

Session Number: Parallel Session 8C
Time: Friday, August 27, PM

*Paper Prepared for the 31st General Conference of
The International Association for Research in Income and Wealth*

St. Gallen, Switzerland, August 22-28, 2010

**The Economic Value of Human Capital and Education in an Unstable
Economy: the case of Argentina**

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INTERNATIONAL ASSOCIATION FOR RESEARCH IN INCOME AND WEALTH

*Thirty-first General Conference-St. Gallen, Switzerland, August 22-28,
2010*

*Parallel Session 8C: Human Capital II
Organisers: Organising Committee
Chair: Alice Nakamura (University of Alberta)*

The Economic Value of Human Capital and Education in an Unstable Economy: Argentina

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1st Draft (23/07/10)

ABSTRACT

The aim of this paper is to present the first estimation of the economic value of human capital and education for Argentina.

We estimated the main indicators such as wealth human capital, productive capital and output of education of the labor force adapting the methodology suggested respectively by Jorgenson and Fraumeni (1989) (1992) and Mulligan and Sala i Martin (1997) (2000) adapting to the case of an unstable economy as Argentina.

In order to obtain life labor income by gender, age and education cohort, we have estimated the age-earning profiles through Mincer earnings regressions.

The case of Argentina, which presents an unstable economy, could be useful to test the methodology generally applied in developed countries. The unstable behavior of its main relative prices, mega devaluations, and disruptions in labor markets (high fluctuations in unemployment rate and real wages) could be the origin of important fluctuations in the value of human capital and output of education.

We find that Human Capital and Output of Education in Argentina have important procyclical behavior and a higher amplitude of fluctuations than developed countries as it is expected in this type of economy. Additionally, the ratio between human capital and capital stock followed the real exchange rate impact on input relative prices.

However, in spite of the unstable behavior at aggregate level during crisis, the composition of wealth human capital in Argentina is more stable between cyclical peaks and replicates some of the main characteristics of developed countries.

The methodology adopted allows to make a comparison of Argentina (a case of development failure) with Spain, Australia and New Zealand (successful present cases), which had similar per capita income as Argentina at the beginning of XX century.

One of the main results of the study is that the Wealth Human Capital in Argentina doubles Physical Capital Stock; similar to what has been found by ABS (2004) and Trinh (2004) for Australia and New Zealand.

Productive human capital is higher in Argentina, taking into account its relative more unequal income distribution than Australia and New Zealand.

The Output of the Education Sector is equivalent to aggregate GDP and 30 times greater than the education service industry measured in National Accounts; similar findings were verified in the case of USA (Jorgenson and Fraumeni (1996), Spain (Serrano and Pastor (2002), Australia and New Zealand (ABS (2004) and Trinh (2004).

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1. Introduction ^{*}

Since seminal works of Shultz (1961), Becker (1964) and Mincer (1974), human capital constitutes one of the milestones in economic analysis: well being, income distribution, labor market, economic growth, competitiveness and wealth.

Human Capital is the knowledge and abilities that the population has. It is the result of a set of demographic, social and economic phenomena, mainly education and experience as well as health, learning at work, migration which have present and future impact on the stock of human capital, etc.

Human capital accumulation has also important economic implications because it is considered as an input in production and as a one of the main assets that make up the wealth of a nation.

A country's employment structure and labor income in terms of workers' personal skills and jobs' characteristics evolve in time in response to changes in labor market conditions and to a country's macroeconomic situation, contributing to changes in labor demand, income distribution, well being, productivity and wealth of the economy.

The economic literature has pointed out the importance of human capital contribution to economic growth.

As long as one recognizes human capital as a production factor, even as an extended definition of capital stock, human capital may be one of the main components which explain not only a country's wealth but also its potential GDP or future capacity of production.

Moreover, human capital constitutes a fundamental competitive attractor of foreign direct investment.

Until now, there is no consensus in economic literature about the definition of human capital and how to measure it, especially at the level of official statistics about the place of Human Capital must have in the System of National Accounts.

There are several approaches in the economic literature that focus on different aspects of human capital: from simple quantity indicators (literacy rate, schooling rates, and structure of employment by education and experience cohorts) to mixed indicators (quantity and labor income) approach.

Mixed indicators consider human capital as a productive capital and as an asset or component of a wealth of a nation.

^{*} This paper update a research by the author thanks to the support of the General Coordination of Studies on Education's System Costs at the Ministry of Education, Science and Technology in Argentina in 2005. The Author would like to thank Alejandro Morduchowickz, vice-minister of Education, for his initiative to develop this project and for his permanent support. He would also like to thank Luisa Duro and Rosana Bonaparte for reviewing the paper and for their support. Without their help, this paper would not have been possible. This paper benefits from the contributions of W. S. Escudero, F. Groismann and S. Kidyba. Also we thank the support of CONICET. The opinions expressed in this paper are of exclusive responsibility of the Author.

The first one proposed by Mulligan and Sala I Martin (1997, 2000) consider human capital as a productive input taking into account relative labor income as a proxy of relative productivity of the average worker of an economy.

Jorgenson-Framumeni approach (1996a,b) value it through life labor income approach taking into account not only the skill structure of labor force but also taking into account the life labor income that workers could obtain through education and experience during its life cycle.

The aim of this paper is to present the first estimation of the economic value of human capital and education in Argentina.

The unstable behavior of their main relative prices, mainly input prices due to mega devaluations, and disruptions in labor markets (high fluctuations in unemployment rate and real wages) could have important impact on the level and performance of the economic value of human capital and education.

The case of Argentina, which presents an unstable economy, could be relevant to test the methodology usually applied in developed countries.

Structural reforms implemented at the beginning of the nineties¹, initially generated an apparent important rise in the productivity of the Argentinean economy.

In fact, it was expected that a set of phenomena related to human capital² originated in the implemented economic regime, would generate sufficient productivity gains so as to maintain and sustain long run growth.

The increase in the quality of investment, especially through investment in imported ICT assets, improved the quality of human capital through a skilled biased technical change effect which help to maintain and improve the profitability and productivity of the whole economy.

However, the macroeconomic regime of the nineties did not achieve the expected results in terms of sustainability of growth and external accounts: lower real exchange rate (due to Convertibility Plan) provoked a sharp rise in labor costs; labor demand growth revealed insufficient, unemployment increased to levels nearly 20% of the labor force.

The economic crisis which took place at the beginning of the 21st century showed the internal weakness of the Argentinean economy, caused by the inconsistency of the economic policy ("twin non-sustainable deficits).

The new economic policy regime inherited from the 2002 crisis based on high real exchange rate (also known as "competitive exchange rate") and the recovery of commodities' prices, especially of agricultural and farming goods, in whose production Argentina has a competitive advantage, enable the resurgence of economic growth.

¹ Exchange rate convertibility regime and real appreciation of the domestic currency, external trade and financial openness, privatization, deregulation and concession of public services, etc.

² For an analyses of the impact of changes of macroeconomic regime and instability in Argentina in terms of input and industry origins on productivity slowdown and growth profile, see Coremberg (2009).

The subsequent recovery of the Argentinean economy until 2008, was generated with a substantially higher real exchange rate and therefore with lower labor costs than in the previous decade.

This encouraged the increase in labor demand hiring less skilled workers, who had lost their jobs in the previous decade, allowing the recovery of employment to nearly the levels prevailing at the beginning of the nineties decade, reducing the unemployment rate in almost ten percentage points.

One of the purposes of this paper is to estimate how these important changes in labor markets have affected the measurement of the economic value of the human capital.

We have estimated the main indicators such as productive capital, wealth human capital, and output of education of the labor force applying the methodology suggested respectively by Mulligan and Sala i Martin (1997) (2000) and Jorgenson and Fraumeni (1996a) (1996b) and adapted to the case of an unstable economy as Argentina.

In order to obtain life labor income by gender, age and education cohort, we have estimated the age-earning profiles through Mincer earnings regressions.

Besides, the methodology adopted allows to make an homogeneous comparison of Argentina (a case of development failure) with United States, Spain, Australia and New Zealand (successful development cases), countries which had similar per capita income as Argentina at the end of XIX century.

The structure of the paper is the following: section 2 briefly presents human capital theory, section 3 briefly discusses human capital in the national accounts framework, and section 4 describes the methodology of the simple and mixed indicators to estimate the economic value of human capital and education. Sections 5 to 9 analyze the main results of the estimation of traditional and mixed indicators of human capital stock (the Mincer regressions are in the annex). Finally, the conclusions are presented.

2. The Value of Human Capital and Education: Theoretical Background

In this section, we present a brief analysis of the main points of human capital theory, specifically related to measurement issues.

Human Capital is the stock of knowledge and skills which a country's population has. This knowledge is the result of a set of conditions and demographic, social and economic behavior which have present and future impact on human capital stock, mainly education and experience as well as health, formal education achieved, on the job training, migration, job search, etc.

The canonic economic theory of human capital was mainly developed by Gary Becker (1964), Jacob Mincer (1974) and Theodore Schultz (1961). These authors identified the activities which can increase the individual's stock of knowledge and experience as investments in human capital.

By analogy with the economic theory of investment, the economic theory of human capital suggests that people invest in human capital in order to increase their future well-being.

In strictly economic terms, investment in human capital through spending more time in formal and informal education implies a sacrifice of present consumption in order to improve the income profile that an individual expects to receive in the future (or permanent income), which can increase future consumption capacity.

The canonic theory of human capital points out that formal and informal education, within or outside the job enables an improvement of the earnings' profile of the population independently of the differences in individual capacities or their family characteristics.

The measurement of the value of human capital implies the economic valuation of the knowledge received through education and accumulated experience, not only in terms of the accumulation of past human capital investment included in the stock, but also in terms of the capacity to acquire new knowledge in the future.

Various economic agents implicitly make economic valuations of human capital in order to make decisions, as a function of their interests:

- A firms' labor demand is based to a large extent on their perception of the human capital that the potential worker has.
- Workers determine the wage at which they are willing to work (reservation wage) in part as a function of their perception of their own acquired human capital or as a function of the human capital they can obtain through on the job training.
- Households make savings and consumption decisions as a function of the income that they expect to receive in the future.
- The financial system lends consumer loans as a function of their valuation of the permanent income path that consumers have in function of their personal labor experience and skills.

The main implicit assumption in the theory of human capital is that the

level of education and experience are a valid proxy to labor force skills. The differentials in relative skills translate in productivity differentials. Lastly, these productivity differentials are equivalent to relative wages.

In this way, relative wages by educational attainment show the returns of education that can be obtained in the labor market. The wage premiums obtained in the labor market summarize the valuation of education that is “in fact” made by society.

Therefore in order to estimate the value of human capital, it is not enough to know the gender/age/education cohorts of the population but also the expected lifetime labor income for each of these cohorts or groups.

The human capital approach estimates the permanent income of the population stratified through the wage distribution by age group and educational level. In this way, the expected wage of an individual aged t with university educational level is his present wage plus the sum of wages obtained by individuals belonging to the subsequent age groups with the same educational level.

According to the analysis of this study, either relative wages by educational level represent worker’s present relative productivities or they represent the valuation that the market does with respect to labor force’s potential productive capacity.

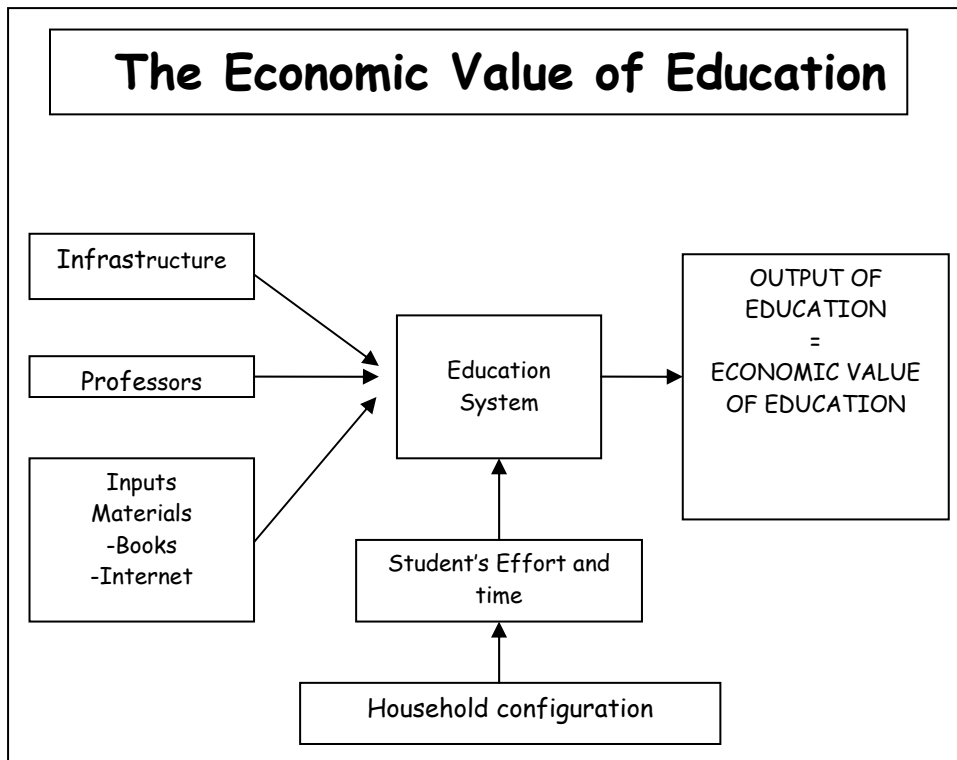
Formal education has turned into the “signal” by excellence, apart from experience, in order to achieve the human capital “quality” of a worker.

The objective of this paper is to assess the economic value of human capital and the output of education, representing the valuation of human capital that society makes through market wages

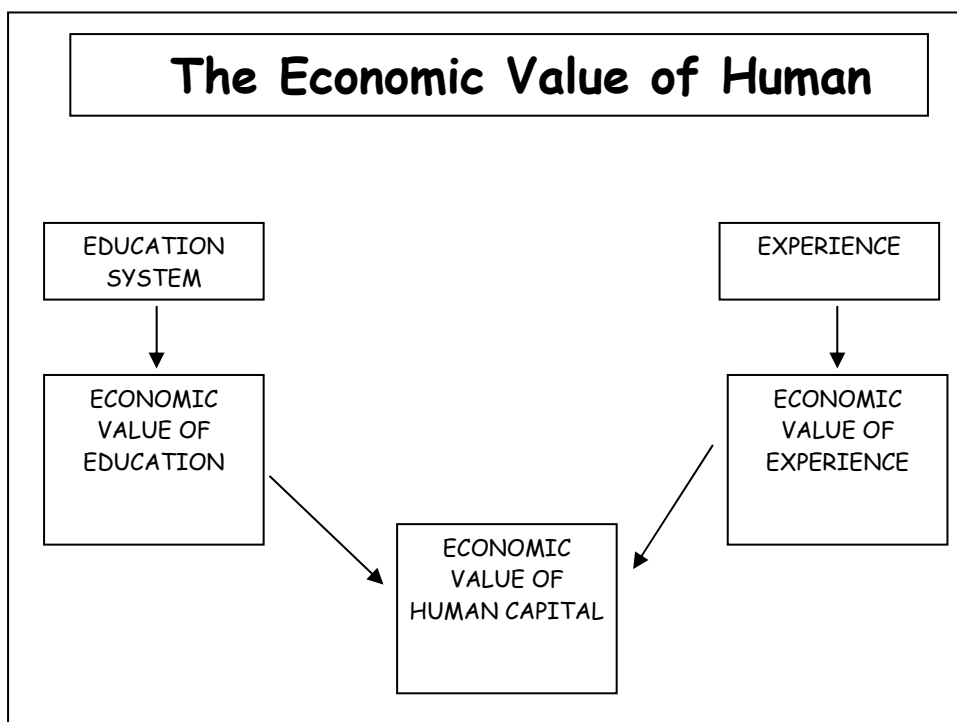
According to Fraumeni and Jorgenson (1992, 1996b) and Serrano and Pastor (2000) it is possible to consider education as an economic sector whose aim is to combine the different inputs (infrastructure, books, professors) in the education system (thought as a production function) so that the students obtain human capital.

In economic terms, the economic value of education is the increase in permanent income of the population as a consequence of schooling. This result is called “the output of education” by the economic literature.

The economic value of education is the main output of the education system as it is shown in the following scheme:



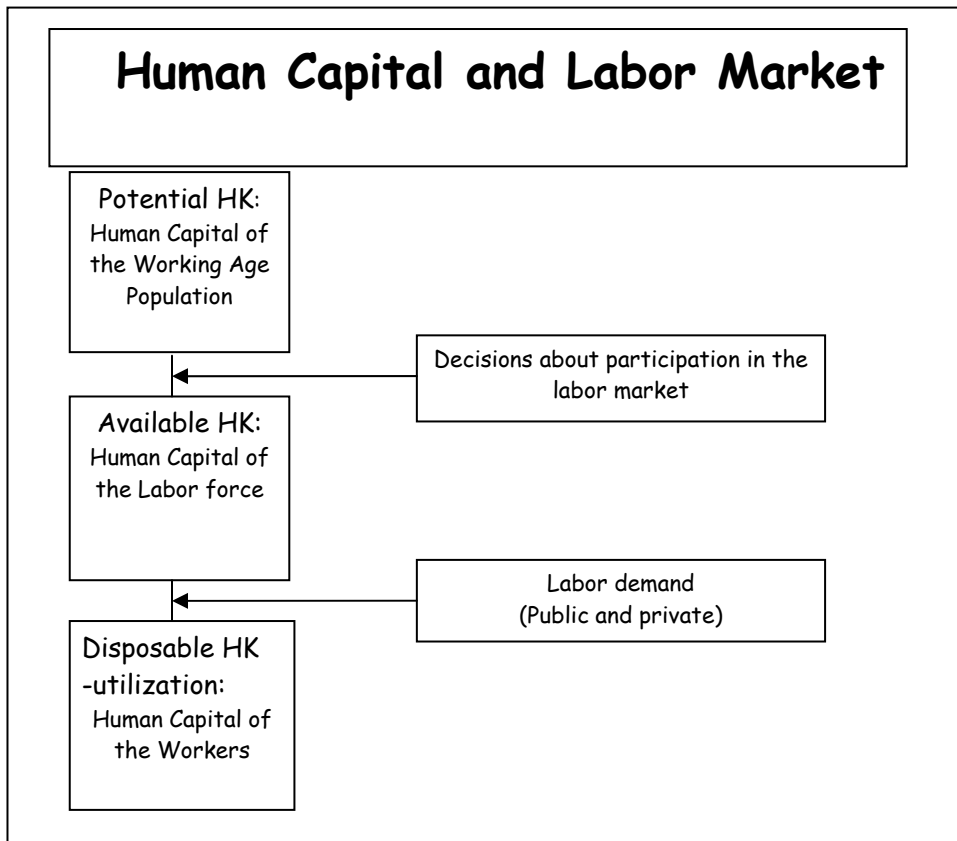
However, another main source of human capital is experience. The latter is the knowledge and capacities obtained as a result of learning by doing, non-formal education, on the job training activities, etc. Both education and experience are the two fundamental components of the denominated human capital. Precisely the economic valuation of these two components results in the economic value of human capital.



