Wage convergence in Argentinean provinces

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Abstract

This paper analyses Argentinean regional labor markets for the period 1997-2013. It tests regional wage convergence and wage flexibility based on semiparametric estimation techniques. Evidence on wage convergence among Argentinean provinces is found. Wages do not seem to be flexible, depending mainly on the evolution of the average national wage while having small response to changes in local productivity or unemployment. Unions could to be responsible for this process.

Keywords: wages, convergence, wage flexibility, semiparametric

JEL code: O4, R0, E6

Resumen

En este trabajo se estudia el mercado laboral de las provincias argentinas para el periodo 1997 – 2013. Se busca analizar el fenómeno de la convergencia en salarios, y al mismo tiempo, dilucidar el grado de flexibilidad salarial en los mercados laborales provinciales para lo que se utilizan técnicas semiparamétricas de estimación. Se encuentra evidencia de convergencia en los salarios reales en las provincias argentinas para el periodo analizado, y escasa de flexibilidad en los salarios. Esto es, los mismos dependen más de los condicionantes nacionales que de factores tales como la propia productividad laboral o el desempleo local. La influencia de los sindicatos nacionales podría estar detrás de estos hallazgos.

Palabras clave: salarios, convergencia, flexibilidad salarial, semiparamétrica

Código JEL: O4, R0, E6

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I. Introduction

Alberdi wrote a very sharp judgment: "May Revolution of 1810, made by Buenos Aires, which must have the sole object independence (...) regarding to Spain, it also had the object to emancipate the province of Buenos Aires of Argentina or rather to impose the authority of this province to the nation emancipated from Spain. That day ceased the Spanish power and was replaced by the power of Buenos Aires on the Argentine provinces".

Alberdi also expresses, "The May Revolution was made by Buenos Aires and naturally for Buenos Aires; without the provinces and naturally against the provinces" and "(...) the Revolution because of the ambition of Buenos Aires, has created two countries under the guise of one: the state metropolis, Buenos Aires; and the vassal country, the Republic. The one rules, the other obeys; one usufructs the treasure, other produces (...), one has a guaranteed income and expenditure, the other is not sure about his bread. "(Alberdi, 1897) .[2]

Similar judgment comes from Artigas, who as an elderly man, told José María Paz during his "retirement" in Paraguay: "(...) I did the war (...) to centralism, which was far only a step of Hispanic authoritarianism, (...) they wanted to make Buenos Aires an imperial Rome, sending their pro-consuls governing provinces militarily and deprived of political representation" (quoted by O'Donnell, 2006, p. 101/102).

Taking this valuable historical framework, as in other occasions, we have highlighted the phenomenon of external constraint on regional economies. The regional difficulties problem are reflected in its Regional Balance of Payments (RBP). The need to achieve the "external" balance leads to an adjustment of the effective level of income, which eventually gravitates near the income level that balances the RBP (in this we follow Thirwall, 1980) .[3]

In other words, the long-term equilibrium income is one that meets the equilibrium of the RBP. In Thirwall (1980), it stated as simple empirical rule that the growth rate of most countries can be approximated by a relationship between the growth rate of exports and the income elasticity of imports, as growth is restricted by BP problems. Thirlwall says that this rule is much more accurate and strict when applied to regions. A region could not grow faster than what its BP allows, unless it gets a continued extra-region funding (which in this case will come from other regions, for example in Argentina via central government funds).

On many previous occasions, and in order to outline in a simple way the problem we propose a model with two areas, Coastal Industrial Front (CIF) and the Interior Regional Economies (IREs). We call CIF the geographical area of the Pampean coastline, which runs roughly from Santa Fe to La Plata (with a depth inland of about 100/150 kilometers). The rest of the territory we have called IREs. In this way, we mark the spatial duality CIF vs IREs.

[2] Since the scandal generated by some of his opinions, here is another reflection of Alberdi, in the same work, his "Posthumous Writings" (1897): "There are two ways to write the history. (...) forged by history (...) by a kind of political mythology (...) or according to the documents, which is the true history, but that few people dare to write for fear of hurting the vanity of the country with the truth. "

[3] Thirlwall argument that Thirlwall has continued reiterating in McCombie and Thirwall, 1994 and Thirwall, 2002.

For the IREs, the basic problem lies in the tradable sector, where their comparative advantages are insufficiently developed. This is due to wrong economic policies (i.e. a "closed economy" for the purposes of protectionism under the strategy of import substitution industrialization process) that damages their internal terms of trade (relative prices). For example, in the case of Brazil, Baer (1965) demonstrated the existence of strong income transfers from "Nordeste" to "Center-South" due to adverse relative prices for "Nordeste" because of the exchange rate policies.

That is, the economic policies of national (i.e. exchange or foreign trade policy) are not neutral between regions ... will only be so if, in all the cases, the relevant regional parameters ("structure of the region") were essentially equal to the respective national parameters.

In Argentina, the problem of unfavorable relative prices for ERI has attempted to be mitigated by various mechanisms. For example, redistributive and equalizing mechanisms of revenue sharing, attempting a regional or geographical balance. In other words, the search for a geographic convergence in income per capita.

II. A crucial mechanism of convergence: the labor market

The question we ask is why the economic convergence between regions has not operated enough to turn the spatial map of our economy "balanced" (at least in *a socially acceptable* measure).

Key to this problem is the presence of a nationally integrated a labor market perfectly capable of sustaining its mechanisms (wages and conditions) by the area that appropriated the geographical-spatial "surplus", the so-called Coastal Industrial Front (CIF) (acting as a center and operating via relative prices) but not by the region that lost it: the Interior (operating as periphery), Interior Regional Economies (IREs).

But, as we know, in the IREs prevailed an excess of labor supply (the so-called "Lewisian" market) that should have produced a differential wage and, consequently, a differential accumulation, with an expected equivalence of Turgot, leading to differential growth, tending to equalize per capita wage levels among regions.

However, this convergence did not occur for two reasons: a) a migration process; b) the integration of labor markets over time.

Migration from the periphery (IREs) to the center (CIF) decompressed the labor markets of the interior, and prevented the Lewisian mechanism to operate completely. Meanwhile, in the CIF "integrated" market[4], supply deficiencies persisted despite migration. This led to favor a strong and aggressive unionization over time.

[4] Llach, 1988 (Villanueva 1988, p. 4), a labor market is called "baumolian" (referring to William Baumol), due to the particular characteristics of the market (other than a Lewisian market, which is characterized by excess labor supply).

The restrictive policies for agriculture (export sector in which periphery economies are specialized), led to a growth in unemployment in the IREs (including the area called Pampas). As a result of social pressure, the government applied a compensatory fiscal policy (the main demand, was directed to the domestic sector and not to the tradable sector). Therefore, the result of this strategy led to an expansion of public employment in the IREs. All this meant an imbalance of "regional relative prices" that hampered the capacity for expansion of the tradable sector.

Thus, in this historical context, remunerations leave the pattern of productivity fixed by sociological grounds (Villanueva, 88, p. 172).[5] Union pressure causes the integration of markets, especially by expanding public employment and the employees of the interior, in the ERI, took as a guideline benchmark the national public employee salary. In this way, salary is then established institutionally.

In practice, wages in the IREs are lower than wages in the CIF ($W_{IREs} < W_{CIF}$), but without a sufficiently large wage differential, and accompanied with a substantial share of public employment.[6]

On the other hand, the per capita income in the IREs is lower than the per capita income in the CIF ($Y_{IREs} < Y_{CIF}$). In addition, the public employment of the economically active population grows more in the IREs tan in the CIF (Porto, 1986).

