conditions (Withers and Pope 1985; Pope and Withers, 1993; Marr and Siklos 1994, 1995; Shan et al, 1999; Gross, 2002; Gross, 2004; Feridun, 2004; Feridun, 2007; Molrey, 2006; Dritsakis, 2008; Gonzalez-Gomez and Giraldez, 2011; Boubtane et al, 2011).

Most studies find no evidence of immigration causing higher unemployment rates. However, Boubtane et al (2011) using annual data over the period 1980-2005 for 22 OECD countries found that the interaction between immigration and economic activity depends on the host country. More precisely, they found that in six countries (Australia, Denmark, Greece, Portugal, Netherlands and Spain) unemployment negatively Granger causes migration, while in any country, migration does not Granger cause unemployment. On the other hand the results imply that in three countries (Iceland, Norway and United Kingdom) per capita income positively Granger causes migration, while no evidence of reverse causality is found. Morley (2006) found evidence of long-run causality running from per capita GDP to immigration but not vice versa for Australia, Canada and the U.S. Dritsakis (2008) using annual data over the period 1970-2006 for Greece finds evidence of bidirectional causality between immigration and economic growth. Finally, Gonzalez-Gomez and Giraldez (2011) found bidirectional causality between immigration and

per capita GDP in Germany. On the other hand, no evidence of long-run relationship is found for Switzerland. According to the authors, the difference in the results is indicative that the Swiss immigration was more restrictive.

The above theoretical considerations have already been studied by means of time series analysis for many countries. The evidence implies that a stable long-run relationship is running from immigration to GDP but not vice versa. On the other hand, no long-run relationship is found between immigration and unemployment.

This chapter is structured as follows: The next section discusses the data and illustrates the Johansen cointegration methodology, the ARDL approach to cointegration. Section 3 shows the results from the examination of the unit root properties of the series under consideration. It also reports the results from the cointegration tests. Section 4 presents the results from the Granger non causality tests. Finally, section 5 concludes the chapter.

2. Data and Methodology

We used annual data for the time period 1960 to 2008. All data are drawn from the World Bank World Development Indicators and were transformed into logarithmic terms. Immigration rate is measured by the migration stock as a percentage of total population. GDP per capita is gross domestic product per capita at constant prices (base year is 2000) and unemployment rate is the percentage of the labor force without work who seeks for employment.

Using time series data at the national level, we avoid any bias towards zero due to endogenous regional choice of immigrants or native internal migration. However, it

may introduce a different bias because immigrants tend to come to a country at times when labor market conditions are favorable (Friedberg and Hunt, 1995).

Nevertheless, when dealing with time series, a main concern for statistical analysis is stationarity. In its weak version, stationarity is defined as the time invariance of the mean, the variance and the covariance of a series. The common practice to avoid spurious regressions is to estimate equations using cointegration techniques. The concept of cointegration was first introduced by Engle and Granger (1987) and became indispensable in the analysis of non-stationary variables. The underlying idea is that two non-stationary variables are said to be co-integrated there exists a linear combination of them which is stationary. This definition leads to useful interpretations in Economics, such that the variables have a stable long-run relationship. The cointegrated variables can then be represented by an Error Correction Model (ECM) which includes a variable representing deviations from equilibrium.

2.1 Unit root tests

The first step of the empirical analysis involves testing the order of integration of the variables under consideration, that is, per capita migration, unemployment and per capita GDP. Suppose that each variable follows an AR(1) process:

$$Y_t = \rho Y_{t-1} + u_t , \qquad u_t N(0, \sigma^2) \tag{4.1}$$

- If $|\rho| < 1$, then each variable is stationary or integrated of order zero, I(0).
- If $|\rho| = 1$, then each variable contains a unit root.

The above definition can be tested by applying the Dickey-Fuller (1981) test. Equation (4.1) can be reformulated such that to avoid possible spurious regression estimates:

$$\Delta Y_t = (\rho - 1)Y_{t-1} + u_t \tag{4.2}$$

$$\Delta Y_t = \mu + (\rho - 1)Y_{t-1} + u_t \tag{4.3}$$

$$\Delta Y_t = \mu + \delta\tau + (\rho - 1)Y_{t-1} + u_t \tag{4.4}$$

where equation (4.2) includes no exogenous terms, equation (4.3) includes a constant and finally equation (4.4) includes both a constant and a linear trend.

The Dickey-Fuller test however, often suffers from autocorrelation in first differences. A solution to this problem is given by the Augmented Dickey-Fuller test, which includes the term $\sum_{i=1}^{\rho} \delta_i \Delta Y_{t-i}$, to correct for autocorrelation. Thus the above equations can be rewritten as:

$$\Delta Y_t = (\rho - 1)Y_{t-1} + \sum_{i=1}^{\rho} \delta_i \Delta Y_{t-i} + u_t \tag{4.5}$$

$$\Delta Y_t = \mu + (\rho - 1)Y_{t-1} + \sum_{i=1}^{\rho} \delta_i \Delta Y_{t-i} + u_t \tag{4.6}$$

$$\Delta Y_t = \mu + \delta\tau + (\rho - 1)Y_{t-1} + \sum_{i=1}^{\rho} \delta_i \Delta Y_{t-i} + u_t \tag{4.7}$$

Alternatively, we test for the order of integration of the variables by applying the Phillips-Perron (1988) test. As in the ADF test, the Phillips-Perron methodology covers the three alternative cases. Nevertheless, it resolves the possible effects of autocorrelated errors by modifying the t-statistics using non-parametric analysis.

The null hypothesis of unit root can be stated as:

$$H_0 : \alpha = \rho - 1 = 0$$

against the alternative:

$$H_1 : \alpha = \rho - 1 < 0 .$$

If the coefficient is statistically different from zero then the hypothesis *y* contains a unit root is rejected. Rejection of the null implies stationarity, that is, the variable is integrated of order zero, I(0). If the calculated statistic is higher than the critical values then the null hypothesis is not rejected and it is concluded that *y* is non-stationary, i.e it has a unit root.

In addition, we also use the Zivot and Andrews (1992) unit root test with an endogenous structural break. This methodology is built on Perron's (1989) procedure. Based on Perron (1989) the following equations are estimated to test for the unit root:

$$Y_t = a_0 + a_1 DU_t + d(DTB_t) + \beta t + \rho Y_{t-1} + \sum_{i=1}^{\rho} \phi Y_{t-1} + e_t \quad (4.8)$$

$$Y_t = a_0 + \gamma DT_t^* + \beta t + \rho Y_{t-1} + \sum_{i=1}^{\rho} \phi Y_{t-1} + e_t \quad (4.9)$$

$$Y_t = a_0 + a_1 DU_t + d(DTB_t) + \gamma DT^*{}_t + \beta t + \rho Y_{t-1} + \sum_{i=1}^{\rho} \phi Y_{t-1} + e_t \quad (4.10)$$

Where the intercept dummy DU_t represents a change in the level; DU_t =1 if (t > TB) and zero otherwise; the slope dummy DT_t* represents a change in the slope of the trend function; DT_t* = *t* if (t>*TB*) and zero otherwise; the break dummy (DTB_t) = 1 if *t* = *TB*+1, and zero otherwise; and *TB* is the break date. Each of the three models has a unit root with a break under the null hypothesis. Depending on the model variant, the alternative is a trend stationary process that allows for a one time break in the level, the trend or both. The difference between the Zivot and Andrews methodology and the Perron procedure is that the latter treats the time of the break exogenous (known) while the latter is endogenous. More precisely, the Zivot and Andrews procedure is a sequential test which uses a different dummy variable for each possible break date. The time of the break is selected where the t-statistic from the ADF is at a minimum.