Following Serrano and Pastor (2002), the objective of this study is the valuation of the human capital that individuals obtain with productive aims in order to increase their permanent income. As such, not all the investment in human capital is made for economic and productive reasons.

The potential human capital will be given by the human capital of the working age population. The available human capital is given by the Labor force and finally the human capital utilization or disposable human capital will correspond to the employed population.

Precisely, the human capital of the workers is the relevant concept to analyze human capital as an input which generates growth and productivity.



3. Human Capital Contribution to Economic Growth

The economic literature has pointed out the importance of human capital contribution to the economic growth of a firm, a sector or a country. As long as one recognizes human capital as a production factor, even as an extended definition of capital stock, human capital may be one of the main components which explain not only a country's wealth but also its potential product or an economy's future growth capacity, in addition to being a fundamental competitive factor and attracting productive investment to the country.

An improvement in workers' skills increases the workforce's productive performance, enabling greater complementarities with the stock of physical assets, the incorporation of more technologically advanced equipment and the improvement in the production process organization.

The endogenous growth theories have pointed out that human capital contributes to economic growth beyond factor remuneration. This is so because human capital can contribute to an economy's total factor productivity growth as a consequence of generated externalities (Lucas 1988) as well as through the recognition that its factor remuneration is greater as the one traditionally quantified in its share in income once workers' skills differential returns are taken into account (Mankiw, Romer, Weil 1992)

More recently, the economic literature has pointed out the role of the skilled workers in R&D activities to sustain economic growth. This special labor force generate externalities and increasing returns beyond the sectors in which it is installed; linking the capacity of generating innovation, learning by doing, increasing returns, variety in inputs and outputs³ with the magnitude that the skilled workforce attains⁴.

This is why the measurement of changes in the workforce attributes composition becomes very relevant in growth accounting. If labor input was not differentiated by attributes (sector, gender, age, education, etc.) the contribution to economic growth could be underestimated and a positive bias in TFP measurement could be obtained. Likewise, externalities and complementarities generated by human capital would be included in TFP⁵.

As we will see in methodological section, the contribution of human capital has been estimated by a quality index mainly following Jorgenson, D, Ho, M. and Stiroh, K. (2005) methodology taking into account the skills of the workers (their relative productivity and workforce stratification), looking for a measure of labor as input adjusted by quality.

³ Pointed out by Romer 1986, 1990

⁴ see, Aghion & Howitt (1998), Young (1998), Jones (1999).

⁵ About the key role of human capital contribution to GDP and labor productivity growth, see Coremberg (2009).

4. Human Capital and Education in the National Accounts

The purpose of this section is to briefly analyze the main issues about human capital and education of the present System of National Accounts (SNA (08))

4.1 *The measurement of Education in the National Accounts*

The traditional approach adopted by the present SNA(08), to measure the contribution of the education system to the productive process is the cost based approach: that is the valuation of the inputs used in the education sector, intermediate inputs (chalks, books, paper), labor costs (wages and wages of the teaching and non teaching personnel) and the depreciation of the school infrastructure⁶.

In the case of the private sector, one counts as revenue the enrollment fees plus the subsidies granted by the State net of taxes.

In general, this approach does not take into account the time invested by the students in the education process or the time consumed outside the classroom by the teacher both for training and for performing educational tasks outside the school.

However, according to Jorgenson and Fraumeni (1992, 1996 a,b) this cost approach ignores one of the fundamental characteristics of the education process considered as investment: the gestation lag between the inputs application, the education services delivered by teachers and the time that students invest in their education and the generation of human capital embodied in the graduates of the education system.

The gestation period is of considerable magnitude, as a function of the average time that it takes for a student to graduate in the different educational levels.

As Jorgenson and Fraumeni analyze (1996 a b), a measure of human capital generated by the education system is necessary in order to put the education sector at the same level of the other sectors producing goods and services. This measure must reflect the fact that education is a services industry whose product is investments in human capital. Given that the effects of formal education remain throughout the useful life, the authors use the impact of education on the worker's permanent income as a measure of output of education.

So the output of the education system should reflect the increase in the value of life labor income due to education generated by the education costs and the temporal value of money (interest rate or discount rate).

A great part of the benefits from investment in education is registered in terms of increments in permanent income through the labor market by means of higher expected present and future wages originated in the increase of the education level of

⁶ SNA 08, paragraph 1.54 and 1.55

the population⁷.

Precisely, the sum of these benefits, which represent the economic value of education, is what the authors call "Output of Education".

Given that SNA08 adopt the cost approach, official national accounts only register as output of the education sector the value of primary and intermediate inputs used in the education system.

Therefore, in order to know a country's Output of Education it is not enough to know the cost of the inputs that education system used but also the permanent income that the population obtains when it graduates as the main result of the education system.

4.2 The measurement of Human Capital in the National Accounts

In the previous subsection, the education component of human capital was analyzed.

The Economic Value of Experience emerges when one considers improvements in the population's permanent income as a consequence of experience⁸.

Including the experience component to the education component, one obtains the Economic Value of Human Capital.

According to certain economic literature, the Economic Value of Human Capital represents human wealth, given that human capital as every economic asset will be valued through its potential of obtaining higher future revenues, in this case by the present value of expected wages.

As every economic asset, human capital produces flows which are the hours worked valued at market wages used in the production process.

Despite the importance of human capital stock, as one of the main components of wealth and as a necessary input for a country's economic growth, there are, in general, no official statistics of its level and performance.

Especially in the case of Argentina, the National Accounts do not present estimations for human capital. For the set of economic assets, National Accounts have estimations of the tangible fixed capital stock⁹.

⁷ Also there are benefits are not intermediated by the market such as a higher reward for leisure time or home tasks.

⁸ In general, given the shortcomings of labor statistics in registering the labor paths of individuals throughout time, the criterion of using population's age as a proxy of experience is adopted. In this way, the economic value of experience comes up from the economic benefits that one can obtain in the labor market in terms of life labor income as a function of age.

⁹ See Coremberg (2004). This paper constitutes the only background of official estimations for the capital stock consistent with Argentina's system of National Accounts and with the international methodological recommendations: OECD, EUROSTAT, BEA, etc.

SNA08 did not consider human capital as an economic asset, because the Manual consider economic assets that are not only used in production but mainly those are subject to ownership rights. Besides, SNA08 also excludes it because the measurement problems about how to value human capital¹⁰.

But SNA08 recognizes that in order to analyze welfare, economic growth and productivity it could be necessary to redefine the system of accounts including the value of human capital in the assets' boundary and the generated services as a component of the Gross Investment Account¹¹.

In that sense there is also background in the economic literature, which has treated human capital as part of the economy's assets' boundary, recognizing human capital as an important asset that made up a wealth of a nation, welfare, as a capital input and its main contribution to GDP growth and productivity and also in GDP and Gross Investment accounts.

Kendrick (1976) was the first who took into account the measurement of human capital investment and stock in an alternative national accounts system. But he only considered costs of education (including forgone income by students), on the job training, mobility costs and the expenditures to rearing children to working age.

More recently, Hill (2002) proposed the inclusion of intellectual human capital in the SNA. He focused, as Kendrick (1976) did, human capital as intellectual capital as an output which is defined as the acquisition of knowledge and skills. The main input of this production were the cost of informal and formal of providing education services, including the own human capital formation. But the main innovation was that he proposed to include human capital production as an own account in analogy with housing services.

Aulin-Ahmavaara (2002) treated human capital as a produced asset in a dynamic input-output model. According to this approach, the total time utilization of the population must be included in human capital output and all the goods and services consumed by the population are used as inputs in these production processes

Corrado, Hulten and Sichel (2004) (2005) and Hulten (2006) extend the asset boundary to any outlay that is intended to increase future rather than current consumption is treated as a capital investment. When this deferred-consumption rule is applied to one of the most important "new economy" questions-business intangible outlays and knowledge inputs: R&D, brand name, patents, software and specially human capital should be capitalized in national accounting system. Hulten and others (2004) (2005) had strengthened that the difference between intangibles and tangible goods (verifiability, visibility, non-rivalness, and appropriability) is relevant to the issue of whether to treat intangible expenditures as capital.

As we will see in more details in the next section, Jorgenson and Fraumeni (1996a) present a system of national accounts taking into account the impact of human capital in the economy. They defined human capital in terms of life labor income of the total population of a country (also non-market human capital activities)¹², including

¹⁰ SNA08, paragraph 3.46 and 3.48

¹¹ SNA08, paragraph 29.51

¹² This is one of the main approach that we applied in this paper.

human capital impact in every account of the US: GDP, investment, saving, consumer outlay, national expenditures, labor outlay, private domestic factor outlay, labor income, national income, capital accounts and wealth.

As Jorgenson and Landefeld (2006) pointed out, "...although these are all economic assets that are "produced" by markets they are often regarded as nonmarket assets because there are no significant third-party markets and associated market prices for these assets that can be used to value either the assets or services provided by these assets. As is the case with consumer durables and government capital, what is needed is the development of an expanded set of satellite accounts that include R&D and other intangibles, human capital, and natural resources accompanied by a research program to improve the valuation basis for these expanded accounts."

In that sense, the recent book of Jorgenson, Landefeld and Nordhaus (2006)¹³ is an important milestone in order to proposed a consistent national accounts system which include human capital and the output of education as an other non-market sectors assets and activities which have a key role in not only economic growth but also environmental and welfare economics.

¹³ See also Jorgenson (2009)

5. Measurement Issues

5.1 *Traditional indicators*

Conventional human capital measurements made by comparative international studies are usually based in various education indicators as proxy variables: literacy rates, education level attained by the population, schooling rates in the education system, and the average schooling years.

One must distinguish among them, those which measure flows (e.g.: schooling rates) from those which measure stocks, due to the fact that the latter are the most relevant and pertinent for an approximation to the relationship between education and human capital endowment.

In this sense – and despite a wide availability – various reasons are mentioned which suggest not using schooling rates as human capital indicators of the economy: there is no stable relationship in time and space between schooling rates and the population's educational composition. Even contemplating the corresponding gap there is no direct relationship between both variables.

On the other hand, from the point of view of the measurement of education stocks, the indicators which are mostly used are the adults' literacy rate, the population's composition according to the maximum educational level attained and the population's average schooling years.

The adults' literacy rate is one of the most widespread indicators, but it is not informative. Even if it is important to be able to distinguish between literate and illiterate, in order to know the degree of productive capacity of the labor force, it is even more important to know the distribution among the different educational levels. Literacy rates lack relevance even more to describe the degree of human capital in the case of developed economies: Nowadays many developing countries have a literacy rate similar to the ones verified in developed countries.

On the other hand, the population's composition according to educational levels attained gives more pertinent information in terms of accumulated human capital.

Alternatively to the latter, it is usual in specialized studies to present the use of synthetic indicators of the composition by educational levels as a proxy to the human capital endowment: the adult population's average schooling years.

In empirical studies of economic growth, it has been detected that there is an international long run tendency of increase in the number of the population's schooling years independently of the improvement in the living standards in each country.

However, the improvement in the population's educational achievements can be not necessarily correlated with a country's economic growth and neither with the social and market valuation of human capital: certain professions which require considerable educational effort (e.g.: in terms of years of schooling) could be receiving low relative wages as a consequence of their low contribution to the production process or their low contemporaneous social valuation.

Moreover, an important limitation of the average schooling years is that it assumes comparable educational qualities among countries, when one can expect that 5 years of a school in a poor country are different to the same amount of

years in a richer country.

These indicators also have difficulties for capturing changes in the quality of education. In this sense, in order to capture the quality disparities, indicators associated with the resources destined to the education system or with the students' performance have been used. However, existing empirical studies have shown that a consistent association between resources and education performance has not been verified, although there is a partial association between relative wages by education strata and performance¹⁴.

Moreover, it might be that a certain number of years in the education system does not directly translate into knowledge and abilities relevant for the economic activity (CSLS, 2001 and OECD 1998); a fact that would be captured through the wages that are paid in the labor market, as mixed indicators try to capture.

Therefore, from the point of view of the economic valuation of human capital according to the approach adopted by the methodological proposal presented in this document, the education indicators which have been previously described are complementary for the human capital characterization of a determined population but they are not strict proxy variables of its value because they do not take into account labor income.

In this way, for example, these measures are based on the assumption that there is a direct correlation between qualification and relative productivities of the labor force and the years of schooling, as well as a perfect substitution among workers belonging to different educational strata independently of time and place.

Given the problems of attributing quality to the different educational levels and to the different labor experience levels, recent economic literature based on the human capital approach, suggests using market valuations of the different labor qualities, in other words, the wage differentials by educational and experience level. This approach assumes that a person's human capital determines the wage differential that he receives, the human capital corresponding to each type of education is reflected in the relative wages' structure by educational level.

These indicators are called mixed indicators, as it is developed in the next section, because in order to value human capital, they take into account not only the population's stratification in terms of gender, age and education but also the relative wages that the different population's strata obtain. The population's stratification and the wages by gender, age and education enables the estimation of the economic value of human capital which comes from the formal education attained and also from the experience acquired on the job.

¹⁴ see Serrano and Pastor (2002)

5.2 Human Capital as Labor Input Contribution to Growth

In the context of source of growth, the measurement of contribution of human capital to GDP and labor productivity growth is measured by a labor quality index, as it was proposed in the economic literature by: BLS (1993) and Jorgenson, D, Ho, M. and Stiroh, K. (2005) for the United States, Schwerdt & Turunen (2007) for the European Union Case, OECD (2001), as well as the EUKLEMS (2007) project for the homogeneous measurement of productivity in Europe, US and other OECD countries

Labor quality growth was estimated as the difference between a labor input measured by differentiated skills and a measurement of raw labor.

Labor input is measured by the following index:

$$\Delta \ln L = \sum_j \bar{s}_{j,t} \Delta \ln H_{j,t} \quad s_{j,t} = \frac{W_j H_{j,t}}{\sum_j W_j H_{j,t}}$$

Where L is the labor input (differentiated), H is hours worked, s_j are the weights of each worker's attributes in the labor income structure of the total labor input in the economy.

The labor quality index results from the difference between differentiated labor input growth and a raw labor growth (for example: non-differentiated hours worked' growth):

$$\bar{\alpha}_L \Delta \ln L^Q = \bar{\alpha}_L \Delta \ln L - \bar{\alpha}_L \Delta \ln H$$

This procedure enables one to obtain a labor factor index differentiated by each of its attributes. Workers with better attributes receive a higher weight (more experience, better educational levels, etc.).

So the contribution of human capital to economic growth, and also to labor productivity growth, in this methodology is measured by the weighted labor quality index.

5.3 Mixed Indicators

Mixed indicators are an approximation to human capital value. These are based in the labor income. The canonical approach of human capital additionally assumes that there is a correlation between relative wages and relative productivities (and that these are correlated with relative education), according to what was mentioned in section 1. Differences in the qualification or "quality" of the labor force can have their origin in the differentiation by some of the mentioned characteristics and give as a result differences in relative wages of each group. In the economic literature work quality or productivity differentials are approximated attributable to its characteristics. Assuming that relative wages by attribute are a good proxy variable of the quality or productivity differentials of each type of job.

However, relative wages can be correlated with other macroeconomic and idiosyncratic variables different from the relative productivities.

In this sense, relative wages by educational strata can only be partially correlated with the worker's education, since they can be explained to a large extent by characteristics which are unobservable or not captured by the employed statistical sources (health, intelligence, family characteristics, socioeconomic conditions, etc.) or by macroeconomic variables such as capital stock levels and the total factor productivity of the economy.

Moreover, if relative wages are correlated with relative productivities at sector level, it is probable that the relative wages vector is correlated with characteristics of the sector which is demanding labor, as we have seen in the previous section.

Nevertheless, the canonic theory of human capital includes exclusively personal characteristics as determinants of human capital value, excluding market labor demand variables on the side of the hiring firms.

Even taking into account these objections, relative wages by age and education determined in the labor market is a valid alternative to value human capital stock embodied in the labor force, understanding human capital originated exclusively in education and experience.

5.3.1 *Productive human capital*

One of the important objectives of human capital measurement is to express human capital stock in terms of present productive capacity that a determined population has, or the endowment of workers in a firm, an industry or a country.

In this sense the productive human capital expresses the present productive capacity that the labor force has available for the economy, as an input of the production function of a firm, industry or country.

This indicator differs from the human capital wealth indicator. Just as we will see in the following section, this indicator values future productive capacity in terms of the present value of wages or permanent income that the population expects to receive throughout its working life.

The productive human capital indicator measures the productive capacity in terms of a worker's relative productivity with respect to a worker without human capital (with no qualification: without education and without experience). This indicator can also be expressed in terms of the equivalent number of unskilled workers that would be necessary to obtain the productive capacity of the average worker of the economy.

An alternative to value productive human capital would be to take into account the relative wage by gender, experience, educational level, etc. However, Mulligan and Sala I Martin (1997) (2001) point out that wages not only depends of workers' qualifications but also on macroeconomic variables such as the state of technology and the level of fixed capital stock. For example, given the labor force, the larger the machinery endowment is, the higher is the relative labor productivity and therefore wages are higher.

Mulligan and Sala i Martin (1997) (2001) suggest following the canonical approach of human capital, a measure of productive human capital based on labor income, that even when it implicitly assumes a correlation between relative wages and relative productivities by educational level and experience, it enables the measurement of the worker's productive capacity without the effect of macroeconomic variables.

The indicator of Mulligan and Sala i MArtin (1997) (2000) enables the measurement of a country's productive human capital through the ratio

between the economy's average labor remuneration and an unskilled worker's wage. This ratio will express the amount of unskilled workers that the reference population's productive capacity represents (either the Labor force, the employed population or the total population in the age of working) that provides the labor services flow in a certain period, eliminating in this way the effect of macroeconomic variables on relative productivities or capacities.