Therefore, we can theorize that the whole country forms a "baumolian" labor market, with a different sectoral and spatial segmentation as the represented in the Lewis model. This reality of the labor market prevented (and prevents) the emergence of a wage differential (lower wage in IREs) to compensate for the risk and other incremental costs of that area (i.e. transport costs) and hampers a higher relative accumulation of capital in the Interior than on the coast, in order to encourage a process of convergence.[7] Thus, it can be said that further growth in the CIF becomes inevitable, because of an "efficiency wage" (in the terminology of Kaldor), as well as an "efficiency factor" (defined from WERI <WFIL, but with a much higher productivity in the FIL, with a differential that exceeds wages).

The particularity of labor markets requires further reflection. When there are differences in productivity between areas, the economic disadvantaged areas, to keep employed their less productive resources, devalues its currency. But this alternative is ruled out when we talk about regions belonging to the same country and therefore have the same currency. There are two mechanisms that operate as balancers: a) wage differentials; b) compensatory fiscal mechanisms.

6. Villanueva (1988) presents an equivalent mechanism, although referring to sectoral aspects, from the "structuralist" view, although the authors included as reference are Baumol (1967) and Balassa (1964). Here we apply it to the spatial and geographical view.
For a provincial perspective of relative wages (or wage differentials), at the end of this essay are presented Map A1 and A2, with provincial wages relative to the average (for 1997 and 2009).

[7] El concepto de acumulación de capital en el lenguaje “clásico” se refiere al “excedente económico”, al beneficio (sea normal o sea superbeneficio). Sería lo equivalente a lo que en la terminología neoclásica se denomina ahorro (o inversión, ya que suponemos situaciones de equilibrio, la conocida “equivalencia de Turgot”
The concept of accumulation of capital in the "classical" language refers to "economic surplus", to the benefit (normal or supernormal profit). It is the equivalent of what in the neoclassical terminology is called savings (or investment, as we assume equilibrium situations, the known "equivalence of Turgot".

In order to understand better, it is possible to use a common and brief formalization. According to conventional principles of neoclassical economics, an equilibrium in two regions is assumed when real wage equals its marginal product. In this way an equilibrium is met in the center (W_C / P_C = $PMgL_C$), and in the Periphery (Wp / Pp = PMgLP).

For example, from a hypothetical position of identical productivity, if the Periphery is delayed in the evolution of productivity, -it's loosing relative competitiveness- it can counterbalance this situation with a reduction of wages (in an international framework, a devaluation can be used). If this reduction of wages does not happen, unemployment will occur. Here, the old principle holds that the adjustment either will be via prices (for instance, wages) and / or via quantities (employment).

Figure 1. Behavior wage-employment

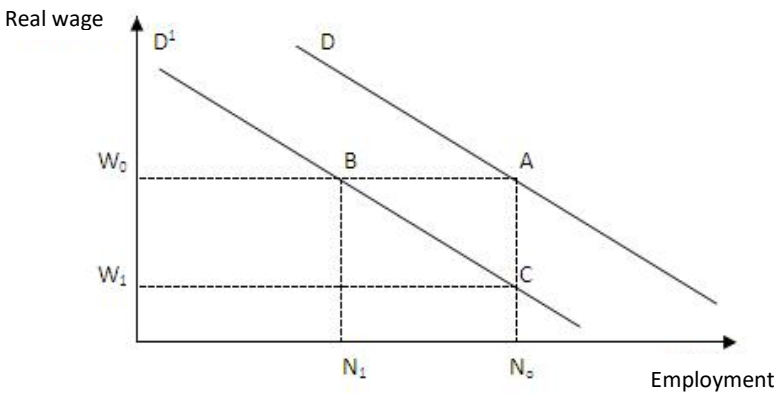


Figure 1 shows that when productivity falls, labor demand curve drops to D1. Faced with the loss of (relative) competitiveness, the periphery (ERIs) has two possibilities: (a) move from A to B, with the same real wage W_0 and less employment; (b) move from A to C, with the same level of employment (N_0), but lower real wages ($W_1 < W_0$).

In the first case, we would be facing a situation of a similar wage across the territory. In other words, there could be wage convergence with employment (or unemployment) divergence. Following our arguments it could be theorized that if, as the evidence indicates, given the existence of differences in productivity, the higher level of convergence in wages, the level of convergence in employment (and eventually product level) will be lower. As we said, this disparity in levels of employment / income per capita will be presented by the existence of different regional productivities, transportation costs, energy costs, etc. This differential facts, as it is evident to all committed observers, are present in Argentina.

The question that arises is: *Is the presence of a convergence in wages "desirable", even with "perverse" differences in other cost elements, such as taxes, transportation, or technology?*

In a first impression for competitive reasons it is desirable, with a view of growth, that less developed regions have lower relative wages (that allows them to make greater extra-region exports). This was the "historical trick" present in Korea, Taiwan, Singapore or China.

Everyone at the time, did the same to offset their disadvantages compared to more developed areas on the world stage. And with this described situation, the greater wage competitiveness, will allow in the future, in the long term, an income per capita convergence.

CONVERGENCE AND WAGE FLEXIBILITY

We have used the term "wage flexibility", as contained in the Spanish literature (i.e. Maza Fernández, 2006) and conceptualizing the degree to which wages are flexible to the conditions of regional markets. That is, we are talking about the degree of presence of "interprovincial wage differentials".

It is expected that a higher wage convergence, will result in lower interprovincial wage differentials (ie, less "wage flexibility"). In other words, this wage flexibility, in theory, would be higher when more intense is the response of the salary of each region to the changes occurring in its own labor market. In short, if the connection between wages and regional unemployment rate, provincial wages and regional productivity, etc. is high, then it might suggest, at least on first analysis, that the results would reveal the existence of a high degree of wage flexibility. On the contrary, if there is no relationship between these variables the conclusion would be different: the labor market is characterized by the existence of wage rigidity. In this case, wages would not respond to provincial labor market itself but to a “single large market " (baumolian).

III. Wage convergence as a particular case

The convergence hypothesis has been studied in Argentina using per capita Gross Geographic Product (GGP) (i.e. Marina, 2001; Utrera and Koroch, 2000, Willington, 1998). As a contribution, in this paper, wages are used to analyze the alleged convergence process. Wages are a better measure of regional income, having a more direct relationship with the living standards that other variables such as GDP per capita. Therefore, we understand that this paper provides a more genuine convergence vision and better understanding of regional disparities in income distribution across the country.

Convergence studies mainly focus on the convergence analysis on growth, and are derived from the Solow-Swan growth model. To put it briefly, that idea already classic, asserts that a beta convergence process implies that a poor country (or region) tends to grow faster than rich one. Thus, the poor country (or region) tends to reach (catch-up) the rich area in terms of per capita income.

Moreover, the traditional literature analyzes complementarily the existence of σ Convergence, commonly associated with a decrease of the dispersion between regions.[8]

[8] However, in a convergence process the SD should decrease if the SD is above its steady state value but it should increase when the initial value is lower than the long-term value. This is to emphasize that a decreasing standard deviation implies convergence only when it is above its steady-state value.

The conventional view of a process called convergence has focused on the evolution of per capita income. Here, as we said, we analyze the convergence in wages.

III.a. Beta convergence

Following the concepts of convergence in growth (see for example Barro and Sala-i-Martin, 1992), it can be said that the average rate of wage growth for the economy *i* can be estimated by the following equation:

$$\frac{1}{T}\left[\ln(w^{i}_{t+T}) - \ln(w^{i}_{t})\right] = \alpha + \frac{1-e^{-\beta T}}{T}\ln(w^{*}_{i}) - \left[\frac{1-e^{-\beta T}}{T}\right]\ln(w^{i}_{t}) + u^{i}_{t} \quad [1],$$

where w^{*}_{i} is steady state real wage, w^{i}_{t} is real wage for province *i* in year *t*, *T* is the number of years considered, and u^{i}_{t} is error term.