2.2 Johansen and Juselius (1990) Approach

Let us assume that Z_t is a vector containing n endogenous variables which can be represented by the following Vector Autoregressive (VAR) model:

$$Z_t = \Pi_1 Z_{\tau-1} + \Pi_2 Z_{\tau-2} + \ldots + \Pi_\rho Z_{\tau-\rho} + BX_\tau + u_t \tag{4.11}$$

Assuming that the vector of endogenous variables contains non-stationary variables, the VAR model can be reformed in a Vector Error Correction model:

$$\Delta Z_t = \Pi Z_{\tau-1} + \sum_{i=1}^{r-1} \Gamma_i \Delta Z_{\tau-i} + BX_\tau + u_t \tag{4.12}$$

where $\Pi = \sum_{i=1}^{\rho} A_i - I$ is a $\nu \times \nu$ matrix which determines the number of co-integrating relationships and $\Gamma_i = -\sum_{j=i+1}^{\rho} A_j$ is is a $\nu \times \nu$ coefficient matrix. The rank of matrix Π determines how many linear combinations of the variables are stationary. When Π has a reduced rank (i.e. there are $r \leq (n-1)$ linearly independent columns) there are $r \leq (n-1)$ co-integrating relationships. When Π has a full rank (i.e. there are $r = n$ linearly independent columns) then the variables in Z_t are I(0). Finally, when the rank of Π is zero (i.e. there are no linearly independent columns) there are no co-integrating relationships.

Two likelihood ratio tests are used for testing the number of cointegrating vectors, the maximum eigenvalue (λ_{max}) and the trace (λ_{trace}) statistic:

$$\lambda_{\max} = -T\ln(1-\lambda_{r+1}) \tag{4.13}$$

$$\lambda_{trace} = -T\sum_{i=r+1}^{\rho} \ln(1-\lambda_i) \tag{4.14}$$

where T is the sample size; λ_i is the *ith* largest estimated eigenvalue; and r = *0,1,2,…….p – 1* is the number of cointegration vectors.

When there exists Co-integration the Vector Error Correction Model (VECM) is of the form:

$$\Delta Z_t = \alpha\beta' \mathrm{Z}_{t-1} + \sum_{i-1}^{r-1} \Gamma_i \Delta \mathrm{Z}_{t-i} + \mathrm{B}X_t + u_t \qquad (4.15)$$

where $\beta' \mathrm{Z}_{\tau-1}$ is a vector of co-integrating relationships and α is the vector of adjustment coefficients.

According to Johansen (1995) there are five sub-models which are special cases of the VECM given by equation (4.15). These models assume a constant and/or a trend in the long-run model and a constant and/or a trend in the short-run model. The assumptions of the five sub-models are illustrated below:

Model 1: No intercept or trend in Co-integrating Equation or VAR. In this case there are no determinist components in the data or in the co-integrating relationships.

Model 2: Intercept (no trend) in Co-integrating Equation, no intercept or trend in VAR. This is the case where there are no linear trends in the data. Instead an intercept is included to the long-run model.

Model 3: Intercept in Co-integrating Equation and VAR, no trends in Co-integrating Equation and VAR. In this case there are no linear trends. Instead an intercept is included both in the short-run and the long-run model

Model 4: Intercept in Co-integrating Equation and VAR, no trend in VAR, linear trend in Co-integrating Equation. This case allows for intercepts in both Co-integrating Equation and VAR while there is no trend in the short-run model.

Model 5: Intercept and quadratic trend in Cointegrating Equation, intercept and linear trend in VAR. This model allows for linear trends in the short-run model and quadratic trend in the long-run model.

2.3 The ARDL Bounds Testing Approach

The ARDL approach to co-integration, developed by Pesaran et al. (2001) involves the estimation of the following VEC model:

$$\Delta y_t = a + \beta_y y_{\tau-1} + \beta_x x_{\tau-1} + \sum_{\iota=1}^{\rho-1} \gamma_{1i} \Delta y_{t-1} + \sum_{i=0}^{q-1} \gamma_{2i} \Delta y_{t-i} + u_t \tag{4.16}$$

where y_t is an I(1) dependent variable, x_t is a vector of long-run forcing I(0) and I(1) regressors, with a multivariate identically and independently distributed (*i.i.d*) zero mean error vector , u_t, and a homoskedastic process. The first step in the ARDL bounds testing approach is to estimate equation (4.16) by ordinary least squares (OLS), in order to test for the existence of a long-run relationship between the variables. Then, an F-test is employed for the joint significance of the coefficients of the lagged levels of the variables: $H_0 : \beta_y = \beta_x = 0$ against the alternative $H_1 : \beta_y \neq \beta_x \neq 0$. Afterwards, the F-statistic is compared with two asymptotic critical values bounds provided by Pesaran et al. (2001), when the independent variables are I(d) (where $0 \leq d \leq 1$): a lower value assuming the regressors are I(0) and an upper value assuming purely I(1) regressors. If the test statistic exceeds the upper bound critical values, then we establish the existence of a stable long run relationship. If it is below the lower critical value bound there is no evidence of a long run relationship, and if it lies between the critical value bounds the test is inconclusive.

In the second step, once cointegration is established, the conditional ARDL (*p*,*q*) long-run model for Y_t can be estimated as:

$$y_t = a + \sum_{\iota=1}^{\rho} \gamma_{1i} y_{t-1} + \sum_{i=0}^{q} \gamma_{2i} y_{t-i} + u_t \tag{4.17}$$

3. Empirical Evidence

Table 4.1 summarizes the results of the Dickey-Fuller (ADF), Philips-Perron (PP) and Zivot and Andrews (ZA) tests for the levels and first differences of the variables. The optimal lag length in the ADF test was selected using the Schwarz Bayesian Criteria, whilst a serial correlation LM test ensures the absence of serially correlated residuals. In addition, the inclusion of the exogenous terms (constant or trend) was determined using a t-test. From Table 4.1 we observe that all variables are integrated of order one, I(1) according ADF, PP and ZA tests.

Table 4.1 Results from the unit root tests

	ADF		PP		ZA
Variable	Exogenous term (lags)	t-stat	Exogenous term (bandwidth)	t-stat	t-stat
LIMM	Constant (1)	-1.692	Constant (4)	-0.432	-2.634 (1976)
ΔLIMM	Constant (0)	-2.994**	Constant (1)	-3.118**	-7.155** (2000)
LGDP	Constant and trend (3)	-2.598	Constant (4)	-2.653	-3.245 (1969)
ΔLGDP	Constant (0)	-4.765**	Constant (4)	-4.913**	-8.381** (1974)
LUNE	Constant and trend (1)	-2.891	No (4)	-0.225	-3.039 (1981)
ΔLUNE	No (0)	-3.54**	No (2)	-3.256**	-6.600** (1980)

Notes: LIMM, LGDP and LUNE denote the fraction of foreign population relative to total population, the gross domestic product and the unemployment rate of natives in logarithms. Δ denotes first differences. ADF is the augmented Dickey-Fuller test. PP is the Philips-Perron test. ** denotes significance at 5% significant levels. Lag length was determined using the Schwarz information criteria. The numbers in parentheses in the last column are the dates of structural break.

Given that the variables under consideration are all integrated of order one, I(1), we can apply both the Johansen and Juselius (1990) and the ARDL bounds testing approach (Pesaran et al, 2001).

The two likelihood ratio tests, the maximum eigenvalue (λ_{max}) and the trace (λ_{trace}) statistic, are shown in Tables 4.2 and 4.3 below. When the long-run relationship between immigration and per capita GDP is examined (Table 4.2), model 2 indicates that the null of no Cointegration can be rejected by both the trace and maximum eigenvalue statistics. However, models 3 and 4 indicate that the null cannot be rejected at 5% significant level. Table 4.3 reports the results when the endogenous variables are immigration and unemployment. As it is evident, neither the trace statistic nor the maximum eignevalue statistic rejects the null hypothesis of no cointegration.

Table 4.2 Cointegration tests based on the Johansen approach

Model 2

Null Hypothesis	Trace Statistic	5% Critical Value	Maximum Eigenvalue Statistic	5% Critical Value
$r = 0$	24.44708	20.26184	21.78540	15.89210
$r \leq 1$	2.661685	9.164546	2.661685	9.164546

Notes: Trace test indicates 1 cointegrating eqn(s) at the 0.05 level. Max-eigenvalue test indicates 1 cointegrating eqn(s) at the 0.05 level.