At the aggregate level, the authors suggest to use the average labor remuneration estimated by National Accounts and the wage of an unskilled worker. The ratio between these two variables would reflect an economy's productive capacity of the employed labor force as a consequence of the weighted average qualification of the working people in a country without the effect of the state of technology or the level of machinery endowment.

Analytically:

$$\boxed{HKP_t = \frac{w_t}{w_{e1,t}}} \quad (1)$$

HKP: productive human capital

w_t : the economy's average wage calculated as the ratio between labor remuneration and the number of working people¹⁵

e_1 : average wage of the educational strata level 1 (incomplete primary school or without education).

On the other hand, the availability of wage data by educational level and age enables the decomposition of productive human capital between an experience component (corresponding to the one that would have been obtained even in the absence of education) and the other component due to the education acquisition.

According to Serrano and Pastor (2002), the productive human capital of experience is obtained through the comparison between the average wage of a worker with no education with the wage of worker with no education and no experience (for example, younger than 20); while the productive human capital of education emerges as the difference between total productive human capital and experience human capital.

Analytically:

$$\boxed{HKP_t^{experience} = \frac{w_{e1,t}}{w_{e1,a20,t}}} \quad (2)$$

$HKP^{experience}$: experience human capital

$w_{e1,t}$: Average wage of a worker with educational level 1

$w_{e1,a20,t}$: Average wage of a worker with educational level 1, younger than 20

$a_{<20}$: age < 20 years

¹⁵ Mulligan and Sala i Martin (1997) (2001) use the data of income generation of the National Accounts both because the consistency with the rest of the System of Account (GDP, Saving, etc.). This procedure also allows to adjust income underreporting.

e_1 : educational strata level 1 (incomplete primary school or no education)

$$\boxed{HKP_t^{education} = HKP_t - HKP_t^{experience}} \quad (3)$$

$HKP^{education}$: education human capital

Therefore the measurement of productive human capital will depend on how the wage of an unskilled worker is approximated.

According to international experience, it is important to consider various alternatives for the implementation of this concept as a function of the assumption about unskilled workers:

1. Incomplete Primary School (Including workers without education)
2. Complete Primary School
3. Complete High School: according to the tendencies of present Argentinean labor market through which complete high school is required to have access to a job.)
4. Incomplete Primary School and younger than 20: According to the definition adopted in the IVIE paper by Serrano and Pastor (2002) for Spain.
5. Value of the constant to the origin of the regression equation of hedonic wages which represents the category of workers with the lowest perceived wage (equation 2): is the criterion adopted by Mulligan and Sala i Martin. (1998) (2000).

In order to avoid assumptions concerning which characteristics determine the low qualification, Mulligan and Sala i Martin (1997) (2000) suggest to use the constant to the origin of a regression of wages à la Mincer, which consists in the correlation of workers' wages with their main attributes: gender, education, experience (see appendix). The use of this methodology for estimating the wage of a worker with low qualification has two advantages. The first is that the constant enables the estimation of the wage without qualification even when the database does not have data on workers with low qualification. Secondly, if it is assumed that the wage regression à la Mincer imposes the correct relative wage structure (in case of biases or other problems of the database used), the estimations for a low qualification worker's wage will be more precise because they will be using the total information of the individuals included in the sample.

5.3.2 Wealth Human Capital

This approach values human capital in the sense suggested by the traditional economic theory of human capital as a function of the expected returns that an individual can generate in the labor market throughout his working life. This method takes into account not only the present labor income but also future income that the worker can potentially earn as a consequence of his formal education and his job experience.

For this purpose one has to make an estimation of the present value of expected average wages for each strata in which the total labor force and be disaggregated, taking into account its attributes: age, gender and education. The value of wealth human capital results from the multiplication of labor force classified

by skill group by their present value of wages. A country's wealth human capital will be the sum of the estimated values for each strata.

The method that is generally used is the life labor income approach or the permanent income method¹⁶. It consists in estimating the present value of wages taking into account the cross section distribution of wages by gender, age and education as if it was a time series representative of the future evolution of expected wages for each group, adjusting this evolution by the probability of job continuity and the survival probability¹⁷.

The probability of changing educational strata is given by the incidence of each education level in the total population or age cohort being analyzed. The probability of job continuity can be estimated by employment rates by strata and the survival probability come from the mortality rates.

This approach assumes that a person aged t with a certain educational level bases his expectations of future income in n years towards the future taking into account the present wages earned by the people aged t+n of the same educational strata and gender:

$$VPS_{g,a,e_i,t} = w_{a,e_i,t} * o_{a,e_i,t} + VPS_{a+1,e_i,t} \frac{(1+g)}{(1+r)} * sr_{a+1,e_i,t} * o_{a+1,e_i,t}$$

VPS: Present Value of the wages of education strata e_i

w: present wage

g: expected growth rate of labor income

r: discount rate

a: age

e_i: educational strata of level i

O_{gaet}: Probability of being employed or employment rate of the strata g, a, e, t

sr: survival probability

The present value of labor income for each age and each educational level can be recursively calculated (beginning by the wage of the person who is about to retire on the following year towards the younger strata). For example, if one assumes that all individuals retire from the labor market at the age of 65, the present value of income for a person aged 64 is simply her current income. For people aged 63, the present value of their income will be equal to the present value of income for a person aged 64 plus their current income. The calculation goes on until one achieves the present individual's or the age of a group of individuals of homogeneous age being analyzed.

However, a great part of the individuals change their educational level and

¹⁶ This method was originally created by Jorgenson and Fraumeni (1989), it was used in the estimation of the Australian Bureau of Statistic ABS (2004) for Australia, Trinh, Gibson and Oxley (2004) and Spain, Serrano and Pastor (2002)

¹⁷ According to the economic theory of investment, an investment is the present value of a sum or flow of income that one expects to earn in the future as a result of immobilizing present resources. For example, making a one year calculation, one divides the amount to be received in a year by the discount rate. This rate represents the opportunity cost of the invested money in education and that one will not consume in the present but in the future. This investment's opportunity cost is generally represented by the interest rate that one can charge for investing money in an alternative financial asset to the investment that is being made. In this way, if the present value of future income that one expects to earn as a result of the investment (machinery, education) discounted by the market interest rate is positive, then the investment is profitable.

therefore their income path. According to the permanent income method, the individuals who potentially work and study have all the time expectations of two possible future income flows: the one corresponding to the job continuity in the same educational strata and the other corresponding to the possibility of working and studying and go to the income path of the following educational strata:

$$VPS_{g,a,e_i,t} = w_{a,e_i,t} * o_{a,e_i,t} + \left\{ \begin{array}{l} (1 - \sum_{j \in E} \sum_{t \in T} se_{a,e_i,t}^{j,t}) * o_{a+1,e_i,t} * VPS_{a+1,e_i,t} + \\ + \sum_{j \in E} \sum_{t \in T} se_{a,e+1,t}^{j,t} * o_{a+t,e+1,t} * VPS_{a+t,e_j,t} \end{array} \right\} \frac{(1+g)}{(1+r)} * sr_{a+1,e_i,t} \quad (4)$$

VPS: Present Value of the wages for educational strata e_i

w: current wage

g: Expected growth rate of labor income

r: discount rate

e_i : educational strata of level i

se: percentage (probability) of individuals who change educational strata, having e_i of education at the age of t

For example, as a function of the social and economic situation in Argentina, it is expected that the working life takes place between the age of 15 and 65, and that the studying-working phase of the Labor force is concentrated between the age of 15 and 35 following the convention generally used.

The wealth value of human capital results by multiplying per capita permanent income calculated for each stratum of individuals disaggregated by gender, age and education by the amount of people in each group.

$$HKR_t = \sum_{g,a,e} VPS_{g,a,e_i,t} n_{g,a,e_i,t} \quad (5)$$

HKR: wealth human capital

VPS: per capita permanent income

n: number of workers in the labor force¹⁸

Main assumptions for measuring wealth human capital

Given the pioneering nature of the present paper, a standard methodology has been adopted by the international experiences previously cited: the Mulligan and Sala I Martin approach for productive human capital and the Jorgenson-Fraumeni (JF) approach for wealth human capital and the economic value of education described in the previous sections.

A summary of the assumptions used is presented:

Cycle Effect and Cohort Effect

¹⁸ One can take other reference populations, such as the working population and the total population.

The JF permanent income methodology assumes that the best approximation to the expectations of future labor income is the age profile of contemporaneous wages of the population stratified by age, gender and education. It also assumes a certain discount rate for a long run trend of wages and a relevant discount rate.

The use of the cross section relative wages distribution as a future distribution assumes that one can extrapolate to an alleged steady state the age profile of current wages; this can be influenced by the economic cycle through its effects on wages and on the unemployment rate, biasing the wealth value of human capital (Cycle effect). According to ABS (2004), in economic recession years, the high unemployment rates and the low wages can cause a pessimist revision of the permanent income expectations and generate sub estimation of the true value of wealth human capital and in the opposite direction in the years of a booming economy. In other words, permanent income has to be calculated based on expectation free of economic cycle influence.

Moreover in the case of Argentina and of other emerging economies, cyclical effects could be very important because it has been proved that permanent income has had fluctuations which are as volatile or more even volatile than current income in situations of deep economic crisis like the ones experienced in our country in 1989-1990 (hyperinflation) and 2002 (default and maxi devaluation). These economic crises are derived from the inconsistency of macroeconomic stabilization plans implemented during the previous stage as well as from the misperceived expectations about the long run trend by private agents and policy makers, which determine the expected permanent income¹⁹. Therefore, in unstable economies such as the Argentinean one and other emerging economies, the economic cycle also influences permanent income. One must notice that the economic cycle's influence on the calculation of permanent income is included in the wealth value of human capital formulation here set out in equation (4) through the inclusion of employment rates as weights of expected wages by age and educational group.

As a corollary of the cycle effect, there could be "cohort effect". A person who was born in the 90's could expect a different future income flow from a person born in the 80's.

This effect can be eliminated through a panel data regression to estimate permanent income using all the past and present information concerning the wage age profiles. However, as the ABS (2004) points out, the past information is less relevant than the present information for estimating the future income flow, and earnings' age profiles do not necessarily repeat themselves in time.

Discount rate and expected growth rate of labor income

The assumptions concerning the discount rate should be correlated with the economic reality of the country being analyzed and it should not depend on the analyst's criterion. Following JF, the fixed capital profitability rate was adopted in this paper as the relevant rate for Argentina, assuming implicitly that this is the alternative profitability against which one compares human capital investments.

The expected growth rate of labor income was estimated base on per capital GDP growth in Argentina in the last 50 years.

¹⁹ see Galiani, Heymann and Tomassi (2003)

Taking into account these last two objections about not incorporating the cohort effect, in this paper the JF method was adopted for estimating permanent income in very important years: 1997, 2001 and 2004

1997 was the year in which labor income was maxima in the past decade

2001: the beginning of the crises, when there was deflation with same kind of inflexibility in nominal wages

2004: after crisis 2001 and megadevaluation in 2002, the economy performed and important recovery which was partially passthrough to labor income.

The purpose of this paper is to analyse if Argentine human capital: through labor income and life labor income structure changed during those important years where the Argentinean economy experimented important unstable behavior and structural change.

5.3.3 The Economic Value of Education: the Output of Education

The services delivered by the education system are an important economic activity. As such, it is part of the Gross Domestic Product. According to National Accounts information the participation of educational services in Argentina's GDP was 3.4% in 2004.

However, the measurement of educational services which are part of GDP are done by the so called Costs Approach: including the sum of wages and intermediate inputs in the production value, discounting the latter to estimate the sector's value added. The measurement of educational services by sum of costs does not include the result of these services, investment in human capital.

Precisely one of the outputs of the education system are the increases in the economic value of human capital as a consequence of the improvements in the graduate population's wage expectations, amount which is not habitually measured in the calculation of the Educational Sector Output in the National Accounts, as we have seen in section 3.1

Taking into account the definition of wealth human capital, the education system's main output is the increase in permanent income of the Labor force originated in the increases of formal education of graduated people at working age.

Analytically:

$$YH_t = \sum_e i_{e,t} n_{e,t} = \sum_e (VPS_{e,t} - VPS_{e-1,t}) n_{e,t} \quad (6)$$

YH_t: output of education in period t

$i_{e,t} = VPS_{e,t} - VPS_{e-1,t}$: investment in education or improvements in permanente income of the graduate population

$VPS_{e,t}$: per cápita permanent income of education level e in period t

$VPS_{e-1,t}$: per cápita permanent income of educational level e-1²⁰ in period t

²⁰ Immediate previous

$n_{e,t}$: number of workers in labor force of the educational level e in time period t

According to International experience, the value of this type of investment is far higher than the Value Added of the Educational Sector in National Account, demonstrating the importance in terms of economic well-being that society's investments in education generate.

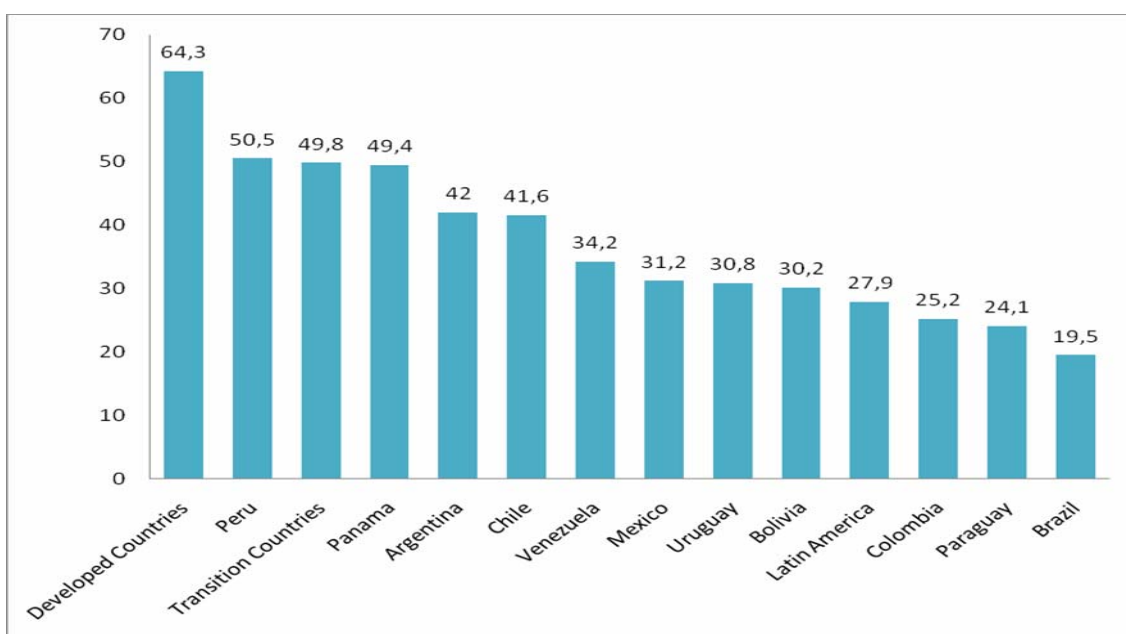
Precisely, it is one of the main objectives of the present paper to identify the output of the education system in Argentina and its relationship with education's services as it is usually measured in GDP.

6. Traditional Indicators of Argentina

According to previous analyses of the methodology, this chapter shows the estimations of some traditional indicators of human capital for Argentina.

Based in international comparative studies (Barro and Lee 2000)²¹, Figure 1 shows the percentage which has at least finished high school education for Argentina and for other countries. It is observed that 42% of the adult population in Argentina has finished high school. This value is almost 14 percentage points higher than the regional average and it is the third highest value after Peru and Panama. However, this value is far below of the average for developed countries where the high school coverage is significantly higher: almost two thirds of the adult population in developed countries has completed its high school studies.

FIGURE 1 Population with High School Education



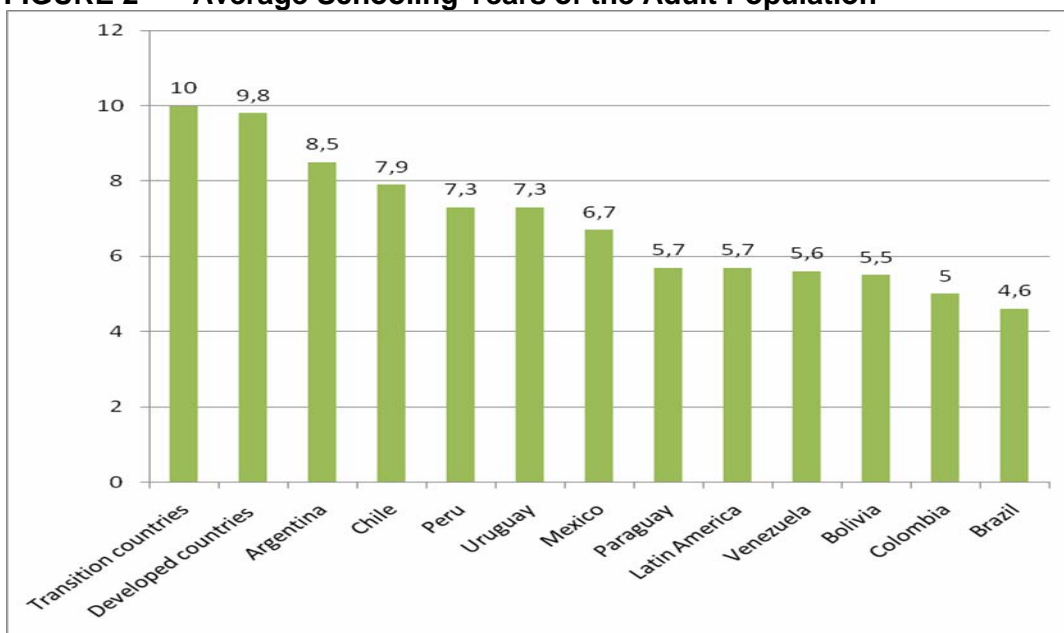
Note: Regional Averages weighted by population size

Source: Barro and Lee (2000)

From the average schooling years' point of view, the population of Argentina attains an average of 8 years and a half, which positions the country as the second highest value in Latin America and the Caribbean. This means that an Argentinean adult has on average three more years schooling than the average adult of the region. Likewise, it is observed that Argentina is below the levels observed in developed countries and in transition countries.

