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EDUCATION AND WAGES ACCORDING TO REGION, AGE AND GENDER. THE ARGENTINIAN CASE

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Abstract: This work focuses on estimating the Mincer salary equation by segregating the labor market according to the level of instruction, gender, experience and region in order to explain the wage differences and therefore, the inequality. Moreover, it is also desired to find a correlation between the economic cycle and the real wages, tendencies for each variable and the evolution of the Gini index.

The econometric model is estimated by minimum ordinary squares method due to the database number of observations show the characteristics needed to find a coherent and correct output. Dummy variables are used and the age is a proxy variable for the experience. The database was obtained from the "Encuesta Permanente de Hogares" (Permanent home statistics) gathered by Argentine's INDEC (National Institute of statistics).

The main econometric objective is to find a statistic significance of each variable and their relation between the economic cycle. Besides, the economic objective is to analyze the data and bring conclusions about the wage level for each region, the gender gap and specially the relevance of education showed by the levels of instruction.

As a conclusion it was found that education is an extremely determinant factor of salaries and income. Also it was found that between regions in Argentina there are significant differences in wages, moving far from Buenos Aires means lower wages. Regarding the gender gap, it is clear that females earn less, but young females suffer a greater inequality.

Keywords: Education, inequality, gender, wages, income distribution.

Introduction

Jacob Mincer is considered as the founding father of Labor Economics. He was born in Poland, survived the Holocaust and achieved getting his Ph. D degree at the University of Columbia. Even though he did not win a Nobel Prize, he had been Chief at the Chicago School of Economics and elaborated the first theories of Human Capital. Decades ago, when the equation that has his name was first used, the labor market was simpler than now. Men were widely majority, monetary policy was different (gold pattern), and the economic cycle more predictable. Moreover, the education structure has evolved and there are several more careers, masters and skill-development faces. Those are the main reason why the original equation just explained wages with experience and education. With the time, mainly at the U.S.A., race, city size, political party inclinations and gender were also considered.

The equation has been implemented in research papers all over the world due to the desirable characteristics that it has. It is easy to gather the information needed because most of the national bureaus of statistics made wage and working questions in their polls, follows the law of large numbers having a normal distribution and as a result ordinary least squares method can be applied for the regression (most software's use them). A visible

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outcome is that the equation is the most used in OCDE countries and scientist and investigators use the word “mincerized” when any other equation has desirable characteristics too.

They still exist discussions about the wage’s variables that explains it. The most used theory is the one PSACHARAPOULOS and TZANNATOS (1991) published, which includes Mincer’s variables plus gender. Also the Human Capital theory (BECKER 1983) is adopted for the econometric estimation due to its scientific approval through dummy and proxy variables to implement ordinary least squares. Empirical experience provides unbiased, coherent and significant variables (María Teresa BLACONA 2001).

The Econometric Model

Based on BECKER (1983) Human Capital model (education, experience and gender) adding “region” and “labor dependence”. The freedom degrees’ loss is no problem due to the size of the sample and avoid a selection bias.

$$\ln W = \alpha_0 + \beta_1 Education + \beta_2 Gender + \beta_3 LaborDep + \beta_4 Region + \beta_5 Age + \beta_6 Age^2 + \mu$$

W represents wages measured in current US Dollar prices. Due to the absence of negative values logarithms were applied to reduce the variance and obtain accurate estimators (log-linear model with ordinary least square regression). The constant α_0 avoids common origin regression problems. Education was divided in three levels (elementary, high school and college). In Gender males are represented with 1 and female with 2. Labor Dependence was divided in three (independent, employed, high labor dependence). Regions were assigned from northwest to south, from 1 to 6 (Northwest, Northeast, Cuyo, Pampa, Buenos Aires province, Patagonia).

At first instance it is expected to find statistical significance in all variables except labor dependence which is applied for the first time in Argentina and it is unknown. Although the semi-elasticity can be easily find, it is not the study focus of this paper so it is going to be compared qualitatively between periods of time, the economic cycle and the Gini coefficient.