Model 3

Null Hypothesis	Trace Statistic	5% Critical Value	Maximum Eigenvalue Statistic	5% Critical Value
$r = 0$	12.95006	15.49471	10.53879	14.26460
$r \leq 1$	2.411268	3.841466	2.411268	3.841466

Notes: Trace test indicates no cointegration at the 0.05 level. Max-eigenvalue test indicates no cointegration at the 0.05 level

Model 4

Null Hypothesis	Trace Statistic	5% Critical Value	Maximum Eigenvalue Statistic	5% Critical Value
$r = 0$	20.98795	25.87211	18.18887	19.38704
$r \leq 1$	2.799077	12.51798	2.799077	12.51798

Notes: Trace test indicates no cointegration at the 0.05 level. Max-eigenvalue test indicates no cointegration at the 0.05 level.

Table 4.3 Cointegration tests based on the Johansen approach

Model 2

Null Hypothesis	Trace Statistic	5% Critical Value	Maximum Eigenvalue Statistic	5% Critical Value
$r = 0$	19.28289	20.26184	13.84936	15.89210
$r \leq 1$	5.433528	9.164546	5.433528	9.164546

Notes: Trace test indicates no cointegration at the 0.05 level. Max-eigenvalue test indicates no cointegration at the 0.05 level

Model 3

Null Hypothesis	Trace Statistic	5% Critical Value	Maximum Eigenvalue Statistic	5% Critical Value
$r = 0$	11.08425	15.49471	7.540861	14.26460
$r \leq 1$	3.543386	3.841466	3.543386	3.841466

Notes: Trace test indicates no cointegration at the 0.05 level. Max-eigenvalue test indicates no cointegration at the 0.05 level

Model 4

Null Hypothesis	Trace Statistic	5% Critical Value	Maximum Eigenvalue Statistic	5% Critical Value
$r = 0$	14.93498	25.87211	10.00668	19.38704
$r \leq 1$	4.928302	12.51798	4.928302	12.51798

Notes: Trace test indicates no cointegration at the 0.05 level. Max-eigenvalue test indicates no cointegration at the 0.05 level.

Using the bounds testing approach, a stable long-run relationship running from per capita GDP to immigration is established. The optimal lag length is selected using the Schwarz Bayesian Criterion whilst a serial correlation LM test ensures the absence of serially correlated residuals. Table 4.4 shows that the F-statistic lies above the upper bound critical value when per capita GDP is the endogenous variable and hence the null hypothesis of no cointegration is rejected. On the other hand, when the long-run forcing variable is immigration, the reported F-statistic is below the lower bound critical value and hence we can not reject the null hypothesis of no cointegration. Similarly, the F-statistics suggest that there is not evidence of long-run relationship between immigration and unemployment.

Table 4.4 Results from the ARDL bounds testing approach

	Lags	F-statistic	LM	Outcome
F_{GDP}(GDP/IMMI)	0	6.751	1.434	Cointegration
F_{IMMI}(IMMI/GDP)	1	3.205	.358	No Cointegration
F_{UNE}(UNE/GDP)	1	4.275	.582	No Cointegration
F_{IMMI}(IMMI/UNE)	1	2.151	.241	No Cointegration

Notes: The optimal lag length was determined using the Schwarz Bayesian Criterion. LM is a serial correlation test

4. Granger non-causality tests

According to Granger (1969), *Y* is said to "Granger-cause" *X* if and only if *X* is better predicted by using the past values of *Y*. The causal relationships that should be analyzed are summarized as follows:

1. A unidirectional causality running from immigration to GDP (unemployment)
2. A unidirectional causality running from GDP (unemployment) to immigration
3. A bidirectional causality between immigration and GDP (unemployment)
4. No causality between immigration and GDP (unemployment)

Given that *X* and *Y* are stationary the Granger non-causality test is illustrated as follows:

$$Y_t = a + \sum_{i=1}^{\rho} \beta_{1i} Y_{t-i} + \sum_{i=1}^{\rho} \beta_{2i} X_{t-i} + u_t \tag{4.18}$$

$$X_t = a + \sum_{i=1}^{\rho} \beta_{1i} Y_{t-i} + \sum_{i=1}^{\rho} \beta_{2i} X_{t-i} + u_t \tag{4.19}$$

An F test is then carried out for the null hypothesis of no Granger causality $H_0 : \beta_{21} = \beta_{22} = ... = \beta_{2\rho} = 0$ for equation (4.18) and $H_0 : \beta_{11} = \beta_{12} = ... = \beta_{1\rho} = 0$ for equation (4.19). However, the above analysis is valid when the variables under consideration are integrated of order zero. In the case of non-stationary variables, the direction of causality can be determined via F tests in the first differenced VAR model:

$$\Delta Y_t = a + \sum_{i=1}^{\rho} \beta_{1i} \Delta Y_{t-i} + \sum_{i=1}^{\rho} \beta_{2i} \Delta X_{t-i} + u_t \quad (4.20)$$

$$\Delta X_t = a + \sum_{i=1}^{\rho} \beta_{1i} \Delta Y_{t-i} + \sum_{i=1}^{\rho} \beta_{2i} \Delta X_{t-i} + u_t \quad (4.21)$$

On the other hand, in the presence of cointegration, Granger causality requires the inclusion of an error correction term to capture the convergence to the long-run equilibrium (Narayan and Smith, 2004). Given the results from the cointegration analysis, a vector error correction model is used when the dependent variable is per capita GDP, and a vector autoregressive model for the other cases. The significance of the first differenced explanatory variables indicates short-term Granger causality, while a significant error correction term is indicative of long-run causality.

The results from the Granger causality tests are reported in 4.5. The coefficient of the lagged error correction term is statistically significant at the 1% significant level with a negative sign. This finding implies that immigration Granger causes per capita GDP in the long-run. The error correction coefficient also implies that the speed of convergence to the long-run equilibrium is very slow. On the other hand, the F-statistics suggest that we can not reject the null hypothesis of no Granger causality between immigration and GDP. When it comes to the Granger causality between immigration and unemployment, we can not reject the null hypothesis that immigration does not Granger cause unemployment, but we reject he null hypothesis that unemployment does not Granger cause immigration.

Table 4.5 Results for Granger causality

	F-statistics [Probability values]	
		ECT_{t-1}
Null hypothesis		
Immigration does not granger cause GDP	0.619	-0.084***
	[0.543]	(-3.084)
GDP does not granger cause Immigration	0.895	
	[0.416]	
Immigration does not granger cause Unemployment	1.509	
	[0.233]	
Unemployment does not granger cause Immigration	3.779**	
	[0.032]	

Notes: ***,** indicate significance at 1%,5% significant levels. t-statistic is shown in parenthesis below the estimated coefficient of the error correction term.

5. Conclusions

In this chapter we investigated the existence of causality between immigration and two macroeconomic variables: unemployment and per capita GDP. Immigrants do not only affect the employment opportunities of natives, but they also take into consideration the employment opportunities in their decision to migrate. Using annual data over the period 1960-2008, we employ both the Johansen and Juselius (1990) cointegration methodology and the ARDL bounds testing approach (Pesaran et al, 2001).

Our findings imply that there is a stable long-run relationship running from per capita GDP to immigration.. On the other hand, the estimations suggest that we can not reject the null hypothesis of no cointegration between immigration and unemployment. The results are robust whether the Johansen and Juselius approach or the ARDL bounds testing approach is employed.

In the final part of this chapter we employed the conventional Granger non-causality tests. Our findings indicate that per capita GDP causes immigration in the

sense of Granger, while no evidence of reverse causality is found. On the other hand, there is evidence of short-run causality running from unemployment to immigration.

Our results are in line with the findings of previous empirical studies (see e.g. Dritsakis, 2008; Boubtane et al, 2011), which used different datasets and econometric techniques. Dritsakis (2008), using data from the National Statistical Service of Greece for the period 1970-2006, found evidence of bidirectional causality between immigrants and per capita GDP. Boutbane et al (2011) found that, among 22 OECD countries, the unemployment negatively causes immigration in Greece.

