Distributive patterns in settler economies: land and income inequality during the First Globalization (1870-1913)

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Abstract

The aim of this paper is to identify different distributive patterns in the settler economies (Argentina, Australia, Canada, Chile, New Zealand and Uruguay) during the First Globalization (1870-1913). We present our methodological decisions, discuss our results and propose some conjectures about the long-run evolution of inequality. As agriculture was the most important productive activity in the settler economies and one of the main sectors in leading the land frontier expansion, a study of the evolution of the distribution in this sector will be of interest. We focus on two dimensions of the distributive process in the agrarian sector. We consider inequality in terms of assets –land distribution– and incomes –functional income distribution– because both dimensions have immediate relationships with developmental issues. Asset distribution is a common subject in the literature but up to now it has scarcely been measured and analyzed from a comparative perspective. First, we discuss the land distribution in settler economies –and accept regional disparities in large economies– on the eve of WWI. After that, we present the notion of functional income distribution and discuss the existence of two distributive patterns: in one of these, the territories that were British colonies, where the capitalist relationships predominated, and in the other, in former colonies of Spain, economic relationships were based on agrarian rental incomes. During the period, income distribution worsened in the Australasian economies and Canada, but it worsened even more in the South American Southern Cone countries, and these two groups had different dynamics of expansion onto new land. Our conjecture is that different endowments of natural resources explain, at least partially, these differences.

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1. Introduction: settler economies, First Globalization and stylized facts

During the First Globalization (from the mid-19th century to the 1910s), the settler economy development pattern was characterized by a strong primary export-led economic growth and increasing income inequality. In the closing decades of the 19th century, the economic growth of the members of the "settler club" –integrated by Argentina, Australia, Canada, Chile, New Zealand and Uruguay[1]– was encouraged by the export of primary products (leather, wool, meat, wheat and, in some cases, mineral products),[2] and the abundance of natural resources was a "blessing" for the productive expansion of the settler economies. But this blessing also contained a "curse" in that income distribution worsened and specialization in primary production adversely affected the expansion of incipient artisan and basic manufacturing activities (de-industrialization, according to Williamson, 2004).

The standard trade theory (in the tradition of the Stolper-Samuelson theorem from the Heckscher-Ohlin theory) predicts that free trade will raise the incomes of agents that own the abundant-factor and will reduce incomes of agents that posses the scarce-factor. Given a situation where labour works the land and each economy takes commodity prices as given by world markets, movements towards globalization –through trade and commodity price convergence– favour workers' incomes (as opposed to those of landowners) in places where labour is abundant and land is scarce, whereas in places where labour is scarce and land is abundant the relative incomes of landowners are favoured. Considering that labour remuneration in labour-abundant and land-scarce economies was initially lower than labour remuneration in labour-scarce and land-abundant ones, and that the opposite happens in landowner incomes, globalization in a pre-industrial environment leads to a levelling of world income (O'Rourke & Williamson, 1999). The impact of mass migration reinforced this trend.

In the Atlantic economy real wages and living standards converged from the mid-19th century until the WWI. This process was driven by the narrowing of the wage gap between the New and the Old World. Many European countries, particularly the poorer ones, were catching up with the economic leaders in Europe (the industrial countries). Migration affected long-run equilibrium output and wages through changes in aggregate labour supply; it raised wages in countries with high emigration rates and reduced them in countries that received migrations. Capital flows acted as an anti-convergence force (in the sense of the Lucas Paradox) because they moved towards rich

[1] See Lloyd & Metzer (2006), Álvarez et al. (2007), and Willebald (2007) for a characterization of the settler economies.
[2] Willebald (2006, 2007) presents the external specialization of the settler economies during the period.

countries, rather than poor ones, in pursuit of abundant natural resources, young populations, and the (potential) abundance of human capital (Clemens & Williamson, 2004).

Research into inequality trends in countries that participated in the global economy looks at two kinds of empirical evidence. First, it considers trends in the ratio between farm rents per unit of acre and the unskilled wage rate (*r/w*), which can be understood as a measure of how many days an employee has to work to pay the rent for one unit of land. This is an adequate index of inequality in a world with a big agricultural sector where land is a critical component of total wealth and a decisive factor in income generation, and where the landowning class is a minority. Second, the other inequality evidence from factor prices uses trends in the ratio between GDP per worker and the unskilled wage rate (*y/w*) and yields an index of how far the recipient of an average income is from the typical unskilled worker near the bottom of the income distribution scale. In order to make historical and long run comparisons of globalization and inequality, it is important to take into account two shortcomings of this approach.

First, there is a serious empirical obstacle to obtaining satisfactory results, which is that consistent data, even for a single country, are scarce and fragile. Data have often been compiled from a variety of sources –which involves us in all the difficulties of working with different methodologies– and they have been used to create different types of series for real wage rates (for unskilled urban workers, usually taken from the construction sector), land prices (rural areas), trade (the exchange of goods and international commodity prices), migration (distinguishing regions of origin and destination), and capital movements (financial and foreign direct investment). In particular, when we work with rental-wage ratios (or income-wage ratios) changes in the structure of the active population are not considered, so the ratios can be interpreted as indicators of income polarization rather than overall inequality. Second, from a conceptual point of view the framework to understand this question is based on the neoclassical approach to the theory of international trade and specialization. The H-O-S approach is a useful framework to help us think about and interpret several features of the process, but other aspects seem to be hidden behind prices and their comparative evolutions. In particular, productivity gains, the possibility to advance into unoccupied regions, the possibility to change the specialization of inhabited areas, and changes in the economic structure have consequences that are hard to incorporate into the neoclassical approach.