Defining: $\alpha + \frac{1-e^{-\beta T}}{T}\ln(w^{*}_{i}) = \theta$, $-\left[\frac{1-e^{-\beta T}}{T}\right] = \gamma$, the equation to estimate is:

$$\ln(w^{i}_{t+T}) - \ln(w^{i}_{t})) = \theta + \gamma \ln(w^{i}_{t}) + u^{i}_{t} \quad [2],$$

where θ summarizes the information regarding the steady state, and beta coefficient is calculated by $\beta = -\frac{\ln(1+\gamma)}{T}$.

For the existence of beta convergence, a negative relationship between the growth rate of wages and its initial level is needed. Parameter γ has to be negative and significant at conventional levels. As can be seen in Table I, the Argentine provinces evidence a process of wage convergence in the period 1997-2013.

Table I. Beta Convergence

	All provinces	**Without Patagonia**
	Coefficient (Std. Err.)	**Coefficient** (Std. Err.)
Estimated Beta	**0,0329915**	**0,04841418**
Log. initial wage (¥)	-0.0304141♦ (0.0159467)	-0.0429999* (0.0187231)
Constant (θ)	0.1007957* (0.0453333)	0.1332978 * (0.0524448)
N	312	247
Wald	♦	*

♦p<0.1,* p<0.05, ** p<0.01, *** p<0.001.
Patagonia: Río Negro, Neuquén, Chubut, Santa Cruz, Tierra del Fuego.

Beta provides a measure of the speed of convergence or divergence of the wage distribution. When Beta is positive, the growth rate is a decreasing function of the level of wages. This implies that, ceteris paribus, wages in regions with lower wages grow faster. The higher this ratio, the faster it tends to close the gap between "rich" and "poor" and therefore regional disparities will be reduced.

On the other hand, if Beta is negative, the growth rate is higher in regions with higher initial level of wages, resulting in a steady increase in the level of inequality.

The estimated value of β (Table I) implies a speed of convergence of about 3% yearly. Consequently, it would be required twenty one years to cover half of the distance that separates the provinces to its own steady state [9].

In the last column of Table I, the values obtained are reported excluding the Patagonian provinces data. This differentiation is due to the analysis of sigma convergence (presented in the next section), that suggests a different behavior when the provinces of Patagonia are excluded. When the provinces of Neuquén, Río Negro, Chubut, Santa Cruz and Tierra del Fuego are excluded, the values obtained reflect greater convergence: a speed of convergence of almost 5% a year, and therefore a lower number years needed to achieve their particular steady state (fourteen years for half of the distance to the steady state).

III.b. Sigma convergence

The degree of difference between geographical areas can be measured by the variance or the standard deviation (SD) in the group of a particular economic variable (e.g. income or wages). Its evolution, or dynamic perspective, is called sigma (σ) convergence.

The interpretation of the sigma evolution is conditioned to its long term value. In a convergence process the SD should decrease if the SD is above its steady state value but it should increase when the initial value is below the long term value. This is to emphasize that a decreasing standard deviation implies convergence only when the variable is above its steady-state value.

The existence of beta convergence between the provinces (i.e. the provinces of lower wages tend to grow higher than those of higher wages), should tend to generate convergence sigma in the provinces, although this process can be counteracted, among other factors, by new shocks that tend to increase the dispersion again (see Barro and Sala-i-Martin, 2004, p. 462 for further explanation regarding the relationship between the two types of convergence[10]).

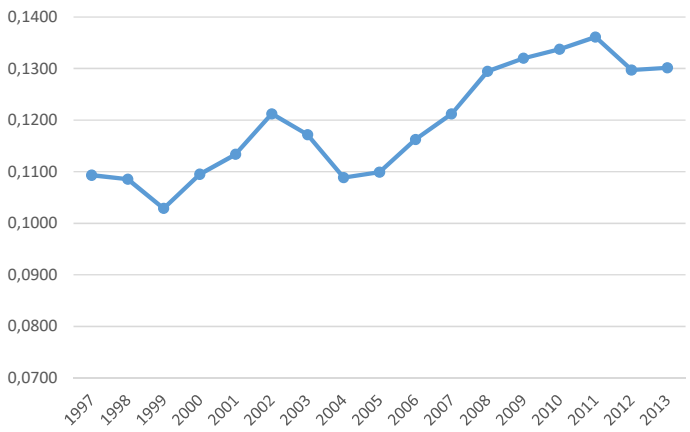
However, in our work, according to the analysis of σ convergence, during the analyzed period a divergence process is verified. That is, if we take all the provinces, dispersion of real wages has increased (Figure 2.a.). The same result is observed working with the coefficient of variation (Figure 2.b) instead of the SD.

As it can be observed, disparities have increased significantly, as the value of the SD increased by 20% between 1997 and 2013. This, however, does not contradict the finding of beta convergence. Indeed, the presence of beta convergence does not imply the presence of sigma convergence. In other words, the beta convergence is a necessary but not sufficient condition for sigma convergence (cfr. Barro and Sala-i-Martin, 2004).

[9] If we define the number of years as "h", it can be easily calculated according to the expression: $e^{-\beta h} = 1/2$.

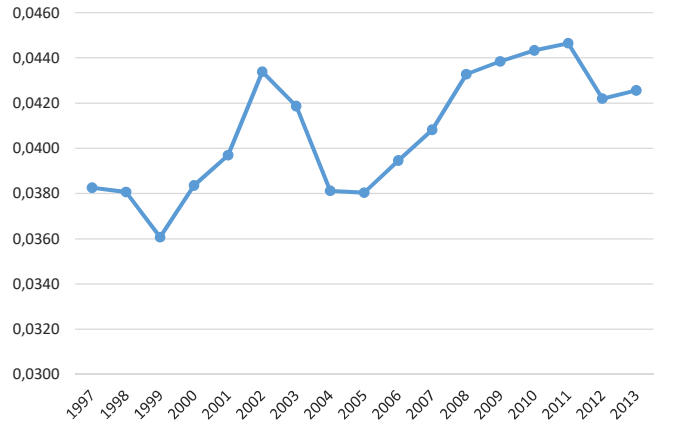
[10] Barro y Sala-i-Martin (2004), p. 462 “Convergence of the first kind (poor countries tending to grow faster than rich ones) tends to generate convergence of the second kind (reduced dispersion of per capita income or product), but this process is offset by new disturbances that tend to increase dispersion”.

Figure 2.a. Sigma convergence:
SD log10 of real wage (1997-2013)



Year	SD Real wages
1997	0,1093
1998	0,1086
1999	0,1029
2000	0,1095
2001	0,1134
2002	0,1212
2003	0,1172
2004	0,1089
2005	0,1099
2006	0,1163
2007	0,1212
2008	0,1294
2009	0,1320
2010	0,1337
2011	0,1361
2012	0,1297
2013	0,1301

Figure 2.b. Sigma convergence:
Coefficient of Variation log10 of real wage (1997-2013)

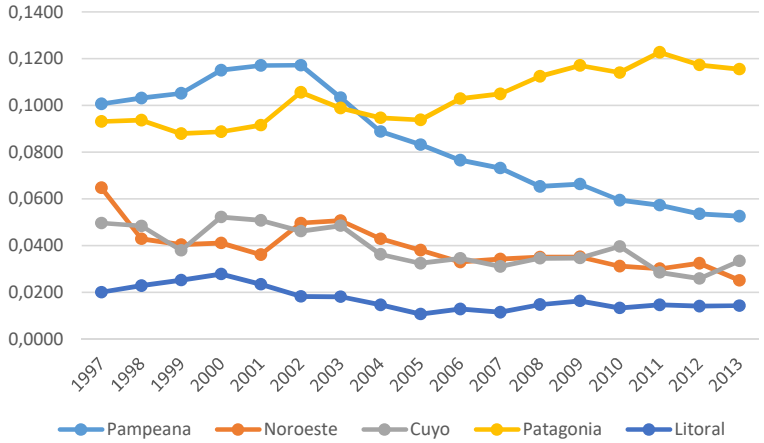


Year	CV log10 Real wages
1997	0,0383
1998	0,0381
1999	0,0361
2000	0,0384
2001	0,0397
2002	0,0434
2003	0,0419
2004	0,0381
2005	0,0380
2006	0,0395
2007	0,0408
2008	0,0433
2009	0,0438
2010	0,0443
2011	0,0446
2012	0,0422
2013	0,0426

Indeed, if we look at the process of sigma convergence of all the 23 jurisdictions, but now at intra-regional level, a process of wage rapprochement is observed within each region. The most notable case is the convergence between the Pampean provinces (the indicator changes from 0.10 to 0.057) and Northwest Region provinces. The exception to this general behavior is the Patagonian region[11].

