

Ferraz, Diogo; Ribeiro de Oliveira, Fabíola Cristina

**Article — Accepted Manuscript (Postprint)**

## Impact of the National Professional Qualification Program (PNQ) on Income: An Econometric Analysis in Piracicaba/ SP-Brazil

Pesquisa & Debate

*Suggested Citation:* Ferraz, Diogo; Ribeiro de Oliveira, Fabíola Cristina (2018) : Impact of the National Professional Qualification Program (PNQ) on Income: An Econometric Analysis in Piracicaba/SP-Brazil, Pesquisa & Debate, ISSN 1806-9029, Pontifícia Universidade Católica de São Paulo, São Paulo, Vol. 28, Iss. 2, pp. 105-123, <https://revistas.pucsp.br/index.php/rpe/article/view/34838/>

This Version is available at:

<https://hdl.handle.net/10419/171454>

**Standard-Nutzungsbedingungen:**

Die Dokumente auf EconStor dürfen zu eigenen wissenschaftlichen Zwecken und zum Privatgebrauch gespeichert und kopiert werden.

Sie dürfen die Dokumente nicht für öffentliche oder kommerzielle Zwecke vervielfältigen, öffentlich ausstellen, öffentlich zugänglich machen, vertreiben oder anderweitig nutzen.

Sofern die Verfasser die Dokumente unter Open-Content-Lizenzen (insbesondere CC-Lizenzen) zur Verfügung gestellt haben sollten, gelten abweichend von diesen Nutzungsbedingungen die in der dort genannten Lizenz gewährten Nutzungsrechte.

**Terms of use:**

*Documents in EconStor may be saved and copied for your personal and scholarly purposes.*

*You are not to copy documents for public or commercial purposes, to exhibit the documents publicly, to make them publicly available on the internet, or to distribute or otherwise use the documents in public.*

*If the documents have been made available under an Open Content Licence (especially Creative Commons Licences), you may exercise further usage rights as specified in the indicated licence.*

# IMPACT OF THE NATIONAL PROFESSIONAL QUALIFICATION PROGRAM (PNQ) ON INCOME: AN ECONOMETRIC ANALYSIS IN PIRACICABA/SP-BRAZIL

Diogo Ferraz\*

*University of Sao Paulo (USP)*

*400 Trabalhador são-carlense Avenue, Parque, 13566-590 - São Carlos, SP/Brazil*

[diogoferraz@usp.br](mailto:diogoferraz@usp.br)

Fabíola Cristina Ribeiro de Oliveira

*Methodist University of Piracicaba (UNIMEP)*

*Rodovia do Açúcar, km 156 (SP-308), 13.423-170 – Piracicaba, SP/Brazil*

[fbcoliveira@hotmail.com](mailto:fbcoliveira@hotmail.com)

## Abstract

This paper presents the analysis of the results of the National Program for Professional Qualification - PNQ in Piracicaba/Sao Paulo - Brazil. It analyzed the impact of PNQ on the income of workers. The Theory of Human Capital is presented as a suitable theoretical basis. We used econometric method "diffs-in-diffs", which compares the income of a group of skilled workers with others who did not attend the program. It proved to be rise in income and increased formalization of skilled workers. It was proved the viability of public policy professional qualifications in the municipality.

**Keywords:** Professional qualification; Income; Econometrics; Difference in Differences Method; Program for Professional Qualification - PNQ.

## IMPACTO DO PROGRAMA NACIONAL DE QUALIFICAÇÃO PROFISSIONAL (PNQ) SOBRE A RENDA: UMA ANÁLISE ECONOMÉTRICA EM PIRACICABA/SP

### Resumo

Este trabalho apresenta os resultados da análise do Programa Nacional de Qualificação Profissional – PNQ em Piracicaba/SP. Analisou-se o impacto do PNQ sobre a renda dos trabalhadores. A Teoria do Capital Humano se apresentou como embasamento teórico adequado, ressaltando a importância do treinamento na vida dos trabalhadores. Utilizou-se método econométrico “*diffs-in-diffs*”, que compara a renda de um grupo de trabalhadores qualificados com outro que não frequentou o programa. Comprovou-se elevação na renda e aumento da formalização dos trabalhadores qualificados. Destacou-se a importância da participação de outros agentes sociais. Ficou comprovada a viabilidade da política pública de qualificação profissional no município.

**Palavras-chave:** Qualificação; Renda; Econometria; Diferença em Diferenças; Programa Nacional de Qualificação Profissional – PNQ.

**Journal of Economic Literature Classification:** J2; I2.

## **1. Introduction**

Several studies have analyzed the importance of education on income and employment (Ashenfelter, 1978; Dehejia and Wahba, 1999). However, there are few studies that analyze the effect of professional qualification in municipalities. These studies are important because the qualification reduces the inconsistency between supply and demand for skilled and experienced workforce and seeking resources to reduce the lag in formal schooling of a relevant part of the economically active population.

The aim of this article is to analyze the impact of the public policy of professional qualification, through the Plano Nacional de Qualificação Profissional – PNQ, or in English Program for Professional Qualification, in the municipality of Piracicaba, Sao Paulo State – Brazil in 2011. Moreover, we want to investigate the effect of the types of qualification courses (administrative, cargo driver, receptionist and others) on income. To achieve the proposed objectives, we propose to estimate the effect of public policy on the income of skilled workers in relation to those who did not participate in the program. In addition, the model highlighted the differences in salary earnings by type of course offered. The Human Capital approach proved to be the theoretical framework favorable to the hypotheses of the econometric model. The results of the model are in accordance with the theoretical basis and with the educational rates of return investigated in the literature.

We emphasize the need to analyze the impact of public policies in order to justify government spending on the programs offered by the Brazilian State. Moreover, there is still a lack of empirical estimates about professional qualification programs in the country, especially at the municipal level. This study is justified by estimating the impact of public investment on human capital in a recent period and by comparing the effect of a public policy with municipal and federal public investment. We seek to answer to what extent short courses influence income generation. This paper is divided into four other sections beyond this introduction. The second section discusses the literature review on education and policies for employment and income generation. The third explains the database and the method. The fourth estimates the results of the econometric model. The fifth section presents the conclusion of the paper.

## **2. Literature review**

### **2.1 Education and professional qualification in Brazil**

Studies have analyzed the role of education and professional qualification on income, occupation and formalization of the workforce (Ashenfelter, 1978; Lalonde, 1986; Dehejia and Wahba, 1999), especially in developing countries. In countries where industrialization is still necessary, the qualification of the workforce becomes increasingly important. Besides the monetary capital, investments in physical capital and determination of the working day, the quality of the economic agents is fundamental to the promotion of income and permanence in the formal market. The introduction of technologies reveals the need to absorb new technical skills and transforms labor relations, from purely quantitative structures and physical strength to qualitative relations that value educational accumulation.

