Wage differential of a trans–border labor market, a quantitative analysis

by

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To my parents and Jas ...

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Introduction

Introduction

This dissertation is composed of three related essays. The first one investigates observed regional wage differentials in Switzerland, while the other two focuses on the Swiss border Canton of Ticino analyzing wage differentials between natives and foreigners and the impact that cross–border commuters may have on the wages of the local labor supply.

The interest in explaining wage differentials in labor economics is closely related to the incomplete description of the labor market provided by the basic neoclassical theory. The basic model of competitive labor markets implies that as long as workers or firms can freely enter and exit the marketplace, there will be a single wage in the economy. This result was based, on the restrictive assumptions of perfect competition, free factor mobility, and homogeneity of firms and workers. Therefore, new theories have been developed in order to better describe the labor market behavior to explain wage differentials.

In the context of this dissertation, it is important to underline the relevant role of the theory of equalizing differences. This theory that dates back to Smith (1776) and subsequently formalized by Friedman and Kuznets (1945) and Friedman (1962) has generated considerable theoretical and empirical interest to exploit the existence of wage disparities among individuals. Reviewed by Rosen (1986), the theory refers to observed wage differentials required to equalize the total monetary and nonmonetary advantages or disadvantages among work activities and among workers themselves. In its basic framework, activities that offer favorable working conditions attract labor at lower than average wages, whereas jobs offering unfavorable working conditions must pay premiums as offsetting compensation in order to attract workers.

The compensating principle has inspired the development of two important economic models, the human capital theory and the hedonic wage approach. These theories have played an important role for both the theoretical interpretation of the wage differences and for the development of the earnings wage function as empirical

instrument widely applied in the economic literature.

The human capital theory postulates that individual expenditures on training and education should be considered as an investment to increase personal future income. The theoretical insight of the human capital theory was first developed by Mincer (1958, 1962) and Becker (1964, 1975) in an extension of Friedman and Kuznets (1945) analysis of income differences among independent workers, and successively extended by Mincer (1974) who had the merit to develop the standard human capital earnings function.

The hedonic approach, as explained by Kumar and Coates (1982), focuses on "quality" variation in both worker and job attributes as an explanation for wage differences. The essay of Rosen (1974) provides an important general framework for the hedonic price theory while successively Thaler and Rosen (1975) extended this approach to the labor market viewed for the first time as an hedonic market. The empirical studies in this literature typically estimate the hedonic wage function by correlating a workers wage with various job characteristics, after adjusting for other factors, such as differences in skills, human capital, that might generate wage differentials among workers.

Moreover, Rosen (1986) shows that the theory of equalizing differentials has found its earliest and most widespread use in the economic theory of discrimination which is viewed as arising from specific preferences for association with identifiable groups in the workplace. The modern economic analysis of discrimination can be traced back to Becker (1957) and his concept of taste discrimination. As underlined by Borjas (2002), in Becker's approach, a prejudiced person incorporates race, national origin, and gender of market participants in the long list of disadvantages that influence the value of the exchange. The labor market, therefore, may have to generate differentials to compensate prejudiced persons for their utility loss or gain.

There is a wide range of empirical analysis on labor market discrimination[1].

[1]See the survey provided by Cain (1986).

One of the most important contributions has been provided by Blinder (1973) and Oaxaca (1973). They developed a methodology to decompose observed average wage differentials among two groups into two components: a wage differential due to skills and a wage differential due to market discrimination.

In this dissertation, the special interest in the Swiss case arises from its small scale, its federalist structure, its geographical position, its high share of immigrant workers and its strong regional wage disparities.

The small scale of the country and the ensuing short distance between the regional labor markets should provoke an important mobility of the labor force, on the one hand, and promote spatial concentration and differentiation of economic structure among regions, on the other. The former will tend to minimize regional wage differentials, the latter will tend to increase them.

The federalist system of Switzerland, based on historical differences in language, culture and religion, will impose a cost on internal migration contributing to wage differences among regions but it will also reduce barriers for the integration of foreigners coming from the neighboring countries.

The location of Switzerland in the center of Europe without being member of the EU implies that wages can be greatly influenced by trans-border labor markets which are of different relevance for the various regions.

Switzerland historically has a high share of immigrant workers that increases in Swiss border Cantons due to the possibility to hire cross-border commuters. In 2002, foreigners accounted for a quarter of the Swiss manpower even if the access of immigrant labor force has always been limited by a system of quotas and by permits for foreigners that have been conceded only in absence of equivalent local labor supply.

Since 1st June 2002 the Swiss labor market is experiencing a transition period where the Free Movement of Persons between Switzerland and the European Union

member states will be gradually introduced and fully implemented within 12 years[2]. This change removes the most important instrument that has been used by Switzerland to control the immigration inflow, especially in Swiss border Cantons.

One of these border regions is the Canton Ticino which represents an interesting case of analysis. Ticino is a Swiss Canton on the north Italian border with 160'000 workers (4% of Switzerland) with twice the national share of foreign workers (41% in 2000 in Ticino, 25% in Switzerland). This is due to the possibility to employ foreign cross-border commuters coming from the North Italian Provinces whose share in the foreign employment in Ticino is 50%. This category of foreign workers has never been limited by quotas but regulated through geographical restrictions.

The neighboring Italian Provinces represent an "infinite" source of manpower for Ticino[3], that can be attracted by existing wage differentials. Due to the similar cultures between Ticino and the Italian Provinces (same language, and similar educational systems) the human capital is easily transferable. However cross–border commuters earn, ceteris paribus, less than Swiss workers. For these reasons, the Canton Ticino's situation represents an interesting extreme case of analysis in view of a complete liberalization of the Swiss labor market.

The heterogeneity of the Swiss labor market and the strong wage disparities among regions motivate the study presented in the first essay. Inter-regional wage differentials are a matter of great interest that have been studied for several countries such as the USA by Gerking and Weirick (1983), Spain by García and Molina (2002), Portugal by Vieira et al. (2005), and Switzerland by Rochira and Rosas (2005). Switzerland represents a typical case in which Zurich plays the role of the strong economic center that prevails among the other Swiss regions for its strong economic structure and its high concentration of human capital. In 2002, the wage in the Canton of Zurich was between 8% and 29% above the average Swiss level.

[2]The national priority has been abolished in June 2004 while the quotas will be abolished in June 2007.

[3]The employment basin of the neighboring Italian Provinces counts around 1 million workers that can potentially apply for a cross–border commuter working permit.

The purpose of this study is twofold: firstly, average observed wage differential between Zurich and the other Swiss regions are decomposed into a part due to the different characteristics of the labor force (endowment component) and one due to different remuneration of identical characteristics (remuneration component); secondly, and more interestingly, the contribution of each explanatory variable to the two components is identified, thus relating endowment and remuneration differentials to individual characteristics.

Two streams of literature have to be considered in this context. The first one follows the hedonic wage theory of Rosen (1986), while the second follows Blinder (1973) and Oaxaca (1973) wage differentials decomposition. As shown by Jones (1983), Oaxaca and Ransom (1999) and Horrace and Oaxaca (2001), application of the Blinder-Oaxaca methodology provokes an identification problem when attempting to estimate a detailed decomposition using sets of dummy variables. Yun (2005) developed a technique in order to solve the identification problem. Applying the latter methodology has the advantage to measure not only a detailed decomposition but also to reorganize the results in a more suitable way. The aggregation of the variables in categories as human capital, socioeconomic characteristics and job and firm characteristics is useful in the interpretation of the results. This appears specially relevant when analyzing wage differentials among regions rather than by ethnicity or gender where the focus is in the measurement of the total discriminatory component.

The results show that with respect to the richest Swiss region, Zurich, the average wage differentials appear rather balanced among both components except for the Lake of Geneva Region where the endowment component largely prevails. Among the factors that cause such wage differentials individual characteristics play an important role in the remuneration component, while the job and firm characteristics mainly influence the endowment component. In particular, human capital variables are the most important causes of the bias, not because Swiss regions show differences

in the human capital levels but in its remuneration. This seems to indicate a limited geographical mobility of the labor force due to the characteristics of Switzerland explained above. In contrast, endowment depends mainly on economic structure and type of occupation. Especially stronger economic regions can compensate disadvantages from endowment through remuneration of human capital attracting mobile foreign labor force.

The second essay decomposes the wage differential between natives and foreign permit groups in the Canton Ticino considering a segmentation of the labor market by tasks into a deterministic and an unexplained component. Following the pioneering study by Piore (1973) and successively extended by Bulow and Summers (1986), when separating the market by tasks it is implicitly assumed that the market behaves differently relative to skill segments. The reasonable assumption that high skill workers would likely be employed in the high task segment, allows the comparison of the wage gap decomposition across segments and types of permit for workers employed in similar tasks

However, two sources of selection bias make the comparison of the wages between native and foreign workers difficult. The first is related to the *selection based on observables*: different characteristics and different distribution of these characteristics, while the second comes from the *selection based on unobservables*: differences across the different groups like unobserved abilities, incentives to migrate, discrimination and others. There is a large literature that has been focusing on selection when considering the wage gap between natives and immigrants, the main contribution stemming from Borjas (1994) who explains immigrants self selection and the decision to migrate based on relative advantages. Moreover, selection can arise due to immigration policies of the host country. The unobserved bias can be attributable not only to incentives to migrate and to the local policies but also to integration problems, skills, language, living costs and discrimination.

In this paper two methodologies have been adopted in order to decompose the

wage differential between Swiss and foreigners. The first is the usual Blinder-Oaxaca parametric approach, and the second a nonparametric technique using a propensity score matching approach developed by Rosenbaum and Rubin (1983). The two methodologies produce a slightly different decomposition but the overall conclusions remain the same. In general, the results show that human capital plays an important role in explaining the wage differentials especially in the low task segment. When including the whole set of variables, in general from 15% to one third is attributable to the unexplained component in both the task segments except for two cases, i.e. cross–borders in low task segment and annuals in high task segment, where 40% and 60% of the observed wage gap are attributable to the unexplained component respectively. The Canton Ticino shows a scarcity of human resources on the local labor market (not surprisingly given the high share of foreigners). Foreign workers show a different distribution of characteristic depending on the permit to work. Annuals are much more similar in the high task segment to Swiss workers than permanent and cross–borders than are less skilled. In the low task segment, foreigners appear less skilled than Swiss workers. Cross–border commuters are always the least paid group with highest unexplained negative penalty suggesting that for high skill jobs, local firms could not find the required skills in the neighboring region.

Finally the third essay tries to verify if cross–border commuters generate a pressure on the wages of Swiss and resident immigrant workers in Ticino. This category of foreign workers has never been limited by quotas but regulated through geographical restrictions. Cross-border commuters must reside in a bounded region of no more than 30 km from the Swiss border line[4]. Moreover, they can be employed only in a predefined Swiss border area[5], where cross-border commuters can compete with local workers, and distinguish it from a region where they cannot be employed.

[4]A North–Italian worker must reside in the Italian border region at least 6 month previous to the application for cross–border working permit.

[5]A cross–border commuter who resides in Northern Italy is allowed to work only in the south part of Switzerland.

The possibility to distinguish these two areas in Ticino is the key to the analysis. Taking into account immigration endogeneity as well as the limited mobility of local labor supply, comparing local worker wages across the regulatory discontinuity it is possible to measure the cross-border commuters wage pressure on the native wages.

The impact of immigration in Switzerland has been analyzed by several authors. Following production theory developed by Christensen et al. (1971), applications to the Swiss case have been provided by Butare and Favarger (1992) and by Sheldon (2000) finding that immigrants have little negative effects on Swiss workers' wages. Authors as Golder and Straubhaar (1999) provide evidence that immigrants tend to have a negative impact on the Swiss economy.

In the U.S. context, a more recent contribution by Ottaviano and Peri (2006), developing a general equilibrium framework in an extension of Borjas (2003), concluded that in presence of differentiated labor, the inflow of immigrants belonging to a certain group can be expected to have asymmetric impacts on the wage of different native groups: a negative effect on groups with substitutable characteristics and a positive effect on groups with complementary characteristics. This paper focuses on the expected negative effect cross–border commuters may have on local labor supply, because the intention of the author is to identify which group of the local labor force may be more susceptible to suffer from negative consequences, and to quantify this penalty.

The results show significant wage disparities between low skill workers employed in the two regions. Only a small group of Swiss workers seem to be affected by this pressure because the cross–border commuters attracted in Ticino are low skilled and therefore more similar to resident immigrants. Finally, this study permits to reflect upon the possible impacts the liberalization may have on the Swiss labor market. The Canton Ticino represents an extreme case of analysis where a high concentration of cross–border commuters produces only small effects on natives, but the impact on other foreign categories of workers could be more problematic.

This dissertation analyzes three issues relative to wage differentials that are of general interest, it investigates wage differentials among regions, and between workers origins, and the impact foreign workers may have on native wages.

The applied methodologies represent a relevant contribution to the economic literature in three respects. First, the reinterpretation of the Blinder-Oaxaca approach to analyze regional wage differentials represents a useful instrument to identify the factors at the origin of such disparities. Then, the application of nonparametric methodologies, i.e. the propensity score matching, to analyze wage discrimination by origins adds more evidence to a new stream of literature developed in recent years. Finally, this dissertation also provides a study on cross-border commuters, a topic that finds very few references in the economic literature.

The results obtained evidence the important role of the human capital to explain wage differentials among regions and between origin groups. It is found evidence that foreign workers in Ticino do not suffer systematically a wage penalization relative to natives, specially when considering high skill temporary immigrants. However, cross-border commuters are the lowest paid group generating wage pressure on low skill workers that is more likely to affect other foreign workers than Swiss. Therefore, all these results permit to reflect on the possible impact the liberalization may have on the Swiss labor market.

In what follows, it is first presented the analysis of wage differentials among Swiss regions, then the investigation relative to wage disparities between Swiss workers and foreigners in Ticino, and finally the contribution that investigates the impact of cross-border commuters on native wages in the Canton of Ticino.