The Argentinian Case

The work was centered on the last 4 federal governments periods (2003, 2007, 2011 and 2015 third quarters) to analyze how the variables change and their relationship with the economic cycle. Into the equation has been added the variables “region” and “labor dependence” (not often used in Argentina). The reason is that Argentina’s working system and laws firmly protects the workers’ rights and have deep economic consequences; the country is the seventh in size in the world and has specialized each region according to the natural resources available, causing big wage differences. In addition, the Gini coefficient has been calculated to measure inequality between regions and its evolution in time. The data used was taken from the INDEC (National Bureau of Statistics).

Macroeconomic data

For further analyses a major economic analyses were needed. The economic cycle was vital for the evolution of the variables and Gini coefficient measure. The GDP and Potential GDP were obtained from the last corrected measure made by the federal government.

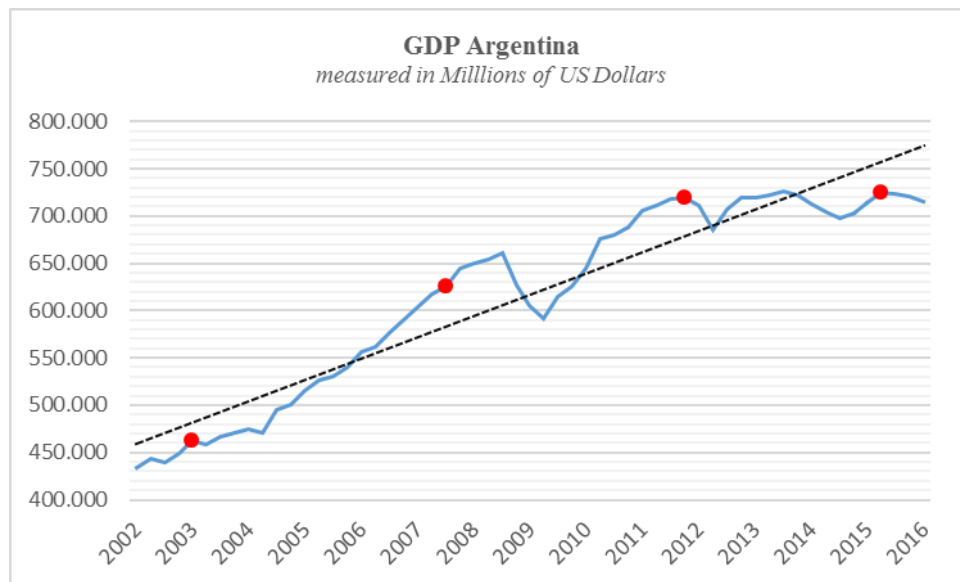


Figure 1. Argentina's GDP. Source: Ministerio de hacienda

In Figure 1 can be observed that the GDP fluctuates as the economic theory indicates. The periods 2003 and 2015 are below the potential GDP, a valley. On the other hand, the 2007 and 2011 periods above, a peak. After the 2002 macroeconomic crises the GDP began recovering, especially due to the commodities higher prices and debt default. Until 2007 the GDP growth was incredibly high, the world economy was growing, the global demand for Argentine products was bigger and the expansionary fiscal and monetary policy. The Financial Crises of 2008 affected the country's exports, but a great deal of domestic consume measures were taken. Finally, in 2011, the country was still growing but at a high price. The monetary expansion was huge and so the inflation rate, fiscal deficit began being unsustainable and the central bank reserves were going down due to a virtual fixed exchange rate. The 2015 period meant an end to the *Partido Justicialista's* government of 12 years, and the outcome of populist measures were visible. The country was at a stagnation-inflation period, with big fiscal issues and the world's economy recovering slowly from the 2008 crises.

To summarize, the economic model began in a valley period, was effective until 2015, when the measures taken had rough countermeasures to be taken in order to fix the economic course. There are two periods of valley and two periods of peak.