Recent studies have addressed the first point in two ways. First, they try to improve the quality and quantity of the data by elaborating new series (Arroyo Abad, 2008, for Argentina, Mexico,

Venezuela and Uruguay in the 19th century; Bértola and Colab, 2000; Bértola, et al., 1999, for Argentina, Brazil, and Uruguay; Bohlin & Larsson, 2007, for Sweden; Greasley & Oxley, 2005, for New Zealand) or by considering evidence so as to allow for regional diversity (Emery, et al., 2007, for Canada; Shanahan & Wilson, 2007, for Australia). Second, these new studies estimate inequality and poverty in the long run using various indices (Prados de la Escosura, 2005, 2007, for Latin America) or in a direct way using population and economic census data and assigning income to active individuals depending on their economic activity, profession, gender, and region (Álvarez & Nicolini, 2010, for one region in Argentina; Bértola, et al., 2007, and Bértola, et al., 2009c, for Brazil; Bértola and Rodríguez Weber, 2009, and Rodríguez Weber, 2009, for Chile; Bértola, et al., 2009a,b, and 2010, for the South American Southern Cone).

Other authors have addressed the second shortcoming by emphasizing the relationship between growth and inequality in pre-industrial economies. The basic idea is that the level of possible inequality depends on the level of per capita income, the subsistence level of the majority of the population and the size of the elite that may appropriate the eventual surplus (Milanovic, et al., 2007). Other authors take the evolution of productivity as a central concept and treat it as a process that depends on the interaction between technical progress, changes in the productive structure and changes in the demand pattern, which have consequences for the development of international trade (Bértola, 2000; Porcile and Bértola, 2007; Willebald, 2006, 2007). Finally, in a 2007 article, Knick Harley argues the following.

> "Applying the Stopler-Samuelson paradigm from the Heckscher-Ohlin trade theory, the result is an approach that sees price convergence as pivotal in defining, identifying, and measuring globalization. This focus, however, obscures the implications of frontier incorporation and other insights achieved by viewing nineteenth-century globalization as a mechanism whereby peripheral economies were incorporated into the core of organized economic activity. A frontier-centred perspective also reintroduces the role of economic institutions as a crucial element of economic growth and development." (Harley, 2007:238).

Bringing the frontier into the analysis involves the discovery of export staples, a process of learning how best to exploit them, and the mobilization of capital and labour for production, use and distribution. In a recent article, Camilo García-Jimeno and James Robinson show similar interest in the frontier. They analyze the classical F.J. Turner (1920) view, the "Frontier (or Turner) Thesis", for North, Central and South America from the middle of the 19th century to 2007 (García-

Jimenos & Robinson, 2011). They suggest that institutional quality, taken together with the open frontier, explain the success or failure of these economies in the long-run.

> "The consequences of the existence of a frontier for different countries in the Americas depended a lot on the nature of political institutions which formed in the early independence period. If these institutions featured few constraints on the executive, having a frontier was actually bad for economic development". (García-Jimeno & Robinson, 2009: 18).

From this viewpoint, the focus centred on frontiers –the incorporation of regions that were originally almost unoccupied and outside European economic influence– supplements the mainstream approach and helps to explain new questions. In particular, land frontier expansion may be a pivotal concept insofar as it enables us to connect considerations about technological progress and institutional formation in a different way, as based on the combination of endogenous growth in the use of the productive factor and regional and local perspectives.

Our paper is part of the literature that seeks to understand the effects of the First Globalization on economic growth and income distribution. Our aim is to identify different distributive patterns in the settler economies from a sector approach then we focus on the evolution of agriculture. As it was the most important productive activity in the settler economies and one of the main sectors in leading the land frontier expansion, a study of the evolution of the distribution in this sector will be of interest. We concentrate on two dimensions of the distributive process. We consider inequality in terms of assets –land distribution– and incomes –functional income distribution– because both dimensions have immediate relationships with developmental issues. In Section 1 we discuss land distribution –and accept regional differences in large economies– on the eve of WWI. After that, in Section 2, we present the notion of functional income distribution and discuss the existence of two distributive patterns: in the countries that were British colonies it was capitalist relationships that predominated, but those countries that were colonies of Spain economic relationships were based on agrarian rental incomes. During the period, income distribution worsened in the Australasian economies and Canada, but it worsened even more in the South American Southern Cone countries, and the two groups had different dynamics of expansion onto new land. We present our methodological decisions, discuss our results and

propose some conjectures about the long-run evolution of inequality. However, we do not advance in detailed explanations; they will be matter of other articles. [3]