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Chapter 1

Why are wages in economic center higher? Exploring wage differential in Switzerland

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Abstract

This paper analyses wage differentials between Zurich (the economic center) and the other regions of Switzerland. We decompose the regional wage differentials in two components (i.e. endowment and remuneration) applying a method proposed by Yun (2005) in an extension of the Blinder–Oaxaca methodology which solves the identification problem of detailed differential decomposition. The results show that with respect to the richest Swiss region, Zurich, the wage differentials appear rather balanced among the two components. Among the factors that cause such disparities, human capital plays an important role in the remuneration component, while economic structure influences the endowment component.

JEL classification: J31, R12

Keywords: Regional wage differentials, Blinder–Oaxaca decomposition

1.1 Introduction

The process of spatial concentration in a country is closely related to important wage differentials. In most countries rich urbanizations tend to concentrate activities and attract competences from poor peripheries generating regional disparities rather than processes of convergence. Literature on spatial agglomeration provides evidence that workers employed in urban density earn more than workers in nonurban areas. Authors as Krugman (1991) and Ciccone and Hall (1996) demonstrate that higher urban productivity can be related to the interaction of transport costs and scale economies. Alternative approaches as in Glaeser (1999), Rauch (1993) and Ciccone and Peri (2006) investigate human capital externalities in cities as explanation for differences in productivity between core and periphery. However, the question to what extent wage differentials are due to the economic differentiation process as such, to the presence of competitive firms in the center or rather to higher wages paid for human capital remains an issue to be explored.

This article analyses observed average wage differentials among Swiss regions. Inter–regional wage differentials are a matter of great interest that have been studied for several countries such as the USA by Gerking and Weirick (1983), Spain by García and Molina (2002), Portugal by Vieira et al. (2005), and Switzerland by Rochira and Rosas (2005).

The special interest in the Swiss case arises from its strong regional wage disparities, its geographical position, its small scale and its federalist structure, but also because it represents a typical case in which Zurich plays the role of the strong economic center[1] that prevails among the other Swiss regions for its strong economic structure and its high concentration of human capital. In 2002, the wage in the Canton of Zurich was between 8% and 29% above the average Swiss level. The location of Switzerland in the center of Europe without being member of the EU implies that wages can be greatly influenced by trans–border labor markets which are of different relevance for the various regions. The small scale of the country and the ensuing short distance between the regional labor markets should provoke an important mobility of the labor force, on the one hand, and promote spatial concentration and differentiation of economic structure among regions, on the other. The former will tend to minimize wage differentials, the latter will tend to

[1]Zurich produces 22% of the national GDP and shares 20% of total employment.

increase them. Finally, the federalist system of Switzerland, based on historical differences in language, culture and religion, will impose a cost on migration contributing to wage differences.

It seems therefore promising to decompose the average wage differentials among Swiss regions: a first component related to the composition of the workforce employed in different regions, and a second one related to the regional segmentation of the labor market that remunerates identical characteristics differently.

The purpose of this paper is to perform a detailed decomposition to determine the contribution of each characteristic (in both the components) to the total observed regional wage differentials. In particular we want to identify the role played by human capital, socioeconomic characteristics and economic structure of the markets in the generation of the regional disparities.

Two streams of literature have to be considered in this context. The first one follows the hedonic wage theory of Rosen (1986), which states that the wage differentials between two occupations are given by the compensation due to different job characteristics, which themselves depend on different human capital requirements or on different working conditions. The second stream of literature follows Blinder (1973) and Oaxaca (1973) who developed a method to decompose wage differences by gender or ethnicity into different characteristics among individuals and different remuneration of the same characteristics.

As shown by Jones (1983), Oaxaca and Ransom (1999) and Horrace and Oaxaca (2001), application of the Blinder–Oaxaca methodology provokes an identification problem when attempting to estimate a detailed decomposition using sets of dummy variables. Dummy variables in the regression equations do not cause problems in estimating and decomposing total wage differentials, but generate different results in the detailed remuneration effects attributed to dummy variables because these components are not invariant to the choice of the reference group, arbitrarily chosen by the researcher. In other words, the problem arises from the lack of direct identification of all group effects when using $n-1$ dummy coefficients and the constant in the regression equations (see Suits (1984)).

Authors like Nielsen (2000), Gardeazabal and Ugidos (2004) and Yun (2005) have developed techniques to solve the identification problem. Here the "averaging of coefficients"

method proposed by Yun (2005) is applied, the methodology developed by Nielsen (2000), proposing OLS regression with transformed dummy variables, being too cumbersome in presence of several sets of dummy variables (as in our case). The method proposed by Gardeazabal and Ugidos (2004) produces, under determined constraints, the same results as the averaging of coefficients method. Applying this latter method thus permits to identify a coefficient also for the reference category and to perform a complete decomposition of wage differentials.

In the following, we present the model of wage decomposition proposed by Yun (2005), describe the data used and the sample characteristics. We then present and discuss the empirical findings and draw conclusions.

1.2 The wage decomposition

The purpose of this paper is twofold: firstly, average observed wage differential between Zurich and the other Swiss regions are decomposed into a part due to the different characteristics of the labor force (endowment component) and one due to different remuneration of identical characteristics (remuneration component); secondly, and more interestingly, the contribution of each explanatory variable to the two components is identified, thus relating endowment and remuneration differentials to individual characteristics.

Following the proposition of Yun (2005) in an extension to the Blinder–Oaxaca methodology to solve the identification problem, we estimate by ordinary least squares (OLS) a hedonic wage equation for each Swiss region j as proposed by Mincer (1974):

$$lnw^j = \alpha^j + \sum_{n=1}^{N} X_n^j \delta_n^j + \sum_{s=1}^{S} \sum_{k_s=2}^{K_s} D_{sk_s}^j \beta_{sk_s}^j + \epsilon^j \tag{1.1}$$

where lnw^j is the gross monthly standardized natural logarithm of wage for the region j. In equation (1.1), we include N continuous variables X_n (in our case human capital variables) and S sets of categorical variables D_s each including K_s categories with $K_s - 1$ dummy variables (the first category as the reference group)[2]. Finally α, β and δ are the parameters

[2]Using the Yun (2005) averaging approach, the choice of the reference group in equation (1.1) is invariant to the detailed decomposition.

to be estimated and ϵ is the error with the usual properties.

Adopting the "averaging coefficients" approach, equation (1.1) is transformed into a new "normalized" regression equation:

$$lnw^j = \alpha^j + \sum_{s=1}^{S} \overline{\beta}_s^j + \sum_{n=1}^{N} X_n^j \delta_n^j + \sum_{s=1}^{S} \sum_{k_s=1}^{K_s} D_{sk_s}^j \left(\beta_{sk_s}^j - \overline{\beta}_s^j \right) + \epsilon^j \tag{1.2}$$

where $\overline{\beta}_s^j = \frac{1}{K_s} \sum_{k_s=1}^{K_s} \beta_{sk_s}^j$, and $\beta_{s1}^j = 0$ (the coefficient for the reference category).

The dummy coefficients resulting from the normalized regression equation show the deviation of the OLS estimates of the dummy variable from the mean coefficients[3].

Then setting $\beta_{sk_s}^* = \beta_{sk_s}^j - \overline{\beta}_s^j$ and $\alpha^{*j} = \alpha^j + \sum_{s=1}^{S} \overline{\beta}_s^j$, we can rewrite the "normalized" regression equation (1.2) as:

$$lnw^j = \alpha^{*j} + \sum_{n=1}^{N} X_n^j \delta_n^j + \sum_{s=1}^{S} \sum_{k_s}^{K_s} D_{sk_s}^j \beta_{sk_s}^{*j} + \epsilon^j \tag{1.3}$$

After estimating the parameters $\widehat{\alpha}$, $\widehat{\beta}$ and $\widehat{\delta}$ from equation (1.1), the normalized regression equation (1.3) enables us to identify all the coefficients associated with the dummy variables (including the reference category) and the constant term.

Then applying the Blinder–Oaxaca method to the equation (1.3) taking Zurich[4] (z) as reference region, we decompose the observed mean wage differentials with respect to the other Swiss regions (r) in two components:

$$ln\overline{w}^z - ln\overline{w}^r = EC + RC \tag{1.4}$$

where $ln\overline{w}$ is the mean of the monthly natural logarithm of wage observed in the respective regions, EC is the *endowment component*, and RC is the *remuneration component*

[3]Since the $\beta_{sk_s}^*$ are a linear combination of the β_{sk_s}, their variance can be calculated from the variance–covariance matrix of the estimated coefficients β_{sk_s} from the equation (1.1).

[4]Vieira et al. (2005) use the national wage equation as a reference, analyzing consequently regional wage differentials in deviation to the national wage average. We prefer to use the highest wage region (i.e. in our case Zurich) as reference which enables us to confront the other labor market realities with the most important Swiss labor market, rather than with an "inexistent" average.

respectively defined as:

$$EC = \sum_{n=1}^{N} \widehat{\delta}_n^z \left(\overline{X}_n^z - \overline{X}_n^r \right) + \sum_{s=1}^{S} \sum_{k_s=1}^{K_s} \widehat{\beta}_{sk_s}^{*z} \left(\overline{D}_{sk_s}^z - \overline{D}_{sk_s}^r \right) \tag{1.5}$$

$$RC = \widehat{\alpha}^{*z} - \widehat{\alpha}^{*r} + \sum_{n=1}^{N} \overline{X}_n^r \left(\widehat{\delta}_n^z - \widehat{\delta}_n^r \right) + \sum_{s=1}^{S} \sum_{k_s=1}^{K_s} \overline{D}_{sk_s}^r \left(\widehat{\beta}_{sk_s}^{*z} - \widehat{\beta}_{sk_s}^{*r} \right) \tag{1.6}$$

where $\overline{X}$ and $\overline{D}$ are the means of the observed characteristics, the endowment component, EC, reflects the part of the wage difference due to workers' characteristics, while the remuneration component, RC, shows the wage difference due to the different remuneration of the individual characteristics.

1.3 Data and descriptive statistics

The empirical analysis is based on data from the Swiss Wage Structure Survey 2002 (or SWSS) that provides cross section data[5]. The survey has been implemented by the Swiss Federal Statistical Office (SFSO) among a representative sample of 45'000 firms (with more than two employees) reporting individual attributes of 1.1 million individual workers in Switzerland. The dataset provides gross nominal monthly standardized logarithm of wages in Swiss Francs[6], human capital characteristics in the form of years of schooling[7], potential experience (age minus years of schooling minus six), and years of tenure in the current firm. We also controlled for ten sets of dummy variables that describe the economic structure (four type of contracts, five hierarchical levels, four levels of task required by firms, seven classes by firm size, 24 sectors[8] and 24 occupations) and individual socioeconomic characteristics (gender, marital status, five categories of part time work and

[5]In German the survey is called "*Schweizerische Lohnstrukturerhebung (LSE)*".

[6]The SFSO provides individual nominal October's 2002 gross wages in Swiss Francs standardized to 4 and 1/3 weeks at 40 hours and including 1/12 of an annual bonus where applicable. Real wages would be much more appropriate in such analysis because it considers different cost of living that may arise between regions. Unfortunately a consumption price index is not available at regional level limiting our analysis.

[7]The SWSS dataset provides a categorical variable describing the highest scholarly degree obtained by each worker. In order to estimate the return on years of schooling, the categorical variable has been transformed attributing the number of years necessary to achieve the respective degree.

[8]The sectors are defined according to the official general classification of economic activities used in Switzerland, i.e. NOGA 2002 (in French: "*Nomenclature Générale des Activités Économiques*").

five types of permits for foreigners).

We dispose of a SWSS sample that includes only firms active in the private sector, and have selected those individual observations which include all the variables used in the wage equations. The result is a representative sample of 784'139 available individual observations of occupied workers.

The SWSS 2002 survey is the first since its creation in 1996 that allows to decompose the entire Swiss sample in seven large regional sub–samples: the economically strong regions of Zurich (ZH), North Western Switzerland (NWS) and Lake of Geneva Region (LGR), the economically weak regions of Eastern Switzerland (ES), Espace Mitteland (EM) and Ticino (TI), and the periphery of Zurich represented by Central Switzerland (CS)[9].

Table 1.1 shows the descriptive statistics of selected variables[10] for the seven regional sub–samples. Comparing the regions, Zurich pays, on average, the highest monthly wage and shows important wage differentials even relative to the other strong regions. The lowest wage gaps are observed in North Western Switzerland and in Lake of Geneva Region, respectively 8% and 9% (in log terms), while the gap rises to 12% in Central Switzerland and to much higher percentages in the other weak regions: Eastern Switzerland 17%, Espace Mitteland 18%, and in Ticino 29%.

Considering the human capital components, it is important to note that the Swiss regions show similar but statistically different levels of years of education, experience and tenure[11]. The only remarkable difference is the low average level of years of tenure in the region of Zurich, probably due to higher incentives on workers' turnover as compared to the other Swiss regions.

The economic structure reveals interesting regional specificities that oppose the strongest

[9]The seven Swiss regions are composed by the following Swiss Cantons: *Zurich*: Zurich; *North–Western Switzerland*: Basel–City, Basel–Country, Aargau; *Lake of Geneva Region*: Vaud, Valis, Geneva; *Central Switzerland*: Lucerne, Uri, Schwyz, Obwalden, Nidwalden, Zug; *Eastern Switzerland*: Glarus, Schaffausen, Appenzell A. Rh., Appenzell I. Rh., St. Gallen, Graubunden, Thurgau; *Espace Mitteland*: Berne, Fribourg, Solothurn, Neuchâtel, Jura; *Ticino*: Ticino.

[10]A detailed descriptive table with all the variables included in the model is available from the authors on request.

[11]T–test of equal means show that the mean values of Zurich are statistically different at the 99% level from the mean values observed in the other regions. The detailed results are available from the authors.

economic regions to the weakest economies. With respect to industry composition, Zurich and the Lake of Geneva Region are respectively the first and the second financial places in Switzerland, and show the high share of workers in the computer industry and related activities, while North Western Switzerland (thanks to the Canton of Basel) shows relevant employment shares in the chemical industry. On the other hand, the weak economic regions show high shares of employment in manufacturing activities. Not surprisingly, the rich economic regions also show lower shares of repetitive tasks required by firms and high shares of very large firms.