Then the Gini coefficient was calculated from the Lorenz curve method. Although the limitations the coefficient has to be compared, it is compared between periods of time to have an idea of the income distribution evolution. The index is between 0 and 1, being 0 perfect equality.

Table 1. Gini coefficient

REGION	2003	2007	2011	2015
ARGENTINA	0,492	0,474	0,487	0,465
NORTHWEST	0,330	0,329	0,393	0,307
NORTHEAST	0,316	0,268	0,306	0,244
CUYO	0,402	0,368	0,374	0,383
PAMPA	0,484	0,462	0,467	0,461
BUENOS AIRES	0,607	0,517	0,507	0,491
PATAGONIA	0,638	0,680	0,671	0,695

The index shows mixed data. There is a notable correlation between the economic cycle and the coefficient (inequality is reduced during economic growth) in the metropolitan area of Buenos Aires, but in the other regions is different. Tax promotions helps some regions, meanwhile others suffer the fixed exchange rate and lose considerably competitiveness for their export.

Wages have, instead, a bigger and clearer correlation with the economic cycle. The country average and the regions have similar behavior.

Table 2. Wages by region

REGION	2003	2007	2011	2015
ARGENTINA	7.775	9.462	9.733	9.049
NORTHWEST	5.618	4.686	7.411	6.994
NORTHEAST	5.578	7.019	7.462	7.188
CUYO	6.511	8.268	8.295	8.133
PAMPA	7.796	9.406	9.653	9.022
BUENOS AIRES	10.225	10.349	10.942	9.285
PATAGONIA	11.523	14.503	14.122	13.713

The economic analyses was crucial for amplifying the outputs given by the econometric data. The continuity of measures implemented directly to improve equality, growth and development have to be studied deeply in order to rate the efficiency of the politics.

Econometric Estimations

The econometric model was worked with the software Eviews 9. The following tables show the outputs from the regressions for each period of time.

Table 3. Output regression by period

2003					2007				
Variable	Coefficient	Std. Error	t-Statistic	Prob.	Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	6,15	0.072211	8521920	0.0000	C	6,81	0.057789	1177852	0.0000
Education	0,23	0.004178	5518538	0.0000	Education	0,22	0.003233	6844791	0.0000
Age	0,07	0.002769	2493035	0.0000	Age	0,07	0.002294	2871265	0.0000
Age2	-0,001	3.19E-05	-2072311	0.0000	Age2	-0,001	2.68E-05	-2524982	0.0000
Region	0,12	0.004001	3006400	0.0000	Region	0,15	0.002852	5175577	0.0000
Gender	-0,46	0.013313	-3487333	0.0000	Gender	-0,54	0.010133	-5281193	0.0000
Labor Dependence	0,13	0.012242	1022356	0.0000	Labor Dependence	0,04	0.009248	4812521	0.0000
R-squared	0.297038		F-statistic	9351664	R-squared	0.329748		F-statistic	1622960
Adjusted R-squared	0.296720		Prob(F-stat)	0.000000	Adjusted R-squared	0.329545		Prob(F-stat)	0.000000
Durbin-Watson stat	1,78				Durbin-Watson stat	1,74			

2011					2015				
Variable	Coefficient	Std. Error	t-Statistic	Prob.	Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	7,04	0.058806	1197100	0.0000	C	6,47	0.054834	1180635	0.0000
Education	0,20	0.003378	5960626	0.0000	Education	0,19	0.003115	6050381	0.0000
Age	0,06	0.002414	2559470	0.0000	Age	0,06	0.002198	2810815	0.0000
Age2	-0,001	2.80E-05	-2222063	0.0000	Age2	-0,001	2.52E-05	-2436268	0.0000
Region	0,13	0.000856	8347784	0.0000	Region	0,11	0.002674	4190705	0.0000
Gender	-0,49	0.010382	-4731265	0.0000	Gender	-0,47	0.009351	-5062820	0.0000
Labor Dependence	0,18	0.009463	1927450	0.0000	Labor Dependence	0,22	0.008761	2518212	0.0000
R-squared	0.229603		F-statistic	1009478	R-squared	0.282011		F-statistic	1330396
Adjusted R-squared	0.229376		Prob(F-stat)	0.000000	Adjusted R-squared	0.281799		Prob(F-stat)	0.000000
Durbin-Watson stat	1,77				Durbin-Watson stat	1,74			

The output regressions show how the Mincer equation adjusts correctly (R-Squared 0.28; Prob (F-Stat) 0). Each variable, including Labor Dependence, are statistically significant and have the expected sign (positive or negative). The results and findings are statistically satisfying.