Investment in the qualification and training of labor as well as the diffusion of knowledge act as forces of convergence for the reduction of income inequality (Piketty, 2014, p. 27). By acquiring educational foundation and work experience, investment in human resources is provided. According to Schultz (1961), the investment in human capital extends the possibilities of the individuals, besides providing gains to income, health, quality of life, productivity and to contribute to the promotion of economic development. For Mincer (1974) there is a positive and linear correlation between education, experience and workers' income. Becker (1994) states that the growth of countries is conditioned by educational abundance, among other variables. The amount of human capital, technology, and productivity that the nation enjoys defines the dynamics of wealth growth, propitiating the development of research and technology, as well as attracting new investments to the country.

Technology and education are directly proportional, which increases the importance of professional qualification becoming easier the use and absorption of new technologies, generating greater productivity and providing better critical analysis in risk and decision-making environments. In this context, public investment in qualification and training of labor is essential, since public educational policies increase the chance of citizens remaining in the labor market.

The availability of educational resources is linked to investment in physical and human capital, which requires rates of return that make up the opportunity cost of the service (Barros *et al.*, 2001). Estimating educational rates of return enables public and private investments according to high rates of return to the citizen and society, and vice versa. Table 1 summarizes the estimates some studies.

Table 1 - Summary of estimates of the rates of return of education in Brazil

Research	Database	Method	Characteristics	Return (%)
Leal and Werlang (1991)	PNAD (1976 - 1989)	Mincer's Equation	Men / Women	15.0
Kassouf (1994)	Pesquisa Nacional de Saúde e Nutrição	Heckman's Model	Men	7.3
			Women	8.5
Barros et al. (1999)	PPV (1996 - 1997)	Control variables (race / sector / experience)	Omission variables	13.0
			Insertion variables	10.0
Soares and Gonzaga (1999)	PNAD (1988)	Duality in the labor market	Primary sector	11.8
			Secondary sector	23.4
Sachida et al. (2004)	PNAD (1992 - 1999)	Several methods: Heckman; OLS pseudo panel and Garen cross section	Heckman's Model	14.7
			OLS pseudo panel	17.3
			Garen cross section	19.3
Resende and Wyllie (2006)	PPV (1996 - 1997)	Enhanced measures of experience and quality of education	Women	12.6
			Men	15.9
Barbosa Filho and Pessôa (2008)	PNAD (1981 - 2004) e Censo Demográfico (2000)	Internal Rate of Return per Cycles	0 to 4 years of study	9.8
			4 to 8 years of study	14.8
			8 to 11 years of study	13.9
			>11 years of study	13.8

Source: Prepared by the authors

When detecting educational returns, we explain the income distribution, which depends on the distribution of schooling. According to Barros and collaborators (2007), the speed of growth of average schooling reaches the reduction of school inequality and income. The authors showed that, between 2001 and 2005, changes in schooling determined 40% of the fall in inequality in labor remuneration and 20% in the reduction

of the inequality of the Brazilian per capita family income. A brief overview of educational returns demonstrates the importance of education in Brazil.

Leal and Werlang (1991) used the Pesquisa Nacional por Amostra de Domicílios - PNAD / IBGE (1976 to 1989) and found high returns of 15% or more. The research presented by the authors is limited in the question of sample selectivity. Kassouf (1994) advanced the model of Heckman (1974, 1979), using the Pesquisa Nacional sobre Saúde e Nutrição - PNSN / IBGE (1989), through the sample selectivity method, the rate of return was 7.2% for men and 8.5% for women. Soares and Gonzaga (1998), using PNAD (1988), estimated rates of 11.8% for sectors with worse quality of jobs compared to a return of 23.4% for sectors with better quality. Barros and collaborators (1999), through the Pesquisa sobre Padrão de Vida - PPV / IBGE (1996/97), estimated a salary increase of 10% controlling experience, sector, skin color, etc. With the same sample, Resende and Wyllie (2006) estimated rates of 12.6% for women and 15.9% for men.

For Menezes-Filho and Picchetti (2001), in 1977, if Brazil eliminated educational inequalities, the wage inequality would be 50% lower. Moreover, the gains associated with education declined from 17% (1977) to 14% (1997), which can be explained by the increase in people with primary and secondary education, and the reduction of school inequality in higher education.

These estimates show us that there is no consensus on estimates of income education. In addition, no work estimated educational returns for the Brazilian municipalities or applied the econometric method of difference in differences. The change in educational rates of return in Brazil occurs due to the variation of time surveys, the estimated econometric models and the use of different databases. This reinforces the importance of this article in estimating the return of professional qualification on workers' income.

This paper contributes to presenting unprecedented estimates of the impact of a municipal public policy on workers' income. Policies to combat unemployment and income distribution have become a priority in the governmental agendas of both rich and poor countries. Financial crises have impacted different regions of the world in different ways (Salm and Fogaça, 1998). Professional qualification as a complement to formal education is a vital tool for productive agents, guaranteeing them a better chance of remaining in the formal labor market and increasing productivity (Dedecca, 2002, p.60; Castro and Macedo, 1998, p. 224; Ackerman, 1998, p. 218).

## **2.2 Public Policy on Professional Qualification in Brazil**

Social Welfare and the goal of full employment are dynamic factors in the emergence of public employment systems in several countries, although in Brazil the process of transforming the agrarian economy into an urban and industrial economy has maintained social and economic inequality as a characteristic of society. After the 1988 Constitution, the development of public employment policies began. After 1996, public investments were oriented towards human capital, in order to improve the quality of workers or reorient them to new occupations in the labor market. The Sistema Nacional de Emprego – SINE disseminated public policies of orientation, training and professional qualification, providing better use of technical skills, increasing the survival of workers in the labor market and improving productivity and profits

(Moretto, 2010; Cacciamali, 2005; Hoffmann, 2001; Barros *et al.*, 2000; Moretto, 1999; Castro and Macedo, 1998; Hoffmann and Duarte, 1972).

The Plano Nacional de Qualificação Social e Profissional – PNQ had as a strategy the integration of employment, labor, income, education and development policies, although some studies point out that this type of public policy is not enough to reduce poverty and inequality of workers, with a timid impact on the increase of probability of job (Moretto, 2010; Peixoto, 2008; Cacciamali, 2004; Carmo, 2003). In addition, municipal governments in large and medium-sized cities began to formulate agreements for professional qualification with their own resources. This is because, often federal resources were insufficient to contain the demand of workers.