²¹ The used source is the database built by Barro and Lee (2000). Using census information and household surveys they estimate this indicator for 142 countries for various years until 1995 and they project the value for 2000 which is the value that is here presented.

FIGURE 2 Average Schooling Years of the Adult Population

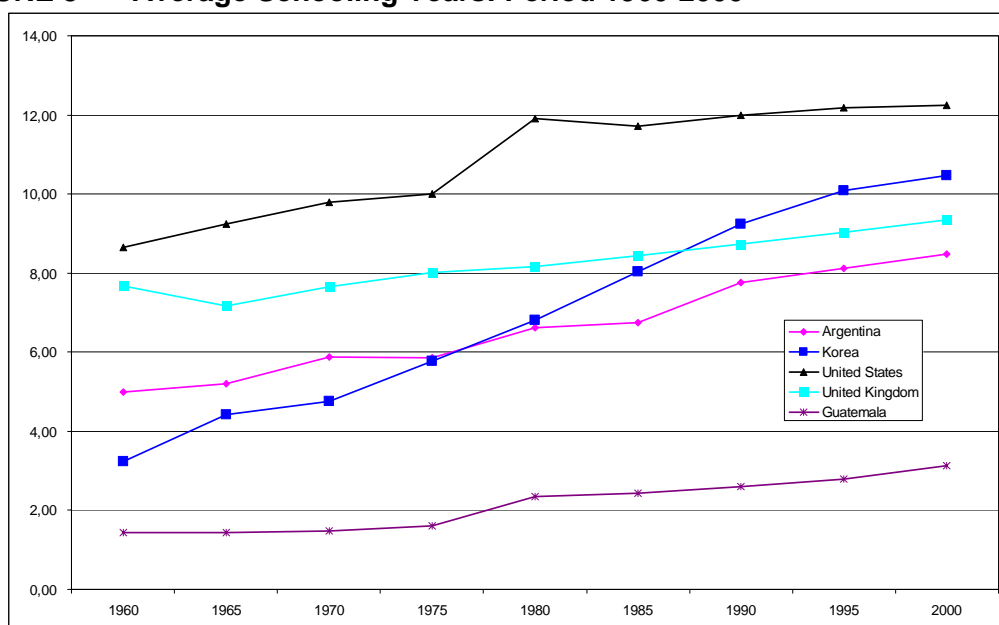


Note: Regional Averages weighted by population size
 Source: Calculated based in Barro and Lee (2000)

Human capital stock in terms of average schooling years of Argentina's population older than 25, has grown between 1960 and 2000 at an annual average rate of 1.3% (see Figure 3). If one assumes that this rate is maintained in time, the country would take approximately 11 years to attain the present level of developed countries (9.8 average years).

Southeast Asian countries have shown a fast growth in the human capital stock on the second half of the last century. Korean went from having an average of 3.23 years in 1960 to 10.46 in 2000 (average annual growth of 3%) overtaking in 2000 the average of developed countries.

FIGURE 3 Average Schooling Years: Period 1960-2000



Source: Barro and Lee (2000)

According to these findings, Argentina is one of the leaders in traditional indicators. Literacy rates, adult high school attainment and average school years figures are among the highest in at the top of Latinamerica.

However, but they are lower than in developed and transition countries; the growth of simple human capital indicators of Argentina has been surpassed by the performance of Nic's experience during the last decades.

7. Human Capital Contribution to Growth in Argentina

Following the methodology of Jorgenson, Ho and Stiroh (2005), human capital as labor input contribution to economic growth in Argentina was estimated adjusting labor force by quality: stratifying workforce by skill groups (by age, gender, education and employment status) weighted by relative labor income²².

According to these estimations, labor quality grew at 1.8% annual rate between 1990 and 2006, surpassing the performance of the main developed countries:

Country	Period	Average Annual Growth %
Argentina	1991-2006	1.6
USA	1989-2001	0.5
Canada	1989-2001	0.7
UK	1989-2001	0.7
France	1989-2001	1
Germany	1989-2001	0.5
Italy	1989-2001	0.6
Japan	1989-2001	0.6
EU	1984-2004	0.62

Source: Own estimations base on BLS (1993), Jorgenson, Ho & Stiroh (2005a) y Schwerdt & Turunen (2006) methodology.

This important performance of labour input was greater during at the beginning of nineties decade than the present cycle:

	1991-2006	1991-1994	2002-2006
Labor Input	4,1	3,9	7,0
Jobs	2,5	1,0	5,7
Labor Quality	1,6	2,9	1,3

Source: Own Estimations based on Permanent Household Survey

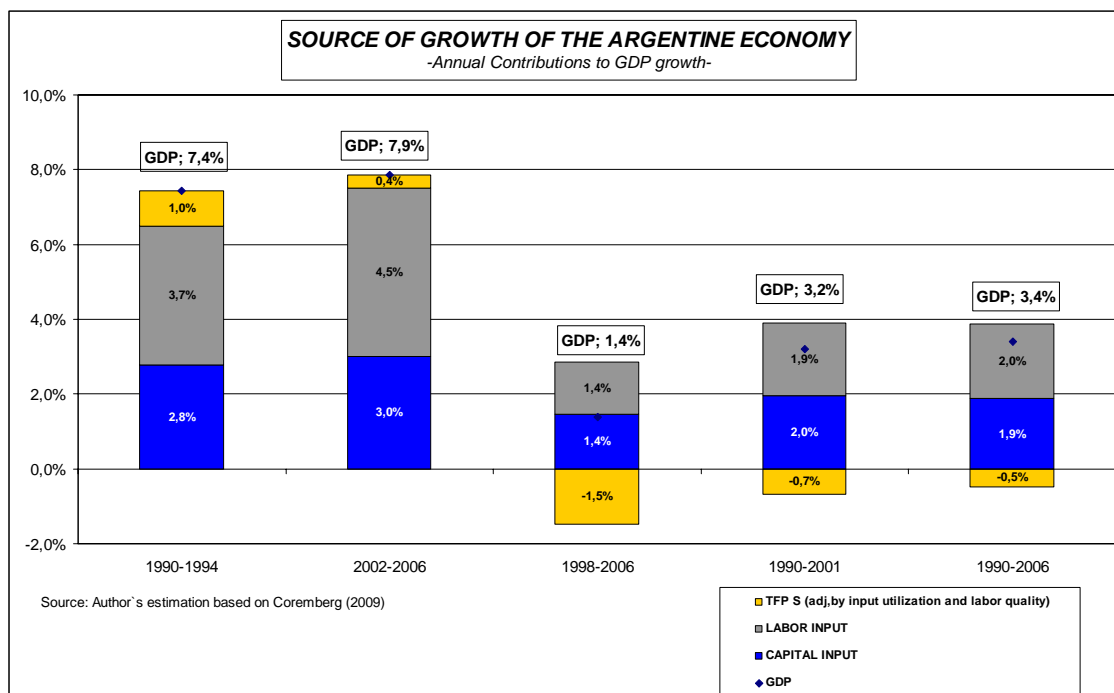
Independently of changes in relative wages, the skills of workforce in Argentina in terms of educational attainment increased: in 1993, the workers who have attain a secondary degree or greater were 42% of the total workforce, but in 2006, this group weighted 54.6%.

²² In the Argentinean case, an index was estimated which consisted in weighting labor input (worked hours) according to the labor income structure taking into account the following characteristics: gender, 3 education levels, 3 occupational categories a 4 age strata obtained from National Accounts Income Generation Account and the Permanent Household Survey for the entire country, resulting in work differentiation by 72 groups. 4 educational strata: until incomplete high school, complete high school, incomplete tertiary school or university and complete tertiary school or university. 3 age strata: until 30, between 31 and 45 and more than 45. Three Occupational categories: registered worker, non registered worker and free lance workers.

Taking into account the measurement focus of the paper, it could be interesting to briefly analyze the role of labor quality in Argentine GDP and Labor Productivity growth²³.

As it is shown in the following figure, Argentina's economic growth was driven by input contribution for 1990-2006 periods and between cyclical peaks²⁴.

FIGURE 4



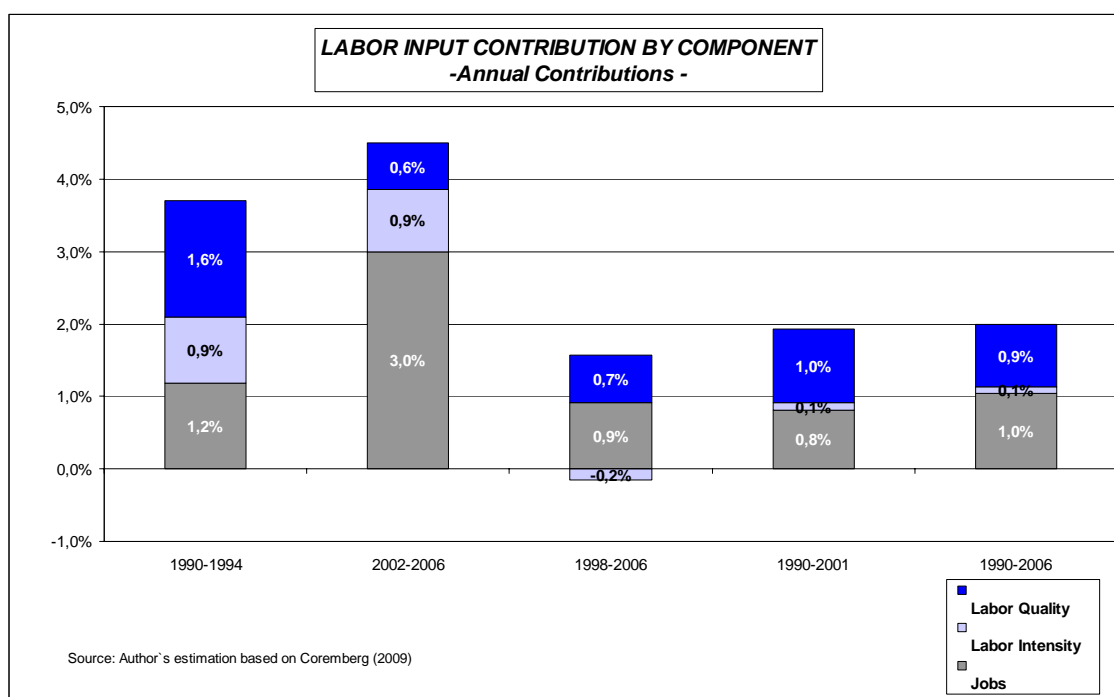
According to Coremberg (2009), the exhaustive growth accounting verified that Argentina have an extensive growth profile. Strict TFP changes showed a positive sign only during recoveries phase of GDP cycle.

Labor input explained nearly half of the factor's contribution to GDP growth independent of the period, but its composition was very different by subperiods as it is revealed in the following figure:

²³ Figures present here are extracted from Coremberg (2009).

²⁴ Capital input contribution to growth is given by the growth weighted sum of services provided by non ICT capital, TIC capital and natural resources and its utilization effect. The labor factor contribution to GDP growth results as a consequence of the growth in the amount of jobs, labor intensity (utilization effect) and labor quality.

FIGURE 5



Between GDP cyclical peaks, during Convertibility Period (1990-2001) and total period (1990-2006); labor input contribution was explained equally by labor quality and by net jobs creation²⁵.

But the performance of labor input and its composition were very different during the positive phases of gdp cycle under consideration.

First labor input utilization proxied by labor intensity has an important role only during the turning points of the economic cycle, being its contribution nearly equal between both positive phases.

Labor input contribution was higher during the post2002 crisis than at the beginning of the 1990's, mainly because net job creation was nearly the triple of the previous decade. But, human capital contribution (in terms of labor quality) during the post2002 period was nearly half of the previous positive phase.

Labor quality explains nearly the half of labor input contribution to gdp growth during 1990-2006, mainly due to 1990's decade.

In terms of gdp, labor quality contributed by 22% of GDP growth during the 1990-1994 phase. However, its contribution reduced to only 8% of GDP growth in the 2002-2006 period.

This difference is mainly due to the effect of labor hoarding and returns to skills behavior.

The returns to skill improved during the 1990's because of a skill-biased

²⁵This paper follows Davis, Haltiwanger and Schuh (1997) concepts, Net job creation equal is the difference between jobs creation and job destruction.

technology change effect. The latter was due to increases in technological change embodied in the imported capital goods, which had an impact on human capital demand as a complementary input²⁶.

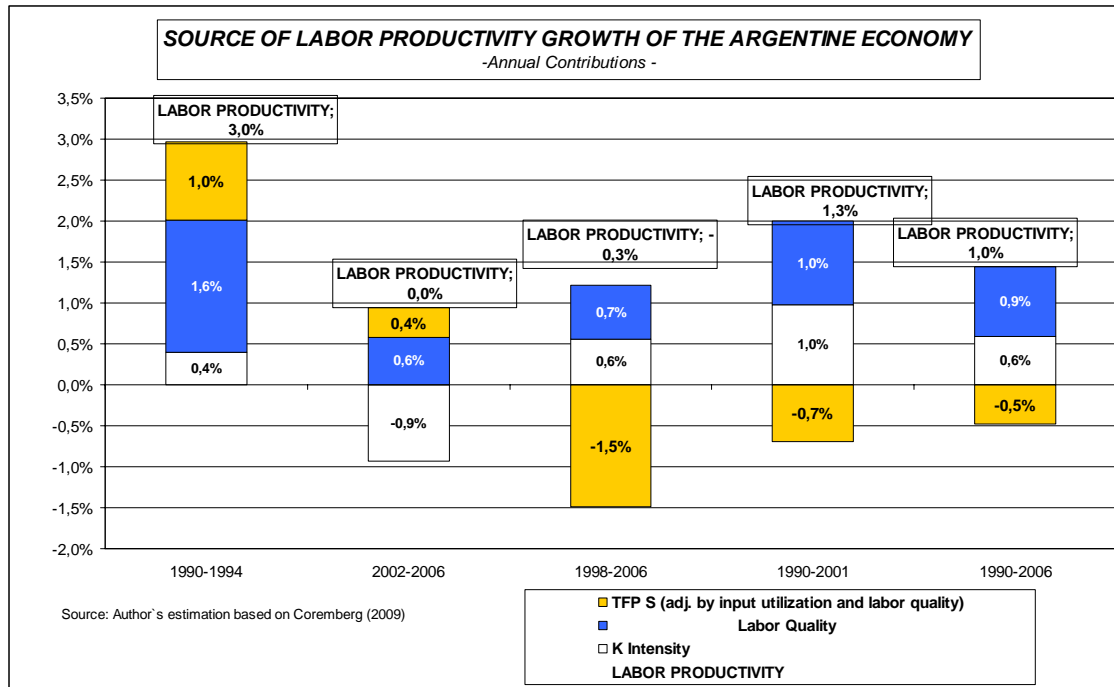
But also it is important to point out that the phenomena were in part a consequence of labor hoarding cyclical effect. During the initial phase of the economic reforms implementation in the previous decade, net job creation substantially diminished (side negative effects of higher labor cost and structural reforms of the economy) causing an important increase in unemployment, specially of lower skill workers. Likewise, this phenomenon of the lower labor demand growth caused a significant change in the labor structure, which was orientated to retaining skilled workers (labor hoarding)²⁷.

The subsequent recovery 2002-2006, was generated with a substantially higher real exchange rate and improvement in terms of trade and therefore with lower labor costs than in the previous decade, encouraging the increase in labor demand for less skilled workers, who had lost their jobs in the previous decade.

This phenomenon deteriorated the performance of labor quality growth after the 2001 crisis, even though the weight of registered employment began to increase after 2004.

According to the following figure, during 1990-2006, the performance of capital intensity and human capital were the main source of labor productivity growth, in spite of the negative trend of sustainable TFP.

FIGURE 6



²⁶ The analyses of this important phenomena exceed the space of this paper but it could be inferred that the important capital imports growth during the last decade could generate a skill biased technological change in the sense of Acemoglu (2002).

²⁷ See Bernanke and Parkinson (1990).

Labor productivity didn't grow between cyclical peaks; the negative trend of strict TFP was exactly compensated by the contribution of capital intensity and labor quality.

Labor quality was the main factor that contributed to labor productivity growth (GDP per hours worked), during the 1990-2006 period (90%) generating labor productivity gains in spite of the negative behavior of strict TFP.

8. Productive Human Capital in Argentina

This section shows the main results of the productive human capital estimation in Argentina according to the methodology and procedures presented in section 4.

As we have previously seen, the productive human capital indicator measures the productive capacity of the workers as their relative productivity with respect to a worker with no human capital (with null qualification: without education and without experience).

The productive human capital of each person will be the number of unskilled workers that would be necessary to obtain his productive capacity.

This indicator is obtained through the ratio between the economy's average work remuneration and the unskilled worker's wage. This ratio will express the amount of unskilled workers that reference population's productive capacity represents and that provide the labor services' flow in a certain period of time.

In order to define an unskilled worker's wage, in this section it has been chosen to use criterion d raised in section 3.2.1: a worker with incomplete Primary School and younger than 20. This is the definition adopted by the IVIE book written by Serrano and Pastor (2002) for Spain. This will allow a methodologically homogeneous comparison between the estimations for the Argentinean case and the case of Spain.

Additionally, this section presents the estimations for productive human capital experience and for education human capital, according to the methodology presented in section 4. This estimation takes into account the parameter of Mincer earnings regressions according to the methodology and results reported in the Appendix.

The next table presents the estimations of productive human capital by worker in Argentina according to the different alternatives described:

Table 3			
Productive human capital indicators by characteristics.			
Global Productive Human Capital			
	1997	2001	2004
Criterion d: (Unskilled worker: Incomplete Primary School and younger than 20- IVIE criterion)	1,97	2,11	2,14
Productive human capital components			
	1997	2001	2004
Productive human Capital experience	1,14	1,14	1,18
Productive human Capital education	0,83	0,97	0,96

Source: Author's estimations, based on data from the Household Permanent Survey (EPH) and the National Accounts department at INDEC.

According to the previous table, a worker's productive capacity in Argentina would be equivalent to the productive capacity of 2.14 unskilled workers if one adopts the Serrano & Pastor (2002) criteria.

It is important to point out that the productive human capital path is always increasing for the three measurement years.

Considering the approach presented in section 4, the productive human capital can be the result of investment in education or the acquisition of knowledge

and greater productive capacities through experience. The productive human capital components were analyzed following the criterion used for total productive human capital.