The research from Luciano DI CRESIA and Alberto PORTO “Gasto Público Social” (2011) helps explaining why Labor Dependence was significant and countercyclical. The fiscal spending in Argentina has grown considerably, and continued until 2016, and near 30% of the whole estate expenditures are assigned to salaries.

The permanent workers in the Argentine estate has been doubled since 2003 and the real wages improved. The legal structure in the country creates a bias towards the employee (especially estate employees) making difficult and expensive to fire an employee. Due to it, the unions succeeded protecting the labor force, establishing a considerable stability for workers, but slowing down the new hiring.

Besides, the Region variable was also significant. As it was explained in the introduction, Argentina has a diversified economic structure. Also it can be seemed that where poverty and inequality is higher, wages are lower (it will be shown further on this paper). In recent literature about georeferentation linked with the economic structure, exchange ratio, fiscal correspondence and federal expenditures show how the income distribution and federal investment is irregularly spent and has historically been disorganized.

Results and Findings

The econometric analysis was not wide in order to focus it on the economic relation. The economic cycle affects directly most of the activities in different ways. Making inferences without the proper data may imply design political measures to contain the economic cycle consequences incorrectly.

Economic Cycle

The following table shows how each coefficient varies according to the economic cycle status.

Table 4. Coefficient behavior according to the economic cycle

VARIABLE	2003	2007	2011	2015
Gini Banco Mundial	0,535	0,474	0,436	0,546
Gini EPH	0,491	0,478	0,471	0,465
C	6,15	6,81	7,04	6,47
Education	0,23	0,22	0,20	0,19
Age	0,07	0,07	0,06	0,06
Age2	-0,00066	-0,00068	-0,00062	-0,00062
Region	-0,46	-0,54	-0,49	-0,47
Gender	0,12	0,15	0,13	0,11
Labor Dependence	0,13	0,04	0,18	0,22

The traditional Mincer equation variables have different correlation with cycle than expected. The C constant behavior means that the wage increases as a result of the economic bonanza. The Education factor, which only takes into account the formal education, has descendant tendency. According to the World Economic Forum's recent reports, the labor market demand is changing, considering not also the college degree but also other skills like idioms, computer related, social networks, multitasking, etc. Argentina is extremely competitive in areas like agriculture research and software development. Adding the new service export structure this new skills explain why the country is also affected by the world's tendency even though in the last years the country partially closed its borders. Experience, represented by Age, has a similar behavior like Education due to the greater management of the recent explained skills that young people has. Also the TIC's and Computing jobs are very well paid in Argentina making the coefficient act this way. The gender inequality has been treated in several laws in the last periods, affecting the coefficient and closing the gap between male and female employees. However, the gap is still big and the legal structure cannot fix it completely.

On the other hand, the added variables had an expected behavior. The region variable is widely cyclical. The Pampa, Patagonia and Buenos Aires regions are benefited by the cycle, having considerable tax cuts when economy is doing well and implemented when the federal government has an increasing deficit. But the rest of the regions suffer the lack of strong markets for their exports and the exchange rate volatility make and amplifying effect on their cycle. Therefore, the previously mentioned lack of federal policies, makes the difference between regions is wide and the variable to behave cyclical. Labor Dependence also showed to be correlated to the cycle but negatively. In periods of prosperity the company's do not have economic stimulus to share the profits with the employees because during valley periods the legislation in labor obliges them to keep the employees on their expenses even if the company may shut and go to bankruptcy. In effect, when the cycle is in a peak moment the Labor Dependence is worst, but the stability during the valley period compensates it.