Technical education prepares workers with low educational attainment who are at risk of becoming structural unemployed. Public policies of professional qualification aims to insert or reinsert workers in the labor market or to enable the generation of income. However, this type of program considers that skills alone do not create jobs, but it is an essential component for public policies that want to develop the economy, due to the fact of the mix of products that an economy makes constrains the occupational choices, learning opportunities (Hartmann *et al.*, 2017).

The PNQ aims to meet a minimum target of 20% of the economically active population at the end of its execution. According to Lessa (2011), the average attendance of the program was 100,000 workers per year throughout Brazil. This demonstrates that the PNQ does not reach the goal stipulated by the Federal Government. The target audience of the program are people in conditions of social vulnerability, for example, black people, women and people with low income and schooling. Lessa (2011) states that the program has served many women and blacks. However, the average schooling of those served by the program is 7.4 years of study, and the complete High School is the level that most appears among skilled workers.

According to the Anuário de Qualificação Social e Profissional (2011), 181 thousand workers enrolled in the PNQ in 2011. Of this amount, 16.3% were in the state of São Paulo and 67% were women. Regarding the race, the browns (25.6%) were the majority, followed by whites (14.3%) and blacks (10%). The age group that prevailed was between 25 and 39 years (42.1%), followed by those with 18 to 24 years (31.1%), 40 to 50 years (19.9%), 10 to 17 years ( 5.8%) and 60 years or more (1.1%).

According to Lessa's analysis (2011), the complete High School (39.2%) was the most frequent schooling, followed by Incomplete High School (19.8%) and Complete Elementary School (14.5%). The most declared family income was 1 to 2 minimum wages (27.1%). According to Lessa (2011), the PNQ courses have an hourly load of two hundred hours, although some schools have reduced hours. Data from the Anuário de Qualificação Social e Profissional (2011) confirm this information. The workload varies according to the executing institution (school). On the one hand, universities (204.7 hours) and the "S" System<sup>1</sup> (198.7) presented higher hours. On the other hand, NGOs

---

<sup>1</sup> According to Cacciamali (2005), the "S" System was created in 1940. The employer class is the main responsible agent, being financed by corporate payroll tax (1.5% plus 1% for social activities ). These entities are denominated National Service of Learning and they have activities in all the Brazilian states and in the great majority of the municipalities. In the 1990s, this system empowers and trains the workforce with the skills and knowledge updated and sufficient to meet the qualification requirements of companies and a modern economy. In this study, when we refer to the "S" System, it means as follows: National Service of Commercial Learning (SENAC) (support for comercial learning), National Service of Industrial Learning (SENAI) (support for industrial learning) and National Transportation Learning Service (SENAT) (Support for learning in the transport service).

(185.8), Community Centers (169.4) and Producer Associations (140.6) were the institutions with the lowest working hours. In addition, all entities presented the same hour / student cost (R\$ 3.90), financed by the Brazilian federal government.

In this context, empirical research on policies on (re) qualification is essential. These initiatives can have a better cost effectiveness due to the low cost, showing positive results when correlated to local business demand. Identifying the impact of these projects on workers' income contributes to the improvement of technical skills of the working class in a short period of time, increasing the probability of return to the labor market and meeting the business demand for labor shortages (Moretto, 2010; Cacciamali, 2004; Carmo, 2003).

### **2.3 The municipality of Piracicaba/SP**

Several Brazilian cities seek to use resources to invest in human capital, through agreements and projects. The municipality of Piracicaba stands out for obtaining and developing actions on professional qualification, because the city is an important regional center of industrial and agricultural development, located in one of the most industrialized regions of the state of Sao Paulo - Brazil. According to the Instituto Brasileiro de Geografia e Estatística (IBGE, 2010), Piracicaba was the 48th largest economy in Brazil and the 15th economy of the state, classified by its Gross Domestic Product (GDP) per capita as the 22nd economy among Brazilian cities with more than 300,000 inhabitants. The industrial area of the city is strong and diversified, with activities in the metallurgical, mechanical, textile, food and fuel sectors (production of petrochemicals and ethanol), and more recently with the implementation of the automotive sector and the Technological Center.

The illiteracy rate of the population aged 15 years and over is around 5%. The mean age of study of the population aged 15-64 is 7.83 years, with approximately 55% of the 25-year-old population having more than 8 years of schooling and that almost 42% of the population from 18 to 24 years presents complete high school (SEADE, 2012).

Piracicaba is classified in the group of Brazilian cities with good human development conditions, with HDI of 0.836 (PNUD, 2000). According to data from the Registro Administrativo de Informações Sociais (RAIS, 2012) of the Ministry of Labor and Social Security (MTPS), the stock of formal jobs in the city, in December 2011, was 127,119 jobs, of which 62.13% were men and 37.9% women, with men in manufacturing (42%) and women in services (46%). Of this stock of jobs approximately 47% is in the age group of 30 to 49 years, being of 19.5% the percentage in the range of 18 to 24 years and of 18% in the range of 25 to 29 years. Of this workforce, 44.7% have completed full secondary education, 15.5% complete primary education and 12% complete higher education. As for the average monthly labor income, 38.25% receive from 1 to 2 minimum wages, 24% from more than 2 to 3 minimum wages, and just over 26% from more than 3 to 7 minimum wages.

Taking the year 2004 as the basis for calculating employment growth (in 2004, the stock of formal jobs was 83,296 jobs), the stock of jobs has grown on average from 2005 to 2010 at a rate of 5.4% per year, with the total stock of jobs in December 2011 reaching 127,119 formal jobs, and in December 2012 reached a total of 129,585 jobs. The total stock of formal jobs in December 2012 (of 129,585 jobs) grew by 55.6% in

relation to the stock in December 2004 (which was 83,296 jobs), since in the last 9 years the stock of formal jobs increased in 46,289 jobs in the city.

The labor market in Piracicaba is expanding, requiring more skilled workers. This characterizes the economic environment of a city that grows and is modernized, with the presence of technologically intensive industries, adding values and multiplying their effects on the other sectors of the local and regional economy.

The data presented in this topic corroborate the development of qualification courses that meet the profile of the workers of local companies, reducing as much as possible the gap in the formal schooling of a relevant part of the economically active population. This article assesses whether or not there is an impact on the income of participants in public qualification programs. Regardless of the outcome of the impact analysis, we believe that the actions of this kind of public policy will contribute to better training of the workforce and, consequently, to better workers' competitiveness.