Regarding the relationship between immigration and unemployment, the results are in line with our expectations. As emphasized by Bodvarsson and Van den Berg (2009), there are few reasons why we should expect no long-run effects of immigration on the employment opportunities of natives. To name but a few, capital responses, changes in output mix, technological and product market responses, can all mitigate any possible migration pressure due on the labor market. The finding that immigration responds to unemployment in the short-run suggests that immigration is sensible to the employment opportunities in the host country.

On the other hand, our findings suggest that immigration is not responsive to per capita income. This result probably indicates that the migration decision is more related to the employment opportunities in the receiving country, than it is related to per capita GDP. Finally, our results also confirm that per capita income is caused by immigration in the sense of Granger. This finding has already been suggested by Sarris and Zografakis (1999) who showed that immigration brought about a 1.5 percent growth in the Gross National Product (GNP).

Chapter 5

Wage and Employment Differentials Between Ethnic Groups in Greece

1. Introduction

The present chapter concentrates on the labor market differentials between natives and immigrants in the case of Greece. Despite the large literature concerning the gender labor market discrimination in Greece (see among others: Psacharopoulos (1983), Papapetrou (2004), Cholezas and Tsakloglou (2006), Livanos et al. (2009), Livanos and Pouliakas (2009)), and contrary to other immigration countries[50][51], little work has been done with respect to native/immigrant labor market discrimination in Greece. Lianos et al (1996) found that equally productive immigrants on four prefectures of Northern Greece earn about 40% lower wages than natives. Moreover, their findings imply that immigrants do not displace natives, because they are mostly employed in low-status, low-paid jobs forsaken by natives.

Demoussis et al (2008), using data from Greek Household Budget Survey (2004-2005) and employing the Oaxaca (1973) and Blinder (1973) decomposition method, found that about 48% of the wage differential is attributed to discrimination.

[50] See: Kidd, 1993; Kee,1994 and 1995; Golder, 2000; Nielsen, 2000; Lang, 2000; Coulon, 2001; Arai and Vilhelmsson, 2001; Bevelander and Nielsen, 2001; Liu and Chong, 2004; Nielsen et al, 2004; Aldashev et al, 2008; Sanroma et al, 2009.

[51] With respect to the wage differentials between immigrants and natives, there is also another strand of the literature, the *assimilation* literature, first introduced by Chiswick (1978) (see also Borjas, 1985; 1995). This literature, typically assumes that upon arrival, immigrants earn less than natives, because they lack host country-specific human capital, and analyzes whether immigrants earnings eventually converge to the earnings of natives. This methodology relies on the estimation of the following Mincerian wage equation, augmented by the variable years since migration:

$$w_i = \alpha + \beta_1' x_i + \beta_2 ysm + \beta_3 ysm^2 + \beta_4 M + u_i$$

Additional analysis however, reveals that about 90% of the unexplained gap can be attributed to asymmetrical occupational access by natives and immigrants.

Drydakis and Vlassis (2010) using experimental data found strong evidence of discrimination against Albanians in three dimensions. First, Albanians face 43.5% less chance of access to occupations; second, Albanians face 36.5% less chance of being registered with insurance coverage; and finally, their potential wage contracts are 8.8% below those of Greeks, and 5.3% below the legal minimum wage.

The present study contributes to the literature by providing further evidence on the native/immigrant wage and employment differentials. As far as wage differential is concerned, this paper differs from the paper of Demoussis et al (2008) in the following aspects: First we use used from the Greek Labor Force Survey (LFS, 2009) instead of the Greek Household Budget Survey used by Demoussis et al, 2008).

Second, we examine the importance of distinguishing between immigrants originating from EU countries and immigrants originating from countries outside EU, most of whom are illegal immigrants. The rationale behind this strategy is to asses the widely accepted belief in the Greek society, that immigrants originating from 'poor', outside EU countries[52] (mainly from Albania, Bulgaria, Rumania, Pakistan, India, Egypt, Philippines, Bangladesh, Iraq and Nigeria), constitute an *unwelcome* group of immigrants, in terms of the traditional economic literature of discrimination. To do so, we estimate a Mincer (1974) type earnings equation for each ethnic group; namely, natives, the total sample of immigrants, immigrants outside EU and immigrants within EU, and then we apply the Oaxaca and Ransom (1994) decomposition

[52] It should be noted however, that the group of immigrants originating outside EU consists of immigrants, originating from US, Canada and Australia. These groups of immigrants are in general not considered as *unwelcome*. Unfortunately, the data does not allow us to exclude those immigrants from the group of immigrants outside E.U.. Despite these data limitations, we consider that the validity of the empirical results is not seriously disturbed, since the vast majority of immigrants, originating from countries outside EU, are those characterized *unwelcome*.

methodology. The evidence indicates that about 61% of the average wage differential between natives and immigrants as a whole is explained by differences in the average characteristics. The residual 39% remains unexplained. Similar results, are drawn when the analysis is carried out for the group of immigrants outside EU. However, when the native/ EU immigrant wage differential is considered, the evidence indicates that EU immigrants earn more than equally productive Greeks.

Finally, we analyze the native/immigrant employment gap. To the best of our knowledge, there is no previous study concerned with this feature of labor market discrimination in Greece. A logit regression is estimated, for the probability of natives and immigrants to obtain employment. As it is standard in labor economics studies, we assume that the probability of employment is determined among others by years of schooling, years of experience, the presence of children and the residual household income. Then, Fairlie's (1999; 2005) decomposition for non-linear models is applied in order to analyze the employment gap[53]. The evidence suggests that 69% of the native/immigrant employment gap is explained by differences in endowments and that the residual part attributed to discrimination is 31%. Again, separate analysis for the native/EU immigrant employment gap reveals that EU immigrrants have an employment advantage on the Greek labor market.

The remainder of this chapter is organized as follows: The next Section discusses the economics of labor market discrimination. Section 2 discusses discrimination from a theoretical point of view. Further, we present the Blinder and Oaxaca decomposition methodology and its variants for linear and non-linear models. Section 3 describes the data. In Section 4 we describe the empirical specification. We also discuss the issue of sample selection bias. In Section 5, we report the OLS and logit

[53] Gomulka and Stern (1990) developed a model for decompositions based on a probit model, Nielsen (1998) for a logit model, while Fairlie (1999; 2003) for both probit and logit model

regression results for each ethnic group, while in section 6 we report the results from the decomposition technique. Finally, section 7 concludes the chapter.

2. The Economics of discrimination

2.1 Taste Discrimination

The literature on economics of discrimination is largely based on the seminal model of employer discrimination of Becker (1971). The assumption in the employer discrimination model is that employers treat less favorably the members of a minority (i.e. women, immigrants) than members of a majority with identical productive characteristics. This implies that when a woman or an immigrant is employed, the employer considers the cost to be both the wage and the disutility from hiring a member of the minority group. Hence, minority workers have to compensate employers by accepting lower wage for identical productivity or by being more productive. Thus, in the simple case where for example natives and immigrants are perfect substitutes in production, employers can be thought of as maximizing a utility function of the form:

$$U = pf(n+m) - w_n n - w_m m - dm \tag{5.1}$$

where p is the output price, f is the production function, n is the number of natives, w_n is the wage paid to natives, m is the number of migrants, w_m is the wage paid to migrants and $d>0$ is a constant reflecting prejudiced tastes against migrants. Normalizing the price of output to unity, the first order conditions determine the optimal number of workers hired at each firm:

$$f'(n) = w_n, f'(m) = w_m + d \tag{5.2}$$

Since d is positive, the only equilibrium in which natives and immigrants are employed is the one in which $w_n = w_m + d$ (if d=0 we must have $w_n = w_m$). On the other hand, if d, as it seems more likely, varies across employers, then employer i hires only native workers when $w_n < w_m + d_i$, and only immigrants when $w_n > w_m + d_i$.

2.2 Statistical Discrimination

Wage differentials between a majority and a minority group may arise even if employers are not prejudiced against the members of the latter group. The theory of statistical discrimination is based on the fact that employers do not perfectly observe the qualifications and the productivity of an agent (Phelps, 1972; Arrow, 1973). The uncertainty about the productivity of a candidate employer encourages employees to use statistics about the average score of a group of workers in order to forecast the productivity of the candidate. Hence, candidates that belong to high productivity groups tend to benefit while candidates belonging to low productivity groups do not.