2. Land distribution in the eve of WWI

2.1 Data and results

A question that is discussed repeatedly in the context of the historical evolution of the formation of land ownership rights in the settler economies is land distribution and its consequences in terms of economic performance. What does the evidence tell us about inequality? Is it clear that, as a result of different evolutions, different distributive patterns developed? In a recent working paper, the relationships between inequality and economic growth are reviewed in the light of new evidence. Ehrhart (2009) states that, in the empirical field, the econometric estimates of the direct and indirect links from initial inequality to future growth led to overall results that were rather mixed. Cross-section reduced form regressions show that inequality of wealth (human capital and land) significantly and negatively affects the future growth rate. Asset inequality turns out to be a more robust determinant of growth than income inequality. Findings from cross-section structural form estimates reveal that only the endogenous fertility approach and the explanation based on political instability are substantially supported by the data. Finally, in panel data regressions, initial inequality of assets has a significant and negative effect on the future growth rate. Similar results were obtained by Deininger & Squire (1998) and Deininger & Olinto (2000) some years ago. A study permanently referenced as Barro (2000) has been recently updated to review the relationships with a similar approach as before but better data. International data would reveal that the Kuznets' curve is a clear empirical phenomenon. A cross-country growth framework shows a negative effect from income inequality on growth, holding fixed a usual group of other explanatory variables. This effect diminishes as per capita product rises and may be positive for the richest economies (Barro, 2008:9). In the literature various different channels have been suggested to explain how inequality affects growth (political economy, imperfect capital markets, social conflicts, residence segregation, friction in factor markets, natural resources, and the creation of institutional arrangements)[4] but the debate is still open theoretically and empirically. To compare and evaluate differences within the "club" we present land ownership inequality indicators, which include Gini and entropy indexes, percentiles

[3] See, for instance, Álvarez & Willebald (2011) and Willebald (2011).

[4] Willebald (2006, 2007) and Willebald & Bértola (2011) present an analysis of these relationships for settler economies in historical perspective.

and average establishment size. The specifications (year, area ranges[5] and sources) are detailed in Table 1. The indicators are for the eve of WWI, which can be considered the "end" of the First Globalization era and is a good point in time to compare "results" (Table 2).

2.2 Analysis and shortcomings

When we compare two of the large economies –Argentina and Australia– we find that the former had significantly higher levels of inequality, and this result is consistent with the predominant view about high land concentration in the River Plate (see Willebald, 2006, for a review of the literature). On the Gini Index, Argentina has a value of 0.85, which is almost 10 points higher than the value for Australia, and the sense of the discrepancy is confirmed by all entropy indices. The average sizes of holdings in the two countries were similar (531 and 552 hectares, respectively) but there are big differences between regions within these countries. In Australia, the most unequal regions were New South Wales and Tasmania, which were colonized first. This would be linked to the different timing of the settlements, and as the agents were learning from the process they were able later on to implement more effective policies in terms of intensification and the division of the estates. In South Australia, Western Australia and Victoria the authorities implemented a more egalitarian land ownership rights distribution system and the results were favourable. Thus this evidence brings out the structural character of land distribution and indicates that policies were effective when they were systematically implemented from the very beginning of the settlement.[6] The distributive pattern in Argentina was different.

The less unequal regions differ considerably as regards the timing of their settlement –La Pampa (0.76) was colonized early and Patagonia (0.74) was colonized late– and as regards the size structure of land ownership (the average holding size in Patagonia is 9 times greater than in La Pampa). The entropy indexes confirm this perception; Patagonia had the lowest *GE(1)*, which indicates that it was a case of "equality among riches" and that policies of land intensification or division were not successful. In addition, these regions have different productive specializations (La Pampa is suitable for crops, especially wheat, and Patagonia for the wool industry) and their production scale requirements were dissimilar, which explains some of the differences between them. The most unequal region was Cuyo, a fact probably related to the long colonial history of

[5] The number and size of ranges or classes impose limitations on the comparison of inequality indicators. However, the differences do not determine the general conclusions.

[6] It is probable that certain productive features contributed in the same direction (remember the increasing mining activity during the 1850s and 1860s in these regions) but we can not be conclusive in this argument.

that area and the persistence of traditional property structures.[7] These features are extensible to the entire region that has Tucumán as the centre of gravity.

The situation in Canada was quite equitable; its Gini Index value was only 0.50, which contrasts sharply with that of the Anglo-Saxon countries in the southern hemisphere. "Even the strictest enforcement of the conditions that the selection laws prescribed could not have made Australia a nation of small independent farmers such as grew in this country [the US] and Canada". (Burt, 1965:75). The eastern provinces (Prince Edward Island, Nova Scotia and New Brunswick) had small estates and their rating fluctuated around the average for the economy as a whole. But the really interesting point is that the provinces that were formed at the end of the 19th century through land frontier expansion (Manitoba, Saskatchewan and Alberta) had values close to 0.32. The land ownership regime in these provinces was based on the farming system and holding sizes were in accordance with productive requirements (these holding sizes are the biggest in Canada and close to the sizes in La Pampa, in Argentina[8]). Finally, British Columbia had a distributive pattern close to other settler economies but its holding sizes were below average.