Other interesting socioeconomic characteristics are the high share of non–unionized workers in Zurich (72% of total employment) and the lowest one (below 50%) in Ticino - a region with a minority of Swiss workers (43%) and a 30% of cross–border commuters.

1.4 Empirical results

Table 1.2 illustrates the results of the decomposition of the wage differentials by region as a percentage of the observed wage differential (and in percentage points in parenthesis), taking Zurich as reference. For every region, the first column shows the percentage of the observed wage differential explained by each characteristic. Therefore, the total of the first column is always one hundred of the observed unadjusted mean wage differential. The second column shows the part of the wage differential due to the endowment component, while the third column shows the share attributable to the remuneration component. It is important to note that a positive sign of these values must be interpreted as a positive contribution to the wage differential in favor of Zurich, whilst a negative sign indicates a contribution in disfavor of Zurich.

The total decomposition of the wage differentials (i.e. the last row) appears rather balanced between the two components in all the regions except for the Lake of Geneva Region where the endowment component explains 70% of the existing gap. Therefore, in the weak economic regions the total decomposition is similar to the one in the strong North Western economy.

In order to understand the details of the decomposition it is necessary to comment

the role played by the difference between the constant terms, i.e. the part of the wage differential not explained by the variables and included in the remuneration component.

The constant effect is always large and negative except for Central Switzerland where a large positive value is found. This latter region represents a case in which our model has less explanatory power than in the other regions. Excluding the constant, the sub total row shows that the human capital, the economic structure and the socioeconomic characteristics explain only half of the observed wage gap. In the other regions, the negative constant effect reduces the gap by 14% to 40% raising the remuneration component. Therefore, the sub total row shows that the model explains more than 100% of the observed wage differential, and the remuneration component shares from 70% to 90% of the observed gap doubling the part attributed to the endowment component in the weak regions and in North Western Switzerland. The details emphasize the relevant role played by the human capital in explaining regional wage disparities, explaining between 70% and 105% of the observed wage gap and doubling the share attributed to the economic structure. The part of the gap generated by the human capital is exclusively attributed to the remuneration component and not to differences in the human capital levels. On the other hand, the economic structure explains between 35% and 60% of the wage differentials but this time due to the endowment component. The economic structure of Zurich generates an advantage because the labor force is more concentrated in high value added activities.

It is also important to note that the human capital does not play a relevant role in explaining the wage gap in Lake of Geneva Region, where the returns on schooling are slightly higher than in Zurich (see Table 1.3 in the appendix 1.7). Here, the gap relative to Zurich is due to differences in the observed means of the economic structure and in the remuneration of the socioeconomic characteristics.

Other important aspects of wage differentials relative to Zurich, can be observed by a more detailed decomposition (see Table 1.4 in the Appendix B). In particular, gender reduces the differential relative to Zurich in Central Switzerland, Eastern Switzerland and North Western Switzerland, respectively by -11%, -10% and -6.6% of the total wage gap. In these regions the attenuation effects are due to males while females tend to increase the disparities with respect to Zurich. Differently, in the Lake of Geneva Region, both males

and females contribute to increase the disparity by 4.9%. Permits for foreigners enlarge the bias with respect to Zurich in Lake of Geneva Region and in Ticino. However, while in Ticino the gap is attributable to cross-border commuters in both the components, in the Lake of Geneva Region, Swiss workers are at the origin of the differential due mainly to the remuneration component. Elsewhere, Swiss and foreigners with a permanent work permit lower the bias through the remuneration component. Another important source of regional wage disequilibrium is the part time variable, it explains from 7% to 27% of the total wage differential relative to Zurich due exclusively to differences in the remuneration component. The hierarchical level acts through the remuneration component and is relevant in the Lake of Geneva Region where it explains 11% of the total bias. In Central Switzerland and in Espace Mitteland we found the opposite result, the hierarchical level's total effects reduce the differentials respectively by -13% and -6%. Finally, contract type and firm size are both only important in isolated cases, while the task required by firms has a high and positive effect everywhere in the endowment component but a negative one the remuneration component. As a result, the total impact on the wage gap is positive and relevant in Lake of Geneva, Ticino and Eastern Switzerland while in the other regions the two components balance.

1.5 Conclusions

In this paper, the wage differentials among different Swiss regions have been decomposed into a differential due to individual endowments and to a different remuneration of the characteristics (market). This has been done applying the "averaging coefficient" approach developed by Yun (2005) in an extension to the Blinder–Oaxaca methodology to solve the identification problem for detailed decomposition of wage differentials.

The results show that with respect to the richest Swiss region, Zurich, the average wage differentials appear rather balanced among both components except for the Lake of Geneva Region where the endowment component largely prevails. Among the factors that cause such wage differentials individual characteristics play an important role in the remuneration component, while the job and firm characteristics mainly influence the

endowment component. In particular, human capital variables are the most important causes of the bias, not because Swiss regions show differences in the human capital levels but in its remuneration. This seems to indicate a limited geographical mobility of the labor force due to the characteristics of Switzerland explained above. In contrast, endowment depends mainly on economic structure and type of occupation. Especially stronger economic regions can compensate disadvantages from endowment through remuneration of human capital attracting mobile foreign labor force. The remaining characteristics do not play an important role in explaining the wage differentials except for isolated cases.

Therefore, the Yun methodology has the advantage to measure not only a detailed decomposition but also to reorganize the results in a more suitable way. The aggregation of the variables in categories as human capital, socioeconomic characteristics and job and firm characteristics is useful in the interpretation of the results. This appears specially relevant when analyzing wage differentials among regions rather than by ethnicity or gender where the focus is in the measurement of the total discriminatory component.

In this paper no explanation on the causal relation between human capital, socioeconomic characteristics and economic structure has been provided, leaving this relevant question for further research.

1.6 Tables

Table 1.1: Means and standard deviation of selected variables

	ZH	**NWS**	**LGR**	**CS**	**ES**	**EM**	**TI**
Ln wage	8.76	8.68	8.67	8.64	8.59	8.58	8.47
	(0.42)	*(0.38)*	*(0.43)*	*(0.37)*	*(0.35)*	*(0.34)*	*(0.4)*
Lnw differential	-	0.08	0.09	0.12	0.17	0.18	0.29
Human Capital:							
- Schooling (years)	12.23	12.01	12.11	11.86	11.67	11.77	11.63
	(2.16)	*(2.13)*	*(2.31)*	*(2.03)*	*(2.04)*	*(2.04)*	*(2.24)*
- Experience (years)	21.76	22.97	22.35	21.83	22.84	22.8	22.74
	(11.56)	*(11.43)*	*(11.24)*	*(11.49)*	*(11.7)*	*(11.66)*	*(11.25)*
- Tenure (years)	8.11	9.53	8.76	8.95	9.42	9.29	9.05
	(8.33)	*(9.34)*	*(8.65)*	*(8.94)*	*(9.10)*	*(8.99)*	*(8.49)*
Economic structure:							
- Manufacturing*	0.18	0.27	0.16	0.32	0.39	0.33	0.26
- Chemical	0.01	0.09	0.02	0.02	0.03	0.01	0.02
- Financial intermediation	0.17	0.03	0.08	0.03	0.02	0.02	0.06
- Computer & other	0.14	0.09	0.12	0.10	0.06	0.07	0.09
- High skill tasks	0.33	0.29	0.23	0.30	0.29	0.26	0.20
- Repetitive tasks	0.16	0.18	0.26	0.20	0.21	0.25	0.33
- Firm size +500	0.30	0.20	0.17	0.11	0.15	0.19	0.08
Socioeconomic chars:							
- Female	0.36	0.32	0.39	0.31	0.30	0.36	0.36
- Non unionized	0.72	0.67	0.58	0.64	0.63	0.59	0.47
- Swiss	0.75	0.63	0.59	0.79	0.68	0.77	0.43
- Cross-border	0.01	0.14	0.10	0.00	0.05	0.03	0.30
Observations	167'234	115'677	125'023	65'631	96'967	186'416	28'191

Note: For the log natural wage, years of schooling, experience and tenure are reported the mean and standard deviation, while for the other categorical variables are reported the shares. *Manufacturing activities without the chemical sector. A detailed table with mean of all the variables included in the model is available from the authors by request.

Table 1.2: Decomposition of the wage differentials

	North Western S.			Lake of Geneva R.			Central Switzerland		
Characteristics	Total	EC	RC	Total	EC	RC	Total	EC	RC
Human Capital	105.1	-5.2	110.3	3.8	-4.2	8.0	10.0	8.4	1.5
	(8.6)	(-0.4)	(9.0)	(0.4)	(-0.4)	(0.8)	(1.3)	(1.1)	(0.2)
Ec. Structure	47.3	54.4	-7.2	60.0	66.7	-6.8	40.4	46.4	-5.9
	(3.9)	(4.5)	(-0.6)	(5.7)	(6.3)	(-0.6)	(5.1)	(5.8)	(-0.7)
Socioeconomic	-13.1	-1.4	-11.8	50.2	7.5	42.7	1.0	-6.6	7.6
	(-1.1)	(-0.1)	(-1.0)	(4.8)	(0.7)	(4.1)	(0.1)	(-0.8)	(1.0)
Sub Total	139.3	47.8	91.3	114.0	70.0	43.9	51.4	48.2	3.2
	(11.4)	(3.9)	(7.5)	(10.8)	(6.7)	(4.2)	(6.4)	(6.0)	(0.4)
Constant	-39.3		-39.3	-14.0		-14.0	48.6		48.6
	(-3.2)		(-3.2)	(-1.3)		(-1.3)	(6.1)		(6.1)
Total	100.0	47.9	52.1	100.0	70.0	30.0	100.0	48.3	51.8
	(8.2)	(3.9)	(4.3)	(9.5)	(6.7)	(2.9)	(12.5)	(6.0)	(6.5)

	Eastern Switzerland			Espace Mitteland			Ticino		
Characteristics	Total	EC	RC	Total	EC	RC	Total	EC	RC
Human Capital	92.9	6.8	86.1	86.6	4.5	82.1	68.2	3.7	64.6
	(15.9)	(1.2)	(14.7)	(15.6)	(0.8)	(14.8)	(19.6)	(1.1)	(18.5)
Ec. Structure	47.4	45.2	2.2	41.4	49.2	-7.8	35.3	38.0	-2.7
	(8.1)	(7.7)	(0.4)	(7.5)	(8.9)	(-1.4)	(10.1)	(10.9)	(-0.8)
Socioeconomic	-4.7	-4.1	-0.3	-3.5	0.3	-3.7	22.8	3.0	19.9
	(-0.8)	(-0.7)	(-0.1)	(-0.6)	(0.1)	(-0.7)	(6.5)	(0.9)	(5.7)
SubTotal	135.6	47.9	88.0	124.5	54.0	70.6	126.3	44.7	81.8
	(23.2)	(8.2)	(15.0)	(22.4)	(9.7)	(12.7)	(36.2)	(12.8)	(23.5)
Constant	-35.6		-35.6	-24.5		-24.5	-26.4		-26.4
	(-6.1)		(-6.1)	(-4.4)		(-4.4)	(-7.6)		(-7.6)
Total	100.0	47.8	52.2	100.0	53.9	46.1	100.0	44.6	55.4
	(17.1)	(8.2)	(8.9)	(18.0)	(9.7)	(8.3)	(28.7)	(12.8)	(15.9)

Note: Reference region Zurich. EC: endowment component; RC: remuneration component. The value in parenthesis shows the contribution to the total wage differential in percentage points.

1.7 Appendix

Appendix A

Table 1.3: Estimation results of the normalized regression equations

	ZH	NWS	LGR	CS	ES	EM	TI
Constant	7.997	8.03	8.011	7.936	8.058	8.041	8.073
	(1196.48)**	(1099.52)**	(1066.37)**	(722.70)**	(1062.46)**	(1488.23)**	(500.99)**
Schooling	0.037	0.033	0.04	0.039	0.031	0.031	0.028
	(99.16)**	(76.64)**	(94.47)**	(62.05)**	(66.65)**	(94.24)**	(31.14)**
Experience	0.024	0.02	0.018	0.021	0.017	0.017	0.017
	(100.83)**	(77.88)**	(63.18)**	(59.68)**	(63.58)**	(88.92)**	(29.71)**
Exp.^{2}/100	-0.038	-0.032	-0.027	-0.034	-0.028	-0.027	-0.027
	(80.90)**	(62.76)**	(47.43)**	(47.65)**	(52.42)**	(72.85)**	(24.06)**
Tenure	0.003	0.002	0.004	0.002	0.003	0.004	0.003
	(12.63)**	(10.80)**	(16.44)**	(6.20)**	(13.70)**	(22.91)**	(5.18)**
Ten.^{2}/100	-0.002	-0.00028	-0.0046	-0.00007	-0.0018	-0.0043	0.00065
	(2.39)*	(0.44)	(5.79)**	(0.08)	(2.63)**	(8.48)**	(0.41)
Male	0.065	0.069	0.063	0.084	0.091	0.074	0.087
	(83.41)**	(78.18)**	(67.47)**	(65.53)**	(94.12)**	(110.60)**	(45.83)**
Female	-0.065	-0.069	-0.063	-0.084	-0.091	-0.074	-0.087
	(83.41)**	(78.18)**	(67.47)**	(65.53)**	(94.12)**	(110.60)**	(45.83)**
Swiss	0.016	0.045	-0.009	0.016	0.04	0.034	0.013
	(7.76)**	(22.55)**	(4.80)**	(3.90)**	(20.95)**	(21.27)**	(2.62)**
Seasonal	-0.018	-0.062	-0.052	-0.021	-0.045	-0.037	-0.032
	(3.22)**	(8.42)**	(11.68)**	(2.76)**	(11.59)**	(8.65)**	(3.52)**
Annual	0.042	0.043	0.041	0.044	0.007	0.013	0.03
	(14.54)**	(14.19)**	(13.89)**	(8.69)**	(2.53)*	(5.05)**	(3.82)**
Resident	0.005	0.034	0.006	0.018	0.025	0.025	-0.005
	(2.33)*	(15.18)**	(3.04)**	(4.08)**	(11.65)**	(14.01)**	(0.96)
Commuter	-0.015	0.015	0.024	-0.016	0.012	-0.013	-0.048
	(3.26)**	(6.34)**	(9.82)**	(0.91)	(3.98)**	(4.70)**	(9.18)**
Other permit	-0.029	-0.074	-0.01	-0.043	-0.039	-0.023	0.042
	(5.44)**	(17.25)**	(1.80)	(5.21)**	(6.01)**	(4.38)**	(2.03)*
Other chars	Y	Y	Y	Y	Y	Y	Y
R-square	0.6556	0.682	0.6668	0.6289	0.6451	0.6272	0.6608
Observations	167234	115677	125023	65631	95967	186416	28191

Note: We also controlled for marital status, part time, contract type, task required by firms, hierarchical levels, firm size, sectors and occupations. A detailed table is available from the authors by request. Absolute t-statistics values are in parenthesis; * significant at 5%, ** significant at 1%.