### **3. Method**

#### **3.1 Data Base**

The courses were offered through a Federal Agreement, established between the Secretaria Municipal do Trabalho e Renda – SEMTRE/ City Hall of Piracicaba, and Ministry of Labor and Employment (MTPS). This agreement took place via Plano Nacional de Qualificação Profissional – PNQ. SEMTRE was created in 2006, constituting the Public Employment, Work and Income Center of Piracicaba, responsible for recruitment, selection and referral of candidates to the labor market. The courses offered by the secretariat are previously defined through technical criteria (study of the local labor market) and discussions with the Municipal Employment Commission of Piracicaba.

After defining the courses to be offered, the selection criteria of the candidates were: a) date of registration; b) low self-declared individual income; c) preference for low level of schooling and; d) 30% of the total number of places were preferred to the age group above 30 years of age and 10% of the vacancies were destined to people with disabilities. Being unemployed was a necessary condition for joining the program.

Three contracts with schools of the "S" System were signed to provide courses with a 200-hour workload. In the Industrial and Commercial Sector, public funds were invested in the amount of R\$ 52,320.00 to provide 60 vacancies for each sector. The course for the Services sector received resources in the total amount of R \$ 26,160.00 to provide 30 vacancies. The investment per student was R\$ 872.00, that is, R\$ 4.36 student / hour, higher than the investment of the rest of Brazil.

SEMTRE constituted a database totaling 647 workers interested in participating in the professional qualification program, 323 workers were actually qualified and 324 workers who did not get a place in the program or gave up at the beginning of the course. The data of the workers were collected by SEMTRE's information system, guaranteeing the confidentiality of each participant's information.

#### **3.2 Difference in Difference (DiD) Method**

According to Lechner (2010), the Difference in Difference (DiD) method estimates the causal effects of public policies. This method is widely used in empirical



work of the Economics to investigate changes in policy variables, which often arise from changes in legislation and that do not affect all people in the same way and at the same time.

Hausman and Kuersteiner (2008) give as an example a certain state that adopts legislation (treatment group) and states that do not adopt legislation (control group). Assuming that the characteristics of the states do not change over the period, the difference of the periods before and after the treatment group minus the difference of the previous and posterior period of the control group is the DiD method estimator. Generalizing, we have Equation 1:

$$D_C^T = (T_1 - C_1) - (T_0 - C_0) \quad (1)$$

Where:

$T_0$  = Individual income of the treatment group before participating in the program;

$T_1$  = Individual income of the treatment group after participating in the program;

$C_0$  = Individual income of the program control group;

$C_1$  = Individual income of the control group after the program.

According to Delaney and Kearney (2015), one of the assumptions of the Difference in Difference model is that treatment and control groups are behaving similarly before political intervention. The authors applied this method to verify the impact of state-level guaranteed tuition programs on post-secondary tuition levels and they found that, on average, institutions subject to this law increased annual tuition by approximately 26-30%. Other studies<sup>2</sup> have also investigated how political changes have impacted people's lives (Meyer, 1995; Bertrand et al., 2004; Grafova et al., 2014; Cerqueira et al., 2015).

In this article, knowing the impossibility of comparing the situation of the trained (treatment group) in the condition of untrained (Carvalho et al., 2006; Wooldridge, 2002; Foguel, 1997) we adopted as a treatment group the 323 workers who participated in the professional qualification program. Since the choice is not random, for comparison to be unbiased, the control group should show similar characteristics of the people in the treatment group (Meyer, 1994). In this sense, the control group (324) was composed of workers with characteristics similar to the treatment group. This group consisted of individuals on the program waiting list and workers who dropped out of the course early in the program.

In order to estimate the effects of the municipal policy of professional qualification, we propose to use multiple linear regression by the Difference in Difference method. Given the possibility of obtaining information before and after the training period, it becomes feasible to use this method, adapting it to the case of non-randomness. Therefore, instead of using the simple difference of means, this method compares the difference of the variable, such as the income of the workers, in order to verify if the income is higher or lower when compared between the treatment group and the group before and after professional qualification.

---

<sup>2</sup> For details on how to analyze the impact of social policies, see Menezes-Filho (2012).

The method to be used is justified by the available information of the participants and non-participants before and after the program and because the selection of professional qualification programs in the municipality is based on observable characteristics, age, schooling and self-declared income. In addition to unobservable characteristics such as motivation, productivity at work, ambition, etc. The DiD method allows analyzing the impact of public policy on the dependent variable (income) between the treatment group and the control group. In addition, the other control variables allow us to verify their influence on income. For presentation in regression form, we have the following equation:

$$Y_i = \alpha + \beta t_i + \lambda g_i + \delta t_i g_i + e_i \quad (2)$$

Where:

$Y_i$  = Income of the individual  $i$ ;

$t$  = Dummy for time ( $t=1$  if after public policy,  $t=0$  if before the public policy);

$g$  = Dummy for groups ( $g=1$  if treatment group,  $g=0$  if control group);

$tg$  = It is the interaction dummy, which captures the effect of having participated in the Program or not and the group that the individual belongs to.

The result of the program will be measured by the parameter  $\lambda_i$ . If the parameter  $\lambda_i$  is positive and statistically significant, we can affirm that public policy had a positive effect on workers' income. If the parameter is negative, the impact is negative, that is, the income is being reduced or the occupational position is negative in relation to the training participants.

The parameter  $\delta$  is the DiD method estimator presented in Equation 1. If the parameter  $\delta$  is positive and statistically significant, we can affirm that public policy has more impact on the incomes of skilled workers than on unskilled workers. Otherwise, it is not possible to observe the effect of public policy exclusively on the income of skilled workers.

Equation 3 is an extension of Equation 2, adding the control variables based on the studies discussed in Table 1 of this article:

$$Y_i = \alpha + \beta t_i + \lambda g_i + \delta t_i g_i + \phi \Sigma X_i + e_i \quad (3)$$

In this case, the parameter  $X_i$  are all observed characteristics, such as schooling, gender, age group, self-declared income, among other characteristics that were added to the model as control variables, according to the theoretical revision of Human Capital Theory and returns of education on income.