When we compare the small economies –New Zealand and Uruguay– our results initially contradict the high-concentration distributive pattern in the River Plate region that we noted in the analysis of Argentina and Australia. In New Zealand the authorities made efforts to implement distributive land policies (see Álvarez & Willebald, 2011) but the Gini index remained at high levels (0.83 against 0.77). However, the two countries were very different as regards average holding size. The indicator for Uruguay was almost 80 percent greater that the ratio for New Zealand, which indicates that the two countries had very different property size structures (see Álvarez, 2008, for an approach to this question). Starting in the 1890s, the authorities in New Zealand made an effort to break up the large estates and establish a holding size structure more suitable for the new economic conditions, especially the changes wrought by the introduction of refrigeration, the expansion of the dairy industry and the introduction of cooperative land tenure systems. The evolution of the indicators gives a clear picture. In 1891, the values of the Gini index and the *GE(0)* were very similar to 1911 levels (0.84 and 2, respectively) but *GE(1)* decreased (from

[7] The cities of Mendoza and San Juan were founded in 1561 and 1562 as part of the expansion of Chile under the authority of the Viceroyalty of Peru. Buenos Aires was founded later (1580) –after a failed attempt in 1536– as an autonomous development linked to Atlantic Ocean trade, and it had a secondary economic role until the 19th century.
[8] The average holding size in the "West" of Canada was 80 per cent of that of La Pampa. It was the region most similar to Argentina as regards production –land quality, crops and comparable technological options– and this would explain why their productive requirements looked alike.

2.26 to 2.13), which indicates changes in the higher segments of the distribution.[9] Rural changes was speeded up by further enabling legislation in the early 1890s and by the opening of large areas of crown land in North Island, which had hitherto been preserved from falling under the control of the big sheep farmers by Maori resistance. New Zealand then became a nation increasingly dominated by small independent farmers who formed the backbone of society. This achievement is in striking contrast to what happened in Australia but it is not at all surprising because New Zealand had what Australia lacked: a combination of soil and climate that was ideal for close agricultural settlement (Burt, 1965).[10] Another interesting aspect that highlights the importance of the regional differences is the comparison between Uruguay and La Pampa in Argentina. Gini Indexes (0.77 and 0.76) and holding sizes (394 and 355, respectively) were similar and this probably indicates comparable productive specializations and land ownership structures. Lastly, on the eve of the Great Depression (1929-1930), Chile's Gini Index was over 0.9, which was the outcome of a long-run evolution in which the colonial heritage and the political power elite combined to maintain high levels of inequality in its various dimensions (incomes, productive activities and assets) (see Bértola and Rodríguez Weber, 2009; Rodríguez Weber, 2009; and Rodríguez Weber and Willebald, 2010).

The Kuznets' indicators (percentile ratios) clearly confirm that the "shapes" of the distributions are not uniform and there are several features that make it difficult to find clear patterns. For instance, the narrowest gaps between the rich and the poor (the lowest *p90/p10*) were in Argentina and Chile, but according to the Gini Index these were the most unequal economies in the group. In contrast, the third most unequal country (New Zealand) had the highest indicator. Land inequality in Australia and Uruguay was very similar, and the gap between rich and poor was also comparable, but there are big (and contradictory) differences in other percentile ratios. Finally, the most equitable economy –Canada– had the lowest value for the middle segments (*p75/p25*), which confirms a distribution with low concentration. These warnings are not new. Willebald & Bértola (2011) find that differences in land distribution in the "club" are not enough to explain differences in economic performance. Their analysis suggests that the dynamics of the generation of incomes is a better approach when it comes to explaining these differences.

[9] Entropy indices *E(c)* are a "family" of indicators where *c* is a parameter (positive). As *c* decreases, *E* becomes more sensitive to transfers in the low segment of the distribution. Then *E(1)* is more sensitive to changes in the situation of "rich" people (in this case, with much land) and *E(0)* is a better reflection of changes among "poor" agents.

[10] Our analysis of inequality indexes does not consider differences in types of lands. In next steps of the research we will include land adjusted by quality in the calculations of the index, so as to reflect different agricultural conditions.

In other recent literature there are criticisms of the empirical approach to this question. Measures of land inequality only capture inequality among landholders and ignore people who do not have land (Erickson & Vollrath, 2004). Besides this, it is probable that the dispersion of the proprietors' income was low and stable, which undermines the representativeness of the effect of inequality on economic performance. Therefore we commplement our analysis by considering the evolution of functional income distribution in the agrarian sector as the second dimension of the distributive pattern of settler economies in the period.

3. Agrarian functional income distribution

As it was mentioned above, research into inequality trends in countries that participated in the global economy in the second half of the 19th century and up to WWI looks at two kinds of empirical evidence. First, it considers the relative evolution of factor prices –typically land rental/unskilled wage (*r/w*)– and incomes –average income per worker/unskilled wage (*y/w*). Second, there have been efforts to estimate inequality directly from the economic conditions of the population and poverty in the long run, using diverse indices. As a third alternative we work with estimates of functional income distribution, an intermediate line that circumvents the limitations of the first approach (we pay attention to the simultaneous movements in earn rates and quantity of the productive factors) and contributes to the second one by adding details to the characterization (especially because we include sector considerations).

Functional income distribution is a depiction of how income (at the national or sector level) is distributed among the different groups involved in production. As a result, it shows how incomes earned by the owners of the various factors of production (labour, land and capital) are shared out in terms of remuneration (or wages), land rents and profits (dividends or interests). Therefore, in these terms, not only it is important to consider the evolution of the different earning rates (which is what the recent literature is concerned with) but we should also take account of changes in the quantities of factors applied to production. As we consider that agriculture was the main productive sector in the settler economies, and together with its productive linkages it was the main strength in the economic boom at the end of the 19th century, then a study of the evolution of income distribution in this sector will yield some interesting insights.