The following table presents the alternative productive human capital estimations by component for Labor force of Argentina.

Table 4			
Productive Human Capital composition in terms of equivalent non-skilled workers. (in thousands)			
Global productive Human Capital			
	1997	2001	2004
Criteria d: (Unskilled worker: Incomplete Primary School and younger than 20- IVIE criteria)	26.267	30.289	32.101
Productive human capital components (criterion d)			
	1997	2001	2004
Productive human Capital experience	15.176	16.331	17.708
Productive human Capital education	11.091	13.958	14.394
Urban Labor force	13.300	14.336	14.977

Source: elaborated by CGECSE at SSCA of MECyT, based on data from the Household Permanent Survey (EPH) and the National Accounts department at INDEC.

According to criterion d, experience and education explain productive human capita almost proportionally. Nevertheless, education has an increasing contribution for the 1997-2004 period. While education explained 42% of productive human capital in 1997, it explained 45% in 2004.

In terms of the productive capacity of labor force, for example, in 2004 the productive capacity of the 15 million workers who were part of the Labor force was equivalent to the work of 32 million unskilled workers.

The following table presents a comparison with Spain, Australia and New Zealand. It is important to notice that in the cases of these two last countries, the criterion for defining an unskilled worker is not explicitly presented.

Table 5			
Productive Human Capital in Argentina International Comparison			
	Period	Reference Population	Productive Human Capital per worker
Argentina	1997	Labor Force	1,97
	2001	Labor force	2,11
	2004	Labor force	2,14
Australia	2001	Labor Force	1,22
Spain	1995	Labor Force	3,5
New Zealand	1996	Population	1,54

IVIE estimated that the average productive human capital of a worker in Spain in 1995 was equivalent to 3.50 of the productive capacity of an unskilled worker. Our estimation for Argentina, with the same methodological criterion, is 1.97 for the same year.

Notice that these estimations for Argentina are still higher than those for the cases of Australia and New Zealand. However the differences could arise because Argentina presents a relative more unequal income distribution.

9. Wealth Human Capital Components in Argentina

This chapter reports the main results of the estimation of human capital components: the structure of the labor force and labor income by gender, age and education as well as the education premiums by educational level, the gender gap and the age earnings profile through Mincer regressions.

9.1 Labor Force Composition

This section presents the composition of the Labor force.

The following table presents the distribution of the Labor force by gender and educational cohort for 1997, 2001 and 2004

	1997	2001	2004
Male	100,0%	100,0%	100,0%
Incomplete Primary School	9,5%	7,4%	6,9%
Complete Primary School	29,4%	27,3%	25,7%
Incomplete High School	23,2%	22,2%	20,7%
Complete High School	17,4%	20,0%	21,7%
Incomplete University	11,0%	12,9%	12,9%
Complete University	9,5%	10,2%	12,2%
Female	100,0%	100,0%	100,0%
Incomplete Primary School	7,8%	6,0%	5,1%
Complete Primary School	21,7%	20,8%	19,5%
Incomplete High School	17,7%	16,2%	16,6%
Complete High School	19,5%	20,9%	20,7%
Incomplete University	14,0%	14,9%	16,1%
Complete University	19,3%	21,2%	22,0%
Total	100,0%	100,0%	100,0%
Incomplete Primary School	8,6%	6,8%	6,1%
Complete Primary School	26,2%	24,6%	23,0%
Incomplete High School	21,2%	19,7%	18,9%
Complete High School	18,3%	20,4%	21,3%
Incomplete University	12,4%	13,8%	14,3%
Complete University	13,3%	14,7%	16,4%

Source: author's estimations, based on data from the Household Permanent Survey (EPH)

It is inferred that between 1997 and 2004, the proportion of labor force with high school degree and university degree has grown for both genders. While in 1997, the labor force with high school degree and university degree represented 44% of the total Labor force, 48.8% in 2001 and in 52% in 2004.

One must notice that the level and growth of the university cohort of the female labor force are greater than the male case.

As we will see in the following subsection, the increase in the educational level of the labor force was not reflected in the same proportion in the education premiums.

9.2 Labor Income by skill group

The following tables report per capita annual labor income by gender and educational attainment in current prices and in prices of 1993²⁸:

	1997	2001	2004
Male	11.809	10.981	13.934
Incomplete Primary School	6.448	5.822	7.605
Complete Primary School	8.440	7.788	10.134
Incomplete High School	9.403	8.366	10.876
Complete High School	11.872	10.658	13.776
Incomplete University	13.760	12.686	16.561
Complete University	24.235	24.203	28.663
Female	11.520	10.951	13.593
Incomplete Primary School	6.243	5.832	7.036
Complete Primary School	7.454	6.778	8.551
Incomplete High School	8.276	7.495	9.663
Complete High School	10.786	10.039	12.348
Incomplete University	12.065	11.175	13.818
Complete University	19.396	19.439	23.933

Source: Author's estimations, based on data from the Household Permanent Survey (EPH)

	1997	2001	2004
Male	11.687	11.117	9.397
Incomplete Primary School	6.382	5.894	5.129
Complete Primary School	8.352	7.884	6.834
Incomplete High School	9.306	8.469	7.335
Complete High School	11.749	10.789	9.291
Incomplete University	13.618	12.842	11.169
Complete University	23.984	24.501	19.331

²⁸ Current values were deflated by the Consumer Price Index, following the empirical literature which associated labor income to human capital, the objective of present and future consumption. The choice of 1993 as the base period corresponds to the comparability of the estimations with National Accounts' data which are quoted in 1993 prices.

Female	11.401	11.086	9.167
Incomplete Primary School	6.178	5.904	4.745
Complete Primary School	7.377	6.862	5.767
Incomplete High School	8.190	7.587	6.517
Complete High School	10.674	10.163	8.328
Incomplete University	11.940	11.313	9.319
Complete University	19.195	19.679	16.141

Source: Author's estimations, based on data from the Household Permanent Survey (EPH).

It is important to point out first, that nominal wage levels present a decreasing behavior between 1997 and 2001 and increasing in the 2001-2004 period.

Economic depression during 1997-2001 had a negative but heterogeneous impact in wages.

Nominal and real wages dropped for lower educational cohort as a consequence of the lower labor demand in a context of recession..

Nevertheless, nominal and real wages of university cohorts, did not suffer a dropped.

During the 2001-2004 period, wages grew nominally although they fell in real terms, both in purchasing power terms and in US dollars as a consequence of the domestic currency devaluation in 2002 and its partial pass through to the general price level (retail and wholesale).

As a consequence of this phenomenon, the university education premiums increased between 1997 and 2001, as it is reflected in the following table:

	1997	2001	2004
Male	0,99	1,03	1,01
Incomplete Primary School	0,54	0,55	0,55
Complete Primary School	0,71	0,73	0,74
Incomplete High School	0,79	0,78	0,79
Complete High School	1,00	1,00	1,00
Incomplete University	1,16	1,19	1,20
Complete University	2,04	2,27	2,08
Female	1,07	1,09	1,10
Incomplete Primary School	0,58	0,58	0,57
Complete Primary School	0,69	0,68	0,69
Incomplete High School	0,77	0,75	0,78
Complete High School	1,00	1,00	1,00
Incomplete University	1,12	1,11	1,12
Complete University	1,80	1,94	1,94

Source: Author's estimations, based on data from the Household Permanent Survey (EPH).

The education Premium for male university graduates falls in 2004 although it was still higher than the 1997 level; while in the case of female, it remained constant as in 1997.

On the other hand, the gender gap presented in 1997 an ascending order as the educational attainment increased, with the exception of the intermediate value of high school level. This situation remained relatively stable for 2001 and 2004, though for the latter the gender gap increased in the case of Complete Primary and Complete High School levels and it diminished in the case of university workers.

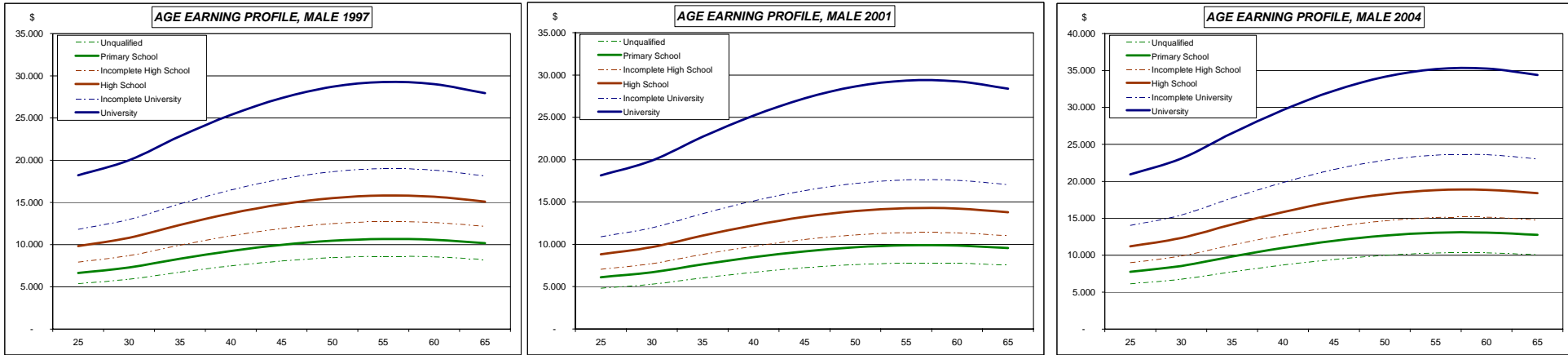
	1,03	1,00	1,03
Total	1,03	1,00	1,03
Incomplete Primary School	1,03	1,00	1,08
Complete Primary School	1,13	1,15	1,19
Incomplete High School	1,14	1,12	1,13
Complete High School	1,10	1,06	1,12
Incomplete University	1,14	1,14	1,20
Complete University	1,25	1,25	1,20

Source: Author's estimations, based on data from the Household Permanent Survey (EPH).

9.3 Age Earning Profiles

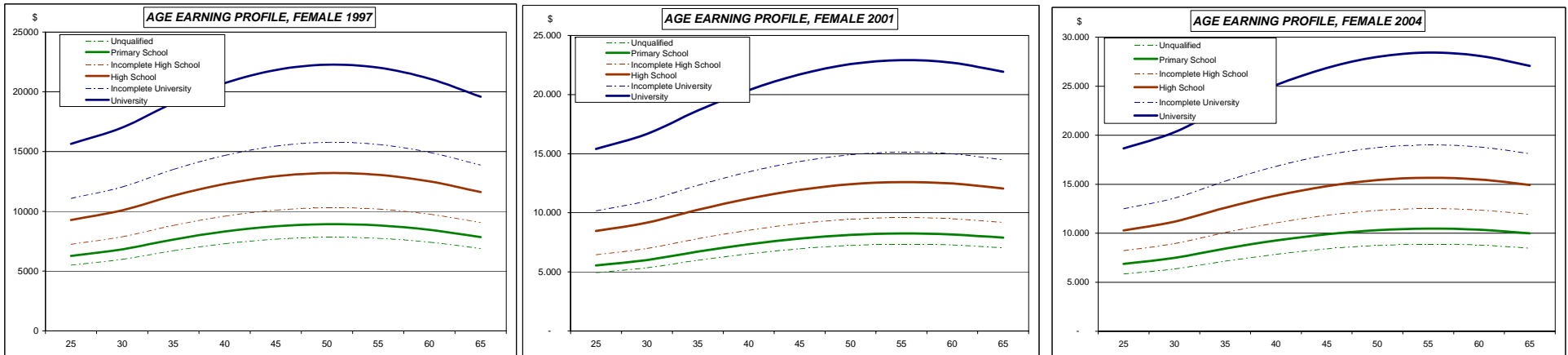
Next, the figures for age profiles of wages are presented by educational attainment and gender for 1997, 2001 and 2004 according to the Mincer earnings regressions presented in the Appendix.

FIGURE 7



Source: Author's estimation based on Mincer Regressions

FIGURE 8



Source: Author's estimation based on Mincer Regressions

It is worth noting that the patterns of age earnings' profiles are similar to the ones presented in ABS (2004). As we have described before, the most notable changes in wages take place in the higher educational levels: wages of workers with higher educational attainment are increased more rapidly with age than in the case of the lower educational cohort. Therefore, there would be a wage differential in favor of more educated workers associated to the experience gained in the labor market.

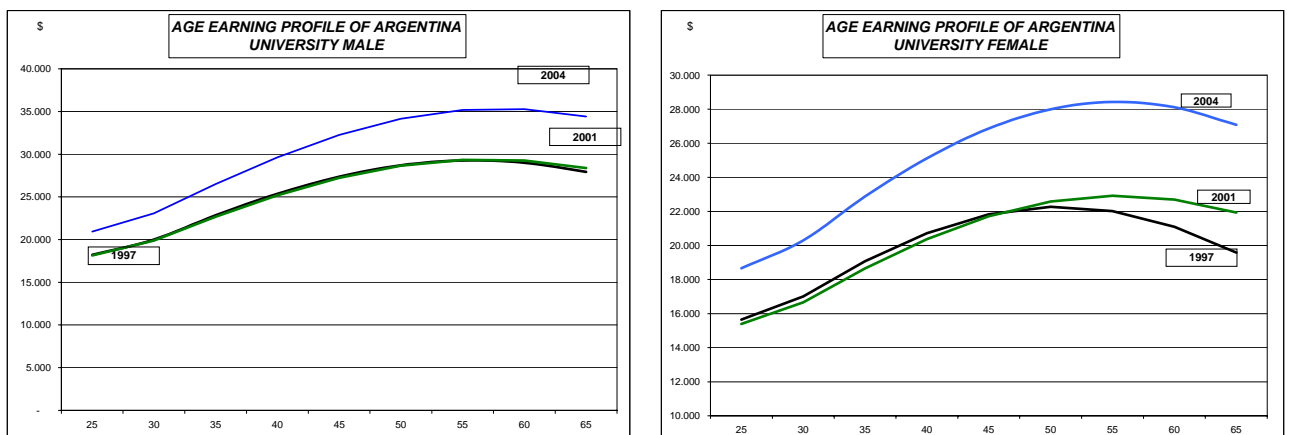
The form of age earnings' profiles demonstrate that education premiums are increasing with education though at decreasing rates (age profiles of wages are concave to the origin); the effect of higher education on wages increases with the participation time in the labor market.

For people with higher educational attainment, labor market experience plays a more important role in the determination of the shape of the curves for their permanent income. The age wage profile of lower educational cohorts are relatively flatter: experience has a smaller effect in wages than in the case of higher educational levels.

As we will see in the following section, *ceteris paribus* the discount rate, the shape of the age profiles of current income have an impact on permanent income levels, given that these crucially depend on the age at which workers obtain their maximum income. In relative terms, Mincer curves are flatter in the case of female than in the case of Male, that is, female's relative wages grow less with age than in the case of Male.

The 2001 economic crisis seems to have increased the Mincer's point of overtaking²⁹, above all in female university workers, increasing the age at which the level of labor income is maximized. In other words, the crisis could have generated human capital obsolescence derived from experience, increasing the years of experience needed to maximize the effect of education on earnings. It is worth to point out that this effect persist until 2004.

FIGURE 9



²⁹ The point at which the effect of formal schooling on earnings is maximized

10. Wealth Human Capital in Argentina

This section shows the main findings of the estimation of wealth human capital taking into account the components analyzed before.

10.1 Per Capita Life Labor Income in Argentina

In order to estimate permanent income, the Jorgenson Fraumeni Approach (J-F) presented in section 4 was applied.

The survival probabilities come from the Ministry of Health. The Employment rates by age and educational cohort come from the Household Permanent Survey.

An objective measure of the discount rate compatible with Argentina's System of National Accounts is the average rate of return of fixed capital stock. This assumes that the opportunity cost of investing in human capital is equivalent to the profitability of investing in a present productive activity. Additionally, a long run wage growth rate is assumed similar to the long run per capita GDP growth rate in Argentina in the last 30 years.

It is worthwhile to notice that these assumptions adapted to the Argentinean case, resulted in a discount factor similar to the one used in the Jorgenson and Fraumeni (1996a,b) estimations for the United States, the one used by ABS (2004) for Australia and the discount factor used by Trinh, Gibson y Oxley (2004) for New Zealand. It was also almost equivalent to the discount rate for their pessimist scenario used by Serrano and Pastor (2002) in the Spanish case³⁰.

The following tables show the main results of the estimation of per capita life labor income:

	1997	2001	2004
Male	93.625	73.639	136.727
Incomplete Primary School	27.342	22.372	53.810
Complete Primary School	58.482	41.105	84.904
Incomplete High School	71.578	51.605	105.829
Complete High School	85.351	72.328	128.331
Incomplete University	115.227	94.545	159.098
Complete University	238.952	192.503	342.365
Female	72.090	78.152	122.871
Incomplete Primary School	24.555	24.680	36.128
Complete Primary School	39.949	42.006	67.377

³⁰ The values suggested by Fraumeni and Jorgenson (1989) have determined a discount rate of 0.97. The equivalent values in Argentina result in a 0.87 factor. In Spain, Serrano and Pastor (2002) use a discount factor for a pessimist scenario of 0.97.

Table 11			
Life labor income per capita by gender and education (at current prices-arg\$-)			
Incomplete High School	46.066	44.444	69.689
Complete High School	60.452	62.747	97.508
Incomplete University	71.950	75.837	107.267
Complete University	144.871	167.077	272.018
Total	82.316	76.181	135.411
Incomplete Primary School	30.049	26.909	53.634
Complete Primary School	53.746	42.774	82.618
Incomplete High School	63.171	50.620	94.188
Complete High School	77.332	71.157	118.230
Incomplete University	95.979	86.710	135.482
Complete University	196.790	186.363	309.271

Source: Author's estimations, based on data from the Household Permanent Survey (EPH)

Table 12			
Life Labor income per Capita by gender and education (at constant prices-arg\$-)			
	1997	2001	2004
Male	92.655	74.547	92.211
Incomplete Primary School	27.059	22.648	36.291
Complete Primary School	57.876	41.612	57.261
Incomplete High School	70.836	52.242	71.373
Complete High School	84.467	73.220	86.548
Incomplete University	114.033	95.711	107.298
Complete University	236.476	194.877	230.897
Female	71.343	79.116	82.866
Incomplete Primary School	24.300	24.984	24.365
Complete Primary School	39.535	42.525	45.440
Incomplete High School	45.589	44.992	46.999
Complete High School	59.825	63.521	65.761
Incomplete University	71.205	76.773	72.343
Complete University	143.370	169.138	183.453
Total	81.463	77.120	91.323
Incomplete Primary School	29.737	27.240	36.172
Complete Primary School	53.189	43.302	55.719
Incomplete High School	62.517	51.244	63.522
Complete High School	76.530	72.035	79.737
Incomplete University	94.985	87.779	91.371
Complete University	194.751	188.662	208.578

Source: Author's estimations, based on data from the Household Permanent Survey (EPH)

Per capita permanent income at current prices grew 64.5% between 1997 and 2004. Between 1997 and 2001, this variable fell by 7.5% while it grew 77.7% between 2001 and 2004.