The next table shows in a chart the behavior of all the variables in order to predict a future continuity and elaborate correct policies.

Table 5. Variables behavior

VARIABLE	BEHAVIOR
Education	Descendant
Age	Descendant
Gender	Descendant
Region	Ciclical
Labor Dependence	Ciclical

Gini Index

It is clear enough to acknowledge that the Gini index has a strong relation with salaries. Part of the income of individuals (most of it) comes from their job. However, the data used in the research refers to income and not just wages, mainly because in Argentina exists a big portion of non-permanent income sources such as housing rental, limited time contracts and season jobs.

The table shows two Gini indexes, one calculated from the data collected and used in the regressions, the other from the World's Bank.

Table 6. Gini index

GINI	2003	2007	2011	2015
Gini Banco Mundial	0,535	0,474	0,436	0,546
Gini EPH	0,491	0,478	0,471	0,465
ARGENTINA	7.775	9.462	9.733	9.049

At first glance it can be seemed that inequality is cyclical. The following table provides a deeper look sorted by region of the index and the average income.

Table 7. Gini index and average income by region

REGIÓN	2003	2007	2011	2015
Argentina	7.775	9.462	9.733	9.049
GINI	0,491	0,478	0,471	0,465
Northwest	5.618	4.686	7.411	6.994
GINI	0,330	0,290	0,343	0,307
Northeast	5.578	7.019	7.462	7.188
GINI	0,316	0,268	0,306	0,244
Cuyo	6.511	8.268	8.295	8.133
GINI	0,402	0,368	0,374	0,383
Pampa	7.796	9.406	9.653	9.022
GINI	0,484	0,452	0,437	0,451
Buenos Aires	10.225	10.349	10.942	9.285
GINI	0,607	0,517	0,507	0,493
Patagonia	11.523	14.503	14.122	13.713
GINI	0,638	0,680	0,610	0,695

Regarding the Gini Index correlation with the economic cycle there are two aspects to take into account. In first place, the regions follow the national tendency, when economy gets better also the inequality and the region inequality. Secondly, the inequality and the general individual income are strictly related, having both the same behavior. In order to expand the certainty for this, a regression analysis was made for Gini Index and Average Real Income.

Table 8. Gini index & average real income regression output

Dependent Variable: AVERAGE REAL INCOME				
Method: Least Squares				
Included observations: 28 after adjustments				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.163.702	8.215.016	1.416.555	0.1685
GINI	17501.20	1.787.456	9.791.118	0.0000
R-squared	0.786651	Mean dependent var		8.918.607
Adjusted R-sq	0.778445	S.D. dependent var		2.451.294
S.E. of regressi	1.153.815	Akaike info criterion		1.700.828
Sum squared r	34613498	Schwarz criterion		1.710.344
Log likelihood	-2.361.160	Hannan-Quinn criter.		1.703.737
F-statistic	9.586.600	Durbin-Watson stat		1.788.594
Prob(F-statisti	0.000000			