We estimate functional income distribution in the agrarian sector during the First Globalization (from 1870 to the eve of WWI) in our six settler economies. More specifically, we survey and estimate the agrarian product, wages and total land incomes in the agrarian sector while the profits are obtained as a residual. We select benchmark years in accordance with the long run

evolution of the settler economies and the information available. We choose years that correspond to points in time prior to the strong expansion in the 1870s and 1880s, in the "initial boom" in the 1890s and in the period before WWI. Our sources and methodology to construct the series are given in detail in the Appendix. In the recent literature, attempts have been made to introduce these categories into the historical analysis by Álvarez (2008), Álvarez, et al. (2011) (both for New Zealand and Uruguay) and Álvarez & Willebald (2009) (for Argentina, Australia, New Zealand and Uruguay). Now we improve our estimates with more and better sources and thus make our assumptions more precise, and we can extend the analysis to include more countries in the sample (Canada and Chile).

3.1 Two distributive patterns

We can identify two "patterns" in the average for the period (see Table 3). In the countries in the South American Southern Cone –the River Plate countries (Argentina and Uruguay) and Chile– income composition is dominated by land rents, with shares of over half total agrarian income. On the other hand, this share is smaller in Canada and New Zealand, with ratios of 47 and 43 per cent, respectively, and Australia with an average of 50 per cent. This relatively smaller share for land rents contrasts with the situation in the Southern Cone, but with different modalities.

On the one hand, in Australasia there was higher total wages in the agrarian sector, with ratios of almost 30 per cent. The "Australian settlers ranged in a gamut extending from the humble poor to the propertied middle class … More of the upper class was omitted from the fragment of British society which was Australia. The working classes predominated in its founding, and their attitudes were of a special character." (Rosecrance, 1964: 282). In Australia, "…the cleavage between labour and capital was much more pronounced than in North America. Even farming was more capitalist … The average Australian was not his own economic boss. He was a wage earner, like the native of Britain…" (Burt, 1965: 75). On the other hand, the high share of profits in the Canadian distribution (an average of more than 30 per cent) can probably be explained by the fact that there were many family farms and small producers so property capital was a significant income source. New Zealand was very like Australia except that it had more intensive and more effective land policies, (at least from 1890 onwards; see Álvarez & Willebald, 2011) and its pattern of high wages and profits make its income structure comparable to that of Canada.

One problem in evaluating the structure of income distribution is that the three components are all moving at the same time and the proportions change in diverse directions. To help

understanding the figures, we present indicators that relate income shares: land rents/profits (*R/P*), wage/land rents (*W/R*), and wage/profits (*W/P*) (see Figures 1, 2 and 3). In the graphs, to illustrate the differences we show the averages in the period for each ratio compared to the mean for the "club".[11] *R/P* ratios are significantly higher in the River Plate, Chile and Australia than in New Zealand and Canada (Figure 1). Argentina (2.8), Chile (2.2), Uruguay (2.4) and Australia (2.3) had ratios where the land rent share was more than twice the profit share. Note that the ratios for New Zealand and Canada have a narrower gap (1.5 in both cases). At the same time, when we consider *W/R* ratios the "club" has a similar profile in which land rental predominates over wages (ratios lower than 1), although the Southern Cone shows this feature more clearly. Canada has the same characteristic while Australia and New Zealand present the contrary feature, with relatively higher wages (Figure 2). The relatively lower land rents in New Zealand are a common result in the comparison with profits and wages, while this outcome is true in the case of Australia and Canada when we compare rents with, respectively, wages and profits (Figure 3). Therefore, it is interesting to distinguish between two distributive patterns. In one of them, the Spanish ex-colonies, the economic relationships based on agrarian rental incomes predominated, and in the other, the British ex-colonies, where capitalist relationships were predominant and encouraged the dynamics of larger markets (i.e., relatively higher wages and profits.

In economies in which a large proportion of the total wealth is in the form of land, total savings can be used either to accumulate capital and attend to market demand or to invest in land (Kurz & Salvadori, 1995; Foley & Michl, 1999). When land is still relatively abundant, investment in this asset is aimed at reaping the benefits that would come from rising land prices. As land prices go up, owners of capital spend a larger part of their wealth on land, and this slows down capital accumulation. On the other hand, when land is not abundant –the frontier is closed– rises in land rents depress profits and boost capital expenditure up to the point at which investment in physical capital virtually stops. In both cases resources are diverted from their alternative destination (capital accumulation) in a sense very close to the idea of the crowding out approach to the curse of the abundance of natural resources[12] and it bases our interest on a "rentist income structure" in some of the members of the "club". When we consider that capital accumulation is one of the main sources of growth and technical change, economies in which land rents and/or opportunities for land speculation are greater, they will find obstacles to the structural change which will affect

[11] Strictly speaking, the graphs do not cover the period 1870-1913 but from the 1870s to around WWI.

[12] See Willebald (2010), for a review of the different approaches to the curse (and the blessing) of the natural resources.

development in the long run. This expectative is not incompatible with stages of economic growth during the period of land frontier expansion. Difficulties would arise when this incorporation of "new" productive factor ran out its influence and the economies faced the challenge of the industrialization.