Per capita permanent income growth path at constant 1993 prices was similar to the one at current prices, following the GDP cycle, though with less volatility. Permanent income at constant prices grew by 12.1% throughout the entire period, it fell by 5.3% in the negative phase of the economic cycle 1997-2001 and it grew by 18.4%

in the 2001-2004 period.

Relative permanent income grows with educational attainment.

The figures reflect that there has been a deterioration of educational premiums between 1997 and 2001 for the case of male, mainly due to the fall in permanent income of male with university educational attainment. It has not recovered until 2004, when the post devaluation economic recovery took place.

In the case of female, the growth in university level education premium was constant for the entire period, even during the economic depression.

	1997	2001	2004
Male	1,10	1,02	1,07
Incomplete Primary School	0,32	0,31	0,42
Complete Primary School	0,69	0,57	0,66
Incomplete High School	0,84	0,71	0,82
Complete High School	1,00	1,00	1,00
Incomplete University	1,35	1,31	1,24
Complete University	2,80	2,66	2,67
Female	1,19	1,25	1,26
Incomplete Primary School	0,41	0,39	0,37
Complete Primary School	0,66	0,67	0,69
Incomplete High School	0,76	0,71	0,71
Complete High School	1,00	1,00	1,00
Incomplete University	1,19	1,21	1,10
Complete University	2,40	2,66	2,79

Source: Author's estimations, based on data from the Household Permanent Survey (EPH)

On the other hand, the gender gap in the case of permanent income is higher than for current income, as a consequence of gender gap in the Mincer curves, employment probability and survival rates.

	1997	2001	2004
Total	1,30	0,94	1,11
Incomplete Primary School	1,11	0,91	1,49
Complete Primary School	1,46	0,98	1,26
Incomplete High School	1,55	1,16	1,52
Complete High School	1,41	1,15	1,32

³¹With respect to the complete high school level Relative income by gender and educational attainment.

Incomplete University	1,60	1,25	1,48
Complete University	1,65	1,15	1,26

Source: Author's estimations, based on data from the Household Permanent Survey (EPH).

However, this gap almost vanished for 2001 as a consequence of a significant reduction in the present value of Male's wages. The wage differentials almost grew to previous levels in 2004. This effect takes place as a consequence of the significant increase in unemployment during 2001, which has affected more male than female, reducing their probability of being employed and therefore their future income perspectives.

In the next figures, the age earning's profiles of the life labor income are presented by educational cohort and gender, estimated for 1997, 2001 and 2004. These figures present the present value of expected wages for the six educational levels considered in this study: Incomplete Primary School, Complete Primary School, Incomplete High School, Complete High School, Incomplete University and Complete University for people ages between 15 and 65 (working life period).

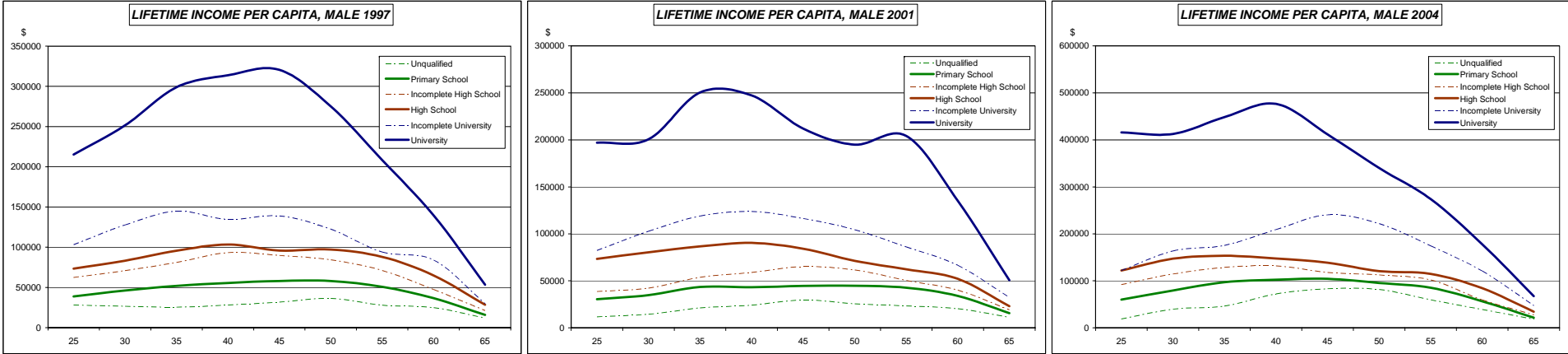
It is important to point out that the shapes of the life labor income profiles are similar to cited cases of developed countries. According to what was pointed out by ABS (2004), the shape of the curves is basically influenced by the age at which current income is maximized, as it was described in previous section.

Income in the year at which the maximum is attained, are very far from the present for young cohorts. However, as age increases, the maximum is closer to the present; income is less discounted and therefore has a higher weight in the remaining expected income flow. This explains why permanent income curves for young cohorts have a positive slope before they decline gradually.

Another important issue is that per capita life labor income profiles are very different by educational attainment. In the case of complete university, its profile is higher than the rest, so the benefits of education though experience are higher in the case of high degree education workers.

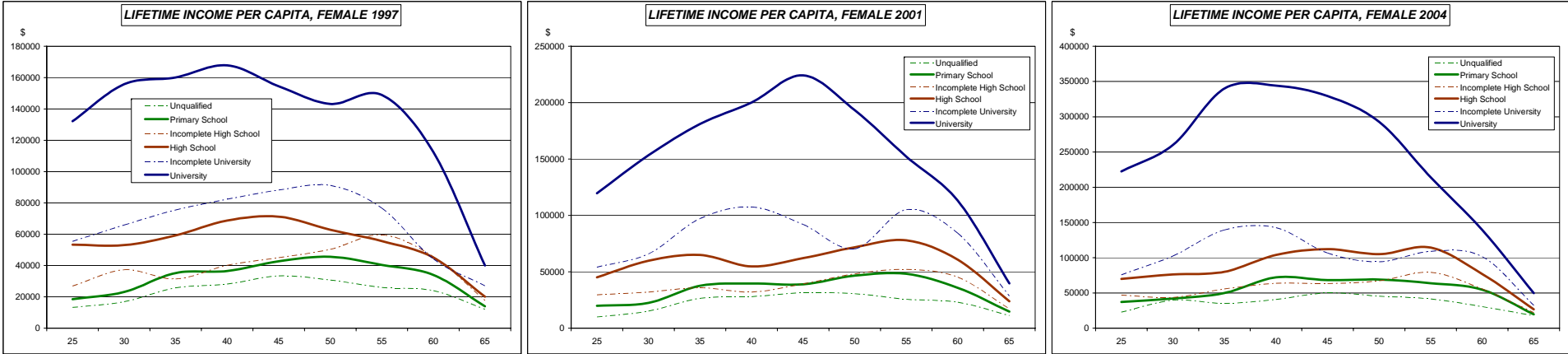
Note that the difference between complete university profile and the rest is higher in the case of female workers than male case.

FIGURE 10



Source: Author’s estimation based on Mincer Regressions

FIGURE 11

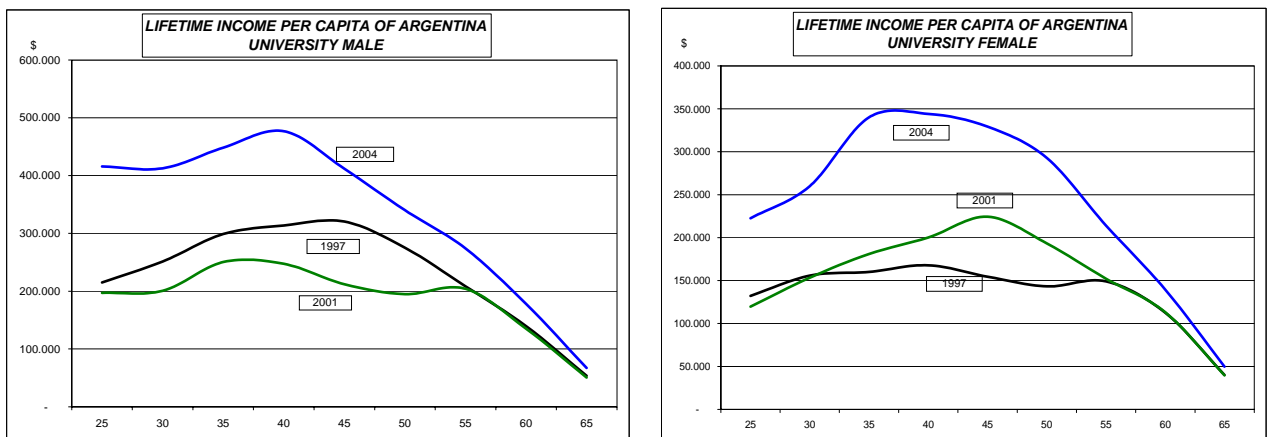


Source: Per capita Life labor income author’s estimation based on Mincer Regressions

Its is important to point out that the crisis of 2001 had change the life labor income profiles as in the case of age earnings profiles. The crisis of 2001 generate an obsolescence of human capital of workers with relative more experience, moreover in male university workers: the age at which the life labor income is maximized decreased.

But the effect of the crises is the opposite in the case of university women workers. In a context of growing unemployment, employers would have tried to substitute male experienced worker by women with similar education and experience but lower relative wages³².

FIGURE 12



³² The 2001 crises generated some cohort's effects in some educational levels, provoking two peaks in some life labour income profile as in the case of male university workers and female high school workers. But this effect apparently disappeared in 2004.

10.2 Wealth Human Capital in Argentina

The value of the wealth human capital is the product of the estimated permanent income and the labor force stratified by gender, age and education groups, using the database of the Household Permanent Survey extrapolated to the total labor force for 1997, 2001 and 2004.

The following table presents the main results at current prices and the next one presents the estimation at constant prices:

Table 15 Wealth Human Capital by gender and educational attainment -at current prices-thousand arg\$--			
	1997	2001	2004
Male	732.664.580	629.521.689	1.203.917.226
Incomplete Primary School	22.907.676	16.403.534	35.224.953
Complete Primary School	141.661.497	98.676.424	193.702.664
Incomplete High School	136.923.563	99.733.153	190.552.907
Complete High School	125.506.709	129.295.040	242.482.587
Incomplete University	106.208.144	105.454.084	177.238.732
Complete University	199.456.992	179.959.454	364.715.382
Female	362.111.117	462.593.390	824.146.945
Incomplete Primary School	11.492.239	9.899.201	13.954.953
Complete Primary School	45.808.422	52.477.932	90.466.999
Incomplete High School	41.139.490	43.474.731	76.241.756
Complete High School	62.313.143	78.340.584	133.934.328
Incomplete University	51.603.821	65.470.185	112.926.522
Complete University	149.754.002	212.930.757	396.622.387
TOTAL	1.094.775.697	1.092.115.079	2.028.064.170
Incomplete Primary School	34.399.915	26.302.736	49.179.906
Complete Primary School	187.469.919	151.154.356	284.169.663
Incomplete High School	178.063.053	143.207.884	266.794.663
Complete High School	187.819.851	207.635.624	376.416.915
Incomplete University	157.811.964	170.924.269	290.165.254
Complete University	349.210.994	392.890.210	761.337.769

Source: Author's estimations, based on data from the Household Permanent Survey (EPH)

Table 16 Wealth Human Capital by gender and educational attainment -at 1993 prices-thousand arg\$--			
	1997	2001	2004
Male	725.073.663	637.285.957	811.941.073
Incomplete Primary School	22.670.336	16.605.849	23.756.273
Complete Primary School	140.193.785	99.893.459	130.636.181
Incomplete High School	135.504.940	100.963.222	128.511.934
Complete High School	124.206.371	130.889.713	163.534.143
Incomplete University	105.107.753	106.754.712	119.532.642
Complete University	197.390.478	182.179.001	245.969.899
Female	358.359.392	468.298.831	555.817.909
Incomplete Primary School	11.373.171	10.021.294	9.411.444

Table 16 Wealth Human Capital by gender and educational attainment -at 1993 prices-thousand arg\$--			
Complete Primary School	45.333.815	53.125.174	61.012.394
Incomplete High School	40.713.256	44.010.931	51.418.663
Complete High School	61.667.535	79.306.805	90.327.457
Incomplete University	51.069.169	66.277.668	76.159.456
Complete University	148.202.446	215.556.959	267.488.495
TOTAL	1.083.433.056	1.105.584.787	1.367.758.982
Incomplete Primary School	34.043.507	26.627.143	33.167.717
Complete Primary School	185.527.600	153.018.633	191.648.575
Incomplete High School	176.218.195	144.974.153	179.930.597
Complete High School	185.873.906	210.196.518	253.861.601
Incomplete University	156.176.922	173.032.380	195.692.098
Complete University	345.592.925	397.735.960	513.458.394

Source: Author's estimations, based on data from the Household Permanent Survey (EPH).

Wealth human capital in Argentina grew 85.2% at current prices and 26.2% at constant prices between 1997 and 2004, but the performance was very different during the GDP cycle.

During depression years (1997-2001), wealth human capital growth was almost null: -0.2% at current prices and 2% at constant prices, as a consequence of the gradual wage deflation and unemployment growth during the 2001 economic depression, the final year of the convertibility exchange rate regime in Argentina, freezing the income perspectives.

In the 2001-2004 period, the wealth human capital value grew 85.7% at current prices and 26.2% at constant prices, showing that the recovery of human capital value towards 2004 essentially takes place in the post devaluation period.

This performance was also heterogeneous when one disaggregates it by gender and educational attainment.

Wealth human capital grew more in the case of females. Male's wealth human capital grew 12% at constant prices between 1997 and 2004, while for female it grew 55% for the same period; mostly due to increase of female's participation in the labor market mainly of the higher education cohorts.

Another characteristic of human capital's dynamism is that the participation of higher education levels grows.

Towards 2001, the peak of the economic crises, lower educational levels' participation in wealth human capital decreased in favor of a higher participation of complete high school and complete university, probably due to the effect of labor hoarding in favor of white collar workers, increasing the unemployment rate of lower skilled workers in a context of recession³³.

³³ See Bernanke and Parkinson(1990)

	1997	2001	2004
Male	40,3%	36,5%	37,2%
Woman	59,7%	63,5%	62,8%
Total	100,0%	100,0%	100,0%
Incomplete Primary School	3,0%	2,4%	2,6%
Complete Primary School	17,7%	14,2%	14,9%
Incomplete High School	17,2%	13,9%	14,2%
Complete High School	16,9%	19,5%	19,2%
Incomplete University	14,5%	16,2%	14,5%
Complete University	30,7%	33,9%	34,7%

Source: Author's estimations, based on data from the Household Permanent Survey (EPH).

As the next table shows, between 1997 and 2004 the weight of higher educational cohorts in wealth human capital grew at substantial rate.

1997-2004	Value	Quantities	Permanent Income
Male	64,3%	12,5%	46,0%
Female	127,6%	33,5%	70,4%
Total	85,2%	12,6%	64,5%
Incomplete Primary School	43,0%	-19,9%	78,5%
Complete Primary School	51,6%	-1,4%	53,7%
Incomplete High School	49,8%	0,5%	49,1%
Complete High School	100,4%	31,1%	52,9%
Incomplete University	83,9%	30,3%	41,2%
Complete University	118,0%	38,7%	57,2%

Source: Author's estimations, based on data from the Household Permanent Survey (EPH).

Wealth human capital with complete high school level grows 100.4% as a consequence of the graduate labor force with high school degree growth, 31.1% and an increase of 52.9% in their permanent income. The wealth human capital of the university graduate labor force grew 118%, explained 38.7% by its population and 57.2% by its permanent income.

10.3 Macroeconomic Consistency

In order to have an idea of the importance of wealth human capital in Argentina, the next table presents a comparison between estimations made with the fixed capital stock and GDP of National Accounts.

Table 19			
Wealth Human Capital in Argentina			
Macroeconomic Consistency			
	1997	2001	2004
Wealth Human Capital /GDP	3,74	4,06	4,53
Wealth Human Capital /Fixed Capital	1,75	1,79	1,60

Wealth human capital was 4.5 times higher than GDP in 2004.

On the other hand, wealth human capital presents a significant positive trend because it has increased more than proportionally than GDP between 1997 and 2004; while the value of wealth human capital grew 85.2%, GDP at current prices grew only 52.7%.

Generally, the value of wealth human capital almost doubles the fixed capital stock; but its fluctuations correlates with real exchange rate and its impact on input relative prices.

The ratio was higher during lower real exchange rate during Currency Board Regime (Convertibility 1u\$s=1\$)) between 1997 and 2001; while the ratio decreases by 11% in 2004 after the 2002 mega-devaluation.

10.4 International Comparison

This section aims at comparing the levels of estimated wealth human capital in Argentina with the reduced set of international experiences.

The next table presents the main macroeconomic relationships for the cases of Australia, the United States, Spain and New Zealand. These countries had estimations for wealth human capital and output of the education system with the Fraumeni – Jorgenson methodology presented in section 3. This enables a methodologically homogeneous comparison among the available estimations for wealth human capital for these countries, though there might be some distortions based on discrepancies in the assumptions made.

Table 20					
Wealth Human Capital in Argentina. International Comparison					
	Period	Reference Population	Wealth Human Capital / Fixed Capital Stock	Wealth Human Capital/ GDP	Fixed Capital Stock / GDP
Argentina	1997	Labor force	1,7	3,7	2,2
	2001	Labor force	1,8	4,1	2,5
	2004	Labor force	1,6	4,5	2,4
Australia	2001	Labor force	3,1	6,3	2,5
Spain	1995	Labor force	3,8	10,7	2,8
United States	1986	Population	6,7	19,6	2,9
New Zealand	1996	Population	2,1	7,4	3,3

Source: Author's estimations, based on data from the Household Permanent Survey (EPH).