[11] See Appendix maps, where it is showed that Patagonian provinces has increased its wage differential compared to the average.

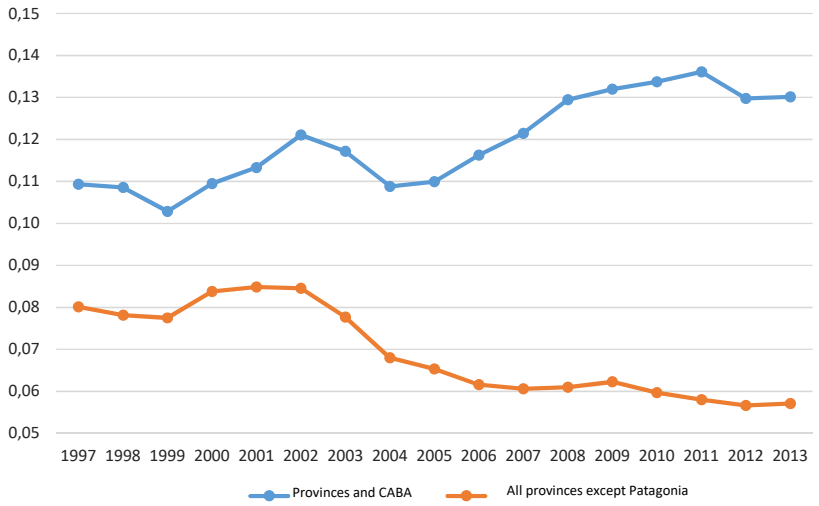
Figure 3. Sigma convergence by regions
SD log10 real wage (1997-2013)



Note: Regions are defined as:
Pampean: C.A.B.A., Buenos Aires, Córdoba, Entre Ríos, La Pampa, Santa Fe; **North-west**: Catamarca, La Rioja, Salta, Jujuy, Tucumán, Santiago del Estero; **Cuyo**: Mendoza, San Juan, San Luis; **Patagonia**: Río Negro, Neuquén, Chubut, Santa Cruz, Tierra del Fuego; **North-east**: Formosa, Chaco, Corrientes, Misiones.

In fact, when the analysis of sigma convergence excluding the Patagonian provinces is done, the situation for the provinces changed significantly: the observed phenomenon of increased variability in real wages in the provinces changes to a decrease in interregional dispersion of real wages. That is, there is a sigma convergence evidence (Figure 4).

Figure 4. Sigma convergence with and without Patagonia (1997-2013)



If, instead of inspecting the convergence sigma via the SD or CV, we do it through another inequality index, such as the Gini Coefficient (GC), the conclusions are the same: if all provinces are considered, there has been divergence between 1997 and 2013 (the GC of 0.142 in 1997, reaches a level of 0.168 in 2013); but if the Patagonian provinces are

excluded, the GC reveals a convergence (from 0.101 in 1997 to 0.032 in 2013) (Figure 5.a and 5.b).

Figure 5.a. Gini coefficient provincial real wage (1997-2013)

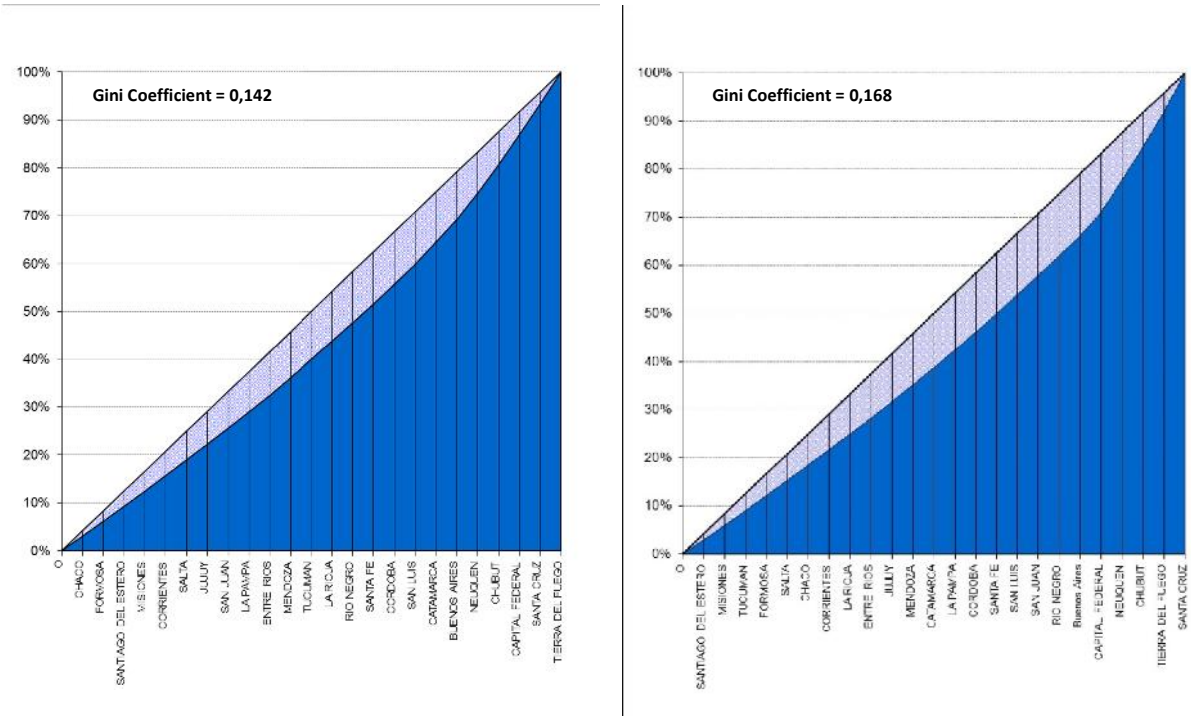
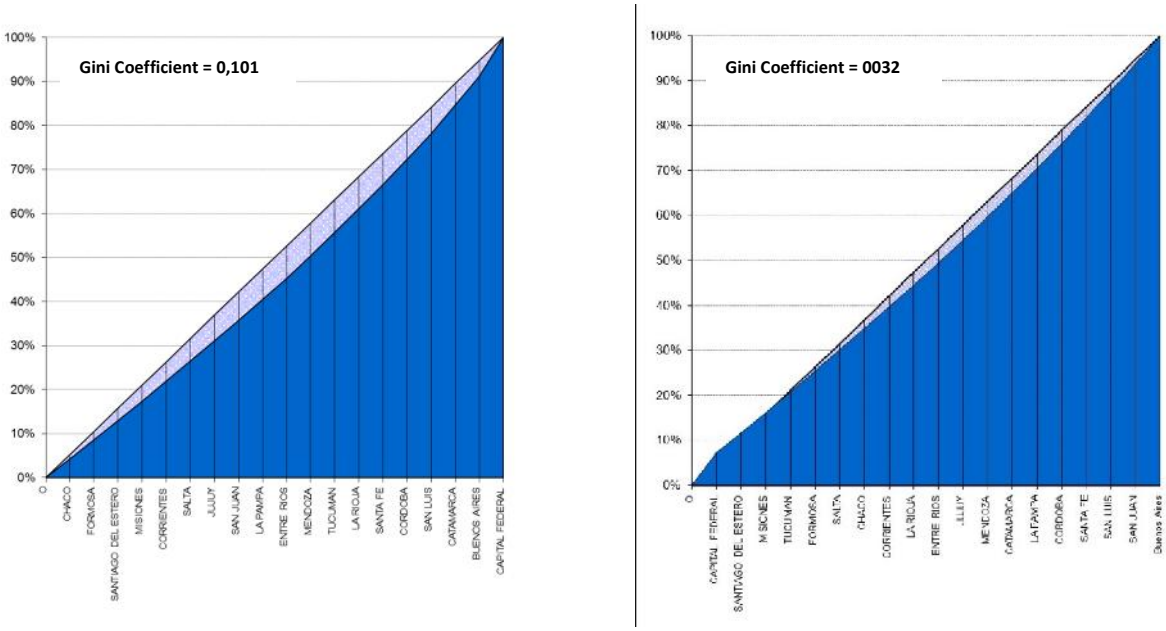