## 4. Results and discussion

### 4.1 Descriptive analysis

The program has 323 workers who participated in the program and 324 individuals who did not participate in the program. Among those who were not qualified, only 38.9 dropped out of the program, the rest are on the waiting list. Both the treatment group and the control group, 50% of the workers had some experience in the labor market. Note that 6.2% of participants had some type of disability. This shows that public policy has not met the goal to have 10% of workers with disabilities. The age group of the skilled workers is concentrated between 18 and 24 years old (48.9%), 30 and 39 years old (15.8%) and 40 and 49 years old (15.5%), which shows that the objective of reaching individuals with older age was fulfilled. More than three-quarters of the total sample is and/or have reached the middle school. In addition, the treatment group showed lower schooling than the control group.

The low formal education of skilled workers occurred because the public policy sought to qualify people with lower levels of schooling. The initiative is justified as a way to help the entry of individuals who are outside the labor market. However, it should be considered, as Ackerman (1998) states, that there is a hierarchy between formal education and professional qualification. Low schooling can become an impediment in the professional relocation process and make it difficult to follow up on the theoretical hours of the courses. An alternative would be to encourage and offer formal education programs for young people and adults for graduates of professional qualification courses.

Regarding the average income, we observed that the treatment group showed a mean income (R\$ 1,174.20) higher than the control group (R\$ 1,040.34) before the program. After 6 months, the treatment group (R\$ 1,337.00) increased income by 13.9% in relation to the period before the program, while the control group obtained a variation of only 5%.

In order to investigate the occupational situation and income before and after the qualification program, information was used from the employment portal of the Ministry of Labor, made available by the public sector piracicabano, preserving the identity of each person in the sample.

After one year of starting the program, unemployment declined and formalization grew. Skilled workers had the greatest decrease in unemployment (-24.7%) when compared to those who did not attend the public program (-16%). For the employees that dropped out and waiting list (16.5%) formal employment grew to a lesser extent, which shows that individuals who did not attend public policy were less likely to enter the formal labor market. In other words, employment with a formal contract grew more between the treatment group (26.9%) than for the control group (16.5%).

Table 2 summarizes the characteristics of the sample and Figure 1 shows the results found.

Table 2 - Summary of characteristics of Treatment Group and Control Group

Variable	Treatment Group		Control Group		Overall	
	num.	%	num.	%	num.	%
Position - Professional qualification						
Concluding	323	100.00	0	0.00	323	49.92
Evaded	0	0.00	126	38.89	126	19.47
Waiting list	0	0.00	198	61.11	198	30.60
Total	323	100.00	324	100.00	647	100.00
Disabled people						
With Disability	20	6.19	3	0.93	624	96.45
Non-Disability	303	93.81	321	99.07	23	3.55
Total	323	100.00	324	100.00	647	100.00
Education						
Illiterate	3	0.93	0	0.00	3	0.46
Elementary School Incomplete	41	12.69	33	10.19	74	11.44
Complete primary education	8	2.48	16	4.94	24	3.71
Incomplete high school	121	37.46	152	46.91	273	42.19
High School Completo	129	39.94	103	31.79	232	35.86
Incomplete Higher Education	7	2.17	10	3.09	17	2.63
Full Higher Education	14	4.33	10	3.09	24	3.71
Total	323	100.00	324	100.00	647	100.00
Type of Education						
Technical education	9	2.79	3	0.93	12	1.85
Regular	282	87.31	277	85.49	559	86.40
Education for Youth and Adults	32	9.91	44	13.58	76	11.75
Total	323	100.00	324	100.00	647	100.00
Age Group						
Up to 17 years	2	0.62	12	3.70	61	9.43
18 to 24 years	158	48.92	121	37.35	247	38.18
25 to 29 years	37	11.46	52	16.05	83	12.83
30 to 39 years	51	15.79	74	22.84	125	19.32
40 to 49 years	50	15.48	44	13.58	88	13.60
50 to 65 years	25	7.74	21	6.48	43	6.65
Total	323	100.00	324	100.00	647	100.00
Average income						
Before the Program	1,174.20	0.00	1,040.34	0.00	1,114.12	0.00
6 months after the program	1,337.00	13.86	1,092.29	4.99	1,216.18	9.16

Source: Prepared by the author

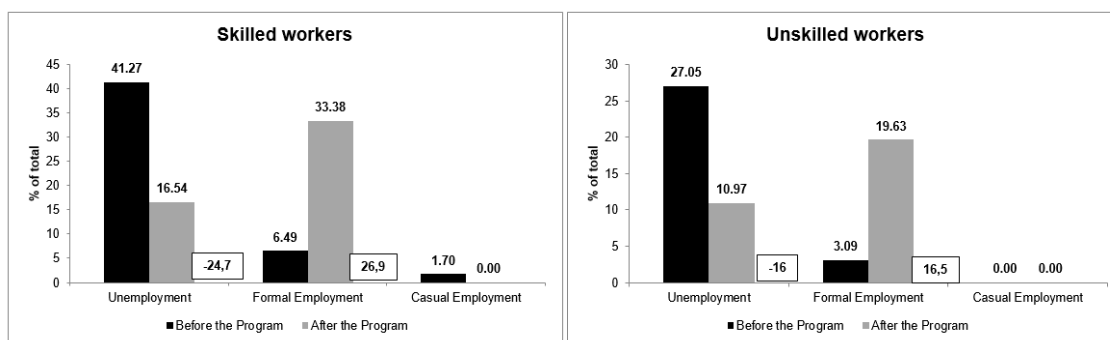


Figure 1 - Comparison of employability of skilled and unskilled workers

The data imply that professional qualification positively impacted employability, labor market survival, and higher skilled income. It should be considered that the economic situation of the municipality contributed to the positive effects on employability. Note that workers who were not qualified by the program also got some kind of job. However, we argue that skilled workers have developed job skills, reducing the shortage of skilled labor in the municipality.

#### 4.2 Econometric estimation

Numerous studies prove the inequality of income and wage differences due to the educational and opportunity inequalities (Barros et al., 2007; Menezes-Filho, 2006; Menezes-Filho et al., 2003; Barros et al., 2001). This article proposes to estimate wage inequalities from the point of view of professional qualification at the municipal level, using econometric method to calculate the impact of the program on income.