3.2 Income evolution in the face of the First Globalization

What was the impact of the First Globalization? Or more specifically, what were the reactions to the price boom in the 1890s to WWI period? Again, instead of comparing wages and land rental rates as is proposed in the more extended literature (Williamson, 2000, 2002, was the precursor of extensive literature on this subject), we can contrast the evolutions of total wages, rents and profits. This approach differs from the traditional analysis because our ratios include the double effect of changes in earning rates (wages, land rentals, profit rates) and in the number of earners (workers, hectares and capital units).[13] Considering that landowners are a minimal proportion of the population –and that these economies expanded during the period– the increasing share of land rental against wages (and profits) represents worsening inequality. However, the relation between profits and wages in the agrarian sector is not so evident. Estimates of the number of "capitalists" are even more imprecise than estimates of the number of workers, and the farm ownership structure means there are overlaps in these productive roles. In other words, while in some regions "capitalists", "workers" and "landowners" are clearly different agents, in others (especially where family farms predominate) the returns to capital and labour can accrue to the same individual. Then, to focus the discussion on income distribution, we do not consider the *W/P* ratio as a reference and we take *R/P* because we want to catch the "rentist" character of the agrarian sector. Therefore, in our exercise we compare land rentals with wages (*R/W*) and profits (*R/P*). In both cases it is important to consider levels (by what factor do total rents exceed total wages and total profits?) and the evolution (rising trajectories represent a higher share for rental incomes in agrarian society). Although all settler economies underwent "rental drifts" during the First Globalization, the timing and intensity of the process was different in each case.[14]

Until the 1890s, the average in the "club" was that total land rents amounted to twice total wages,[15] but the commodity price boom and land frontier expansion in the First Globalization

[13] We are assuming that the different groups are homogenous and the dispersion within the group is low. This simplification may lead to errors when the economies become more "sophisticated", and when the owners of productive factors combine the roles of workers, capitalists and landowners. Our countries preserved features of "traditional" economies during the period so our assumption should not bias the results.

[14] Thanks to Luis Bértola by suggesting this denomination.

[15] The average ratio for the 1870s was 1.94, for the 1880s it was 2.16, and for the 1890s it was 2.10.

from the 1890s to WWI caused this ratio to increase to 2.7. The impact was not immediate; it only came after a period when the indicator decreased (see Figure 4). This result is consistent with theoretical frameworks (Findlay, 1995; Findlay & Lundahl, 2001) that consider that the incorporation of "new" land requires time and the application of resources to clear land, and this may delay the yield of the investment (which, depending on the type of the factor, may be rents or profits). At the same time, wages on the frontier may be higher for workers –wage premium– and they may even be able to press for higher pay in other regions (see Harley, 2007, for an explanation about Canada).

Canada (Figure 6) had levels and followed a trend very similar to the average for the settlers' "club" (steady at around 2.1). In Australasia (Figures 5 and 8) levels were generally lower than the average although the evolutions followed different trajectories. The worsening impact in Australian income distribution occurred in the 1890s, before the other settler countries. It was probably linked to that country having an earlier process of land frontier expansion (see Willebald & Riaño, 2010). Afterwards the ratio returned to the previous level. In New Zealand, worsening income distribution was persistent, but it started from very low levels and did not reach the ratios of the River Plate on the eve of WWI. This process of worsening moderated at the beginning of the 20th century, a fact that is consistent with the intensification and subdivision of estates in that period (see Álvarez & Willebald, 2011).

In Argentina, the impact of the price boom on inequality raised the indicator to 3.3 (Figure 4) and in Uruguay to 3.2 (Figure 9). Income distribution in Chile improved during the closing decades of the 19th century but this trend was reversed in the first decade of 20th. Chile began the 1900s with the highest levels and the previous improvement was associated with changes outside agriculture. Frontier expansion in the 1880s and 1890s was led by mining (in the North), and the competitive effects on the labour market made for upward pressure in other sectors.[16]

These trajectories are consistent with the theoretical framework that, assuming the land frontier expansion as a costly process, its consequences differ in accordance with the quality of the land (see Berger & Willebald, 2011), and they are correlated with our previous findings about the dynamics of the process in settler economies (see Willebald & Riaño, 2010). In Argentina, Uruguay and New Zealand income distribution clearly worsened (from different levels) and they are precisely the economies that extended their frontiers to the "best" aptitude lands. At the

same time, Chile's income distribution evolution was not homogenous with a strong worsening in the end of the period, which is consistent with the irregular trajectory of its land frontier expansion that affected several sectors (mining and agriculture). Finally, the relatively moderate frontier expansion in Canada and Australia, with high contributions of medium and low quality lands, seems coherent with a steady movement in income evolution.

Until the 1880s, the difference between total land rentals and profits was greater than the difference between total land rents and wages (by a factor of 2.3[17]) in the "club" and income distribution worsened to an equivalent extent (the ratio increased to 3.1 in the 1910s). The First Globalization had huge impacts in terms of the accumulation of land and capital and their returns, and the general rule was for pressure to make income distribution worse. However, unlike in the previous case, the representativeness of the average is lower and the differences between each economy and the mean of the "club" were marked, especially in the cases of Argentina (Figure 10), Australia (Figure 11) and Uruguay (Figure 15).