Nevertheless, Aigner and Cain (1977) argue that the statistical theories of discrimination do not explain most labor market discrimination. To see this, let us assume that employers base their hiring decisions and placement on some indicator of skill, y, say a score test, that measures the true ability, q. Hence, the measurement equation is:

$$y = q + u \tag{5.3}$$

where u is a normally distributed error with zero mean and constant variance. Employers can observe the test score, y, but the main interest is the expected value of the overall ability, q, which is denoted by $\hat{q}$. The expected value of q given y is[54]:

$$\hat{q} = E(q/y) = (1-\gamma)a + \gamma y \tag{5.4}$$

where a is the group mean of q and $\gamma = \frac{Var(q)}{Var(q)+Var(u)} = \frac{Cov(q,y)}{Var(y)}$, and $0<\gamma<1$ shows the reliability of a test score, y, as s measure of true score, q. Now, consider two different groups of workers, say, natives and immigrants, with possible different means, α^N and α^M. Hence, the employer will pay an amount, $\hat{q}$, based on the available information for each group and individual (see equation 5.4):

$\hat{q^N} = (1-\gamma^N)a^N + \gamma^N y^N$ and $\hat{q^I} = (1-\gamma^I)a^I + \gamma^I y^I$.

Aigner and Cain (1977) argue that the profit-maximizing behavior by employers requires that the employer makes a subjective assessment of a worker's skill, i.e. to assess factor productivity and pay accordingly. Hence, if employers mistakenly believe that $a^N > a^I$, if, in fact, $a^N = a^I$, then employers mistakenly overpay natives. However, Aigner and Cain cast doubts that that such mistaken behavior will persist in competitive labor markets.

2.3 Decomposition for linear models

The standard Blinder (1973) and Oaxaca (1973) decomposition method for linear models decomposes the overall pay gap between two groups into a component explained by observable differences in human capital characteristics, and a residual

[54] it is useful to think of equation (5.4) as a conditional expectation from a linear regression function: $q = (1-\gamma)\alpha + \gamma y + u'$. The regression is operational, because employers can measure the actual q of a worker, on the basis of *post hoc* evaluation of the worker's performance.

(unexplained) component, usually referred as discrimination. The first step of the Blinder-Oaxaca method, involves estimating two separate earning equations by ethnic group:

$$\ln W_N = \beta_N X_N + v_N \tag{5.5}$$

$$\ln W_I = \beta_I X_I + v_I \tag{5.6}$$

where lnW denotes the natural logarithms of hourly wages, X is a matrix of the individual characteristics, and subscripts N and I indicate the ethnic group (natives and immigrants, respectively). The mean wage difference can be expressed as the difference in the linear prediction at the group-specific means of the regressors:

$$\ln \bar{W}_N - \ln \bar{W}_I = \hat{\beta}_N \bar{X}_N - \hat{\beta}_I \bar{X}_I \tag{5.7}$$

After making some reasonable rearrangements equation (5.7) can be written as follows:

$$\ln \bar{W}_N - \ln \bar{W}_I = \hat{\beta}_N (\bar{X}_N - \bar{X}_I) + \bar{X}_I (\hat{\beta}_N - \hat{\beta}_I) \tag{5.8}$$

where the first term on the right hand side of equation (5.8) represents the explained component, attributable to individual characteristics, and the second term the unexplained component, attributable to potential discrimination. Decomposition (5.8) is expressed from the viewpoint of group N, that is, the differences in average characteristics are weighted by the coefficients of group N and the differences in coefficients are weighted by group's I average characteristics. Alternatively, the differential can be expressed from the viewpoint of group I:

$$\ln \bar{W}_N - \ln \bar{W}_I = \hat{\beta}_I (\bar{X}_N - \bar{X}_I) + \bar{X}_N (\hat{\beta}_N - \hat{\beta}_I) \tag{5.9}$$

An alternative decomposition given by Oaxaca and Ransom (1994) is based on the assumption that there is some nondiscriminatory coefficients vectors, say β^*, that should be used as weights. The mean outcome difference can then be expressed as:

$$\ln \bar{W}_N - \ln \bar{W}_I = \beta^* \ (\bar{X}_N - \bar{X}_I) + \bar{X}_N(\hat{\beta}_N - \beta^*) + X_I(\beta^* - \hat{\beta}_I) \tag{5.10}$$

where β^* is defined as a weighted average of the coefficient vectors, β_N and β_I:

$$\beta^* = \Omega \hat{\beta}_N + (I - \Omega)\hat{\beta}_I \tag{5.11}$$

where Ω is a weighting matrix and I is the identity matrix. As it is clear, decompositions (5.8) and (5.9) are special cases of decomposition (5.10) when Ω is a null matrix or equal to I. Different assumptions about the form of Ω can be considered. Reimers (1983) proposes the assumption that $\Omega=0.5I$ whereas Cotton (1988) suggests that Ω is equal to sI, where s denotes the relative sample size of the majority group. Neumark (1988) and Oaxaca and Ransom (1994) propose to fit a pooled model to derive the weighting coefficient β^*, such as:

$$\Omega = (X'X)^{-1}(X_N'X_N) \tag{5.12}$$

where X is the observation matrix for the pooled sample and X_N is the observation matrix for the native sample.

Incorporating the issue of sample selection correction mentioned at the beginning of this section, decomposition (5.10) can be written as[55]:

$$(\ln \bar{W}_N - \ln \bar{W}_I) - (\beta_{\lambda N}\lambda_{iN} - \beta_{\lambda I}\lambda_{iI}) = \beta^* \ (\bar{X}_N - \bar{X}_I) + \bar{X}_N(\hat{\beta}_N - \beta^*) + X_I(\beta^* - \hat{\beta}_I) \tag{5.13}$$

[55] See Neuman and Oaxaca (2004).

2.4 Decomposition for non-linear models

For a linear regression, the standard Blinder-Oaxaca decomposition is given by equation (5.8) or (5.9), as discussed above. Following Fairlie (1999; 2003), the decomposition for a nonlinear equation, such as $Y = F(X\hat{\beta})$, can be written as:

$$\bar{Y}^{N} - \bar{Y}^{I} = \left[\sum_{i=1}^{N^N} \frac{F\left(X_i^N \hat{\beta}^N\right)}{N^N} - \sum_{i=1}^{N^I} \frac{F\left(X_i^I \hat{\beta}^N\right)}{N^I}\right] + \left[\sum_{i=1}^{N^I} \frac{F\left(X_i^I \hat{\beta}^N\right)}{N^I} - \sum_{i=1}^{N^I} \frac{F\left(X_i^I \hat{\beta}^I\right)}{N^I}\right] \quad (5.14)$$

Where F^j is the average probability of the binary outcome of interest for race *j* and N^j is the sample size for race *j*. The first term on the right hand side of equation (5.14) represents the part of the employment gap explained by the differences in endowments and the second term captures the residual gap, usually attributed to discrimination[56].

The equality in equation (5.14) does not hold exactly for the probit model, in which F is defined as the cumulative distribution function from the standard normal distribution, but holds very closely as shown by Fairlie (2005).