Appendix B

Table 1.4: Details of the decomposition of the wage differential in percentage

	NWS			**LGR**			**CS**		
	Total	*EC*	*RC*	*Total*	*EC*	*RC*	*Total*	*EC*	*RC*
Total	100.0	47.9	52.1	100.0	70.0	30.0	100.0	48.3	51.8
Constant	-39.3	0.0	-39.3	-14.0	0.0	-14.0	48.6	0.0	48.6
Human Capital	105.1	-5.2	110.3	3.8	-4.2	8.0	10.0	8.4	1.5
Schooling	*67.6*	*10.2*	*57.3*	*-38.8*	*4.9*	*-43.7*	*-13.3*	*11.0*	*-24.2*
Experience	*39.5*	*-11.3*	*50.8*	*52.8*	*-7.3*	*60.1*	*20.5*	*-0.9*	*21.4*
Tenure	*-2.0*	*-4.2*	*2.1*	*-10.2*	*-1.7*	*-8.4*	*2.7*	*-1.6*	*4.4*
Ec. Structure	47.3	54.4	-7.2	60.0	66.7	-6.8	40.4	46.4	-5.9
Hierarchical Level	*-3.1*	*7.1*	*-10.2*	*11.2*	*0.8*	*10.4*	*-12.7*	*-1.7*	*-10.9*
Occupations	*29.6*	*22.5*	*7.0*	*18.1*	*15.9*	*2.2*	*30.5*	*16.2*	*14.3*
Contract Type	*7.4*	*1.9*	*5.5*	*-5.1*	*2.0*	*-7.2*	*-1.6*	*0.9*	*-2.5*
Task Required	*-1.0*	*13.3*	*-14.3*	*19.1*	*28.5*	*-9.4*	*1.2*	*10.0*	*-8.8*
Firm Size	*-3.1*	*-1.1*	*-2.0*	*6.6*	*4.9*	*1.7*	*11.2*	*4.4*	*6.8*
Sectors	*17.5*	*10.7*	*6.8*	*10.1*	*14.6*	*-4.5*	*11.8*	*16.6*	*-4.8*
Socioeconomic chars	-13.1	-1.4	-11.8	50.2	7.5	42.7	1.0	-6.6	7.6
Gender	*-6.6*	*-5.0*	*-1.6*	*4.9*	*4.4*	*0.5*	*-11.0*	*-5.3*	*-5.8*
Marital Status	*1.0*	*-1.4*	*2.3*	*2.3*	*-1.3*	*3.6*	*3.0*	*-0.4*	*3.4*
Permit	*-26.7*	*5.1*	*-31.8*	*15.2*	*3.8*	*11.4*	*-2.5*	*-0.5*	*-1.9*
Part Time	*19.2*	*-0.1*	*19.3*	*27.8*	*0.6*	*27.2*	*11.5*	*-0.4*	*11.9*

	ES			**EM**			**TI**		
	Total	*EC*	*RC*	*Total*	*EC*	*RC*	*Total*	*EC*	*RC*
Total	100.0	47.8	52.2	100.0	53.9	46.1	100.0	44.6	55.4
Constant	-35.6	0.0	-35.6	-24.5	0.0	-24.5	-26.4	0.0	-26.4
Human Capital	92.9	6.8	86.1	86.6	4.5	82.1	68.2	3.7	64.6
Schooling	*51.7*	*12.3*	*39.4*	*47.6*	*9.6*	*38.0*	*44.9*	*7.8*	*37.1*
Experience	*45.4*	*-3.6*	*49*	*43.6*	*-3.5*	*47.1*	*24.5*	*-3.3*	*27.8*
Tenure	*-4.1*	*-1.9*	*-2.2*	*-4.6*	*-1.6*	*-3.0*	*-1.2*	*-0.9*	*-0.4*
Ec. Structure	47.4	45.2	2.2	41.4	49.2	-7.8	35.3	38.0	-2.7
Hierarchical Level	*-6.0*	*2.0*	*-8.0*	*-0.6*	*3.6*	*-4.2*	*1.3*	*0.3*	*0.9*
Occupations	*22.6*	*17.6*	*5.0*	*18.0*	*17.0*	*1.0*	*12.4*	*10.8*	*1.7*
Contract Type	*5.8*	*0.2*	*5.6*	*2.7*	*1.2*	*1.6*	*-2.0*	*2.4*	*-4.4*
Task Required	*5.7*	*10.2*	*-4.6*	*3.9*	*14.0*	*-10.1*	*8.0*	*12.9*	*-4.9*
Firm Size	*3.2*	*2.1*	*1.1*	*0.2*	*1.9*	*-1.7*	*6.6*	*4.1*	*2.5*
Sectors	*16.1*	*13.1*	*3.1*	*17.2*	*11.5*	*5.6*	*9.0*	*7.5*	*1.5*
Socioeconomic chars	-4.7	-4.1	-0.3	-3.5	0.3	-3.7	22.8	3.0	19.9
Gender	*-10.3*	*-4.2*	*-6.0*	*-1.4*	*0.1*	*-1.4*	*-1.9*	*0.2*	*-2.1*
Marital Status	*1.7*	*-0.7*	*2.4*	*-0.3*	*-0.4*	*0.1*	*-1.2*	*-0.5*	*-0.7*
Permit	*-10.1*	*1.0*	*-11.0*	*-8.7*	*0.3*	*-9.0*	*8.0*	*3.4*	*4.7*
Part Time	*14.0*	*-0.2*	*14.3*	*6.9*	*0.3*	*6.6*	*17.9*	*-0.1*	*18.0*

Note: Reference region Zurich. EC: endowment component; RC: remuneration component.

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Chapter 2

Measuring wage differential between immigrants and natives in a trans–border labor market

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Abstract

Wage differentials among natives and foreigners are analyzed for a trans–border labor market segmented by task. Two methodologies have been used to decompose the gap into endowment and unexplained component: the traditional parametric Blinder–Oaxaca approach and a nonparametric propensity score matching technique. The results are quite robust regarding the methodology used. In general, from 15% to 30% of the gap remains unexplained in both the high and low task segments with two exceptions: cross–borders in the low task segment (40%) and foreigners with annual permits in the high task segment (60%).

JEL–Classification: C13, C14, J31, J61, J71

Keywords: Wage decomposition, propensity score matching, foreign workers.

2.1 Introduction

Switzerland historically has a high share of immigrant workers. In 2002, foreigners accounted for a quarter of the Swiss manpower. As a consequence, several authors have studied the immigration problem from different perspectives as in Bürgenmeier et al. (1992), Flückiger (1998), Golder and Straubhaar (1999), Flückiger and Nejadan (2000), de Coulon et al. (2001) and Müller (2003a,b). The special interest in the Swiss case arises from its geographical position, its small scale, and its federalist structure. Situated in the center of Europe without being member of the EU implies that wages can be greatly influenced by neighboring labor markets which are of different relevance for the various regions. Swiss border Cantons historically show higher shares of foreign workers due to the possibility to hire cross–border commuters. Therefore wage differentials between natives and immigrants represent an important topic in Switzerland especially for border Cantons. Nevertheless, low attention has been given to the analysis of the problematic on a regional scale, with the exception of Flückiger and Nejadan (2000) who compare the cases of the Cantons Geneva, Basel and Ticino.

This article analyses wage differentials among natives and foreigners in the Swiss Canton of Ticino, a small labor market with 160000 workers (4% of Switzerland) and situated on the Italian border. Foreign workers in Ticino are 41% of total employment and half of them are foreign cross-border commuters coming from the North Italian Provinces[1] attracted by existing wage differentials. This renewed political attention and provoked, among else, an interest in measuring and explaining wage differentials between domestic and foreign labor force.

The high presence of foreign labor force produced differentiated protectionist regulation, which in the case of Switzerland (and Ticino) has taken the form of various contingents distinguished by different kinds of permits. The attribution of these permits followed a logic of restricting local firms' access to foreign labor force to specific skills not available among the local population[2]. There are four categories of foreigners distinguished

[1]The employment basin of the neighboring Italian Provinces counts around 1 million workers that can potentially apply for a cross–border commuter working permit.

[2]Firms seeking labor in one of these segments were forced by regulation to source first among local work force and only afterwards on the market for permits. As a consequence, the analysis

by this regulation. These categories are: cross–border commuters (implicit contingent via the definition of a corridor beyond the Swiss border), foreigners with an annual permit (contingent), resident immigrants (implicit contingent via the procedure of access to residence after a transition period with annual permits) and seasonal permit (contingent)[3]. One result of this regulation is a strong differentiation by skills of the foreign work force present in these four categories.

The objective of this paper is to decompose the wage differential between natives and foreigners in these permit groups in the Canton Ticino considering a segmentation of the labor market by task required by firms into a deterministic component (endowment) and unexplained component (due to unobservable differences).

Two streams of literature are relevant in this context. A first one follows the pioneering study by Piore (1973) and successively developed by Bulow and Summers (1986) interpreting differences in wages for different groups as a consequence of labor market segmentation. The second is based on Blinder (1973) and Oaxaca (1973) and decompose wage differences by gender or ethnicity into a deterministic component (endowment) and an unexplained component (discrimination). In a more recent literature, nonparametric approaches have been used to investigate wage differential decomposition. In particular, the applicability of the propensity score matching approach developed by Rosenbaum and Rubin (1983) to a large variety of fields including a nonparametric wage differential decomposition into a deterministic and an unexplained component.

Two sources of selection bias make the comparison of the wages between native and foreign workers difficult. The first is related to the *selection based on observables*: different characteristics (common support problem) and different distribution of these characteristics (weighting across the common support), while the second comes from the *selection based on unobservables*: differences across the different groups like unobserved abilities, incentives to migrate, discrimination and others. There is a large literature that has been focusing on selection when considering the wage gap between natives and immigrants, the

of wage formation has to follow a segmentation by skills and a discrimination between locals and foreigners.

[3]This category has not been considered in the empirical analysis due to the small number of observations available.

main contribution stemming from Borjas (1994) who explains immigrants self selection and the decision to migrate based on relative advantages. Moreover, selection can arise due to immigration policies of the host country. The unobserved bias can be attributable not only to incentives to migrate and to the local policies but also to integration problems, skills, language, living costs and discrimination.

When separating the market by tasks required by firms it is implicitly assumed that the market behaves differently relative to skill segments. The reasonable assumption that high skill workers would likely be employed in the high task segment, allows the comparison of the wage gap decomposition across segments and types of permit for workers employed in similar tasks. The interest of such analysis lies in the nature of the permits. Cross–border commuters are subject to a wage penalty because Swiss firms can take advantages of arbitrage due to the different cost of living between Canton Ticino and the neighboring Italian Provinces. Moreover they have never been limited in number but subject to geographical restrictions. Cross–border commuters systematically earn lower wages than Swiss, but it is interesting to understand the nature of the differential across segments. Immigrants, and in particular foreigners with an annual permit allow for another important comparison. This category is subject to a contingent by the Swiss immigration authority and is allowed to live and work in Switzerland for one year, with the possibility of a renewal of the contract. Another interesting comparison is the one between Swiss and foreign workers with permanent residence, the best integrated group of immigrants.

In this paper two methodologies have been adopted in order to decompose the wage differential between Swiss and the four segments of foreigners. The first is the usual Blinder–Oaxaca parametric approach, and the second a nonparametric technique using a propensity score matching. Comparing the Blinder–Oaxaca method with the more flexible and reliable nonparametric approaches permits to achieve more robust results.

In what follows the models of wage decompositions are presented using the parametric Blinder–Oaxaca approach and the non parametric propensity score matching methodology. Then, the data used for the analysis and description of the sample characteristics are presented. Finally, the empirical findings are discussed and some conclusions drawn.

2.2 Methodology

Define an indicator variable $D \in \{s, f_1, f_2, f_3\}$ where s = Swiss (the benchmark group), f_1 = permanents, f_2 = annuals and f_3 = cross–border commuters. The potential *log* wages for worker i are set as w_{si} and w_{ji}, where w_{si} is the wage that individual i would receive if treated as a Swiss worker while w_{ji} when treated as one of the foreign permit group f_j, $j \in \{1, 2, 3\}$. Each individual can observe only one of the potential outcomes, while the remaining non observed wages are the counterfactuals, i.e. the expected wage a worker would earn if in possess of a different permit to work, and assume that there is a positive probability to be a Swiss ($D = s$) or to be a foreign ($D = f_j$) given a set of observed covariates X

$$0 < \Pr(D = d|X) < 1 \tag{2.1}$$

Given this setting, the expected wage for a Swiss worker employed in a determined task segment $T \in \{\text{Low, High}\}$ is $E(w|T, D = s)$, while $E(w|T, D = f_j)$ the respective expected wage for a foreigner in group j and task T.