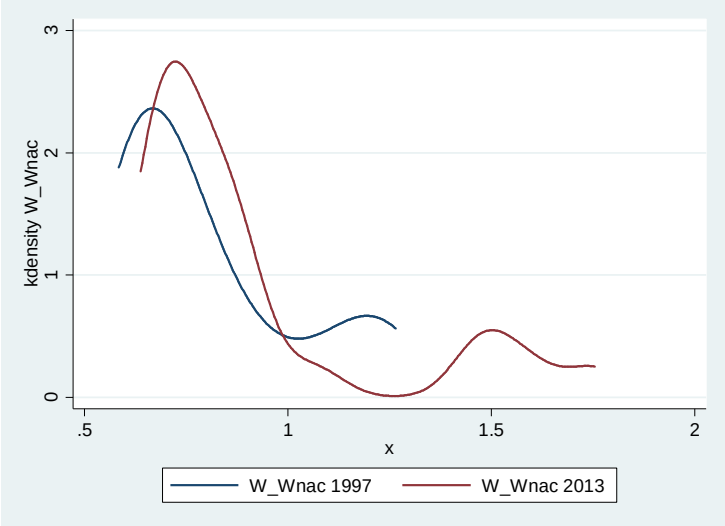
Figure 5.b. Gini coefficient provincial real wage (1997-2013)– Without Patagonia



We can also analyze the density function of provincial wages relative to the mean. The density function estimated is in line with theoretical and empirical findings on income distribution at worldwide level (i.e. in Quah, 1996) and at national level (Arrufat, J., A. Figueras, V. Blanco and M. de la Mata, 2005).

In these studies, the presence of a particular phenomenon is observed, the "existence of two peaks" in distribution. Similarly, in our study we found that this fact is becoming more pronounced: the peaks have sharpened. In Figure 6, the density functions are presented in two selected years of the period under study, 1997 and 2013. As it can be seen, the two "peaks" around which "observations" focus are accentuated in 2013.

Figure 6. The two peaks phenomenon



IV. Another contrasting element: wage flexibility

Wage convergence is linked to the degree of wage flexibility present in each jurisdiction: lower flexibility is associated to a greater the convergence process. This would be the case of a "unified market", nationally integrated and not segmented labour markets, where their payment levels depend particularly on "national values" (values defined or traded in the central regions).

A process of Beta convergence in wages, as we have observed for the Argentine provinces, could not be accompanied by a flexible wage bargaining, since the presence of a regional wage flexibility would imply that the evolution of real wages is linked to the own particular situation of the provincial labor market (linked to both the own unemployment rate and the evolution of labor productivity).

To support this argument, in this section, following following Maza Fernandez (2006) to analyze wage flexibility we estimate a model of wage:

$$\dot{\omega}_t^i = \alpha^i + \beta_1 \dot{\bar{\omega}}_t + \beta_2 \dot{u}_t^i + \beta_3 \dot{\omega pub}_t^i + \beta_4 \dot{P}_t^i + \beta_5 \left(\frac{\omega^i}{\bar{\omega}}\right)_{t-1} + \varepsilon_t^i \quad , \qquad [3],$$

where the growth rate of provincial real wages ($\dot{\omega}_t^i$) depends on factors specific to each province (α_i) and on growth rates of the national average wage ($\dot{\bar{\omega}}_t$), on provincial unemployment ($\dot{u}_t^i$), on provincial public wages ($\dot{\omega pub}_t^i$), and on specific productivity of each province ($\dot{P}_t^i$); and one the ratio of provincial wage to the national average wage, lagged one period, $(\omega^i / \bar{\omega})_{t-1}$.

The estimation of Equation 3 allows to evaluate the flexibility of wages observed in the Argentine provinces. In the above equation, if the evolution of the national average wage ($\dot{\bar{\omega}}_t$) exerted a great influence, wage negotiations would be rather stiff, and in each of the provinces increases in real wages of similar proportion should be observed, with no major differences between them and regardless of their particular situation in terms of unemployment and productivity. Meanwhile, if wage negotiations were flexible enough (autonomous) in each of the provinces, wages would be determined by unemployment and productivity of the region.

Table 2 shows the estimation of the model shown in Equation 3. As is appreciated, the factor that exerts a greater relative weight on the evolution of the wage of each province is the growth rate of the national average wage (coefficient 1.00422), suggesting the existence of a certain rigidity in provincial labor markets.

Table 2. Wage flexibility model. Fixed Effects Estimation by province for the period 1997-2013

	All provinces		Without Patagonia	
Dependent variable: $\dot{\omega}_t^i$	**Coefficient** (Std. Err.)	**Coefficient** (Driscoll-Kraay Std. Err.)	**Coefficient** (Std. Err.)	**Coefficient** (Driscoll-Kraay Std. Err.)
tasawnac ($\dot{\bar{\omega}}_t$)	1.00422*** (0.0351881)	1.00422*** (0.0732884)	1.046109*** 0.0357426	1.046109*** 0.072719
tasa_u ($\dot{u}_t^i$)	-0.0171245♦ (0.0087467)	-0.0171245* (0.0081885)	-0.0225695** 0.0085263	-0.0225695* 0.0083789
tasawrpub_m ($\dot{\omega}$ $_t^i$)	0.0467257** (0.0177359)	0.0467257 (0.0333972)	0.0386843* 0.01765	0.0386843 0.0336256
productivity ($\dot{P}_t^i$)	-0.0056207 (0.0047818)	-0.0056207 (0.0035498)	-0.0032123 0.0051791	-0.0032123 0.0043585
L1.W_Wnac $(\omega^i/\bar{\omega})_{t-1}$	-0.0950932** (0.0295704)	-0.0950932* (0.0434709)	-0.2878745*** 0.0626774	-0.2878745* 0.112298
_cons	0.0777583** (0.0235229)	0.0777583♦ (0.0387112)	0.2065564*** 0.0445895	0.2065564* 0.0822735
N	301	301	248	248

♦p<0.1; * p<0.05, ** p<0.01, *** p<0.001. Std. Err. in parentheses.

As it was mentioned above, the more intense the response of the salary of each region to the changes occurring in its own labor market the more flexible it will be (and lower the convergence process between provinces). In this case, productivity is expected to be of importance in each market. The estimate is not significantly different from zero, denoting certain rigidity in labor markets.