In the case where the immigrant coefficient estimates, $\hat{\beta}^M$, are used as weights in the first term in the decomposition, and the native distributions of the independent variables, $\bar{X}^N$, are used as weights for the second term, the decomposition is written as:

[56] Note that Equation 5.18, applied to nonlinear models, is an equivalent expression of the standard Blinder (1973) and Oaxaca (1973) decomposition applied to linear models (equation 5.12), where the vector of coefficient estimates of native group is used as a norm.

$$\bar{Y}^{N} - \bar{Y}^{I} = \left[\sum_{i=1}^{N^N} \frac{F\left(X_i^N \hat{\beta}^M\right)}{N^N} - \sum_{i=1}^{N^I} \frac{F\left(X_i^I \hat{\beta}^M\right)}{N^I} \right] + \left[\sum_{i=1}^{N^I} \frac{F\left(X_i^N \hat{\beta}^N\right)}{N^I} - \sum_{i=1}^{N^I} \frac{F\left(X_i^N \hat{\beta}^I\right)}{N^I} \right] \tag{5.15}$$

The third alternative, used in this paper, is to weight the first term of the decomposition expression, using the coefficients from the pooled sample of the two groups (Neumark (1988); Oaxaca and Ransom (1994)). Hence, the decomposition equation is stated as follows:

$$\bar{Y}^{N} - \bar{Y}^{I} = \left[\sum_{i=1}^{N^N} \frac{F\left(X_i^N \beta^*\right)}{N^N} - \sum_{i=1}^{N^I} \frac{F\left(X_i^I \beta^*\right)}{N^I} \right] + \left[\sum_{i=1}^{N^N} \frac{F\left(X_i^N \hat{\beta}^*\right)}{N^N} - \sum_{i=1}^{N^N} \frac{F\left(X_i^N \beta^*\right)}{N^N} \right] + \left[\sum_{i=1}^{N^I} \frac{F\left(X_i^I \beta^*\right)}{N^I} - \sum_{i=1}^{N^I} \frac{F\left(X_i^I \beta^I\right)}{N^I} \right] \tag{5.16}$$

where β^*, the nondiscriminatory vector of coefficients is defined as the vector of coefficients from the pooled sample of the two groups.

3. Data and Descriptive Statistics

The data used in or analysis are drawn from the 2009 (second quarter) Greek LFS. This is the richest and most reliable survey conducted on a quarterly basis since 1998. The sample contains about 75,000 individuals where about 6.5% (5,000) consists of immigrants. In order to analyze native/immigrant wage differentials we restrict the sample to individuals working in the wage and salary sector whose age lies between 18 and 64 and who reported that they worked at least one hour the reference week. We exclude self-employed workers since their earnings include returns to

capital and they usually do not report or underreport their earnings. Furthermore, we exclude unemployed, retirees and individuals out of workforce. Suppressing all observations with missing data, we end up with a sample of 14,613 individuals, 1,931 of which are immigrants.

Since the Greek LFS questionnaire asks for the monthly earnings, we construct a measure of hourly earnings based on monthly wages and weekly hours of work. The total number of school years has been assigned between the range of 0 and 20 according to the level of education declared by each individual. Furthermore, we construct a measure of potential experience equal to age-6-years of schooling[57]. Other variables included in the wage determination process have been introduced as dummies. These variables are[58]: marital status, sex, whether an individual is household head / manager / holds a job in a small firm which employs less than 20 workers / holds a job in a large firm which employs more than 50 workers, whether an individual works in the public sector / employed on the basis of a permanent contract or on a fulltime basis. Furthermore, given that a large part of economic activity in Greece is concentrated in Attiki, we use a dummy variable named "living in Attiki". Eventually, twenty economic activities and eight occupational dummies are also used.

When the analysis is carried out for the probability of employment, the sample consists of both workers in the wage and salary sector and self-employed. We consider as explanatory variables those that generally affect the individual's reservation wage and eventually the probability of being employed against being unemployed. Years of schooling and years of potential experience are expected to affect positively the probability of being employed. Residual[59] household income

[57] We subtract 6 because primary education begins at the age of 6 years.
[58] All the variables are analytically defined in the appendix.
[59] Residual income is calculated as the difference between the family income (the income of all members of household) and the income of the person who answer the questionnaire

usually negatively affects the probability of employment, since the higher it is the higher is the reservation wage and the more is the time spend on searching for a job which meets the demands of an individual. Furthermore, the dummies used in the wage determination process are also used in the determination of employment process.

Table 5.1 Means of variables used in the OLS specification (Std. dev. in parenthesis) / Dependent variable : hourly wage

	Natives	Immigrants	Other Immigrants	E.U. Immigrants
Hourly wage	7.13	5.17	5.13	5.41
	(4.24)	(2.87)	(2.82)	(3.09)
Schooling	12.75	9.92	9.64	11.26
	(0.03)	(3.38)	(3.29)	(3.47)
exp	21.46	21.22	21.15	21.56
	(11.80)	(10.01)	(9.82)	(10.88)
male	0.56	0.63	0.67	0.46
	(0.49)	(0.48)	(0.46)	(0.49)
HH	0.47	0.56	0.56	0.52
	(0.49)	(0.49)	(0.49)	(0.49)
Married	0.61	0.66	0.67	0.60
	(0.48)	(0.47)	(0.46)	(0.48)
Manager	0.11	0.02	0.01	0.03
	(0.31)	(0.13)	(0.12)	(0.17)
Small	0.58	0.87	0.87	0.85
	(0.49)	(0.33)	(0.33)	(0.35)
Large	0.16	0.03	0.02	0.03
	(0.37)	(0.17)	(0.16)	(0.19)
Fulltime	0.95	0.91	0.91	0.91
	(0.20)	(0.27)	(0.28)	(0.27)
Permanent	0.89	0.79	0.80	0.74
	(0.31)	(0.40)	(0.39)	(0.43)
Public	0.40	0.02	0.01	0.05
	(0.49)	(0.14)	(0.11)	(0.23)
Attiki	0.31	0.47	0.48	0.43
	(0.47)	(0.49)	(0.49)	(0.49)
N	12682	1931	1614	317

Table 5.1 presents simple statistics of the variables which explain hourly wages. On average, immigrants'[60] earned hourly wage is 27.5% less than the one of the natives. With respect to human capital characteristics, the average native has roughly three years more schooling than immigrants. However, the differential declines to 1.5 years when natives are compared to E.U. immigrants. On the other hand, as regards to years of potential experience, the four sub-categories have about 21 years of working experience. The share of immigrant males (63%) to total population is larger than the one of natives (56%). Greek individuals that report themselves as head of household have a smaller share (47% against 56%) to the total population whereas the share of married foreigners is 5% above the share of married natives. The proportion of natives reported themselves as manager (11%) is larger than the respective proportion of immigrants (2%). The vast majority of foreigners hold a job in small firms (87% against 58%) whereas only 3% are employed in large firms. 89% of natives are employed on a basis of a permanent contract against 79% of immigrants. Only 2% of foreigners are employed in the public sector against 40% of natives. Finally, 47% of immigrants against 31% of natives live in Attiki.

Table 5.2 presents sample statistics of the variables which explain the employment rates[61] of the groups under consideration. Natives have an employment rate of 91% which is 2% higher than the employment rate of immigrants and the one of other immigrants and 1% higher than E.U. immigrants' employment rate. Natives have about two years more schooling than immigrants and than other immigrants but almost the same schooling years with E.U immigrants. Furthermore, immigrants have less working experience (by about three years) than natives. About 47% of natives report themselves as a household head, 64% are married and 65% are parents. On the

[60] The term immigrants, is referred to the total sample of immigrants. We refer the terms other immigrants and immigrant outside EU, interchangeably.
[61] Employment rate is the ratio of employed to labour force (employed + unemployed).

other hand, the shares of immigrants that report themselves as a household head, that are married and parents are significantly higher. Finally, immigrants have a higher residual income (563 euros against 467 euros) and higher residence ratio in Attiki (45% against 25%).

Table 5.2 Means of variables used in the probit specification (Std. dev. in parenthesis) / Dependent Variable : employment rate

	Natives	Immigrants	Other Immigrants	E.U. Immigrants
Employment rate	0.91	0.89	0.89	0.90
	(0.28)	(0.30)	(0.30)	(0.29)
schooling	11.75	9.96	9.67	11.27
	(3.97)	(3.42)	(3.33)	(3.50)
Exp	24.08	21.12	21.05	21.47
	(13.11)	(10.10)	(9.98)	(10.61)
Male	0.57	0.62	0.66	0.43
	(0.49)	(0.48)	(0.47)	(0.49)
HH	0.47	0.54	0.55	0.50
	(0.49)	(0.49)	(0.49)	(0.50)
married	0.64	0.67	0.67	0.64
	(0.47)	(0.46)	(0.46)	(0.47)
children	0.65	0.75	0.77	0.69
	(0.58)	(0.78)	(0.77)	(0.80)
res_income	467.43	563.00	585.38	462.5
	(687.40)	(669.64)	(673.50)	(643.12)
Attiki	0.25	0.45	0.46	0.40
	(0.43)	(0.49)	(0.49)	(0.49)
N	27869	2709	2218	491

4. Econometric Methodology

The fact that the wage and salary earners are probably self-selected (not randomly) from a larger population is a major and well recognized issue (Reimers, 1983; Kee, 1995; Coulon, 2001). The omission of this selectivity bias leads to an underestimation or an overestimation of the discrimination.