Relating the logarithm of income as dependent on an observable variable, and assuming that the relation is log-linear and equal for all individuals. The log-linear model allows us to interpret the results as elasticities (Greene, 2011). By adding all the independent variables of the model, we obtain an equation with a constant term, coefficients for each characteristic and a random error that represents the effect of the variables not estimated in the model, with usual statistical properties and with the treatment of heteroscedasticity. The following explanatory variables are considered:

- a) A dummy for sex, based on the male sex;
- b) The age of the person;
- c) The square of the variable age, considering that the income does not vary linearly with age;
- d) The level of education of the individual, divided among illiterates, elementary school, high school and higher education;
- e) Two dummies for the person's color, being white, black or brown base;
- f) A dummy to distinguish the condition of the individual in the family, the people who make income as a base versus the head of the family;
- g) Four dummies were defined for the qualification courses offered, the road driver's course of load is the base one;
- h) A dummy to distinguish the place of domicile: urban and rural (base);
- i) A variable about experience, which distinguishes whether the person has experience (base) or not;

- j) A dummy to distinguish the time before (base) and one year after the qualification program;
- k) Variable that differentiates the type of group analyzed: treatment group and control group (base) and;
- l) Interaction between group type and time.

The model was adjusted to verify differences in income between the control and treatment groups one year after the courses were offered, through the interaction between qualification and experience (education and age); discrimination by gender and race of equally productive workers (color and sex); differentiation between the courses chosen, based on no explicit or tangible criterion, emphasizing the importance of the choice of the Bus Rider Course for the peculiarity during the planning of the classes.

Our model was significant at the 1% level of confidence and demonstrated to explain 47% of the variability of the dependent variable, demonstrating that it was well adjusted to the expectations of econometric models in the field of social science. The main objectives of this article, analysis of the impact on income one year after the program and choice of courses, were statistically significant at the 1% confidence level, as well as the importance of the experience on the increase in income.

Although the variables such as gender, race, family worker status, schooling and residence area were not statistically significant, we decided to keep these control variables in the econometric model, based on the studies previously presented. Note that the variables Condition in Family, Age and Age Squared showed signs expected according to economic theory.

The fact that workers have some experience has shown that the average number of people without experience earns 70.54% less than workers with some type of experience in the labor market. This variable was statistically significant at the 1%. This is an interesting result, because even after qualification, employers prefer to hire workers with some type of experience, which makes it difficult to enter a skilled workforce, but without professional experience.

On the marital status it was verified that the fact of being divorced raises in 263.8% the income with significance at the level of 5%. This result was unexpected and requires better analysis to be explained.

The variable on schooling did not show statistical significance and the negative sign of the coefficient for workers with higher education was unexpected. Recall that in our sample higher education workers were also unemployed early in the program. The fact that the salary was higher in the past than after the public program may have affected the coefficient signal. However, future studies may use the variable schooling in the form of years of study, which may change the result found in this article.

We observe the differentiation in income by virtue of the choice of qualification courses. Not coincidentally, the course of Road Freight Driver of the Services Sector was taken as a basis. In this course all the students were employed in the occupation of the qualification, remained in the employment until one year after the program and there was no evasion. In spite of the difficulties to find interested people and with National Driver's License, in accordance with the prerequisites of the courses, there was joint action between the executing school of System "S", the union of the area, private companies and public sector. Another important feature of this course was the fact that the employer does not require work experience.

The school offered a quality course, with driving simulations and practical classes in trucks. The employers' union sought out potential contractors. Private companies provided transportation vouchers and snacks for students during the school year. The public sector made possible the agreement to offer the program, registered the workers in the system of professional replacement and monitored the frequency and performance of the students during the classes, avoiding evasions.

The joint action to make the driver's course feasible allowed all the students to be qualified and hired by the formal market. This course had the greatest impact on the income of workers when compared to the graduates of other courses. For example, the student qualified as a Road Freight Driver showed a tendency to obtain 29% more salary than the student who qualified in the Logistics Assistant course (-71%). This tendency was also significant with the courses of Electrical Installations (-61.7%), Sales promoter (-75.9%) and Reception and Telephone Answering in Companies (-71.2%).

Therefore, it can be verified that the other courses, although they also presented increase in the income of the workers, this increase occurred in a lower intensity than for the Road Drivers of Freight. In this way, it can be seen that a course with a more operational scope and a shortage in the labor market achieved a higher income than courses directed to the administrative area, generally characterized by the greater demand of the candidates and the saturation of the labor market. This demonstrates the importance of public policy makers offering courses that actually lack a skilled workforce.

In addition, the analysis of the registration data of the drivers allowed to verify that many left the Metal Mechanical sector, migrating to the Services sector. This may have occurred because better employability after the public labor training program and higher salaries.

Income after one year of the PNQ offer ( $\beta$ ) increased by about 347% and was statistically significant at the 1% level. However, when we analyze the difference between the income of the treatment group versus the control group, we did not find statistical significance, and there was a smaller growth ( $\lambda = 17.28\%$ ). This result can be explained by the fact that formal employment increased for both groups. The lower income growth between the groups indicates the dynamism of the Piracicaba economy, as presented previously. This means that the labor market has generated opportunities even for people without professional qualification. Finally, the interaction between groups and time ( $\delta$  = model estimator of Equation 1) showed that the public policy of professional qualification generated a rise of 7.43% in the income of the skilled workers in relation to the unskilled workers after the program.

The income difference between the groups and the model estimator did not present statistical significance in our econometric model. In this respect, the econometric model confirms the positive effect after the professional qualification program, but does not statistically prove the exclusive effect on the treatment group when compared to the control group, although the coefficient signal was positive. We argue that it is necessary to evaluate better this relation in future studies, increasing the number of observations analyzed or changing the control group. In addition, the economic scenario may have influenced the model's result, which suggests that it is necessary to include economic control variables.

Table 3 - Results of the equation of income of those qualified by the Federal Convention (treatment) and individuals not qualified by public programs (control). Piracicaba, 2011

Variable	Coefficient	Dif. % <sup>1</sup>	Test t	Probability t
Constant	1.638	–	2.33	0.02
Female people (basis: male)	0.156	16.84	1.09	0.275
Age				
Age	0.030	–	0.92	0.36
(Age) <sup>2</sup>	–0.001	–	–1.22	0.225
Schooling (basis: elementary school)				
High school	0.109	11.46	0.71	0.475
Higher education	–0.116	–10.94	–0.56	0.578
Color (base: white)				
Black	0.194	21.42	0.96	0.338
Brown	0.067	6.90	0.64	0.523
Condition in family (base: make up income)	0.097	10.14	0.65	0.517
QSP courses (base: Driver Load Wheel)				
Logistic assistant	–1.237	–70.99	–6.04	0.0001
Electrical Installations	–0.960	–61.69	–4.82	0.0001
Sales Promoter	–1.425	–75.95	–6.12	0.0001
Reception and Phone Service in Companies	–1.244	–71.17	–5.53	0.0001
Urban area (base: countryside)	–0.012	–1.20	–0.04	0.968
Marital Status (Base: single)				
Married	–0.216	–19.40	–1.69	0.092
Stable union	–0.449	–36.17	–1.94	0.053
Divorced	1.291	263.77	2.30	0.022
Experience (base: with experience)	–1.222	–70.54	–9.23	0.0001
After the QSP (base: before the program) ( $\beta$ )	1.498	347.15	11.41	0.0001
Treatment group (basis: control group) ( $\lambda$ )	0.159	17.28	1.01	0.313
Interaction time x group ( $\delta$ )	0.077	7.43	0.41	0.681
<i>Adjusted R<sup>2</sup></i>	46.99			
<i>F test (2)</i>	43.07			
Number of observations	647			

<sup>1</sup> Values obtained by calculating percent growth of income:  $100[\exp(\text{coefficient})-1]$ .