The public sector wage (0.0467257) exerts a significant influence on the evolution of wages. This wage could be following a national trend – and is sometimes referred to as a national reference.

Although its sign is the expected (the higher the unemployment growth rate the lower the wage growth rate), the influence of local unemployment is relatively low (-0.0171245),

The relationship found between wage growth and **the lagged ratio of the average province wage relative to average national wage** (-0.0950932), reinforces the convergence findings of the previous section. This, combined with the fact that the growth rate of provincial wages responds to a lesser extent to each province's inherent conditions, and it fails to reflect changes in productivity, may be because wages depend on institutional factors (for example, the undeniable weight of national unions and centralized bargaining, which have a strong presence in Argentina).

The above is confirmed by the values presented in the last two columns, where the reported values are obtained excluding the Patagonian provinces. This step is undertaken given that in the Sigma Convergence analysis, there has been a clear convergence once excluding the Patagonian provinces. The coefficients reported for each one of the statistically significant variables are higher than in the case where all provincial jurisdictions are included. These higher values of coefficients suggest that the degree of 'flexibility' is lower when the Patagonian provinces are excluded, which is in perfect line with the hypothesis and with the Sigma Convergence analysis.

The lack of response of wages to productivity could be because increases in efficiency have effects on wages only when productivity gains were very high (ie, a nonlinear effect that the presented estimate being parametric would not capture). In this sense, one can say that a high degree of connection between wages and regional productivity may indicate a high degree of wage flexibility in provinces. And, if there was no relationship between these variables, the labor market would be characterized by the presence of wage rigidity in regional labor markets, and responding relatively more to national trends.

V. Productivity-wage relationship

V.a. Non parametric analysis

According to what was pointed out in the last paragraph of the previous section, another possibility of modeling is considered: a semi-parametric model. That is, we conduct a non-parametric analysis in order to examine the relationship between the evolution of the real wage and the rate of change of productivity, as an approximation to rigidity (or flexibility) of the labor market. Specifically, we estimate the function of two-dimensional non-parametric density between the two variables, using Gaussian kernel with optimal bandwidth according to the method of Silverman. The obtained results are shown in Figures 7 to 9.

In Figure 7, the growth rate of provincial real wages is represented in the Y axis, and the rate of growth of productivity in the X-axis, resulting in a projection level curves of the probability density for each point in the space on the X and Y axes (in level curves). In Figure 8, the same set of variables are presented, with a parallel cut to the X and Y axes of three dimensional form, where the Z axis represents the conditional distribution of the rate of growth of wage for a value of the rate of change of productivity. A priori, if the kernel (the probability mass) is placed over the vertical, one can say that there is no relationship between the two variables. Conversely, if the kernel lies along the diagonal, one can say that there is a clear (positive or negative, depending on the direction) relationship between both variables.

Figure 7: Stochastic Kernel among real wage and productivity growth rate (histogram and density contour)

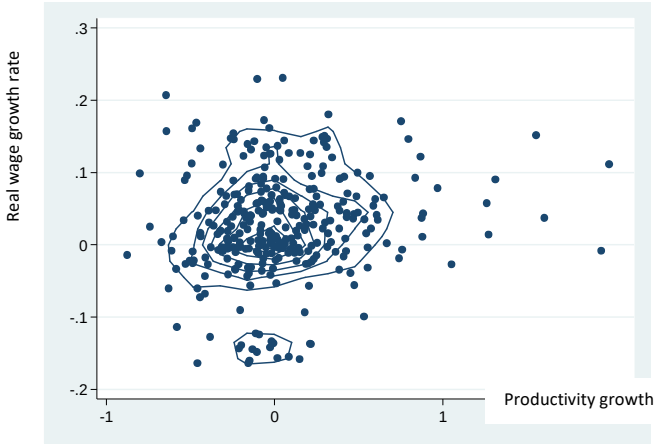
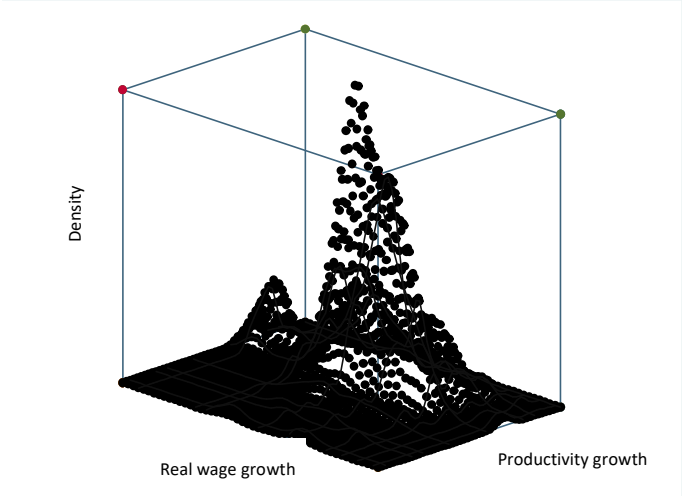
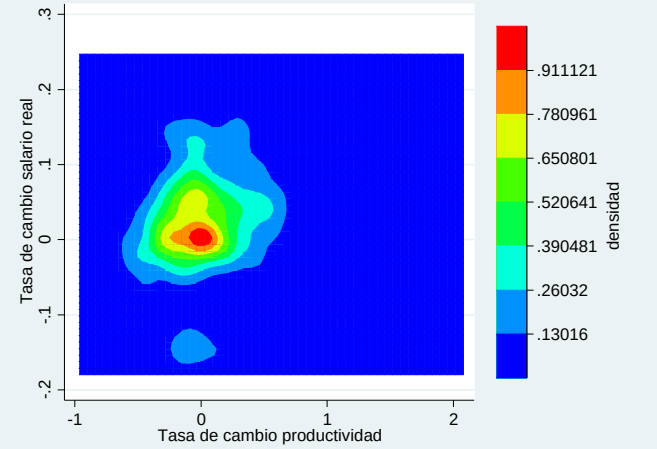


Figure 8: Stochastic Kernel among real wage and productivity growth rate (histogram and density level curves)



None of the plots evidence a clear relationship between wages and productivity. One can say, at least in a preliminary way, that the labor market does not denote a relationship between wage growth and productivity growth.

Figure 9: Stochastic Kernel between the real wage growth and productivity growth (density contour)



Note: The scale level values correspond to the inverse of the density.

V.b. Semiparametric analysis

According to Moral-Arce and Maza Fernández (2010), semi-parametric techniques combine the main advantages of the previous methods: easy interpretation of results and greater flexibility in some features of the model (Li and Stengos, 1996; Li and Hsiao, 1998; Chen et al., 1998; and Baltagi and Li, 2002).

A linear regression $Y = X'\beta + \varepsilon$ is parametric, since $E(Y|X) = X'\beta$, while a semi-parametric model can be interpreted as the sum of a part estimated parametrically and a purely non-parametric part .

Let's consider $Y = \lambda(Z) + X'\beta + \varepsilon$, so that $E(Y|X,Z) = \lambda(Z) + X'\beta$, where λ and β are unknown, being $\hat{\lambda}(Z)$ the non-parametric (kernel and local polynomial) estimator of the function $\lambda(Z)$, obtained with bandwidth *h*.