To correct for the possible sample selection bias, we adopt the Heckman's (1979) two step method. The wage sample selection equation is added to the model in order to estimate potential sample selection bias:

$$E_i^* = \gamma Z_i + u_i \tag{5.17}$$

where E_{ij}^* is the selection variable which is not observed whereas its sign is. Therefore, the selection mechanism is reformulated as:

$$E_i = \begin{cases} 1 & if \quad E_i^* > 0 \\ 0 & if \quad E_i^* < 0 \end{cases} \tag{5.18}$$

and the regression model as:

$$\ln w_i = \begin{cases} \beta X_i + e_i & if \quad E_i = 1 \\ 0 & if \quad E_i = 0 \end{cases} \tag{5.19}$$

with $u_i, e_i \, N[0,0,1,\sigma^2_\varepsilon,\rho]$ and Z is a matrix of observable variables that includes at least one variable that is orthogonal to the wage determination process. Residual household income, years of schooling, experience (and its square) and a dummy variable denoting the presence of children are considered to explain the reservation wage of each individual and her inclusion in the wage and salary sector. Consequently, the regression model that applies to wage and salary earners is a typical Mincerian wage equation augmented by the Heckman correction term:

$$\ln w_i = \beta X_i + \beta_\lambda \lambda_i + v_i \tag{5.20}$$

with λ_i is the Heckman correction term[62] (or the inverse of Mill's ratio). The sign of the Heckman's correction term determines whether the observed wage is above or below the offered wage that would prevail if those unemployed, out of work force or

[62] The inverse of Mill's ratio is given by: $\lambda_i = \phi(\beta X_i) / \Phi(\beta X_i)$, where *Φ(.)* is the standard normal cumulative distribution function and *φ(.)* is the standard normal density function.

self-employed, were wage and salary earners. Thus, a negative λ_i implies that the offered wage exceeds the observed wage and vice versa.

5. Empirical Results

5.1 Regression Analysis

The estimations of the earning function are presented in Table 5.3. Coefficients of the inverse Mill's ratio are negative and significant for natives and European Union immigrants, negative and insignificant for the total sample of immigrants and positive and insignificant for other immigrants. Therefore the offered wages would have been higher if the excluded workers would be included in the wage and salary sector, except for the case of other immigrants where the offered wages would have been slightly lower.

The estimated coefficients of the human capital variables (schooling, experience and experience squared) for the group of natives are significant and have the expected sign. One more year of schooling increases the native wage by 0.013 percent, while experience has an inverted U-shaped effect on the wage. Moreover, natives employed as managers earn more than those belong to the omitted category. Males, married household headers are also rewarded more than the respective omitted categories. Employees in large firms are better paid than those employed in smaller firms. Living in Attiki is more beneficial for employees, in terms of hourly wages, than living in other regions. Employees in public sector earn more than those employed in private sector. Being employed fulltime rewards less than employed part-time, while working as a permanent employee rewards more than working as a temporary employee.

In columns 2 to 4, the log of hourly wage is regressed on the same set of control variables for the different groups of immigrants. The human capital variables - years of schooling and years of potential experience - are now not statistically different from zero. This finding probably confirms the limited transferability of human capital across countries. Furthermore, being the head of household, manager, married and employed fulltime, have a positive and significant effect on hourly wages. As regards the remaining covariates, the results indicate that their estimated effects are far from being significant for all groups of immigrants.

Table 5.4 presents the results from estimation of a logit model for the probability of natives and immigrants to obtain employment. Most coefficients for the sample of natives have also the expected sign. Years of schooling increase the probability of being employed, while potential labor market experience has an inverted U-shaped effect. Being married and male have higher probability of employment. Residual household income decreases the probability of being employed. This is usually explained by its impact on individual's reservation wage. The higher residual household income is, the higher the reservation wage is. Therefore, the individual may spend more time out of employment until he finds a job where the offered wage exceeds his reservation wage. Living in Attiki has a positive impact whereas having children has a negative impact. However, both dummies are far from being significant at the conventional significant levels.

For immigrants, most of the explanatory variables have a weaker effect. Years of schooling do not affect the probability of employment whereas potential experience does (except for E.U immigrants). For an immigrant being household head increases probability of being employed, whereas married and parents have a lower probability of obtaining employment than the respective omitted categories.

Table 5.3 Estimated log wage equation, corrected for sample selection bias

	Natives	Immigrants	Other Immigrants	E.U. Immigrants
	(1)	(2)	(3)	(4)
Schooling	0.013***	0.003	0.002	0.006
	(0.001)	(0.003)	(0.003)	(0.007)
exp	0.013***	0.003	0.005	-0.001
	(0.001)	(0.003)	(0.004)	(0.008)
exp2	-0.000***	-0.000	-0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)
Manager	0.066***	0.153**	0.124*	0.324*
	(0.009)	(0.055)	(0062)	(0.129)
HH	0.031***	0.077***	0.076***	0.067
	(0.007)	(0.019)	(0.021)	(0.047)
male	0.049***	-0.003	-0.001	0.034
	(0.007)	(0.026)	(0.029)	(0.060)
Married	0.041***	0.063***	0.074***	0.002
	(0.006)	(0.017)	(0.020)	(0.041)
Small	-0.040***	-0.006	-0.011	-0.007
	(0.006)	(0.026)	(0.029)	(0.067)
Large	0.018*	0.028	0.039	-0.007
	(0.008)	(0.046)	(0.053)	(0.101)
Fulltime	-0.359***	-0.430***	-0.434***	-0.422***
	(0.013)	(0.027)	(0.030)	(0.066)
Permanent	0.108***	-0.004	-0.021	0.061
	(0.009)	(0.018)	(0.020)	(0.046)
Public	0.142***	0.173**	-0.016	0.467***
	(0.009)	(0.059)	(0.076)	(0.116)
Living in Attiki	0.023***	0.007	0.021	-0.089*
	(0.006)	(0.015)	(0.017)	(0.041)
Lambda	-0.057**	-0.032	0.031	-0.338*
	(0.018)	(0.070)	(0.079)	(0.178)
Constant	1.631***	1.749***	1.700***	1.983***
	(0.037)	(0.116)	(0.130)	(0.278)
Economic activity dummies	*Yes*	*Yes*	*Yes*	*Yes*
R-squared	0.508	0.252	0.221	0.401
N	12682	1931	1614	317

Table 5.4 Logit regression results for the probability of being employed

	Natives	Immigrants	Other Immigrants	E.U. Immigrants
Schooling	0.107***	-0.000	-0.011	0.031
	(0.007)	(0.020)	(0.022)	(0.049)
Exp	0.075***	0.074***	0.081***	0.005
	(0.006)	(0.024)	(0.027)	(0.068)
Exp2	-0.000***	-0.001***	-0.001***	0.000
	(0.000)	(0.000)	(0.000)	(0.001)
Residual	-0.000***	0.000	0.000*	-0.0001
income	(0.000)	(0.000)	(0.000)	(0.000)
HH	0.381***	0.518***	0.683***	0.067
	(0.062)	(0.188)	(0.210)	(0.485)
Male	0.765***	0.171	0.075	1.172**
	(0.051)	(0.179)	(0.203)	(0.486)
Married	0.564***	0-.446***	-0.346*	-1.214***
	(0.056)	(0.162)	(0.183)	(0.445)
Children	-0.024	-0.127*	-0.152*	-0.068
	(0.037)	(0.077)	(0.085)	(0.204)
Living in Attiki	0.085	0.107	0.186	-0.220
	(0.052)	(0.131)	(0.145)	(0.327)
Constant	-0.863***	1.244***	1.179***	2.284**
	(0.133)	(0.367)	(0.409)	(0.934)
N	27869	2709	2218	491
LL	-7502	-868	-716	-143

Notes: Standard errors in parenthesis. ***, **,* indicate significant at 1%,5%,10% significant levels

6. Decomposition Analysis

The results from the decomposition of native immigrant wage gap are reported on table 5.5[63]. Since sample bias correction has applied, the observed differences in mean wages differ from the offered differentials. As far as the wage differential between natives and *immigrants* is concerned, the offered differential (0.331) is slightly higher than the observed differential (0.299). Similarly, the adjusted differential (0.374) between natives and *other immigrants* is higher than the raw differential (0.306). On the other hand, the offered differential (0.086) between natives and *E.U. immigrants* is markedly lower than the observed (0.267). These variations stem from the different

[63] The decomposition is calculated in STATA using Oaxaca (Jann, 2008)

values of the coefficients and mean of the Heckman correction term for the different groups.