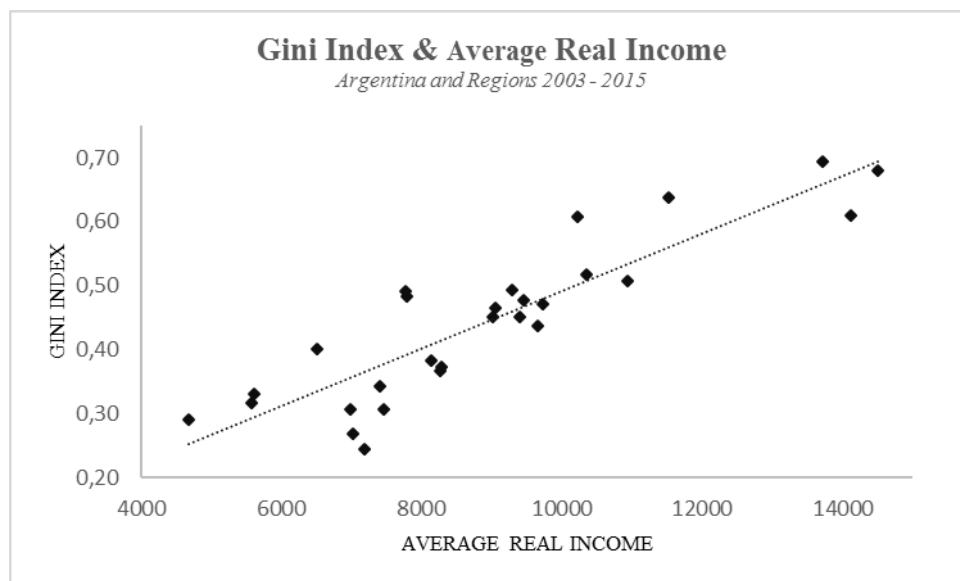


Figure 2. Regression analysis. Gini index & average real income

The regression shows how related the two variables are, the R2 coefficient was 0,786, an statistical high correlation. At higher income average, higher inequality. The highest inequality is in Buenos Aires metropolitan area, were coexists the biggest service indusdry Head Quartes for the country and region, the industrial area and the largest poor areas of the country (including Villa 31). Therefore, high wages and great income distribution issues.

An intuitive answer exists for it. While the average rises, and the basic wage does not in the same proportions, it is clear that the high earners get more and distribution get worse. GASPARINI (2012) researched about this issue and the correlation between education and inequality. He concluded that in Argentina the access to education is not completely equal and it is a big responsible for inequality. In first place, Buenos Aires

concentrates the most prestigious and expensive universities, creating regional differences. On the other hand, certain jobs and companies exclude some universities from their labor force selection.

Predictions

From the econometric coefficients obtained, some predictions were made to show a sample of the relevance that education and gender has in the labor market actually.

Education in Argentina is incredibly cheap and in some areas and universities completely free. Moreover, there are several financial aids besides the free fee. However, the opportunity cost of studying still keeps a big portion of society away from college. The following charts explains how it affects the income earn and the timing of it.

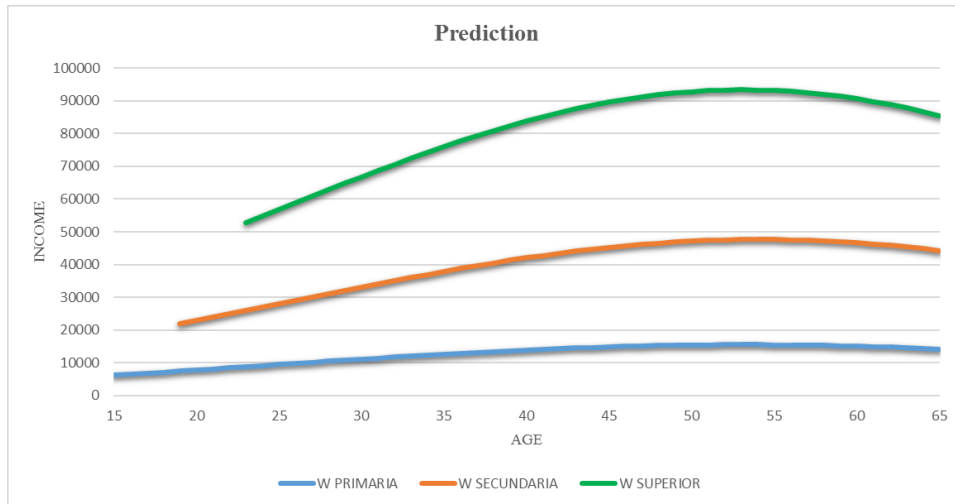


Figure 3. Income according to education level

In the figure can be observed that the biggest gap is between the College degree and the High School. It is a considerable difference, not only in the average wage, also in the maximum wage gain age. The reason why at college degree incomes decreases faster is that the hours worked and the retirement age is earlier due to a bigger saving capacity. Also it can be seen that the working years are less. The entrance to the labor market is later (time spent studying and the opportunity cost is higher) but it is highly rewarded. In this line, Rober LUCAS work on "The Mechanics of Economic Development" reflects education as an productivity engine.