In the River Plate the pattern was similar. In a process that might be a result of the increasing capitalization of agrarian activity (wire fences, buildings, irrigation channels), both indicators fell up to the end of the 19th century. The impact of the price boom and land frontier expansion made for a significant rise in the index until it reached levels where rents almost 6 times profit shares. However, Australia showed an inverse evolution, and starting in the 1890s with values between 4 and 5, the share of rents on profits decreased until similar values were reached (the ratio in the 1910s was almost 1). The capitalization of Australian agriculture and the "desire to change the environment" (Williams, 1975:87), which became very noticeable in the closing decades of the 19th century, were led by the mechanization of production, the construction of irrigation systems and the progressively increasing use of fertilizers and special varieties of cereals that made for increasing profits. The evolution in Canada (Figure 12) and New Zealand (Figure 14) was predominantly below the settler average, which denotes an income structure where rents exceed profits with a narrower gap. In other words, they were less "rentist" and more "capitalist" economies than the others. Finally, Chile (Figure 13) had a similar trajectory to the mean of the club, which confirms that the main component in the inequality was the difference between landowners and workers (Figure 7). The capitalization in the agriculture only became important in

[16] See Rodríguez Weber (2009) and Bértola and Rodríguez Weber (2009) for an extensive analysis of the evolution of income distribution in Chile from the mid-19th century to 1930. See Rodríguez Weber and Willebald (2010) for an analysis of the evolution of agrarian functional income distribution in Chile during the First Globalization.
[17] The average ratio for the 1870s was 2.55 and for the 1880s it was 2.20.

the 20th century, and its effect would be very marked in the subsequent decades (see Rodriguez Weber & Willebald, 2010).

It is important to consider that in our methodological approach total profits are estimated by difference. Therefore, strictly speaking, it is a variable that reflects not only total profits but estimation errors as well. We believe that the directions of the trends are correct, but it is possible that changes may have exaggerated the processes. This point is very important and we will enlarge upon it next stages of our research about settler economies and economic development. In particular, the debate as to whether economic growth is profit-led or wage-led [18] seems an attractive question to analyze and has a bearing on the long-run performance of the "club" and the creation of "(post) staples economies" in the second half of the 20th century (Wellstead, 2007).

4. Final remarks

Our analysis makes three main contributions, one of them in the empirical field and the others in analytical matters. In empirical terms, we present original estimates of functional income distribution in the agrarian sector of settler economies and we do comparative exercises with them. Calculation methodology, sources and assumptions are presented in the Appendix.

We make two contributions to advance in analytical fields. First, the impact of the First Globalization on natural resource abundant (land-abundant) economies in terms of inequality was that income distribution worsened, and in this finding we are consistent with the more extended evidence (although we are working with a different framework). Our estimates for the agrarian sector in the "club" show that wages and profits trended to lose share in sector income while land rentals gained (in a process that we call "rental drifts"). This evolution was clearer in the River Plate economies and Chile than in Australasia and Canada, where the evidence is mixed and the distribution among proprietors of productive factors varied. Second, it is interesting to distinguish between two distributive patterns. In one of them, the former British colonies, capitalist relations (related to profits) and broader markets (related to wages) were relatively predominant, but in the other, the ex-colonies of Spain, economic relations were based on agrarian rental incomes. The trajectories of the club members were not uniform and they were affected in numerous ways, and one of our next objectives is to determine how the dynamics of land frontier expansion was probably one of the main factors in these different influences (see Willebald, 2011, for the first advances in this line of research).

[18] See Bhaduri (2008) for a recent discussion of this concept.

The availability of land resources was the main comparative advantage that enabled these economies to participate in world commodity markets and it was the basis for their export-led growth strategy. But at the same time the First Globalization created pressure to increase inequality. This pressure was expressed as a wider gap between land rentals and other income modalities (wages and profits), a process that combined rising rental rates and the expansion of the productive factor more intensively used to produce food and raw materials (land reacts endogenously to improvements in the terms of trade). However, the natural endowments of the settler economies in the "club" were not homogenous throughout their respective territories, and this made for differing results. In a theoretical framework in the tradition of the "specific factor" model,[19] moving the land frontier onto the "best" land would foster the adverse effects on inequality because it would enable a reduced segment of the population (landowners) to capture increasing rents. The more intensive worsening in income distribution in the agrarian sector in the River Plate was associated with the different timing of land frontier expansion onto land that was better as regards agricultural aptitude and distance. However, the effects of an abundance of natural resources on economic development are not determined by resource endowments alone; we must consider institutional factors so as to make the explanation more complete. The prevailing conditions contributed to the creation of a "*rentist*" pattern in Spain's ex-colonies, where land ownership ensured the elite received incomes without having to make large investments in production, and because land concentration was high due to the colonial heritage (Bértola et al, 2010). In other words, land frontier expansion occurred at the same time that the institutional arrangements that created a new land ownership rights system were set up (see Álvarez & Willebald, 2011, for an extensive analysis).

Willebald & Bértola (2011) analyze the impact of income and land distribution on the economic performance of settler economies, and they say that "…the fact that the distribution of land ownership has little explanatory power would suggest, as a first approach, that it is the generation of income flows, acting together with the incorporation of capital –in its various modalities– that creates the dynamics of demand that impacts on trade and productive specialization." Like in that article, we find that in the "club" of settler economies there are clear differences in the evolution of inequality when we evaluate incomes, but the differences are less marked when we consider land ownership. These authors argue that it is also possible that, even in countries where competitiveness was highly dependent on natural resources, other forms of capital ownership

[19] See Findlay (1995) and Findlay & Lundahl (2001) for a presentation of the model. See Berger & Willebald (2011) for

might be more significant for wealth distribution, such as financial assets, urban property or industries processing primary products. Our analysis sheds new light on this question.