<sup>2</sup> The F values are statistically significant at the 1% level.

Source: Prepared by the authors, based on the database provided by the public sector.

Under a qualitative analysis, some facts need to be considered about the program:

- a) SEMTRE developed a preliminary study of the local labor market, through data from the Ministry of Labor and Employment;
- b) There were previous discussions with Municipal Employment Commission - ComEmprego about the types of the courses;
- c) Prioritization of courses with a lack of labor in the region;
- d) Targeting of courses to meet the main economic sectors of the region;
- e) Division of tasks between the City Hall, trade unions and the private sector and;



- f) Follow-up of workers after public policy through the public employment system.

The program has benefited the professional qualification of the workers. It is worth mentioning the importance of democratic participation in the different spheres of society. The Municipal Government showed itself to be the main agent of public policy. The "S" System schools were responsible for the quality of the courses offered. The unions acted as intermediaries between City Hall, workers and companies. And the private sector, in addition to financing transportation vouchers and snacks, also hired skilled labor. This shared form of managing the public policy of qualification allowed the municipality of Piracicaba to reach its objectives within the scope of the PNQ (qualify the workforce and generate employment and income).

## 5. Final considerations and recommendations

The present study reviewed the economic literature on education, work and described in a synthetic way the history of income and employment generation programs in Brazil. The impact of the public policy of professional qualification in the municipality of Piracicaba in 2011 was measured.

We argue that it is unlikely that individuals who have failed to qualify in public programs have sought other means of qualifying, given the lack of financial resources to enter private institutions. Moreover, we believe that there is a maturation period of short courses through the experience of the qualified. The effects of training may be underestimated by the short period of analysis after completion. It is important to keep researching on the effectiveness of professional qualification programs, and may point out more suitable ways for public investments in the near future.

Although the program has qualified workers and employment has increased, the group of workers who did not participate in the program also benefited from local economic growth in the period analyzed. The econometric model failed to statistically prove that the income from the treatment group increased more than in the control group. This outcome needs to be better investigated and we suggest that future studies evaluate larger databases over a longer period.

## References

ACKERMAN, Michael E. Brevíssima reflexão sobre a formação profissional na cultura dos recursos humanos. In: DIEESE (Org). Emprego e desenvolvimento tecnológico: Brasil e contexto internacional. São Paulo: DIEESE, 1998.

ASHENFELTER, O. Estimating the effect of training programs on earnings. Review of Economics and Statistics. v. 60, p. 47-57, 1978.

BARROS, Ricardo P. et al. A recente queda da desigualdade de renda e o acelerado progresso educacional brasileiro da última década. Rio de Janeiro: IPEA, 2007 (Texto para Discussão, 1304).

BARROS, Ricardo P. et al. Determinantes do desempenho educacional no Brasil. Rio de Janeiro: IPEA, 2001 (Texto para Discussão, 834).

BARROS, Ricardo P. et al. Focalização dos gastos públicos sociais e erradicação da pobreza no Brasil. In: Henriques, Ricardo (org.), Desigualdade e pobreza no Brasil. Rio de Janeiro, IPEA, 2000.

BARROS, Ricardo P. de; MENDONÇA, Rosane. Salário e educação no Brasil. Brasília: Ministério da Educação, 2000.

BARROS, Ricardo P. et al. Uma análise da estrutura salarial brasileira baseada na PPV. Instituto de Pesquisa Econômica Aplicada. Rio de Janeiro: 1999 (Texto para Discussão, 689).

BECKER, Gary S. (1994) Human Capital: a theoretical and empirical analysis with special reference to education. 3rd Edition, The University of Chicago Press, p. 323-350.

BERTRAND, M.; DUFLO, E.; MULLAINATHAN, S. How should we trust difference-in-differences estimates?. Quarterly Journal of Economics. v. 119, p. 249-275, 2004.

CACCIAMALI, Maria C. As políticas ativas de mercado de trabalho no Mercosul. Revista Estudos Avançados. São Paulo, v. 19, n. 55, p. 85–104, set/dez. 2005.

CACCIAMALI, Maria C. As políticas ativas de mercado de trabalho no Mercosul. Tipos, síntese de estudos de avaliação e reorientação, que compõe o documento: OIT, Generando empleo decente en el Mercosur. Empleo y estratégia de crecimiento: el enfoque de la OIT. Lima: OIT, 2004.

CADASTRO GERAL DE EMPREGADOS E DESEMPREGADOS. Ministério do Trabalho e Emprego. Bases Estatísticas. Disponível em: <<http://www.mte.gov.br>>. Acesso em: 15 jan. 2012.

CARMO, C. do C. Educação e qualificação profissional: uma discussão junto aos egressos do PANFLOR em MG. 2003. 150 p. Dissertação (Programa de Pós Graduação em Educação – PPGE Mestrado em Educação) – Faculdade de Educação, Universidade Federal de Juiz de Fora, Juiz de Fora, 2003.

CASTRO, Delúbio S.; MACEDO, Bernardo G. O FAT e o sistema público de emprego: a visão dos trabalhadores. In: DIEESE (Org). Emprego e Desenvolvimento Tecnológico: Brasil e contexto internacional. São Paulo: DIEESE, 1998.

CERQUEIRA, D., MATOS, M., MARTINS, A. P. A., PINTO JÚNIOR, J. Avaliando a efetividade da Lei Maria da Penha. Brasília: IPEA. 2015. Recuperado em 16 de maio de 2017, de [http://www.ipea.gov.br/portal/images/stories/PDFs/TDs/td\\_2048k.pdf](http://www.ipea.gov.br/portal/images/stories/PDFs/TDs/td_2048k.pdf)

DEDECCA, Cláudio. Reorganização econômica, absorção de mão de obra e qualificação. Campinas: UNICAMP, 2002.