In gender inequality the gap is big in Argentina. Although this period has been well known for working against it, the labor market still has a male bias towards hiring and wages.

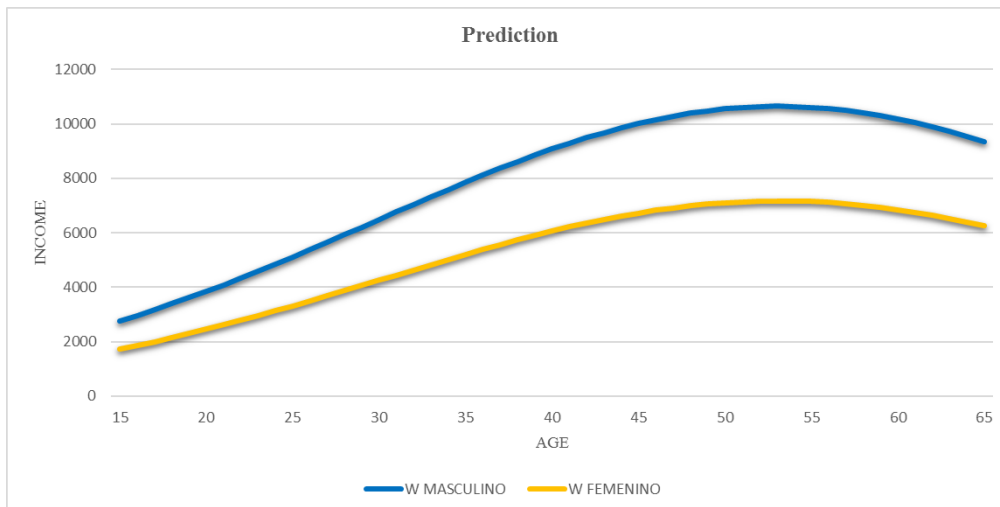


Figure 4. Gender income gap

Some explanations have been provided in several papers. Argentina has a maternity license and it keeps women away from working for a year; it is thought that this makes men have an advantage in company's structure, and gives an economic incentive to recruiters to hire men. Besides from the patriarchal culture that the country has.

Conclusion

After the Macroeconomic and Econometric analysis, it can be inferred how the investment in Human Capital is highly rewarded both for companies and individuals, despite the opportunity cost. Experience is still being considered as an attribute and are reflected in wages. On the other hand, in a dynamic analysis it can be appreciated that the relevance of them are slowing and other skills are beginning to be considered. The gender gap has to be treated more aggressively from the federal government via economic stimulus theory, not only with legislation that sooner or later, the labor market finds a way to avoid it.

Another consideration to take into account is the Labor Dependence behavior regarding the economic cycle. It has been correctly accomplished to insure stability for workers, but the opportunity cost for it is a higher natural unemployment rate, a big young unemployment and higher cost structure; while independent workers and non-regulated jobs earn less due to natural compensation.

Regarding the regional factor, it is clear that regional economies suffer more from the cycle variances, mainly for unregulated and disorganized federal policies. In Argentina the North and West areas are not being take into account for macroeconomic planning.

The Gini index gives a wide specter of the national and local inequality. Disregarding the country has not a serious inequality problem compared to other neighbor countries like Chile and Brazil, inner inequality and a high correlation between the cycle and the income distribution must alert the central government to fix their agenda. Very few measures are implemented to avoid cycle issues, many that can be easily put into practice and it is vital like a saving fund (like Chile's Copper Saving Fund).

Finally, the Development Paradox presented by GASPARINI (2012) alerts that the free education is more a mean than an end and the education monopoly of Buenos Aires principally has to be treated with a long term vision.

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