The semi-parametric panel data model is the following:

$$\dot{\omega}_t^i = \alpha^i + \beta_1 \dot{\bar{\omega}}_t + \beta_2 \dot{u}_t^i + \beta_3 \dot{\omega pub}_t^i + \beta_4 \left(\frac{\omega^i}{\bar{\omega}}\right)_{t-1} + \lambda(\dot{P}_t^i) + \varepsilon_t^i \quad , \qquad [4],$$

Table 3. Semi-parametric estimation of wage flexibility for the period 1997-2013

	All provinces	**Without Patagonia**
Dependent variable: $\dot{\omega}_t^i$	**Coefficient** (Std. Err.)	**Coefficient** (Std. Err.)
tasawnac ($\dot{\bar{\omega}}_t$)	1.061598*** (0.0269975)	1.101988*** (0.0256074)
tasa_u ($\dot{u}_t^i$)	0.0021919 (0.0060757)	-0.0001247 (0.0058088)
tasawrpub_m ($\dot{\omega}$ $_t^i$)	0.0300709♦ (0.0169186)	0.0298202♦ (0.0165514)
L1.W_Wnac $(\omega^i/\bar{\omega})_{t-1}$	-0.7824343*** (0.0661353)	-1.158724*** (0.0857898)
N	276	228

♦p<0.1; * p<0.05, ** p<0.01, *** p<0.001. Std. Err. in parenthesis

Figure 10: Nonparametric estimation of $\lambda(\dot{P}_t^i)$ – all provinces

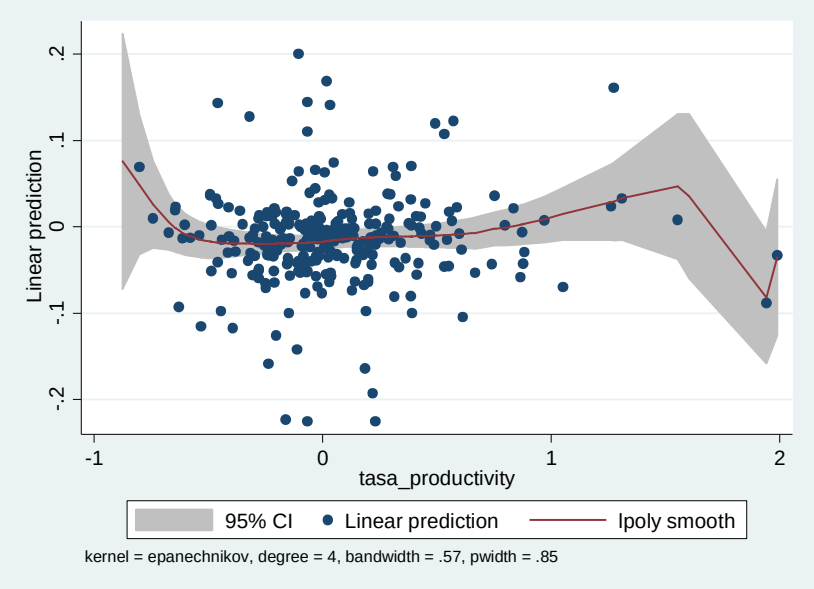
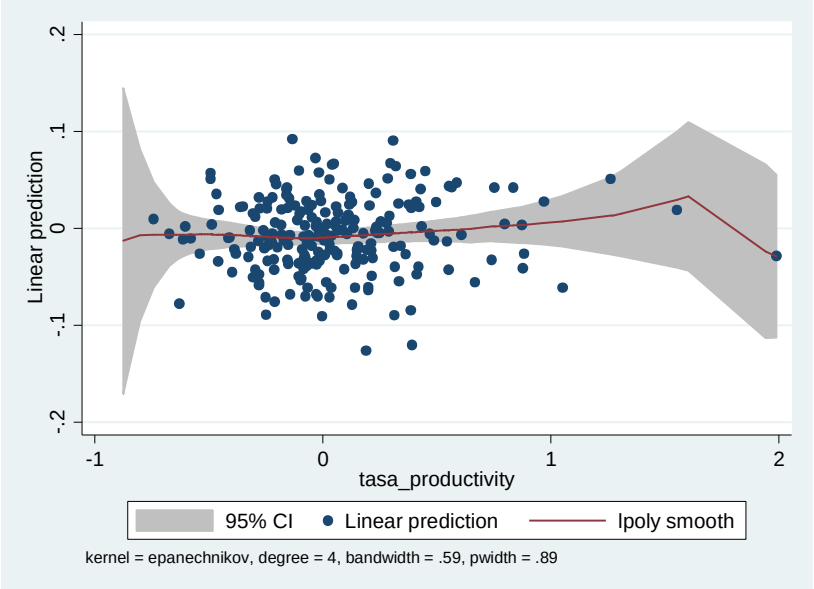


Figure 11: Nonparametric estimation of $\lambda(\dot{P}_t^i)$ – Without Patagonia



The estimation results are presented in Table 3. Once again, the factor that exerts a greater weight on the evolution of the salary for the provinces is the national average wage as it is shown in its associated coefficient (1.061598). This result reinforces the finding of lack of flexibility in wages, in line with the convergence finding. That is, the evolution of wages depends more on national conditioning factors than on provincial factors.

In fact, when analyzing the influence of other variables on the provincial wage growth, it is observed that the provincial unemployment is not significant. Also, the public sector wage variable in the public sector is significant. It could be that this wage incorporates more the impact of what happens at national level than at provincial level (i.e. the undeniable weight of unions and centralized bargaining).

As in the case of the parametric estimation, the relationship between wage growth and **the lagged ratio of the average province wage relative to the average national wage** is negative and significant (-0.7824343), in line with the convergence hypothesis.

Concerning the non-parametric variable, Figures 10 and 11 show that, indeed, the influence of provincial productivity over provincial wages is almost zero, confirming the hypothesis of rigidity in regional labor markets, which is a condition for the existence of beta convergence between wages.

As in the case of parametric modeling, in this semi-parametric model, significant coefficients are higher when excluding the area of Patagonia. This reaffirms a lower degree of flexibility (or differentiation) in labor markets of non-Patagonian provinces.

VI. Conclusions

This paper is focused on the study of wage convergence among Argentinean provinces during the period from 1997 to 2013. Two key aspects of the labor market are studied: on the one hand, the convergence of wages (Beta and Sigma); and on the other, the degree of wage flexibility (or wage differential) in provincial labor markets.

Beta convergence analysis shows that in the case of the Argentine provinces there is a process of convergence in real wages at an annual rate of 3% that leads the provinces to cover half the distance to each own steady state in twenty years.

Sigma convergence analysis, in turn and without being incompatible with beta convergence results, does not indicate convergence between all the 23 jurisdictions. However, in the intra-region study, a clear convergence is detected for all regions, particularly in the Pampean region, with the only exception of the five Patagonian provinces.

Following Maza Fernandez (2006), another element is added to contrast homogeneity in provincial wages: the study of wage flexibility, which is a way to find evidence of wage differentials among provinces.

The analysis of wage flexibility confirms that the evolution of provincial wages is strongly linked to the evolution of the national average wage and on a much lesser extent to the evolution of the unemployment rate in each province, while the influence of the provincial productivity on provincial wages is not significantly different from zero, confirming the hypothesis of rigidity in regional labor markets.

Wage flexibility in the provinces of Argentina appears to be quite limited, which would in turn indicate that wages respond rather to institutional factors (the discussions and wage union agreements that are usually national, which in turn overrepresents what happens in the big littoral labor markets) than to factors inherent to the provincial labor markets.

Therefore, although the Argentinean provinces have reduced wage differentials in the labor markets, this trend does not result from the labor market situation of each of the

provinces but from national trends, showing signs of responding to *a unique large market*, influenced by the weight of unions and centralized negotiations.

According to what was detected in the analysis of sigma convergence (cfr. Figure 4), we proceeded to study the behavior of the markets of non-Patagonian provinces. There we found clear signs of much lower wage flexibility than when working with the complete set of provincial jurisdictions.

To allow the possibility that wages depend on productivity not linearly, a semi-parametric model was estimated. The estimation shows similar results to the parametric estimation.