The value of wealth human capital is higher than the value of fixed capital stock in all the countries of the sample. Given that the value of included goods in both types of stock is given by the present value of the future services that they generate, it is intuitive to expect that the value of human capital exceeds the value of non-human capital for the following reasons:

Duration: Physical capital goods last less (on average) than human capital, because the period of human capital formation (learning + work lifetime, approximately the life expectancy) exceeds the average lifetime of production equipment³⁴. As a result the average lifetime of a country's aggregate capital stock is far lower. The age earnings profiles are much more stable and persistent than other ICT and durable equipment age price profiles.

Skilled Biased Technological Change: Nominal wages are sticky while the prices of capital goods present a negative trend in the long run as a consequence of their embodied technological change³⁵; causing a positive trend in the wage of skilled labor³⁶.

Wealth Human Capital in Argentina is greater than GDP and Tangible Capital Stock but at lower rate than other developed countries.

This could be for two phenomena: diminishing returns in both types of capital and Lucas Paradox.

Diminishing Returns to Capital: According to the previous table, the physical Capital/ GDP ratio is lower in Argentina than in the rest of the countries in the sample. These results are compatible with the canonic theory of growth: the capital's average productivity (the inverse of the capital – output ratio) of the developing countries and consequent capital relative scarcity must be higher than the productivity in developed countries with a greater abundance of physical capital.

³⁴ Notice that constructions, whose lifetime exceeds the life expectancy, are part of the physical capital goods' stock together with machinery and ICT assets, whose average lifetime is lower than half of constructions' life expectancy.

³⁵ Gerschenkron, Alexander (1957), Diaz Alejandro, Carlos (1965), Heymann D., Coremberg, A. Goldzier, P., y Ramos, A. (2007) and Hsieh, Chang- Tai y Peter Klenow (2003)

³⁶ See Acemoglu (2002)

Lucas Paradox: The value of wealth human capital in Argentina is systematically lower than the value in the developed countries of the sample, both when the wealth human capital is measured in terms of GDP and when it is measured in terms of physical capital stock.

Lucas (1990) suggest that in spite of diminishing returns to fixed and human capital; human capital migration flows from developing countries (where human capital is low and it is supposed that returns to education are higher) towards developed countries because there is positive externalities of human capital, better infrastructure and technology in developed countries in comparison to uncertainty and political risk in developing countries that hinder to take advantage from human capital externalities.)³⁷.

11. The Output of Education in Argentina

According to the description of this concept presented in sections 4.2, the economic value of education corresponds to the increases in life labor income that each graduate earns as a consequence of having completed their educational attainment. According to what was previously pointed out, the Economic Value of Education was called Investment in Education or Output of the Education System, understanding that the increase in graduates' permanent income is the education system's main result.

This value is obtained by multiplying the increase in per capita permanent income through every educational cohort by the amount of workers in each group. In the estimation made here for Argentina, the increase in permanent income of the complete educational attainments was considered as the economic value of education, like in the experience of international estimations.

³⁷ See Lucas (1990)

11.1 Output of the Education Per Capita

The next tables present the estimation results for output of education per capita at current and constant prices.

	1997	2001	2004
Male	50.505	39.726	72.762
Complete Primary School	31.140	18.733	31.094
Complete High School	26.869	31.222	43.426
Complete University	153.601	120.175	214.035
Female	38.849	47.422	80.921
Complete Primary School	15.395	17.327	31.249
Complete High School	20.502	20.740	30.131
Complete University	84.420	104.331	174.511
TOTAL	45.754	43.146	76.383
Complete Primary School	26.024	18.255	31.151
Complete High School	24.226	26.384	37.827
Complete University	114.653	110.481	191.186

Source: Author's estimations, based on data from the Household Permanent Survey (EPH).

	1997	2001	2004
Male	49.982	40.216	49.072
Complete Primary School	30.817	18.964	20.970
Complete High School	26.590	31.608	29.287
Complete University	152.009	121.657	144.348
Female	38.446	48.007	54.575
Complete Primary School	15.235	17.540	21.075
Complete High School	20.290	20.996	20.321
Complete University	83.545	105.617	117.693
TOTAL	45.280	43.678	51.514
Complete Primary School	25.755	18.480	21.009
Complete High School	23.975	26.710	25.511
Complete University	113.466	111.844	128.939

Source: Author's estimations, based on data from the Household Permanent Survey (EPH)..

The output of education by worker seems to have a procyclical behaviour. At current prices amounted to 45.754 pesos at current prices in 1997; it fell (-5.7%) to 43.136 prices in 2001 and grew strongly (77%) until it attained 76.383 in 2004. Meanwhile at constant prices, it fell by 3.5% between 1997 and 2001 and it grew 17.9% between 2001 and 2004.

However, the dynamism of investments in education is different by gender and by educational attainment.

During the 1997-2001 period, the output of education fell 21.3% for the case of male workers; while for female it increased by 22.1%.

This phenomenon takes place because in situations of higher fragility in the labor market, the male unemployment rate increases. Female's participation in the labor market compensates the decrease in income in households.

Moreover, the output of education of female worker was higher than male in 2001 and 2004.

The 2001 crisis did not significantly affect the perspectives of improvements in permanent income due to education of high school graduates, although it did affect those of primary school graduates and to a lesser extent that of university graduates, demonstrating the depth of the economic crises experienced in that year.

On the other hand, the post devaluation economic recovery improved the education future income perspectives of the labor force for every gender and educational attainment in current prices but the output of education by worker in constant prices did not recover their pre devaluation levels in any group.

11.2 The Output of Education of the Labor Force in Argentina

The output of education of the labor force is obtained as a result of valuating the graduate worker population with the per capita output of the education system estimated in the previous table.

The next tables present the results at current and constant prices respectively:

	1997	2001	2004
Male	236.137.206	185.736.547	380.609.088
Complete Primary School	76.025.212	45.733.904	70.850.753
Complete High School	38.807.801	45.096.054	81.995.328
Complete University	121.304.193	94.906.589	227.763.008
Female	124.985.538	177.300.141	337.794.481
Complete Primary School	18.089.055	21.760.034	41.958.157
Complete High School	21.012.467	25.679.752	41.387.053
Complete University	85.884.015	129.860.354	254.449.272
Total	361.122.743	363.036.688	718.403.570
Complete Primary School	94.114.267	67.493.938	112.808.910
Complete High School	59.820.268	70.775.806	123.382.381
Complete University	207.188.208	224.766.943	482.212.279

Source: Author's estimations, based on data from the Household Permanent Survey (EPH)

	1997	2001	2004
Male	233.690.659	188.027.347	256.688.870
Complete Primary School	75.237.537	46.297.968	47.782.883
Complete High School	38.405.725	45.652.250	55.298.963
Complete University	120.047.397	96.077.129	153.607.023
Female	123.690.600	179.486.889	227.814.012
Complete Primary School	17.901.640	22.028.414	28.297.253

Complete High School	20.794.763	25.996.476	27.912.092
Complete University	84.994.197	131.461.999	171.604.667
Total	357.381.259	367.514.236	484.502.882
Complete Primary School	93.139.177	68.326.382	76.080.137
Complete High School	59.200.488	71.648.727	83.211.055
Complete University	205.041.594	227.539.128	325.211.690

Source: Author's estimations, based on data from the Household Permanent Survey (EPH)

The economic value of education represented \$ 718.403 billions at current prices in 2004. Its value grew at current prices by 0.5% between 1997 and 2001, and by 97.9% between 2001 and 2004. Meanwhile, at constant prices its value grew by 2.8% between 1997 and 2001 and by 31.8% between 2001 and 2004.

The participation of male workers in the output of the education system notably fell in favor of the female population between 1997 and 2004, according to the following table, from 65.4% to 53%.

The incidence of university students in education investment increased between 1997 and 2004, from 57.4% to 67.1% against the primary school graduate population. The output of the population with high school degree grew from 16.6% to 19.5% between 1997 and 2001. It the reduced to 17.2% in 2004.

	1997	2001	2004
Male	65,4%	51,2%	53,0%
Female	34,6%	48,8%	47,0%
Total	100,0%	100,0%	100,0%
Complete Primary School	26,1%	18,6%	15,7%
Complete High School	16,6%	19,5%	17,2%
Complete University	57,4%	61,9%	67,1%

Source: Author's estimations, based on data from the Household Permanent Survey (EPH).

According to the following table, as in the case of wealth human capital, the increase in the participation of complete high school and complete university education levels in the economic value of education is due to a significant dynamism in output of education by worker more than the number of workers in every educational attainment.

1997-2004	Value	Quantities	Permanent Income
Male	61,2%	11,9%	44,1%
Female	170,3%	29,7%	108,3%
Total	98,9%	19,2%	66,9%
Complete Primary School	19,9%	0,1%	19,7%
Complete High School	106,3%	32,1%	56,1%
Complete University	132,7%	39,6%	66,8%

Source: Author's estimations, based on data from the Household Permanent Survey (EPH).

While the output of the primary school workers increased by 19.9% as a consequence of improvements in permanent income; the output of complete high school and complete university levels increased by 106.3% and by 132.7% respectively mainly as a consequence of an increase in their per capita education output of 56.1% and 68.8% respectively. Meanwhile, the active high school graduate population grew only by 32.1% and the active university graduate population grew by 39.63%

11.3 Macroeconomic Consistency

In order to have a notion of the impact of the education system's output in the Argentinean economy, the next table presents a comparison between the estimations made for the Output of Education with GDP, Education Value Added (estimated by the cost approach) and Investment of the National Accounts^{38 39}.

Table 27			
Output of Education ratios in Argentina			
Macroeconomic Consistency			
	1997	2001	2004
Value Added of Education Sector /GDP	3,9%	4,9%	3,8%
Output of Education/ Value Added of Education Sector	31,8	27,7	42
Output of Education /GDP	1,2	1,4	1,6
Output of Education/Gross Fixed Capital Investment	6,4	9,5	8,4

Source: Author's estimations, based on data from the Household Permanent Survey (EPH)

The Output of the Education system widely exceeds the contribution of the education sector to the Argentinean economy calculated by the costs. In 2004, the consolidated public spending represented 3.8% of GDP of the Argentinean economy at current prices.

However, the output of the education system measured by the increase in the present value of wages earned by people who have completed each educational attainment results in an estimated level for 2004 equivalent to 1.6 times the Argentinean GDP.

This estimation is 42 times higher than the costs paid in the production process of education services according to the figures in the public budget.

Given that the Output of the Education System represents the economic profits that it generates in terms of increases in the present value of wages or permanent income of the graduate population, it is an investment good.

³⁸ The comparisons are made with Consolidated Public Spending in Education. It corresponds to consolidated spending made in the national, provincial and municipal jurisdictions of Argentina with destination to education, including transfers to the private sector with education purposes. The figures correspond nearly to the Education Sector's Value Added in the National Accounts, that would also include private education which add 1% more of GDP.

³⁹ The Gross Domestic Fixed Investment includes capital goods purchases such as housing, non-residential construction, machinery and equipment, livestock capital and farming constructions. The capital stock includes of these same goods.

According to the estimation for 2004, one dollar invested or spent in the education system generates u\$s 42 more in terms of improvements in permanent income of the graduate population. In other words, investment in education services generates significant pecuniary externalities on the graduate population.

Education's magnitude and importance as investment in human capital which enables the improvement of society's well-being is impressive when one compares the figures of the Economic Output of the Education System to Gross Fixed Capital Investment of National Accounts. Education's Output is 8 times greater than Gross Domestic Investment.

As we will see below, these ratios are similar to those found in developed countries.

11.4 International Comparison

This section aims at comparing the estimated levels for the output of the education system in Argentina to the levels of a reduced set of international experiences.

The next table shows the main macroeconomic relationships for the cases of Australia, the United States, Spain and New Zealand which had estimations for wealth human capital and for the output of the education system calculated with the J-F methodology.

This enables a relatively homogeneous comparison among the available estimations for these countries, though there might be some distortions based on the discrepancies of the assumptions made.

			Value Added of Education Sector / GDP	Education Output / GDP	Education Output / Education GDP	Education Output / Gross Domestic Fixed Investment
Argentina	1997	Labor force	3,9%	1,2	31,8	6,4
	2001	Labor force	4,9%	1,4	27,7	9,5
	2004	Labor force	3,8%	1,6	42	8,4
Australia	2001	Labor force	4,4%	1,3	29,0	5,6
Spain	1995	Labor force	4,3%	0,2	4,5	0,8
United States	1986	Population	0,7%	0,3	50,6	2,1
New Zealand	1996	Population	5,2%	2,4	46,3	11,2

Source: Author's estimations, based on data from the Household Permanent Survey (EPH)

Education sector's GDP, according to the National Accounts, has a participation between 4 and 5 % in GDP in each of the economies included in the sample, except for the case of the United States, where participation is less than 1%.

The magnitude of the output of education with respect to the traditional measure of Education GDP is relatively high as in young countries such as Australia and New

Zealand⁴⁰.

On the other hand, the output of the education system widely exceeds gross domestic fixed investment in all the countries in the sample, except in the case of Spain where the output is almost equal to the value of fixed investment. In other words, investment in human capital, understood as improvements in present and future wages of the graduate population highly exceeds investment in physical capital goods.

As a general conclusion, the economic benefits of the education system widely exceed its costs in all the countries in the sample.

Investment in human capital originated in the education system in terms of improvements in the present value of wages of the graduate population is not only higher than the education system's costs and almost equal or even higher than the GDP of each economy but also it constitute the main investment in the economic system because it widely exceeds investment in physical capital.

⁴⁰ Nevertheless, in the United States and in Spain it has a lower magnitude with respect to the countries in the sample. In the case of the United States, this is mainly due to the fact that the reference population is the total population, while in the rest of the countries the comparison is made with respect to the labor force. In the case of Spain, the IVIE estimates permanent income without taking into account the probability of changing educational cohort, generating a potential sub estimation of permanent income and output of education.

12. Conclusions

The aim of this paper is to present the first estimation of the economic value of human capital and education in Argentina.

We estimated the main indicators such as productive human capital, wealth human capital and output of education of the labor force adapting the methodology suggested respectively by Mulligan and Sala i Martin (1997) (2000) and Jorgenson and Fraumeni (1996a,b) adapting to the case of an unstable economy as Argentina.

We find that Human Capital and Output of Education in Argentina have important procyclical behavior and higher amplitude of fluctuations than developed countries as it is expected in this type of economy. Additionally, the human capital-fixed capital stock ratio followed the change of input relative prices due to real exchange rate behavior.

However, in spite of this unstable behavior at aggregate level during crisis, the composition of wealth human capital in Argentina is relatively stable between cyclical peaks and replicates some of the main characteristics of developed countries.

Labor Quality index showed an important performance (greater than developed countries) and it had a key role in GDP and Labor Productivity performance.

Productive human capital is higher in Argentina, taking into account its more unequal income distribution than Australia and New Zealand.

Wealth Human Capital in Argentina is higher than Physical Capital Stock; similar to what has been found by ABS (2004) and Trinh (2004) for Australia and New Zealand, compatible to long run trend in relative prices of capital goods induced by skilled biased technology change effect.

But these ratios for Argentina are relatively lower than developed countries as in Australia, Spain and United States.

The Output of the Education Sector is equivalent to aggregate GDP and 30 times greater than education services measured by cost approach in National Accounts; similar findings were verified in the case of USA(Jorgenson and Fraumeni (1989, 1992), Spain (Serrano and Pastor (2002) and Australia and New Zealand (ABS (2004), Trinh (2004).

The estimations confirm some stylized facts of economic growth theory. According to canonical growth theory, developing countries should have lower fixed capital intensity than a developed country as it's is shown by the estimations for the Argentinean case.

As in Lucas Paradox, the estimations confirms that in spite of their relative scarcity of wealth human capital, Argentina and others developing countries suffered from "brain drain", exporting human capital to developed economies.

According to her high levels of uncertainty, high sovereign risk, volatility behavior of relative prices and macroeconomic activity, and disruptions in labor markets; Argentina could not take advantage from positive spillovers from her important human capital and output of education.

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Appendix

A1 Data compilation and consistency

This section details the sources of information and the estimation procedures for each of the variables which make up the productive human capital, wealth human capital and the output of education: labor income and jobs by gender, age and education for 1997, 2001, 2004.

The years of temporal reference have been chosen considering Argentina's economic cycles' facts. Such years of the preliminary series are: 1997 (reference year of the Convertibility period before the beginning of the 1998 recession), 2001 (year of the last Population Census, last year of the Convertibility plan) and 2004 (most recent available data for EPH and pertinent for comparison, 2004 is the future base year of National Accounts).

EPH presents several problems mainly typical under reporting of labor income of the top quintile and non response. For this reason, it was necessary to make a series of adjustments in order to make the primary data consistent with the National Accounts' data.

A.1.1 Reference Population

The population data by employment status and age, gender and educational cohort come from the Household Permanent Survey of Argentina (EPH) of the National Bureau of Statistics and Census (INDEC). The geographical coverage of this survey corresponds to the most important 28 urban agglomerates of the country.

In order to respect the "exhaustive" criterion, this study uses the EPH data extrapolated to the total urban population taking into account the levels of the National Census of Population and Housing (CNPV) of INDEC whose geographical coverage is exhaustive and includes the urban population not included in the EPH and the rural population.

The EPH underreports income in primary sectors such as mining and farming located in non-urban areas, because it centers its coverage in urban areas. On the other hand, it has over representation of public employment, because it excludes urban areas not included in the EPH with low public employment.

In order to make the estimation for wealth human capital, it is necessary to disaggregate the reference population by gender, age and education cohort.

In principle, the choice of the disaggregation level and the creation of the groups by attribute depend not only on the economic and institutional reality of Argentina, but also on the availability and reliability of the statistical data.

The choice of the reference population is not neutral with respect to the value of human capital to be estimated. Following the international experience it was stipulated that the relevant populations for the estimation of human capital value is the population in the age of working. According to Argentina's economic and social reality, the determination of the age at which the basic productive capacity is formed and the age at which the person stops working is in the range of 15 and 65 years old.

On the other hand, the educational cohorts have been classified according to the standard disaggregation of the Household's Permanent Survey:

Level 1: Incomplete Primary School

Level 2: Complete Primary School

Level 3: Incomplete High School

Level 4: Complete High School

Level 5: Incomplete University

Level 6: Complete University

Level 7: No qualification

Therefore the stratification procedure of the working age population determines 700 groups or cohorts.