The 61% of the mean wage gap between natives and *immigrants* is explained by differences in the average characteristics, while the residual part, usually referred as discrimination, is 39%. A similar picture is found when analyzing the wage gap between natives and *other immigrants*. About 55% of the mean wage differential is explained by differences in endowments and about 45% can be attributed to discrimination. However, when we estimate the wage differential between natives and *EU immigrants*, the negative sign of the part due to discrimination indicates that the earnings disadvantage of this group of immigrants would have been higher if they were treated in a similar manner to natives.

Table 5.5 Linear decompositions of native/immigrant wage gap

	Immigrants	Other Immigrants	E.U. Immigrants
Raw differential	0.299	0.306	0.267
Adjusted differential	0.331	0.374	0.086
Due to discrimination	0.129	0.170	-0.099
Due to endowments	0.202	0.204	0.186

Table 5.6 reports the estimates of the nonlinear decomposition[64] technique for the native/immigrant employment gap. The average probability of being employed between natives and *immigrants* is 0.013 points higher for natives. The part of the employment gap explained by differences in the average socio-economic characteristics accounts for 0.009 (69%) of the native/*immigrant* employment gap, suggesting that discrimination accounts for a small part of the employment gap (31%). The second column reports similar results for the employment gap between

[64] The non-linear decomposition is calculated in STATA using Fairlie. The routine can be found at: http://ideas.repec.org/c/boc/bocode/s456727.html.

natives and *other immigrants*. Endowments account for the 60% of the employment gap, while the unexplained component is estimated to be 40%. The most interesting results are reported in the third column of table 5.6. The employment gap between natives and *E.U. immigrants* is 0.006 points. However, the negative sign of the part of gap attributable to discrimination indicates that EU immigrants have an employment advantage in the Greek labor market.

Table 5.6 Non-Linear decompositions of native/immigrant gap in employment rates

	Immigrants	Other Immigrants	E.U. Immigrants
Employment gap	0.013	0.015	0.006
Due to discrimination	0.004	0.006	-0.004
Due to endowments	0.009	0.009	0.010

7. Conclusions

The mass entrance of immigrants into the Greek labour market since the early 1990's has changed the composition of the population. Foreigners are about 10% of total population and most of them are illegal and come from Albania. It is widely accepted that immigrants are paid less than the Greeks and they are victims of discrimination caused by employers' beliefs and attitudes.

In this chapter we tried to contribute to the empirical literature of discrimination between immigrants and natives in the case of Greece. We investigated the wage and employment differential between immigrants and natives, between natives and non–EU immigrants and natives and EU immigrants. Our results, concerning the wage differential, are a little different than those shown by Demoussis et al (2008). We found that 39% of the wage differential between natives and immigrants is due to discrimination. When we compare non–EU immigrants to natives, the part of wage

gap explained by discrimination is about 45%. On the contrary, the results imply that E.U. immigrants are paid on average more than equally productive natives.

Concerning the employment rate gap, we observe that the part explained by discrimination is 40% when we compare the non–EU immigrants to natives and 31% when we compare all immigrants (non–EU and EU) to natives. Hence, we can argue that discrimination would have been higher were it not for EU immigrants who have superior labor market prospects. On the other hand, the evidence indicates that E.U. immigrants have a higher employment probability than equally productive natives.

To sum up, our results are line with previous empirical studies (see e.g. Lianos et al, 1996; Demoussis et al, 2008) which used different datasets and econometric techniques. Nevertheless, this study offers two interesting conclusions. First, the part of native/immigrant wage gap attributed to discrimination would have been higher, unless E.U. immigrants were paid more than equally productive natives. Similarly, the part of the native/immigrant employment gap that is not explained by differences in the characteristics would have been higher if not immigrants had higher employment probabilities than equally productive natives. Hence, this study highlights importance of distinguishing between different groups of immigrants when examining labor market discrimination and suggests an immigration policy aiming at the smooth integration of non-E.U. immigrants – mainly originating from Albania and other neighboring Balkan countries – on the Greek labor market.

Appendix : Definition of the variables

Variables used in equation shown in Tables 5.3 and 5.4

Schooling is defined as total years of education completed

Experience (*Exp)* is defined as years of work experience

(Exp^2) is defined as years of work experience squared

Manager (0,1) Dummy=1 if an individual is in charge of a certain group of tasks and has a staff of people who report to him

Head of Household (HH) (0,1) Dummy=1 if an individual is the principal income earner of the household

Male (0,1) Dummy=1 if gender = male

Married (0,1) Dummy=1 if married

Small (0,1) Dummy=1 if the individual is working at a firm that employs less than 10 employees

Large (0,1) Dummy=1 if the individual is working at a firm that employs more than 50 employees

Fulltime (0,1) Dummy=1 if the individual is working all the usual working time, i.e. about eight hours a day, five days a week

Permanent (0,1) Dummy=1 if the individual has been hired for a position without a pre-determined time limit

Public (0,1) Dummy=1 if the individual is employed in the public sector

Living in Attiki (0,1) Dummy=1 if the individual lives in Attiki

Residual income is calculated as the difference between the family income (the income of all members of household) and the income of the person who answer the questionnaire

Children (0,1) Dummy=1 if the individual has at least one child.

General Conclusion

Greece was traditionally a country of outward migration. However, since the early 1990's it become a receiver of immigrants. Nowadays, the nearly 1 million immigrants, account for 10 percent of the nation's total population and about 7 percent of the total labor force. The socio-economic effects of the massive influx of immigrants have made immigration one of the most heatedly debated issues in politics. There are two opposite points of view. On the one hand, there are often expressed fears that immigrants displace native workers and reduce national wages. On the other hand, it is often argued that immigrants take low-status, low-paid jobs, forsaken by natives. Nevertheless, the empirical evidence in Greece is scarce.

The key aim of this Thesis was to estimate the effects of immigration on the labor market opportunities of natives in Greece. Our results are in line with most of the previous literature. Our results do not support the argument that immigrants displace natives from jobs. Nevertheless, we found little competition between immigrants and unemployed natives. On the other hand, the results imply that immigrants complement the employed natives. Considering the labor market institutions in Greece (i.e. firing restrictions, minimum wages), these effects are in line with our expectations. Moreover, during the last decade, there is a widespread participation of natives in tertiary and higher education. Thus, young Greeks seem to prefer to wait for employment that conforms to their skills, rather than compete with immigrants in low-status, and low-paid jobs.

Moreover, we studied the causal relationship between immigration and two macroeconomic indicators: unemployment and per capita GDP. The evidence indicates that immigration *Granger* causes GDP. On the other hand, we found short-

run causality running from unemployment to immigration. This latter result implies that immigrants take into consideration the employment opportunities in Greece.

Another issue is whether immigrants experience discrimination in the labor market, and hence are paid lower wages, or have fewer chances for employment than equally productive natives. This is against the antidiscrimination law, which was introduced by the adoption of the Amsterdam treaty (1997). Nevertheless, our findings imply a two speed immigration in Greece. On the one hand, immigrants originating from countries outside European Union face inferior labor market opportunities than natives with equal productive characteristics. On the other hand, E.U. immigrants have an earnings and employment advantage on the Greek labor market. Hence, our results suggest an immigration policy aiming at the smooth integration of non-E.U. immigrants – mainly originating from Albania and other neighboring Balkan countries – on the Greek labor market.

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