The wage differential between foreigners and Swiss for each segment of task T, taking the natives' wages as reference[4], can be decomposed as follows:

$$\begin{aligned} & E(w|T, D = f_j) - E(w|T, D = s) = \\ = \; & \underbrace{\{E(w_j|T, D = f_j) - E(w_s|T, D = f_j)\}}_{\text{unexplained component}} + \underbrace{\{E(w_s|T, D = f_j) - E(w_s|T, D = s)\}}_{\text{explained component}} \end{aligned} \tag{2.2}$$

where the first term indicates the part of the wage differential due to differences in unobservable characteristics[5] (i.e. the unexplained component) while the second measures the endowment effect on the differential (i.e. the explained component). This decomposition follows in a more general setting the one used in Blinder (1973) and Oaxaca (1973).

The conditional wage expectations $E(w|T, D = f_j)$ and $E(w|T, D = s)$ are identified from data and can be estimated by subsample means. In this decomposition, the problem

[4] As a consequence, three wage differentials for each segment T have been considered.

[5] In a treatment evaluation literature context this term is called the average treatment effect on the treated.

is how to identify the *counterfactual* wage

$$E(w_s|T, D = f_j) \tag{2.3}$$

the potential wage earned by foreigners if evaluated as a Swiss worker, that is not identified from data. To avoid this problem, in treatment evaluation literature is common use to assume conditional independence, i.e. that conditional on a set of observable variables X, the probability of treatment receipt is stochastically independent of the potential outcomes[6]. To our purpose, it is sufficient the weaker assumption of *conditional mean independence*

$$E(w_s|X, T, D = f_j) = E(w_s|X, T, D = s) = E(w_s|X, T) \tag{2.4}$$

Therefore, under assumption (2.4), the counterfactual can be identified as

$$\begin{aligned} E(w_s|T, D = f_j) &= E[E(w_s|X, T, D = f_j)|T, D = f_j] \\ &= E[E(w_s|X, T, D = s)|T, D = f_j] \end{aligned} \tag{2.5}$$

where the first equality in (2.5) follows from the *law of iterated expectations* while the last equality follows from assumption (2.4) of *conditional mean independence*.

The expected wage differential between foreigners and Swiss can be rewritten as:

$$\begin{aligned} &E(w|T, D = f_j) - E(w|T, D = s) = \\ &\quad \underbrace{\{E[E(w_j|X, T, D = f_j)|T, D = f_j] - E[E(w_s|X, T, D = s)|T, D = f_j]\}}_{\text{unexplained component}} + \\ &+ \quad \underbrace{\{E[E(w_s|X, T, D = s)|T, D = f_j] - E[E(w_s|X, T, D = s)|T, D = s]\}}_{\text{explained component}} \end{aligned} \tag{2.6}$$

and now the conditional mean expectations are all identified.

In this paper two specifications have been adopted to estimate the conditional mean

[6]This condition is called selection on observables by Barnow et al. (1981), ignorable treatment assignment by Rosenbaum and Rubin (1983) or conditional independence assumption by Lechner (1999).

expectations $E(w|X,T,D=s)$ and $E(w|X,T,D=f_j)$ in order to decompose the wage differential. The first is the usual Blinder–Oaxaca parametric specification, and the second a nonparametric specification using a propensity score matching[7] following the approach developed by Rosenbaum and Rubin (1983) in treatment evaluations.

The advantages in using two methodologies lies not only in the possibility to improve the robustness of the results, but also to take account of the more recent literature that has criticized the traditional Blinder–Oaxaca method in favor of more flexible and reliable nonparametric approaches.

2.2.1 Blinder-Oaxaca decomposition

The traditional Blinder (1973) and Oaxaca (1973) parametric decomposition assumes linearity of the conditional mean expectations:

$$E(w_j|X,T,D=f_j) = \beta'_{jt}X \quad \text{if } T=t \tag{2.7}$$

$$E(w_s|X,T,D=s) = \beta'_{st}X \quad \text{if } T=t \tag{2.8}$$

where β_{jt} and β_{st} are the vectors of parameters. Under assumption (2.4) of conditional mean independence, and equation (2.5), the counterfactual can be defined as

$$E(w_s|T,D=f_j) = \beta'_{st}E(X|T,D=f_j) \tag{2.9}$$

where $E(X|T=t,D=f_j)$ is estimable by subsample means, while β_{dt} are the vector parameters to be estimated in the regression equations by OLS for each T and D subsample

$$w_{jt} = \beta'_{jt}X + \epsilon_{jt} \quad \text{if} \quad D=f_j \text{ and } T=t \tag{2.10}$$

$$w_{st} = \beta'_{st}X + \epsilon_{st} \quad \text{if} \quad D=s \text{ and } T=t \tag{2.11}$$

where ϵ is the error term with the usual form. The Blinder-Oaxaca methodology estimates separately a wage equation (2.10) and (2.11) for each considered subpopulation, allowing different values of the parameters but with the same structural model, i.e. it allows the

[7] For a review of the matching literature see Imbens (2004).

labor market to evaluate the same observed characteristics differently: $\beta_{st} \neq \beta_{jt}$.

Segmenting the market on tasks (T) required by firm it is implicitly assumed that the market evaluates individual characteristics differently across tasks. The idea behind this approach is that firms are looking for skills on the labor market that are not observable. What firms know is the task required for each job offered. Therefore, firms select workers or workers self–select the respective task based on a set of information that is not always common knowledge. Foreigners usually occupy different jobs than natives[8] due to specific individual abilities or due to immigration policies that select foreigners in determined segments of the market in order to protect natives. Therefore it is reasonable to expect different shares in the decomposition of the wage gap relative to each segment for the same permit group, and comparing the wage differential decomposition between Swiss and each permit group across the segments will be useful.

Under these assumptions, the wage differential decomposition can be represented as

$$\overline{w}_{jt} - \overline{w}_{st} = \underbrace{(\hat{\beta}_{jt} - \hat{\beta}_{st})'\overline{X}_{jt}}_{\text{unexplained component}} + \underbrace{\hat{\beta}'_{st}(\overline{X}_{jt} - \overline{X}_{st})}_{\text{explained component}} \text{ if } T = t \tag{2.12}$$

where $\overline{w}_{jt}$, $\overline{w}_{st}$ represent the wage subsample means of the considered groups. The first term on the right hand side in equation (2.12) is the component due to unexplained factors and in the Blinder–Oaxaca tradition this is attributed to different remuneration of the market[9] the second one due to different endowments (or due to differences in the observed characteristics).

The traditional Blinder-Oaxaca parametric decomposition relies on the need of imposing a functional form of the wage structure. Due to its properties, the regression approach ignores the common support assumption, leading the regression to predict the counterfactual outside the common support thus referring to who do not exist which produces misleading results.

[8] A recent work of Ottaviano and Peri (2006) analyses in a general framework the substitutability between foreign and native labor force for the US case. They argue that specific abilities of the foreign workers are an important issue in explaining the differences observed in occupations.

[9] In a comparison by ethnic groups or by gender this component is usually called the discriminatory part of the wage differential.

2.2.2 Propensity Score Matching Methodology

Non parametric approaches, like e.g. matching estimators, do not need any assumption of linearity of the conditional mean expectations, and restrict the comparison of wages in the common support. Recent literature on wage decomposition as Nopo (2004), Djurdjevic and Radyakin (2005) and Jurajda and Paligorova (2006) suggests that employing the regression–based techniques and thus ignoring this comparability issue, often referred as the "common support" problem, can lead to misleading results. As an alternative they consider nonparametric approaches as advocated in the recent program evaluation literature (see, e.g. Heckman et al. (1998)).

The application of nonparametric techniques, e.g. exact matching, can be difficult to implement when the set of conditioning variables X is large. If X are discrete, small cell problems may arise. If X are continuous and the conditional mean expectations $E(w|X,T,D=s)$ and $E(w|X,T,D=f_j)$ are estimated nonparametrically, then convergence rates will be slow due to the so–called "curse of dimensionality" problem. Fortunately, alternative approaches as the propensity score matching technique proposed by Rosenbaum and Rubin (1983) can be used to reduce the dimensionality of the matching estimator. In a line of this literature, Jurajda and Paligorova (2006) show the validity of the instrument when a population is composed by two sub–groups, while Imbens (2000) and Lechner (2001) extend the propensity score matching technique from a binary to a multiple treatment evaluation program.

As shown by Heckman et al. (1998) in an extension of the Rosenbaum and Rubin (1983), under assumption (2.4) of conditional mean independence and assumption (2.1) of positive conditional probability of treatment exposure the expected mean of w_s is also mean independent of D conditional on the propensity score $P^{j|sj}(X)$, namely:

$$E[w_s|P^{j|sj}(X),T,D=f_j]=E[w_s|P^{j|sj}(X),T,D=s]=E[w_s|P^{j|sj}(X),T] \qquad (2.13)$$

where $P^{j|sj}(X)=\Pr(D=f_j|X,T,D=f_j \text{ or } D=s)$ is the conditional propensity score, an index used for the matching and therefore to construct the counterfactual that can be

estimated by probit (or logit) as

$$P^{j|sj}(X) = \frac{\hat{P}^j(X)}{\hat{P}^j(X) + \hat{P}^s(X)} \tag{2.14}$$

where $\hat{P}^j(X)$ is the predicted probability to be a foreigner with permit f_j instead of being a Swiss, conditional on the vector of characteristics X. In this situation as underlined by Lechner (2002) the conditional probabilities are required since the comparisons to be made consider only two different groups of the overall population. Separate binary choice equations are estimated for each of the possible six pairs of groups in order to obtain $P^{j|sj}$. Therefore, only observations that are either on subsample s or one of the f_j's are included in the calculation of the conditional probability[10].

The estimation of the unexplained component of the wage differential can be consequently written as:

$$E[w|T, D = f_j] - E[E(w_s|P^{j|sj}(X), T, D = s)|T, D = f_j] \tag{2.15}$$

where the first term is the expected wage for a foreign worker in segment T, while the second term is the counterfactual estimate of equation (2.3) for foreign worker, i.e. the wage she would earn if treated as Swiss worker in a given segment T and conditional on a propensity score.

After the propensity score estimation, the common support requirement must be accomplished. In the multiple–treatment (e.g. Lechner (2002)) the common support is determined by the minima of the maximum and the maxima of the minima participation probabilities for the various treatment options. In the application, kernel[11] matching with replacement has been performed (Heckman et al. (1997, 1998)).

It follows that the advantage of the nonparametric approach are related to the absence of a specific functional form, the non linearity of the propensity score (precision of the probit) and the comparison inside the common support. Subsequently enlarging the di-

[10]Lechner (2002) shows two different ways of calculating the propensity score but advocates the easier reduce form approach based on the binary choice model as alternative to be preferred to multivariate discrete choice technique.

[11]Kernel matching is based on the estimated propensity scores and takes local averages of the untreated observations near each treated observations.

mensionality of the confounding characteristics vector X it is possible to separate the wage differential attributable to a sub–set of the characteristics X for the explained component (i.e. human capital, sectors, etc ...) for both the methodologies.

2.3 Data and descriptive statistics

The data used for the empirical analysis stem from the Swiss Wage Structure Survey[12] (SWSS) 2004 that provides cross–section data containing information of worker employed in Ticino. The data is collected by the Swiss Federal Statistical Office (SFSO) among a representative sample of firms providing individual information on gross nominal monthly standardized wages[13], age, years of tenure in the current firm, levels of education achievement, gender, marital status, type of contracts, percentage of part–time work, hierarchical level, firm size, 13 sectors (according to the NOGA 2002 classification) and 24 occupations (according to the classification proposed by the SFSO in the survey). The survey also provides specific information on foreigners (by categories of permits: Swiss, permanent, annual, cross–border, other short term[14]) and on tasks required by firms described as the level of task required by the firm for a specific job occupied by a worker (independently of the skill level of the worker actually employed). Two levels of tasks are distinguished and used to segment our samples according to the presence of supervisory tasks (high tasks) and the requirement of special competences (low tasks)[15].

33′604 observations are feasible for our analysis and Table 2.1 and Table 2.2 show mean and standard deviation for a selected set of variables.

Relative to the high task segment (Table 2.1) it can be observed that annuals are the group that shows the highest level of wages followed by Swiss, permanents and cross–border commuters. Annuals are on average younger with less years of tenure (probably due

[12]In German the survey is called *"Schweizerische Lohnstrukturerhebung (LSE)"*.

[13]The SFSO provides individual October's 2004 gross wages in Swiss Francs standardized to 4 and 1/3 weeks at 40 hours day and including 1/12 of an annual bonus where applicable.

[14]In the category of "other short term permits" we can distinguish seasonal workers from foreigners with a year of permit to less than a year. We excluded those categories from our analysis due to the limited number of available observations.

[15]The dataset originally contains four categories of tasks required by firms. In order to have enough observations for the analysis two categories have been constructed from the original four.

to the nature of the temporary permit) and more educated than any other group. Permanent immigrants and cross–border commuters present a more balanced distribution across education achievements than Swiss with higher concentration in the compulsory level. The apprenticeship plays an important role in the Swiss educational system, therefore it is no surprise that 41% of natives possess this degree.

Concerning gender, it may affect the wage distribution due to discrimination. More specifically, foreign workers are less likely to be females than Swiss and this could be related to the migration mechanism.

The human capital composition by groups seems to drive the distribution of hierarchical levels and sectors confirming the decisive role of the wage structure. Swiss, annuals and permanents show similar hierarchical distributions where roughly half of the sub–sample are employed in a top management position, while cross–borders are more likely to be employed in a blue collar position relative to the other groups.

The allocation by sector reveals once more the similarities between Swiss, annuals and permanents, and the fact that cross–borders are more concentrated in low skill activities like manufacturing and construction.

Table 2.2 shows selected descriptive statistics for the low task segment. Here the ranking on wages is different if compared to Table 2.1. Swiss workers earn most followed by permanents, annuals and cross–borders. Again, annuals are younger and with low levels of tenure, confirming the dependence on the permit characteristic.