DEHEJIA, R.; WAHBA, S. Casual effects of nonexperimental studies: reevaluating the evaluation of training programs. Journal of American Statistical Association. v.94, p.1053-1062, 1999.

DEPARTAMENTO INTERSINDICAL DE ESTATÍSTICA E ESTUDOS SÓCIO-ECONÔMICOS (Dieese). Anuário da Qualificação Social e Profissional: 2011. São Paulo: Dieese, 2011. Disponível em: <[http://www.dieese.org.br/anu/Anuario\\_qualificacao\\_profissional.pdf](http://www.dieese.org.br/anu/Anuario_qualificacao_profissional.pdf)>. Acesso em: dez. 2015.

DELANEY, J., KEARNEY, T. D. The impact of guaranteed tuition policies on postsecondary tuition levels: a difference-in-difference approach. *Economics of Education Review*. v.47, p.80–99, 2015.

FUNDAÇÃO SISTEMA ESTADUAL DE ANÁLISE DE DADOS – SEADE: Informações dos municípios paulistas. Disponível em: <<http://www.seade.gov.br>>. Acesso em: 15 jan. 2013.

GRAFOVA, I. B., FREEDMAN, V. A.; LURIE, N.; KUMAR, R.; ROGOWSKI, J. The difference-in-difference method: assessing the selection bias in the effects of neighborhood environment on health. *Economics and Human Biology*. v.13, p.20–33, 2014.

HARTMANN, D., GUEVARA, M. R., JARA-FIGUEROA, C., ARISTARAN, M., and HIDALGO, C. (2017). Linking Economic Complexity, Institutions and Income Inequality. *World Development*, 93:75–93.

HAUSMAN, J., KUERSTEINER, G. Difference in Difference Meets Generalized Least Squares: higher order properties of hypotheses tests. *Journal of Econometrics*. v.144, n.2, p.371–91, 2008.

HECKMAN, James J. Shadow prices, market wages, and labor supply. *Econometrica*, p. 679-694, 1974.

HECKMAN, James J. Sample selection bias as a specification error. *Econometrica*, Menasha, v. 47, n.1, p.153-161, jan. 1979.

HOFFMANN, Rodolfo. Distribuição de renda e crescimento econômico. *Revista Estudos Avançados*, v. 15, n. 41, p. 67–76, 2001.

HOFFMANN, Rodolfo.; DUARTE, João C. A distribuição da renda no Brasil. *Revista de Administração de Empresas*, v. 12, n. 2, p. 46–66, jun. 1972.

INSTITUTO BRASILEIRO DE GEOGRAGIA E ESTATÍSTICA: Síntese de Indicadores Sociais – Informação econômica e Socioeconômica. Disponível em: <<http://www.ibge.gov.br>>. Acesso em: 26 dez. 2011.

KASSOUF, Ana L. The wage rate estimation using the Heckman procedure. *Revista de Econometria*, p.89-107, 1994.

LALONDE, R. J. Evaluating the econometric evaluations of training programs with experimental data. *American Economic Review*. v. 76, p. 604-620, 1986.

LEAL, C. I. S.; WERLANG, S. R. C. Retornos em educação no Brasil: 1976/89. Pesquisa e Planejamento Econômico. Rio de Janeiro, v.21, n.3, p.559-574, dez. 1991.

LECHNER M. The estimation of causal effects by difference-in-difference methods. Found Trends in Econometrics. vol. 4, n.3 p.165–224, 2010.

LESSA, Simone E. do C. A Formação via PNQ e Inserção Produtiva dos CRAS: a reposição empobrecida e emergencial da qualificação dos trabalhadores. Revista Serviço Social e Sociedade, n. 106, p. 284-313, abril/junho, 2011.

MENEZES FILHO, N. Avaliação econômica de projetos sociais. São Paulo: Dinâmica Gráfica e Editora, 2012.

MENEZES-FILHO, Naércio A.; CURI, Andréa Z. Os efeitos da pré-escola sobre os salários, a escolaridade e a proficiência escolar. 2006. Mimeografado.

MENEZES-FILHO, Naércio et al. Rising human capital but constant inequality: the education composition effect in Brazil. São Paulo: Universidade de São Paulo, 2003. Mimeografado.

MENEZES-FILHO, Naércio; PICCHETTI, Paulo. Educação e desigualdade. In: MENEZES-FILHO, N. e LISBOA, M. (Org.). Microeconomia e sociedade no Brasil. Rio de Janeiro, 2001, v. 1, p. 13-50, 2001.

MEYER, B. Natural and quasi-experiments in economics. Journal of Business & Avaliação Econômica de Projetos Sociais 1 181 Economic Statistics. v. 13, p. 151-161, 1995.

MINCER, Jacob. (1974). Schooling, experience and earnings. National Bureau of Economic Research.

PEIXOTO, Patricia E. Do PANFLOR ao PNQ: uma análise comparativa sobre os planos de qualificação no Brasil. 2008. 136 p. Dissertação (Programa de Pós Graduação em Política Social) – Centro de Ciências Jurídicas e Econômicas, Universidade Federal do Espírito Santo, Vitória, 2008.

PIKETTY, Thomas. O Capital no século XXI. Rio de Janeiro: Intrínseca, 2014. 672 p.

PROGRAMA DAS NAÇÕES UNIDAS PARA O DESENVOLVIMENTO – PNUD. Pobreza e Desigualdade. Disponível em: <<http://www.pnud.org.br>>. Acesso em 20 nov. 2011.

RELAÇÃO ANUAL DE INFORMAÇÕES SOCIAIS – RAIS. Ministério do Trabalho e Emprego. Bases Estatísticas. Disponível em: <<http://www.mte.gov.br>>. Acesso em: 15 jan. 2013.

RESENDE, Marcelo; WYLLYE, Ricardo. Retornos para educação no Brasil: evidências empíricas adicionais. Revista Economia Aplicada, São Paulo, v. 10, n. 3, p. 349-365, jul./set. 2006.

SALM, Cláudio L.; FOGAÇA, Azuete. Tecnologia, emprego e qualificação: algumas lições do século XIX. In: DIEESE (Org). Emprego e desenvolvimento tecnológico: Brasil e contexto internacional. São Paulo: DIEESE, 1998.

SCHULTZ, Theodor W. The economic value of education. New York: Columbia University Press, 1961.

SOARES, Rodrigo; GONZAGA, Gustavo. Determinação de salários no Brasil: dualidade ou não linearidade no retorno à educação. Anais do XX Encontro Brasileiro de Econometria, Vitória, vol.II, 9-11, 1998.