In order to close these reflections with economic policy, and paying attention to the problem of regional competitiveness, and since the convergence per capita income has not yet been reached, we can say that homogeneity in wages would hamper the process of long-term convergence. This is due to a loss in competitiveness for those remote regions (with higher freight costs and lag behind in productivity). In other words, we understand that precisely wage differentials in the short term, tied to productivity and the conditions of each provincial market, are the ones that would contribute to a more genuine long-term convergence both in wages and income per capita (and hence, in living standards).

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Appendix

The sample corresponds to the 23 Argentine provinces and the autonomous city of Buenos Aires (CABA). The period of analysis is 1997-2013. The lack of availability of updates to the series prevented us to take a longer period of analysis.

In the case of Beta convergence estimation, the dependent variable is five-year rate of growth in real wages. The definition isT = 5 -see Equation 1 and 2. To estimate the model of wage flexibility, the growth rate is estimated yearly, to capture the dynamism in wage negotiations - see Equation 3 and 4.

Data Sources

Wages: Average Remuneration of registered private workers, drawn from Observatorio de Empleo y Dinámica Empresarial - DGEYEL - SSPTYEL – based on SIPA. Ministerio de Trabajo Empleo y Seguridad Social.

Unemployment: Unemployment rate per province, from Encuesta Permanente de Hogares (EPH) (Base Individuos), Instituto Nacional de Estadísticas y Censos.

Prices: Índice de Precios al Consumidor (IPC), Instituto Nacional de Estadísticas y Censos (INDEC), concatenated with IPC San Luis for the period 2007-2013.

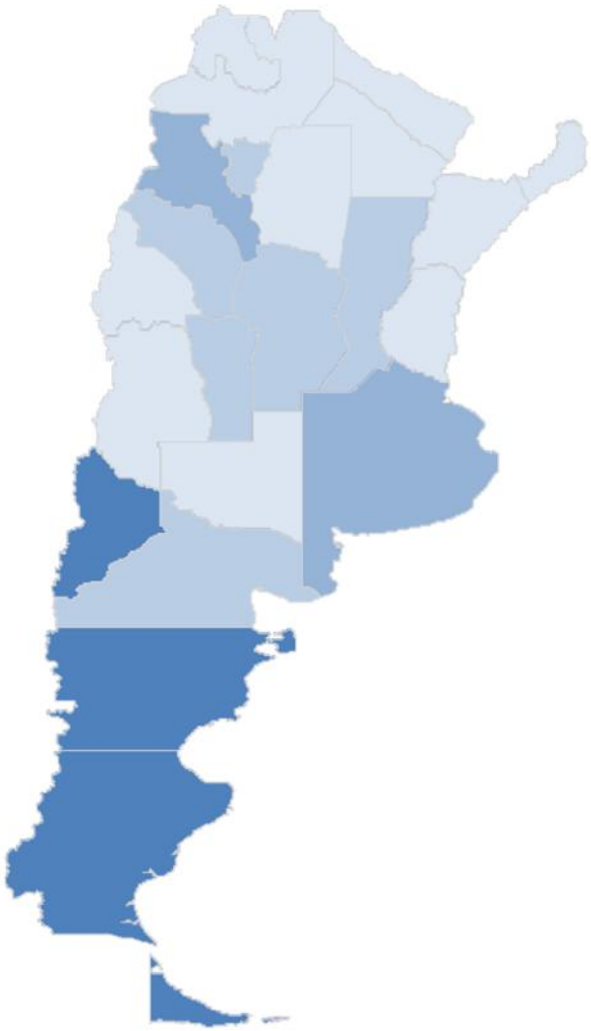
Hours of work: From Encuesta Permanente de Hogares (EPH) (Base Individuos), Instituto Nacional de Estadísticas y Censos.

Gross Geographic Product (GGP): Gross geographic per capita product (base 1993). Source: Ministerio de Economía (MECON), (data from Direcciones de Estadística Provinciales).

Productivity: Productivity measured as GGP/hours of work in the year.

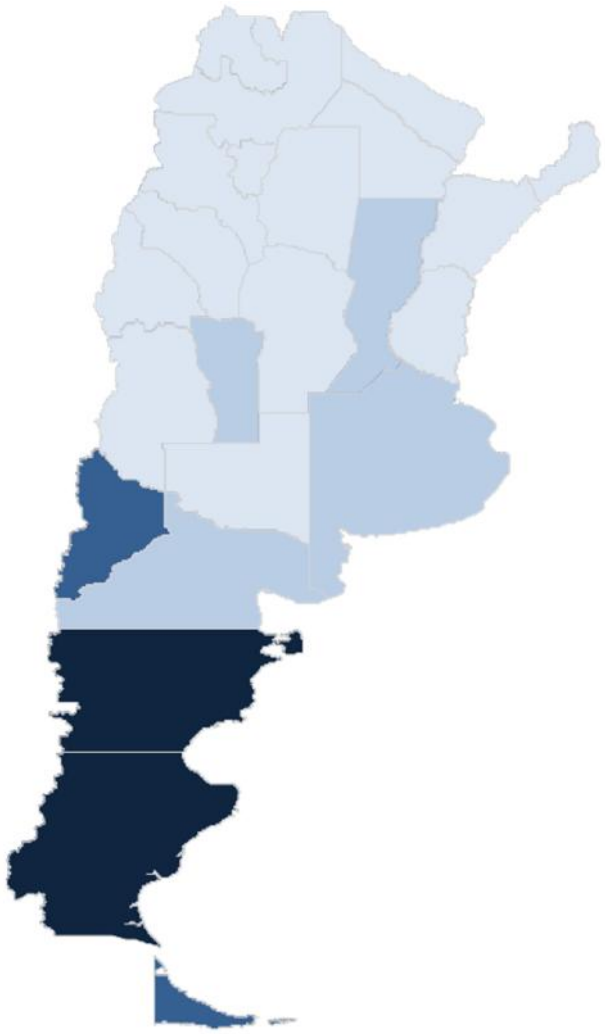
Public sector wage: Average Remuneration of registered public workers per province. Ministerio de Economía (MECON) – Información Fiscal Provincial y Municipal.

Map A1. Real provincial wage– relative to the 1997 mean



742.844	= Mean = 1
0,733	CHACO
0,744	FORMOSA
0,754	SANTIAGO DEL ESTERO
0,755	MISIONES
0,786	CORRIENTES
0,787	SALTA
0,787	JUJUY
0,795	SAN JUAN
0,820	LA PAMPA
0,821	ENTRE RIOS
0,890	MENDOZA
0,914	TUCUMAN
0,929	LA RIOJA
0,934	RIO NEGRO
0,937	SANTA FE
0,987	CORDOBA
1,000	SAN LUIS
1,119	CATAMARCA
1,128	BUENOS AIRES
1,316	NEUQUEN
1,420	CHUBUT
1,510	CAPITAL FEDERAL
1,547	SANTA CRUZ
1,587	TIERRA DEL FUEGO

Map A2. Real provincial wage– relative to the 2009 mean



1076,24	= promedio = 1
0,706	SANTIAGO DEL ESTERO
0,711	TUCUMAN
0,722	CHACO
0,730	MISIONES
0,758	FORMOSA
0,770	CORRIENTES
0,790	ENTRE RIOS
0,795	LA RIOJA
0,797	SALTA
0,819	JUJUY
0,823	SAN JUAN
0,851	LA PAMPA
0,867	CATAMARCA
0,872	MENDOZA
0,892	CORDOBA
0,948	SANTA FE
0,963	SAN LUIS
0,971	RIO NEGRO
1,023	Buenos Aires
1,257	CAPITAL FEDERAL
1,603	NEUQUEN
1,658	TIERRA DEL FUEGO
1,702	CHUBUT
1,972	SANTA CRUZ

If we compare both maps, one can observe homogeneity among non-Patagonian provinces, and a greater differentiation between this subset and the Patagonian provinces.