The distribution of education achievements confirms again the importance of the apprenticeship in the Swiss educational system. 58% of natives possess and apprenticeship while foreigners are more likely to have achieved a compulsory degree.

The share of woman in the low task segment is higher compared to Table 2.1, suggesting that females are less likely to occupy high task jobs than males, and Swiss show a higher share of females compared to foreigners like in the high task segment.

The distribution by hierarchical levels shows that Swiss are more likely to be employed as low manager than foreigners which account for 80% of the workers in blue collar positions.

Considering the allocation by sectors, Swiss are more concentrated in the high skill

activities (financial intermediation and real estate, renting and related activities) than foreigners. The distribution across foreigner groups is very similar, the only relevant differences are represented by the concentration of cross–border commuters in the manufacturing sector and the higher share of annuals in the hotel and restaurant activities (sector characterized by seasonal employment).

This short data description highlights some aspect of the Ticino labor market. First, Swiss workers do not earn systematically more than foreigners. In the high task segment, annuals earn more than any other group suggesting that wage differentials between Swiss and foreigners are not only driven by discrimination but can be the result of selection processes. Second, cross–border commuters are always the lowest paid category in both task segments. Therefore, the arbitrage between Ticino and Northern Italy due to differences in the cost of living seems to play an important role in accentuating the wage differentials that could be reflected in a higher unexplained component. Finally, the human capital variables seem to be important in explaining the wage level and the dependence on the allocation by hierarchical levels as well as by sectors. However, omitting the information on the other observables (sectors, hierarchical levels, etc...) would lead to an overestimation of the unexplained component of the wage differential.

For this reason, the wage differentials have been first decomposed considering only human capital covariates and successively adding other observed characteristics that may influence the wage structure.

2.4 Empirical results

Table 2.3 shows the results of the parametric Blinder–Oaxaca and the nonparametric propensity score matching decomposition of the wage differential between Swiss workers and each group of foreigners taking natives as benchmark group. As previously mentioned for Swiss workers and each permit group two decompositions relative to the task segment have been performed.

The first row of each methodology reports the average wage differential in logarithms and then the corresponding conditional gaps based on different regression specifications

reporting the unobserved component and the relative share. The first specification includes human capital variables, i.e. age and age square, tenure and tenure square, education levels and gender. The second specification includes the whole set of observed covariates[16].

The observed wage differentials slightly differ among the two methodologies because the nonparametric decomposition is restricted to the common support condition[17]. In fact, the sub–sample observations are less for the nonparametric approach than for the classic Blinder–Oaxaca. However, in each Swiss-foreign comparison there are only few observation out of the support, i.e. the estimated propensity scores are well overlapped, the only exception is represented by permanents in the high task segment, where the common support condition reduces the wage gap by 5% as compared to the common support restriction.

Considering the results obtained from the Blinder–Oaxaca parametric approach with the first specification, the human capital has more explanatory power in the low task segment than in the high task segment. For annuals in the low task segment, 30% of the gap remains unexplained when including human capital variables, while the respective figures are 54% and 66% for permanents and cross–border commuters. In the high task segment, the unexplained gap rises to 83% for cross–borders, 74% for annuals and reaches 138% for permanents showing that for the last permit group the human capital reduces the observed wage gap by 38%.

When the model includes all variables, the unexplained component decreases for all groups and in both the segments. In detail, for annual workers the unexplained component is 58% of the observed positive wage gap in the high task segment and 13% in the low task segment where the wage differential is negative. Permanent workers show a lower share of the unexplained component in the high task segment (17%) than in the low task segment (26%), while cross–border unexplained share is 26% in the high task segment and 43% in the lower task segment.

Considering now the results of the wage decomposition from the nonparametric pro-

[16]Since most of the regressors are dummy variables, this specification is rather flexible. Including additionally a large amount of interaction terms was not possible because many cells will have few or zero observations.

[17]The nonparametric decompositions including human capital variables and including all the covariates have been both restricted to the same common support.

cedure, after estimating a probit equation model with the same structure used for the Blinder–Oaxaca model [18], they appear slightly different even if the overall conclusion remain the same.

When the probit model includes only human capital variables, the unexplained component is lower than the parametric approach for cross–borders and permanents but not for annuals. As in the Blinder–Oaxaca decomposition, the human capital variables are more relevant in explaining the wage differentials in low task segments. In this segment, Swiss take profit from human capital differences especially in comparison to the annuals where human capital explains 60% of the gap, while the human capital variables explain 50% of the gap relative to permanents and 44% if considering cross–border commuters. For annuals and cross–borders in the high task segment, more than 80% of the gap remains unexplained, while for permanents in the same segment, the human capital is not informative to explain differences in the earnings.

When including the whole set of observed variables, once again the unexplained component is reduced but now the estimated unexplained components are in general higher than with the traditional Blinder–Oaxaca methodology. For annuals the unexplained part of the wage gap is more than half of the observed differential in the high task segment, while for permanents and cross–borders in the same task segment the unexplained component is roughly one third of the gap. After considering the whole set of the observed variables in the low task segment, for cross–borders 40% of the gap is attributable to the unexplained component, while the figures are 35% for annuals and 26% for permanent workers.

2.5 Conclusions

In this paper, wage differentials between locals, immigrant workers, and cross–border commuters have been decomposed in two components: endowment (selection on observables) and unexplained component (selection on unobservables). Two methodologies have been applied: the traditional Blinder–Oaxaca parametric decomposition and a more flexible

[18] The results obtained from the probit model are available from the author on request.

non parametric propensity score matching technique. The two methodologies produce a slightly different decomposition but the overall conclusions remain the same. The differences in the results may be only partially due to the common support restriction, only few observations remain out of the common support evidencing that for almost every Swiss there is a "similar" foreign worker in every permit group considered. Other sources of differences in the results may be attributable to the parameter estimation and to the choice of the probit model specification.

In general, the results show that human capital plays an important role in explaining the wage differentials especially in the low task segment.

When including the whole set of variables, in general from 15% to one third is attributable to the unexplained component in both the task segments except for two cases, i.e. cross–borders in low task segment and annuals in high task segment, where 40% and 60% of the observed wage gap are attributable to the unexplained component respectively.

The Canton Ticino shows a scarcity of human resources on the local labor market (not surprisingly given the high share of foreigners). Foreign workers show a different distribution of characteristic depending on the permit to work. Annuals are much more similar in the high task segment to Swiss workers than permanent and cross–borders than are less skilled. In the low task segment, foreigners appear less skilled than Swiss workers.

Cross–border commuters are always the least paid group with highest unexplained negative penalty suggesting that for high skill jobs, local firms could not find the required skills in the neighboring region.

2.6 Tables

Table 2.1: Descriptive statistics of selected variables, high task segment

	Swiss		Annuals		Permanents		Cross-borders	
	mean	sd	mean	sd	mean	sd	mean	sd
Ln Wage	8.87	*0.501*	9.07	*0.538*	8.85	*0.500*	8.67	*0.363*
Age	42.61	*11.123*	37.71	*8.649*	43.14	*10.614*	41.26	*9.491*
Tenure	9.76	*9.524*	3.29	*3.721*	9.32	*8.296*	8.23	*8.794*
College	0.27	*0.446*	0.61	*0.489*	0.24	*0.426*	0.23	*0.421*
High School	0.28	*0.451*	0.21	*0.409*	0.23	*0.419*	0.23	*0.422*
Apprenticeship	0.41	*0.492*	0.08	*0.276*	0.37	*0.483*	0.25	*0.434*
Compulsory	0.02	*0.153*	0.04	*0.205*	0.11	*0.311*	0.17	*0.375*
Other Schools	0.01	*0.075*	0.05	*0.226*	0.05	*0.227*	0.12	*0.323*
Female	0.35	*0.477*	0.29	*0.456*	0.25	*0.434*	0.28	*0.450*
Top Manager	0.51	*0.500*	0.55	*0.498*	0.47	*0.499*	0.30	*0.457*
Low Manager	0.29	*0.452*	0.24	*0.426*	0.31	*0.464*	0.39	*0.488*
Blue Collar	0.20	*0.402*	0.21	*0.409*	0.22	*0.413*	0.31	*0.464*
Manufacturing	0.24	*0.430*	0.19	*0.395*	0.25	*0.435*	0.38	*0.486*
Construction	0.04	*0.198*	0.02	*0.154*	0.06	*0.246*	0.10	*0.304*
Wholesale & retail	0.14	*0.345*	0.14	*0.349*	0.17	*0.377*	0.12	*0.330*
Hotels & Restaurants	0.02	*0.133*	0.03	*0.169*	0.05	*0.217*	0.02	*0.131*
Financial activities	0.15	*0.353*	0.22	*0.414*	0.12	*0.323*	0.02	*0.145*
Real estate & renting	0.14	*0.351*	0.10	*0.294*	0.10	*0.302*	0.08	*0.276*
Observations	6'027		410		1'251		1'720	

Table 2.2: Descriptive statistics of selected variables, low task segment

	Swiss		Annuals		Permanents		Cross-borders	
	mean	sd	mean	sd	mean	sd	mean	sd
Ln Wage	8.50	*0.323*	8.38	*0.346*	8.39	*0.289*	8.31	*0.298*
Age	39.76	*11.577*	34.90	*8.307*	41.89	*10.827*	40.34	*10.135*
Tenure	8.20	*8.432*	3.25	*3.746*	8.45	*7.936*	8.30	*8.557*
College	0.05	*0.223*	0.10	*0.298*	0.02	*0.137*	0.03	*0.164*
High School	0.15	*0.357*	0.10	*0.307*	0.07	*0.255*	0.07	*0.262*
Apprenticeship	0.58	*0.493*	0.19	*0.394*	0.31	*0.464*	0.19	*0.391*
Compulsory	0.20	*0.401*	0.51	*0.500*	0.54	*0.499*	0.61	*0.487*
Other Schools	0.01	*0.121*	0.09	*0.288*	0.06	*0.242*	0.09	*0.293*
Female	0.53	*0.499*	0.43	*0.495*	0.41	*0.492*	0.36	*0.481*
Top Manager	0.04	*0.190*	0.02	*0.151*	0.02	*0.139*	0.02	*0.123*
Low Manager	0.27	*0.445*	0.22	*0.412*	0.18	*0.382*	0.19	*0.393*
Blue Collar	0.69	*0.462*	0.76	*0.427*	0.80	*0.397*	0.79	*0.405*
Manufacturing	0.19	*0.390*	0.23	*0.419*	0.22	*0.416*	0.53	*0.499*
Construction	0.03	*0.166*	0.09	*0.282*	0.11	*0.308*	0.12	*0.324*
Wholesale & retail	0.19	*0.395*	0.17	*0.377*	0.20	*0.404*	0.11	*0.315*
Hotels & Restaurants	0.02	*0.145*	0.12	*0.326*	0.07	*0.254*	0.02	*0.141*
Financial activities	0.14	*0.351*	0.07	*0.255*	0.06	*0.237*	0.01	*0.118*
Real estate & renting	0.10	*0.305*	0.11	*0.309*	0.08	*0.271*	0.05	*0.220*
Observations	10'413		943		4'783		8'057	

Table 2.3: Results of the wage differential decomposition, uncexplained component

Blinder Oaxaca

	Annuals		Permanents		Cross-borders	
	High Task	Low Task	High Task	Low Task	High Task	Low Task
Wage differential	0.200	-0.128	-0.02	-0.117	-0.196	-0.199
Human capital						
Unexplained part	0.148	-0.039	-0.028	-0.063	-0.164	-0.132
std error	*(0.024)*	*(0.010)*	*(0.013)*	*(0.005)*	*(0.014)*	*(0.005)*
Share	74%	30%	138%	54%	83%	66%
All variables						
Unexplained part	0.116	-0.017	-0.003	-0.031	-0.05	-0.086
std error	*(0.023)*	*(0.009)*	*(0.012)*	*(0.005)*	*(0.012)*	*(0.005)*
Share	58%	13%	17%	26%	26%	43%
Nr. Foreigners	410	943	1251	4783	1720	8057
Nr. Swiss	6027	10413	6027	10413	6027	10413

Propensity score matching*

	Annuals		Permanents		Cross-borders	
	High Task	Low Task	High Task	Low Task	High Task	Low Task
Wage differential	0.201	-0.127	-0.015	-0.116	-0.193	-0.199
Human capital						
Unexplained part	0.166	-0.052	-0.015	-0.059	-0.157	-0.132
std error	*(0.029)*	*(0.013)*	*(0.017)*	*(0.006)*	*(0.017)*	*(0.007)*
Share	83%	41%	100%	51%	81%	66%
All variables						
Unexplained gap	0.133	-0.044	-0.005	-0.03	-0.063	-0.079
std error	*(0.030)*	*(0.015)*	*(0.017)*	*(0.007)*	*(0.020)*	*(0.008)*
Share	66%	35%	34%	26%	33%	40%
Nr. Foreigners	407	936	1240	4773	1715	8050
Nr. Swiss	5984	10354	5963	10413	5940	10413

Note: * Epanechnikov kernel with bandwidth 0.06. Standard errors in parenthesis.

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Chapter 3

Labor market regulatory discontinuity and the impact on native wages

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Abstract

This paper analyzes the impact of cross–border commuters on Swiss labor market in view of its liberalization. This is a particular labor market with high levels of foreign workers and a regulatory discontinuity across two inside regions. The possibility to distinguish two areas where cross–border commuters can be employed or not is the key of this analysis. Taking into account immigration endogeneity as well as the limited mobility of local labor supply, comparing local workers wages across the regulatory discontinuity I found evidence that cross–border commuters generate downward wage pressure on low skilled workers. However, the penalties seem to be more accentuated for resident immigrants than for Swiss workers due to differences observed in the skill composition.