According to section 2, in order to estimate the value of potential, available and used human capital, it is necessary to include as reference population, the total population, the Labor force and the employed population respectively.

However, one must take into account that the bigger the universe to be captured the larger the amount of imputations that will be necessary in order to obtain the value of human capital.

The Labor force: in this case it is necessary to impute the wage vector for the unemployed. Following the methodology adopted in the cases of Australia, Spain, the United States and New Zealand, this imputation is made under the assumption that the wage earned by the employed acts as the opportunity cost for the unemployed, taking into account the objective of valuing the available human capital.

Total Population: in this case, it will be necessary to impute wages to the inlabor force, apart from imputing the wages for the unemployed. This implies making hypothesis concerning the valuation of activities which are not intermediated in the market like for example the housewife's and other family members' housework (see the valuation of non-market activities)

The degree of wage imputation is considerable when apart from the unemployed one includes the in labor force in the value of human capital. The inclusion of the unemployed implies a wage imputation to the latter in terms of opportunity cost. On the other hand, in the case of the in labor force and in the case of the demanding part time jobs⁴¹, one assumes that the true opportunity cost or the shadow price of the net worked hours is the hourly wage.

However, as Sherwin Rosen points out in his comments to Jorgenson and Fraumeni (1989), the hourly wage could be non-linear with respect to the labor marginal productivities that it allegedly represents. For the people who have a labor disutility larger than their productivity, for example, graduate female with small children,

⁴¹ Demanded part time jobs: it is made up of workers who work less than 35 hours per week. They wish to work more and are willing to do it.

the hourly wage could be lower than the value of their marginal labor productivity⁴². For example in the case of workaholics it may be that the market wage is higher than their marginal productivity. This causes the case known as selection bias for the people who do not work. It is important to notice that this bias does not affect the market wages of the employed but the wage or shadow price of the inactive people.

Given these objections, it was chosen to present an analysis of the valuation for the available human capital which allows one to value human capital of the labor force with the expected wages' profile and then imputing these same profiles to the unemployed as opportunity costs or "shadow price".

A.1.2 Labor Income

Sources

The main labor income data source is the Household's Permanent Survey (EPH)

However, this source has, as any other income survey, a significant problem of income sub reporting of high income deciles. The latter is verified when one compares labor income in the EPH with the levels of aggregate consumption estimated by National Accounts (74% of GDP in 2004). Labor income declared in EPH is substantially lower to current aggregate consumption level in Argentina.

This income underreporting covers all wage cohort independently of the registration condition and the occupational category of the employed, according to DNCN (1999).

The lack of correction by sub declaration of labor income could be a source of negative biases in the estimations of the level of Wealth and productive human capital.

In order to avoid these biases, in this study it has been chosen to use the correction for income sub declaration by activity sector done by National Accounts in Argentina (based on exogenous sources) for the calculation of the base year 1993, the Primary Income Generation Account (Primary Income distribution) and the Input-Output Matrix 1997⁴³. The adoption of this adjustment to labor income enables an estimation of human capital which is comparable with the main macroeconomic aggregates estimated by National Accounts (GDP, Consumption, Investment, Capital Stock, etc.)

A.1.3 wage price (units of measurement)

The international experience for estimation generally takes into account labor income exclusively, excluding non-labor income (rents, dividends, etc.)

⁴² Or in any other case where there are fixed costs in the labor participation decision or the effect of increasing returns to scale of the marginal labor hours in the production.

⁴³ See DNCN (1999) (2004) and MIP AR (1997). The exogenous sources used to adjust labor income in EPH with sector disaggregation are the average gross remunerations of the Retirement and Pension System (SIJyP), official data on public provincial employment and Military Personnel not included in SIJyP, the general Survey of Household's Spending (ENGH 96) and the production of consumption goods calculated by the flow of goods. A synthesis of the methodology is presented in Box 1.

Conceptually, the value of wealth human capital implies taking into account the present value of income that an individual expects to earn throughout his life. The wage price will vary depending on the economic agent who is making the valuation. If the implicit valuation of human capital is done by the individual itself, then the wage price will correspond to the net wage. This person should also consider the potential accounting of future retirement income or differed wages. If the implicit valuation is done by a bank, in its role of future income estimator as a credit supplier or a firm which is about to hire an employee, the relevant wage price will correspond to the gross wage, including employers' contributions, bonus, indemnities, in other words, labor costs.

However, if we take into account that the contributions to the social security system are a differed wage, the inclusion of this component in the calculation of permanent income of the employed for the wealth human capital, would imply a duplication due to the fact that workers are discounting future retirement income that they will earn in the future in the expected wage at present.

Therefore, in this study labor income was calculated based on weighted average net labor income of all occupational categories, using the information on average net remuneration adjusted by sub declaration of the National Accounts.

Nevertheless, even if the labor income level estimated by National Account was taken into account, this series does not present a disaggregation by gender, age and education group or cohort. This information is fundamental because it is the primary source for calculating relative wage differentials of the different cohorts that integrate the human capital to be estimated.

In this study, relative wages by group were estimated to the reference population taking into account the declared labor income by group according to gender, age and education in the EPH.

The following section presents a synthesis of the method used for estimating relative wages by gender, age and educational attainment.

Box 1: Adjustment of the Labor Income in Permanent Household Survey(EPH) in Argentina

This section presents the procedures used by National Accounts to correct the sub declaration of labor income to make them consistent with Aggregate Consumption levels, as it was presented in section 4.

In order to capture the underground economy, methods like the monetary method or the electrical energy method have been suggested. These methods make a correction for sub declaration of production income and not of labor income at a global or macroeconomic level without taking into account the special features of each sector. The monetary method estimates the sub declared income from the estimation of the money demand for transaction purposes through the assumption of constant monetary circulation speed. The method of the electrical energy assumes that the intensity of the energy that the firms use is relatively constant.

However, none of these methods correct the sub declaration in labor income and they don't take into account the special features of each sector's sub declaration. It is important to make clear that the method adopted by National Accounts (employment method), which is adopted in the present study and summarized in this appendix, enables the correction for sub declaration of labor income taking into account the characteristics of the employed, especially the activity sector to which they belong.

Non response of income

Description

This problem appears when some individuals, despite being employed and having different sources of income, do not declare earned income.

A high and variable proportion of non declared income has been observed, which is higher in the case of free lance workers.

Correction Procedure⁴⁴

An econometric model for labor income is defined for each occupational category. It estimates the determinants of hourly wage income. This model is applied to employed people who declare their income, estimating to which extent each characteristic of the person and job characteristics determine this person's labor income level. These coefficients are then applied to those employed people who do not declare their income level in order to obtain an approximation to their real income.

Income Underreporting

Description

The difficulty arises when a person declares a lower income than he has actually earned. This is a generalized problem, though it is more frequently seen among some types of free lance workers. Particularly, the fact of having higher income variability makes employers and free lance workers sub declare income with higher frequency.

Correction Procedure ⁴⁵

⁴⁴ The methodology of this correction was based in the paper by Sosa W and L Gasparini "Income distribution in Argentina and in Buenos Aires Province". Cuaderno de Economía N°49

The labor income sub declaration for free lance workers is measured comparing the spending declaration of these workers with that of the wage-earning workers. The main assumption is that wage-earning workers do not subdeclare whereas employers and free lance workers do sub declare. If for each level of declared income (and similar family characteristics) free lance workers declare higher spending than wage-earning workers, this implies that they are sub declaring earned income (and not over declaring spending). The obtained coefficients are used to correct income declared to EPH. For this estimation, one also resorts to ENGH96.

Adjustment of the bias caused by non response

Description

This arises when the households who are part of the sample do not respond the survey. There is evidence that non response reaches more than 15% of the sample, though this percentage differs in each wave.

It must be highlighted that EPH re weights its results applying a correction factor for non response to the survey. However, this factor implicitly assumes that incomes of those who do not respond are identical to those of people who do respond. Given that there is evidence that this assumption is not fulfilled, the income of non respondents being higher to that of respondents, there would be a bias which is the one that one wants to adjust.

Correction Procedure.

The non response bias is estimated through the comparison of a sub universe of the Households' Permanent Survey (employed people with main occupation in the private sector, wage earning with retirement discounts) with a specific universe (the jobs declared in the Integrated System of Retirement and Pension SIJyP, excluding the wage earning workers in the Public Sector). This analysis is made comparing the distribution of the income variable of the main occupation of formal wage earning workers with the distribution of SIJP of a comparable concept (the habitual net remuneration of the main job, adding family allocations and subtracting the worker's contributions, extra payments, indemnities and the payment of gains' tax). Both distributions differ, above all in the last percentiles. In order to correct this difference, income of the employed people in the EPH belonging to the last ten percentiles is increased so as to make the distribution of income of formal private wage earning workers in SIJP as similar as possible to the distribution which results from the survey. In this procedure, the wages of workers belonging to the other occupational categories in the private sector are also increased.

⁴⁵ The model used is based on the paper by W.Sosa and V Alaimo "The hidden Economy in Argentina: evidence based in spending surveys" in FIEL The Hidden Economy in Argentina.

A.2 Mincer regressions⁴⁶

The primary data source available in Argentina for estimating the wage profile of the employed by group of gender, age and educational attainment is the EPH. However, this source, like any other income data source, has underreporting problems which can distort the level of the indicators of human capital to be estimated.

For this estimation, the correction of sub declaration of income done by National accounts was taken into account. (see Box 1). These corrections are included in the Primary Distribution of Income Account and GDP, enabling one to obtain human capital indicators, consistent with the main macroeconomic aggregates estimated by National Accounts.

However, the data on wage levels of the National Accounts even if they present a disaggregation by occupational category and sector, they do not present a disaggregation by gender, age and educational attainment, which are the main variables that determine the value of human capital.

Therefore, in this study, even if the levels of labor income come from National Accounts, in order to estimate relative wages by attribute or wage profile, the EPH micro data were used.

This section presents a synthesis of the procedures used to estimate the wage profile of the employed.

The estimations of relative wages by cohort are based on the logarithm of declared equivalent hourly wage for all the agglomerates in the EPH for the employed belonging to all occupational categories which have declared positive hours. This adjustment enables the control of variations which take place in the workers' remunerations as a result of short run situations and transitory decisions. Therefore, the hourly wage is a more adjusted indicator of labor remuneration with respect to monthly wage.

Taking into account the disaggregation of the reference population (section 4.1) it was necessary to calculate relative wages for 700 groups or cohorts which appear from the combination of the gender, age and education attributes.

However, EPH is not statistically trustworthy with such a disaggregation level, both for the reference population and the wages.

In order to estimate the wage profile by group there are two alternatives:

Alternative 1: Increase the level of aggregation in the data

Alternative 2: Estimate the wage profile using an econometric estimation of the Mincer Equation.

Alternative 1 has the cost of losing information and at the same time it has the benefit of obtaining the data directly by tabulation. Even if the human capital

⁴⁶ This section shows the main findings of standard Mincer Regressions (as a first exploratory econometric exercise) that were taking into account in the estimation of wealth human capital.

estimations give similar results independently of the level of aggregation, given that one of this study's aims is to offer disaggregated estimations of permanent income based on the wage profile of the labor force participants, alternative 2 was chosen.

Alternative 2 enables the econometric estimation of the wage profile or relative wages of each cohort, taking into account all the information available in the EPH. At the same time the estimated wage profile is statistically validated using the habitual econometric statistics⁴⁷.

This section briefly describes the Mincer specification for the wage profile and the results obtained in the estimation for Argentina.

The Mincer wage specification assumes that, following the canonical approach to human capital, there is a link between the relative educational attainment and the experience of the employed and their relative productivity. There is also a link between the latter and relative wages.

For this reason, Mincer suggests the estimation of the influence of education and experience on wages through the following equation:

$$\log w = c + \delta_1 age + \delta_2 age^2 + \sum_{i=1}^7 \beta_i educ_i + u \quad (7)$$

w: average hourly wage

educ: maximum educational level attained (1,,7 (see section 1))

c: hypothetical wage of null qualification⁴⁸

u: error term: in a cross section regression it represents heterogeneity which is not captured by exogenous variables included in the regression.

δ_i , β_i : parameters associated to each exogenous variable.

Additionally, this method enables one to study the empirical relevance of the each worker's characteristic or attribute influence on wages.

Notice that unlike the standard specification of the Mincer curves, here an individual parameter for each educational cohort ("spline") was estimated, enabling the identification of the effect of each educational cohort on wages.

The e_i variables are dichotomy, that is to say, they take the value of 1 when the worker has the educational attainment i or zero otherwise. The age variable is continuous and it varies between 15 and 65 as a function of the definition for population at the age of working.

In order to avoid the problem of perfect multicollinearity, the e_7 variable was excluded. The parameters must be interpreted as relative wages by educational

⁴⁷ Estimations were made using a third methodology which enable the estimation of wages through micro simulations of labor income assigning the residual – the proportion of income which is not explained by the model – in a random way. This method gave as a result average wages which were similar to the ones obtained through the regression in Alternative 2, though it presented a variability of wage by age which was continuous and similar to the original series. This methodology was discarded given that the important aim was to correctly estimate average wage by age cohort due to the fact that EPH is representative by age intervals and not by continuous age.

⁴⁸ See Mulligan and Sala i Martin (1997) (2001)

attainment with respect to the excluded cohort.

Notice that experience is captured through age^{49} . The variable age^2 , experience to the power of two, enables one to capture the potential concavity of wages as a function of experience, assuming that even the variable experience has a positive influence on wages, this influence decreases with the worker's age.

The expected sign of all the parameters is positive, except for δ_2 which reflects the concavity of the age wage profile previously assumed.

One of the main results obtained thanks to this methodology is the age wage profile by gender and educational attainment, whose figures and analysis were presented in section 5.3

The following table presents the Mincer regressions for Argentina based on the equation previously presented. The estimation of wage profiles was based on these results. The estimation procedure was Least Squares. The data used came from the EPH 1997, 2001 and 2004 for the waves and quarters cited.

Table 1												
Age Wage profile by gender and educational attainment												
Mincer Regressions												
	MALE				FEMALE							
	1997		2001		2004		1997		2001		2004	
	Coef.	P	Coef.	P	Coef.	P	Coef.	P	Coef.	P	Coef.	P
age	0,060	0.000	0,0590	0.000	0,0617	0.000	0,0611	0.000	0,0527	0.000	0,0571	0.000
age ²	-0,001	0.000	-0,001	0.000	-0,001	0.000	-0,001	0.000	-0,000	0.000	-0,001	0.000
educ1	0,143	0.001	0,203	0.001	0,039	0.000	0,048	0.444	0,078	0.323	0,035	0.718
educ2	0,333	0.000	0,408	0.000	0,246	0.000	0,151	0.014	0,179	0.019	0,173	0.063
educ3	0,493	0.000	0,547	0.000	0,386	0.000	0,292	0.000	0,325	0.000	0,342	0.000
educ4	0,723	0.000	0,768	0.000	0,597	0.000	0,543	0.000	0,600	0.000	0,556	0.000
educ5	0,915	0.000	0,981	0.000	0,837	0.000	0,713	0.000	0,773	0.000	0,769	0.000
educ6	1,341	0.000	1,482	0.000	1,213	0.000	1,070	0.000	1,195	0.000	1,163	0.000
gba	0,435	0.000	0,455	0.000	0,497	0.000	0,461	0.000	0,432	0.000	0,444	0.000
noa	0,102	0.000	0,073	0.000	0,087	0.000	0,119	0.000	0,012	0.645	-0,013	0.628
cuyo	0,091	0.000	0,088	0.000	0,203	0.000	0,129	0.000	0,112	0.000	0,090	0.004
pampa	0,223	0.000	0,242	0.000	0,333	0.000	0,255	0.000	0,223	0.000	0,266	0.000
patago	0,619	0.000	0,612	0.000	0,780	0.000	0,656	0.000	0,538	0.000	0,668	0.000
c	-1,209	0.000	-1,421	0.000	-1,255	0.000	-1,105	0.000	-1,130	0.000	-1,131	0.000
Nro Obsv.	20.790		15.008		14.190		12.496		10.043		9.511	
Prob > F	0,000		0,000		0,000		0,000		0,000		0,000	
Adj R2	0,346		0,322		0,307		0,338		0,318		0,309	

Source: Author's estimations, based on data from the Household Permanent Survey (EPH).

The R2 coefficient expresses the degree in which the exogenous variables included in the regression explain the wage variability: In all cases it attains 30%. The F

⁴⁹ In the empirical literature experience is usually included as Age – Years of Education, discounting the years until the person enters primary school, assuming that the years dedicated to obtaining a degree are completely dedicated to studying and not to working. It is important to point out that this specification does significantly affect the results obtained here.

test indicates that the variables included are jointly significant, that is to say, that the probability of rejecting the null hypothesis of non-significant variables is approximately zero.

All the parameters or coefficients present the expected signs. Additionally almost all the coefficients are significant according to the p values of rejecting the null hypothesis that the coefficients are significant which are lower than 1%. The exception is the case of female with incomplete primary school, where the coefficients are significant at a 5% level for 1997 and 2001 and at 6.3% for 2004.

The parameters indicate the so called returns to education or increases in labor income as a result of the educational attainment attained. In all cases, the returns to education increase each year with the educational attainment.

In the case of Male, the parameters increase between 1997 and 2001, though they decrease in 2004, locating themselves in lower levels than in 1997. In the case of female, the returns path is similar to the men's path, though the levels for 2004 were above the levels for 1997.

The parameters for experience in the case of Male present a relative stability between periods. This is not the case for female whose parameter presents a significant decrease between 1997 and 2001 and a mild recovery for 2004, though it is still lower than that of 1997.

Convexity of age wage profile is also verified to be stable for the three years of measurement for both genders.

Just to give some information, some variables of regional location were added to the regression, which turned out to be significant. According to the canonical approach these variables are not part of the variables which strictly determine the value of human capital in a country. However, these variables express the regional special features where human capital is inserted. Given that they were included as dichotomy variables in the general Mincer equation made for the entire country, these variables do not influence the determination of the wage profile made by education and experience variables⁵⁰. It is deduced that the study of the valuation of human capital at a regional level (and provincial level) is relevant. For this reason, an estimation of wage profiles by agglomerate is planned for the next report.

⁵⁰ The North East is excluded because it is captured by the constant.