JEL classification: F22, J24, J31, J61

Keywords: wages, immigrant workers, regulatory discontinuity, skills

3.1 Introduction

The access of immigrant labor force to the Swiss labor market has historically been limited by a system of quotas and by permits for foreigners that have been conceded only in absence of equivalent local labor supply. Since 1^{st} June 2002 the Swiss labor market is experiencing a transition period where the Free Movement of Persons between Switzerland and the European Union member states will be gradually introduced and fully implemented within 12 years[1]. This change removes the most important instrument that has been used by Switzerland to control the immigration inflow. Currently the lack of sufficiently long evidence gives rise to a debate on the possible impacts the liberalization may have on the Swiss labor market, and in particular on whether new immigrant inflows could generate a pressure on Swiss wages.

The location of Switzerland in the center of Europe without being a member of the EU implies that wages can be greatly influenced by trans–border labor markets. One of these border regions is the Canton Ticino which represents an interesting case of analysis used here for a quasi–natural experiment. Ticino is a Swiss Canton on the north Italian border with $160'000$ workers (4% of Switzerland) with twice the national share of foreign workers (41% in 2000 in Ticino, 25% in Switzerland). This is due to the possibility to employ foreign cross–border commuters coming from the North Italian Provinces[2] whose share in the foreign employment[3] in Ticino is 50% as shown in Table 3.1. This category of foreign workers has never been limited by quotas but regulated through geographical restrictions. Cross–border commuters must reside in a bounded region of no more than 30 km from the Swiss border line[4]. Moreover, they can be employed only in a predefined Swiss border area[5], we call it the "Open Area" (A) where cross-border commuters can

[1]The national priority has been abolished in June 2004 while the quotas will be abolished in June 2007.

[2]Como, Varese, Verbano–Cusio–Ossola and Lecco.

[3]It is possible to distinguish two groups of foreigners, cross–border commuters and resident immigrants. The latest group includes all the immigrant categories (permanents and short term immigrants).

[4]A North-Italian worker must reside in the Italian border region at least 6 month previous to the application for cross–border working permit.

[5]A cross–border commuter who resides in Northern Italy is allowed to work only in the south part of Switzerland.

compete with local workers, and distinguish it from the "Closed Area"[6] (B). Inside the area A, it is also possible to distinguish centers[7] ($A1$) from the rest of the Open Area ($A2$), as depicted in Figure 3.1.

The neighboring Italian Provinces represent an "infinite" source of manpower for Ticino[8], that can be attracted by existing wage differentials. Due to the similar cultures between Ticino and the Italian Provinces (same language, and similar educational systems) the human capital is easily transferable. However, as can be shown from Table 3.1 cross–border commuters earn, ceteris paribus, 5% less than Swiss workers. For these reasons, the Canton Ticino's situation represents an interesting extreme case of analysis in view of a complete liberalization of the Swiss labor market.

The main purpose of this paper is to measure the pressure of cross–border commuters on the wage of the local labor supply through the geographical regulatory discontinuity. If cross–border commuters are in competition with the local workforce in the Open Area, they generate a downward wage pressure that can be observed measuring the wage differential between local workers employed in the Open and Closed Areas[9]. Moreover, I would like to understand which group among Swiss and resident immigrants[10] is more likely to suffer from the cross–border commuters competition.

Authors as Borjas et al. (1997) and Borjas (2003) have widely criticized approaches exploiting the fact that immigrants tend to cluster in a small number of geographical areas as in Grossman (1982) and Card (1990), because important problems related to the immigration endogeneity and internal mobility can lead to underestimate the net effect of immigration providing evidence of small and even irrelevant impacts on natives as surveyed by Friedberg and Hunt (1995). However, Canton Ticino resembles a closed economy in terms of intra–national mobility because it represents an Italian–language minority in

[6]The Closed Area is defined by all the communes located north of the communities of Preonzo and Claro. All the remaining regions in Ticino are open to cross–border commuters.

[7]Centers include the cities of Bellinzona, Chiasso, Locarno, Lugano and Mendrisio.

[8]The employment basin of the neighboring Italian Provinces counts around 1 million workers that can potentially apply for a cross–border commuter working permit.

[9]Sheldon (2000) argues that "although Swiss law prohibits paying foreigners less than the going wage, employers may circumvent this regulation by appropriate job down–grading so that in the final analysis foreign labor recruitment in fact does lower the wages of native workers".

[10]In Switzerland there are two groups of foreign workers: cross–border commuters and resident immigrants.

Switzerland[11] and this imposes an important barrier to intra–national mobility.

Nevertheless, in response to the cross–border wage pressures local labor supply may move to the Closed Area equalizing wages across regions. The Closed Area is a periphery region with accessibility problems due to the morphology of the region, and with 6% of total Ticino employment. As can be shown from Table 3.1, the commuting balance among areas (not considering cross–border commuters) is positive only in centers (area $A1$) because they attract workers from the other regions (areas $A2$ and B), while there is no evidence that local workers move to the protected region (B). Table 3.1 shows also that 69% of cross–border commuters are employed in non–center area $A2$, but they do not show significant wage differentials among the areas $A1$ and $A2$. As a consequence, in order to identify the cross–border pressure, I will focus on the comparison between local worker wages among the areas $A2$ and B to avoid the immigration endogeneity issue as well as the local labor mobility problem.

The impact of immigration in Switzerland has been analyzed by several authors. Following production theory developed by Christensen et al. (1971), applications to the Swiss case have been provided by Butare and Favarger (1992) and by Sheldon (2000) finding that immigrants have little negative effects on Swiss workers' wages. Authors as Golder and Straubhaar (1999) provide evidence that immigrants tend to have a negative impact on the Swiss economy.

In the U.S. context, a more recent contribution by Ottaviano and Peri (2006), developing a general equilibrium framework in an extension of Borjas (2003), concluded that in presence of differentiated labor, the inflow of immigrants belonging to a certain group can be expected to have asymmetric impacts on the wage of different native groups: a negative effect on groups with substitutable characteristics and a positive effect on groups with complementary characteristics. This paper focuses on the expected negative effect cross–border commuters may have on local labor supply, because the intention of the author is to identify which group of the local labor force may be more susceptible to suffer from negative consequences, and to quantify this penalty.

[11] There are four official languages in Switzerland and Canton Ticino is the only Swiss Canton whose official language is the Italian.

For these reasons, this paper develops a different approach exploiting the specificities of the Swiss labor market and in particular the cross–border commuter regulatory discontinuity. I show evidence of significant wage disparities between low skill workers employed in the two regions $A2$ and B. Only a small group of Swiss workers seem to be affected by this pressure because the cross–border commuters attracted in Ticino are low skilled and therefore more similar to resident immigrants.

In what follows, I describe the empirical model, present the data used in the analysis and show some descriptive statistics. Then, after presenting the estimated results, I conclude with some reflections.

3.2 Empirical model

In order to measure the pressure of cross–border commuters on wages in Ticino, I compare the wage of Swiss and resident immigrant workers across the regulatory discontinuity defined by the Open and Closed Area ignoring the "core–periphery" forces that may led to underestimate the wage pressure.

As a consequence, the "Open Area" has been subdivided in two regions: the centers ($A1$) and the rest of the Open Area ($A2$), because the area $A2$ is similar to the Closed Area (region B) except for the presence of the cross–border commuters. Then, I focus on the comparison among workers employed in area $A2$ and workers occupied in the area B.

I separate the effects on resident immigrants from those observed for Swiss workers in order to understand which group is more likely to be subject to the trans–border competition. Therefore, I obtain 3 regions ($A1$, $A2$ and B) and two groups of workers (Swiss = S and resident immigrants = F), and from their interactions I construct the following region–nationality categories: $A1^s, A1^f, A2^s, A2^f$ and B^s, B^f.

In order to compare equally skilled workers across areas, following Borjas (2003), I define skill groups in terms of both schooling and labor market experience, because workers within the same educational level, but with different levels of experience, are imperfect substitutes in production. Thereafter, partitioning workers among 5 educational achieve-

ment groups (College, High School, Apprenticeship, Compulsory and Other degrees[12]) and 5 experience categories (from 0 to 10, from 11 to 20, from 21 to 30, from 31 to 40 and more than 40 years) I estimate the following log wage equation (considering the sample of Swiss and resident immigrants):

$$\begin{aligned} lnw_i &= \alpha + \sum_{k=1}^{5}\sum_{m=1}^{5} \gamma^s_{km}.A2^s_{kmi} + \sum_{k=1}^{5}\sum_{m=1}^{5} \gamma^f_{km}.A2^f_{kmi} + \\ &+ \sum_{k=1}^{5}\sum_{m=1}^{5} \phi^s_{km}.A1^s_{kmi} + \sum_{k=1}^{5}\sum_{m=1}^{5} \phi^f_{km}.A1^f_{kmi} + \\ &+ \sum_{k=1}^{5}\sum_{m=2}^{5} \eta_{km} d_{kmi} + \mu F_i + X'\beta + \epsilon_i \end{aligned} \tag{3.1}$$

where lnw_i is the log natural monthly wage for worker i, α is the constant term, while $A2^n_{kmi}$ is a dummy variable that equals 1 if the individual i working in the non–centers of the Open Area with nationality n (= Swiss, foreign immigrant) has the education achievement k and is in the experience group m. Similarly, $A1^n_{kmi}$ is an indicator for individuals working in cities located in the Open Area.

In Equation (3.1), d_{kmi} is "education" nested with "experience", F_i is "nationality" (that equals 1 for foreign immigrants), whilst the vector X represents other observables that describe individual socioeconomic characteristics, job specificities and firm characteristics.

The parameters of interests are γ^s_{km} and γ^f_{km}. These parameters measure the wage differential within education group k and experience group m for each nationality group across areas $A2$ and B. A negative and significant sign of the γ^n_{km} will be interpreted as cross-border downward wage pressure on the local labor supply group for the km skill category.

Including d_{kmi}, F_i and the $A1^n_{km}$ in Equation (3.1) ensures that the γ^n_{km} capture the wage differentials relative to workers within the same nationality–skill group across the regulatory discontinuity defined by the two areas $A2$ and B.

The parameters ϕ^n_{km} will capture the wage differentials between the centers in the

[12]It is important to note that, ceteris paribus, workers with an apprenticeship are more skilled respect to workers with a compulsory schooling level.

Open Area ($A1$) and the Closed Area (B) for each nationality–skill group, and it will be possible to compute the wage differentials between all the areas considered for each nationality–skill group. Nevertheless, all the earning differences relative to the $A1$ include both the core–periphery as well the cross–border effects that are not singularly identifiable.

I would expect that the coefficients γ^s_{km} and γ^f_{km} would be negative and significant for those km–skill segment groups that are more likely to be in competition with cross–border commuters, otherwise I would expect that they do not significantly differ from zero.

3.3 Data and descriptive statistics

The empirical analysis is based on data from the Swiss Wage Structure Survey[13] (or SWSS), that provides cross section data for 2000, 2002 and 2004. The survey has been implemented by the Swiss Federal Statistical Office (SFSO) among a representative sample of 5'000 firms (with more than two employees) reporting salaries, job characteristics and individual attributes of 110'000 individual workers in Ticino (for the three years). I dispose of a SWSS' sample that includes only firms active in the private sectors, and have selected those individual observations which include all the variables used in the wage equations. The result is a representative sample of $105'507$ individual observations of occupied workers.

The dataset provides gross nominal monthly standardized logarithm of wages in Swiss Francs[14], human capital characteristics in the form of age, education (higher education degree achieved), potential experience[15] and years of tenure in the current firm. I also have information on gender, marital status, part time work, four type of contracts (different union coverage), work permits for foreigners, task required by firms, hierarchical level, firm sizes, sectors and occupations (according to a classification proposed by the SFSO). In addition, for each worker the zip code of the employment location is available.

[13] In German the survey is called *"Schweizerische Lohnstrukturerhebung (LSE)"*.

[14] The SFSO provides individual October's gross wage in Swiss Francs standardized to 4 and 1/3 weeks at 40 hours and including 1/12 of annual bonus where applicable.

[15] In order to compute years of potential experience, as age minus years of schooling minus six, the categorical variable describing education has been transformed attributing the years necessary to achieve the respective degree.

Table 3.2 shows the descriptive statistics for selected variables[16] for each of the nationality group (cross–border commuters, Swiss and resident immigrants) by areas.

Comparing the nationality groups among areas, cross–border commuters show similar average wages among areas $A1$ and $A2$[17]. Cross–border commuters also represent the group with the lowest salary, whilst Swiss workers are the group with the highest wage levels. Swiss and foreign immigrants earn, on average, more in the area $A1$ than in the area $A2$. However, Swiss workers show very similar salaries among the areas $A2$ and B while resident immigrants employed in the protected area earn 5% more than in the area $A2$.

It is interesting to observe that cross–border commuters show quite similar human capital distributions among the open areas. On the other hand, Swiss and resident immigrants appear more skilled in the centers of the Open Area where higher shares of workers with a college or high school degree can be founded as compared to the rest of the Open Area.

The distribution by educational achievements shows that 60% of cross–border commuters own a compulsory scholar degree and slightly less than 20% an apprenticeship diploma. Similar shares are found for resident immigrants with the same educational levels, specially in the Closed Area (B). Differently, Swiss workers are more likely to own an apprenticeship than a compulsory degree. In fact, from 15% to 17% of Swiss workers employed respectively in area B and $A2$ own a compulsory degree, while in the region $A2$ 54% of Swiss workers have an apprenticeship, and the share in the same category rises to 64% in the Closed Area. This emphasizes how cross–border commuters are more similar to resident immigrants than to Swiss workers in terms of education.

Native workers also show lower average years of experience than immigrants and cross-borders, probably due to migration decision process. In particular, cross–borders and resident immigrants are underrepresented in the experience category with less than ten years.

[16] A detailed descriptive table with all the variables included in the model is available from the author on request.

[17] T-test of equal mean shows that cross–border commuters mean wages are statistically equal among the two areas $A1$ and $A2$ at the 99% level. The detailed results are available from the author.

Finally, the distribution by sectors reveals that cross–border commuters are overrepresented in manufacturing activities. In the area $A2$ 50% of them are employed in industries which is more than twice the share observed for Swiss workers. On the other hand, the share of foreign immigrants in the manufacturing sector rises from 23% in the area $A2$ to 31% in the Closed Area. 21% of cross–borders are employed in the construction sector where Swiss workers represents 9% in the area $A2$ and 20% in the Closed Area (B).

In synthesis, cross–border commuters are overrepresented in educational category with compulsory degree and in intermediate levels of experience. Moreover, they are likely to be employed in manufacturing and construction activities.

3.4 Estimation results

Table 3.3 shows the estimation results when comparing each nationality–skill group across areas taking the workers employed in the Closed Area as reference. The main interest is in the comparison among the areas $A2$ and B in order to capture the wage pressure of cross–border commuters for each skill segment defined by the education and experience group. Therefore, Table 3.3 shows the coefficients associated to the non-cities part of the Open Area ($A2$) for each skill group in two columns, one for Swiss and one for foreign immigrants[18]. The table reports the results of four estimates for which the covariates have been subsequently added to the model. The first equation, i.e. the first two columns, shows the results when controlled for skill-nationality groups, year, education and experience, nationality and socioeconomic characteristics (gender, marital status and tenure). The second equation includes also job specificities (hierarchical level, task levels, part–time work, type of contract and occupations). The third model includes firm characteristics (two digit sectors and firm size) while the last regression (i.e. the fourth) represents a model with all the variables and some interactions.

In general, the results confirm the intuition that the category of workers most subject to cross–border commuters competition shows negative and significant wage differentials across the regulatory discontinuity. More in detail, high skill workers (i.e. with a college

[18]A detailed table is available from the author on request.

or a high school degree) do not show significant wage penalties if employed in the area $A2$ as compared to those employed in the Closed Area (B) for any experience category, and the results are robust with respect to the introduction of control variables. Foreign workers with a college degree and more than 41 years of experience as well as high school workers in the experience category 21–30 (both Swiss and foreigners) show positive wage differentials across the areas. Considering workers with an apprenticeship, only workers with low experience (less than 10 years) show negative wage penalties that are robust even when introducing interaction terms. The wage penalties observed across areas for this skill category of workers, both Swiss and foreigners, range from 2% to 5%.

Furthermore, workers with only a compulsory educational degree show negative and significant wage differentials. For Swiss workers the penalties are lower than for resident immigrants, and in the full model (the third regression) negative and significant coefficients are found in the intermediate experience groups (i.e. from 11 to 40 years of experience). It can be observed that the wage differential increases with experience, while adding interactions reduces the gap and the coefficient associated to the experience category 11-20 is no longer significantly different from zero. The resulting wage gap for Swiss workers with a compulsory educational degree range from 3% to 6%. Considering resident immigrants with more than 10 years of experience, they show significant negative coefficients that fluctuate between 5% to 7.5%. These results are still robust regarding the introduction of covariates even if the magnitudes of the differentials decrease. Also in this case, the penalties increase with experience but decrease for skill groups with more than 40 years of experience.

3.5 Conclusions

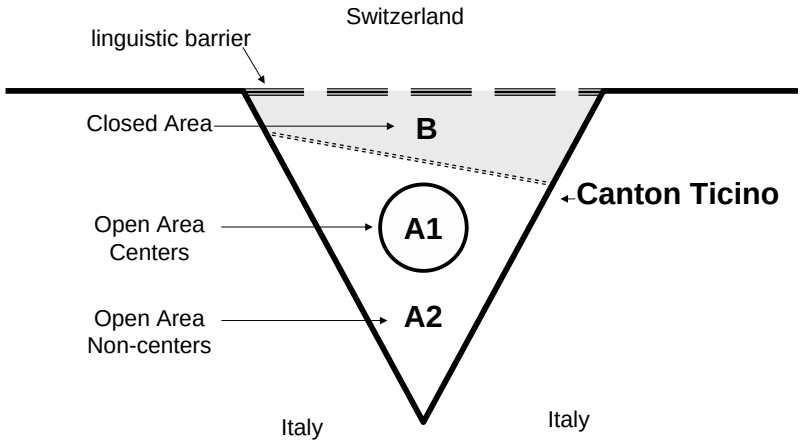
The objective of the paper is to verify if cross–border commuters generate a pressure on the wages of Swiss and resident immigrant workers in Ticino. This is a particular labor market with high levels of foreign workers and a regulatory discontinuity across two inside areas. The possibility to distinguish two areas where cross–border commuters can or cannot be employed is the key to the analysis. Comparing the wages of each of

the Swiss and resident immigrants categories across regions $A2$ and B I found evidence of wage differentials between local low skill workers employed in the two areas. These groups are subject to the competition of cross–border commuters. However, this seems to affect only a relatively small group of Swiss workers while resident foreigners are more likely to be subject to the cross–border competition. No evidence is found for high skill workers of cross–border pressure, but in some isolated cases I found a positive wage gap for intermediate experience categories. The structure of the Swiss workforce is more skilled and it seems that this category of manpower has been protected by the old regulation. Consequently, it is not obvious what the impact of the liberalization on this skilled group would be.

Finally, this study permits to reflect upon the possible impacts the liberalization may have on the Swiss labor market. The Canton Ticino represents an extreme case of analysis where a high concentration of cross–border commuters produces only small effects on natives, but the impact on other foreign categories of workers could be more problematic.

3.6 Figures

Figure 3.1: Scheme of Canton Ticino



3.7 Tables

Table 3.1: Ticino labor market specificities

	Permits distrib.	Adj. wage diff.	Adj. wage diff. A1-A2	Permits distribution across areas		
	Ticino	Coeff. (std. err.)	Coeff. (std. err.)	Open Area A1	Open Area A2	Closed Area B
Swiss	59%	-		46%	47%	7%
Resident immigrants	23%	-0.005 (0.0029)		40%	53%	8%
Cross-borders	19%	-0.048** (0.0028)	-0.006 (0.0030)	31%	69%	0%
Total (absolute values)	100% (161167)			42% (67163)	53% (84791)	6% (9213)
Commuting balance^{+} over area tot. employment				42%	-32%	-17%
Observations		105507	27397			
R^2		0.65	0.69			

Note: The data are from the Swiss 2000 census provided by the Swiss Federal Statistical Office. + Commuting balance without cross–border commuters. In the two regressions, dependent variable is log monthly wage, robust standard errors in parentheses, * significant at 5%; ** significant at 1%. Area $A1$ includes the cities of Bellinzona, Chiasso, Locarno, Lugano and Mendrisio.

Table 3.2: Descriptive statistic of selected variables

	Cross–borders		Swiss			Resident immigrants		
	A1	A2	A1	A2	B	A1	A2	B
lnw	8.32	8.32	8.62	8.53	8.52	8.45	8.39	8.44
Age	39.76	40.65	39.30	40.03	38.63	39.67	39.91	40.84
Schooling	10.73	10.68	12.70	12.27	12.16	11.54	11.07	10.72
Experience	23.03	23.97	20.61	21.76	20.47	22.13	22.84	24.12
Tenure	9.08	9.09	8.74	9.10	9.64	7.05	7.42	8.55
College	0.05	0.03	0.16	0.10	0.08	0.11	0.06	0.02
High School	0.08	0.08	0.18	0.17	0.12	0.11	0.08	0.04
Apprenticeship	0.19	0.18	0.53	0.54	0.64	0.26	0.26	0.24
Compulsory	0.59	0.61	0.12	0.17	0.15	0.45	0.53	0.61
Other Schools	0.08	0.09	0.01	0.01	0.01	0.07	0.07	0.09
Exp 0-10	0.12	0.09	0.22	0.20	0.22	0.17	0.13	0.14
Exp 11-20	0.33	0.31	0.32	0.30	0.31	0.32	0.32	0.27
Exp 21-30	0.29	0.32	0.23	0.24	0.25	0.27	0.28	0.29
Exp 31-40	0.20	0.21	0.17	0.19	0.17	0.18	0.19	0.22
Exp more 40	0.06	0.07	0.05	0.07	0.05	0.07	0.07	0.09
Manufacturing	0.39	0.50	0.10	0.27	0.25	0.11	0.23	0.31
Construction	0.21	0.21	0.07	0.09	0.20	0.13	0.17	0.35
Wholesale & retail	0.14	0.12	0.19	0.25	0.16	0.18	0.16	0.08
Hotels	0.06	0.05	0.04	0.07	0.06	0.22	0.21	0.08
Financial sector	0.02	0.00	0.16	0.04	0.03	0.07	0.03	0.00
Real estate & renting	0.07	0.03	0.21	0.08	0.09	0.11	0.05	0.09
Observations	8542	18855	23267	24082	2318	11069	15407	1967

Note: A detailed table with mean of all the variables included in the model is available from the author by request.

Table 3.3: Estimation results, Swiss and resident immigrants

	(1)		(2)		(3)		(4)	
	Swiss	*Foreign*	*Swiss*	*Foreign*	*Swiss*	*Foreign*	*Swiss*	*Foreign*
College								
Exp 0-10	-0.012	-0.043	0.039	0.004	0.06	0.016	0.033	0.002
	(0.051)	(0.055)	(0.042)	(0.044)	(0.041)	(0.042)	(0.043)	(0.044)
Exp 11-20	-0.031	0.037	-0.014	0.037	0.004	0.048	0.015	0.054
	(0.050)	(0.054)	(0.051)	(0.053)	(0.054)	(0.055)	(0.049)	(0.051)
Exp 21-30	0.162	0.126	0.115	0.09	0.128	0.104	0.154	0.128
	(0.119)	(0.120)	(0.097)	(0.098)	(0.096)	(0.097)	(0.099)	(0.099)
Exp 31-40	0.094	0.280+	0.076	0.184	0.08	0.175	0.062	0.159
	(0.159)	(0.168)	(0.127)	(0.132)	(0.114)	(0.120)	(0.114)	(0.120)
Exp more 41	-0.034	0.490**	-0.059	0.389*	-0.082	0.344**	-0.152	0.285**
	(0.125)	(0.142)	(0.153)	(0.162)	(0.115)	(0.121)	(0.105)	(0.108)
High School								
Exp 0-10	0.025	0.037	-0.015	0.003	0.008	0.008	0.001	-0.002
	(0.044)	(0.058)	(0.034)	(0.046)	(0.027)	(0.040)	(0.029)	(0.040)
Exp 11-20	0.028	-0.032	-0.009	-0.05	0.016	-0.043	0.015	-0.044
	(0.040)	(0.046)	(0.034)	(0.039)	(0.036)	(0.040)	(0.034)	(0.039)
Exp 21-30	0.127*	0.166**	0.077	0.131**	0.092*	0.124**	0.103*	0.136**
	(0.057)	(0.059)	(0.050)	(0.050)	(0.047)	(0.047)	(0.048)	(0.049)
Exp 31-40	0.17	0.158	0.091	0.106	0.103	0.101	0.088	0.088
	(0.115)	(0.125)	(0.081)	(0.089)	(0.076)	(0.082)	(0.079)	(0.085)
Exp more 41	0.147	-0.044	0.127	0.000	0.099	-0.024	0.114	-0.045
	(0.092)	(0.103)	(0.089)	(0.095)	(0.088)	(0.093)	(0.094)	(0.097)
Apprenticeship								
Exp 0-10	-0.012	-0.027+	-0.041**	-0.051**	-0.020+	-0.034*	-0.035**	-0.039**
	(0.012)	(0.016)	(0.012)	(0.015)	(0.012)	(0.014)	(0.012)	(0.014)
Exp 11-20	0.032**	-0.005	0.012	-0.019	0.021+	-0.012	0.013	-0.019
	(0.011)	(0.016)	(0.013)	(0.015)	(0.011)	(0.014)	(0.011)	(0.014)
Exp 21-30	0.007	-0.017	-0.031*	-0.049**	-0.006	-0.034*	-0.004	-0.031+
	(0.016)	(0.019)	(0.014)	(0.017)	(0.013)	(0.017)	(0.013)	(0.016)
Exp 31-40	0.044*	-0.032	0.016	-0.025	0.032+	-0.015	0.025	-0.022
	(0.019)	(0.022)	(0.019)	(0.022)	(0.017)	(0.020)	(0.016)	(0.020)
Exp more 41	0.061	-0.008	0.026	-0.014	0.034	-0.004	0.035	-0.003
	(0.049)	(0.069)	(0.047)	(0.067)	(0.043)	(0.064)	(0.042)	(0.065)
Compulsory								
Exp 0-10	-0.02	-0.068+	-0.038	-0.054	-0.014	-0.021	-0.011	-0.019
	(0.043)	(0.041)	(0.038)	(0.035)	(0.036)	(0.032)	(0.039)	(0.036)
Exp 11-20	-0.028	-0.067**	-0.034*	-0.060**	-0.032+	-0.050**	-0.026	-0.048**
	(0.021)	(0.015)	(0.017)	(0.011)	(0.017)	(0.011)	(0.017)	(0.011)
Exp 21-30	-0.048*	-0.083**	-0.046**	-0.065**	-0.045**	-0.051**	-0.035*	-0.043**
	(0.020)	(0.015)	(0.017)	(0.014)	(0.017)	(0.014)	(0.017)	(0.014)
Exp 31-40	-0.085**	-0.098**	-0.062**	-0.082**	-0.066**	-0.075**	-0.049**	-0.062**
	(0.023)	(0.016)	(0.019)	(0.014)	(0.018)	(0.014)	(0.017)	(0.014)
Exp more 41	-0.089**	-0.109**	-0.013	-0.048*	-0.018	-0.037+	-0.014	-0.042*
	(0.023)	(0.019)	(0.025)	(0.023)	(0.024)	(0.022)	(0.020)	(0.018)
Constant	8.331**		8.277**		8.162**		8.134**	
	(0.018)		(0.019)		(0.021)		(0.032)	
Years-EduExp-Foreign	Y		Y		Y		Y	
Socioec. Chars	Y		Y		Y		Y	
Job			Y		Y		Y	
Firm					Y		Y	
Interactions							Y	
Observations	78110		78110		78110		78110	
R-squared	0.46		0.60		0.64		0.67	

Note: Dependent variable is log monthly wage. Robust standard errors in parentheses. + significant at 10%; * significant at 5%; ** significant at 1%.

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