The literature has concentrated on land ownership and not paid enough attention to the quality of land factor. In next stages of the research, we will introduce this aspect into the discussion and consider agrarian aptitude, and the interaction with institutional quality. The appropriability problem arises when it is possible to capture huge rental differentials in the process of land frontier expansion. If institutions give legitimacy to this trajectory, income distribution will worsen more intensively. This was what happened in the settler economies in the South American Southern Cone. The evolution was more related to the generation of incomes than to the ownership of land, it was a process that involved all agents regardless of whether or not they were proprietors, and the generation of wealth involved the participation of assets other than land, such as railways, ports, financial support and agrarian machinery. We deal with this subject in greater depth in Willebald (2011).

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analyzing the effects of introducing different land qualities.

Appendix: functional income distribution, estimation methodology, sources and assumptions

1. Introduction

We estimate the functional income distribution of the agrarian sector during the First Globalization (from 1870 to the WWI) in selected settler economies (Argentina, Australia, Canada, Chile, New Zealand and Uruguay), and we take one year from each decade as a benchmark. We choose years that represent points in time prior to the strong expansion (the 1870s and 1880s), the "initial boom" (during the 1890s) and the period before WWI. The available information on the settler economies varies, both in quantity and quality, and we need to make several assumptions and specific calculations to obtain compatible estimates. Our aim in this Appendix is to describe the estimation method and the different decisions we made. We survey and estimate the agrarian product, wages and total land rents in the agrarian sector. Profits were obtained as a residual in all the cases. In general, the evolution of the variables at current prices is irregular. As far as possible we smooth out the series by calculating 3-year averages to reduce the risk of taking an abnormal year as a benchmark, and we take the middle year of the three to name out mark. We usually use reverse chronological order starting with a benchmark year for the 1910s. Our decision to take some year close to WWI as a reference is based on the availability of data about the diverse components of the aggregated variables. Information from the previous decades is scarce and it is usually necessary to use indirect indicators. We select a year in each decade as a benchmark on the basis of information availability criteria and we explain this point separately for each country.

In this introduction we outline the general themes and aspects that are common to all our economies and we organize our material by country (in sections) and by variable and period (in subsections). Each section includes details of (i) agrarian product, (ii) rents, and (iii) wages, although the ordering within each subsection differs depending on what is most suitable for the explanation. At the end of Appendix there are bibliographical references classify by section.

1.1 Agrarian income

To measure agrarian income we consider the gross domestic product (GDP) of the activity according to official data and the best available estimates. We have annual estimates at current prices for Australia, Canada and Uruguay, at constant prices for Argentina and Chile, and estimates of other variables for New Zealand that we associate with agrarian GDP. We have estimates of agrarian income for Uruguay and Chile. We use these data to calculate some components of the total distribution, but as we have agrarian GDP for the other countries we work with GDP to maintain homogeneity within the sample. We will refer to agrarian income as agrarian product.

1.2 Land income

In a previous study (Álvarez & Willebald, 2009), to measure land income we followed Dwyer (2003) and Gaffney (1970). In general, when the value of land is stable, land income is the annual rental for the land. However, when land value increases, the future rentals for land are expected to be higher. As a result, land has two types of yields or returns, one directly associated with the productive activity and the other with land value appreciation (like in the case of an investment). (see Carmona & Rosés, 2009, for a discussion). There is little reliable historical data available about this so researchers usually adopt a conservative 5 per cent fixed rental yield and add a percentage to represent the accrual of future rentals. However, this method introduces too many assumptions and as far as possible we have used a different approach to estimating land income.

Our aim is to calculate rents in terms of the earnings remuneration of land as a productive factor regardless of whether or not the land has been rented. Therefore we consider the total of land used for agricultural production (cultivated land and pasture) and measures of the rental rate per surface unit (hectares or acres). In order to consider the differences as regards the quality and relative remoteness of land we include in our estimation the geographical differential value of the land and its rental rates. This is especially important when dealing with large economies such as Argentina, Australia and Canada. In this sense, we follow the Ricardian concept of land rent.

> "Rent is that portion of the produce of the earth which is paid to the landlord for the use of the original and indestructible powers of the soil. It is often, however, confounded with the

> interest and profit of capital, and in popular language the term is applied to whatever is annually paid by a farmer to his landlord. If, of two adjoining farms of the same extension and of the same natural fertility, one had all the convenience of farm buildings, and was properly drained and manured, and advantageously divided by hedges, fences and walls, while the other had none of these advantages, more remuneration would naturally be paid for the use of one than for the use of the other; yet in both cases this remuneration would be called rent. But it is evident, that only a portion of the money paid annually for the improved farm would be given for the original and indestructible powers of the soil; the other portion would be paid for the use of the capital which had been employed to ameliorate the quality of the land and to erect such buildings as were necessary to secure and preserve the produce." [Ricardo (1821 [2010]), Ch.2:5].

However, it is usually very difficult to distinguish between land and land improvements, and sometimes our data include some components that exceed the strict concept "of the original and indestructible powers of the soil".

It is common in the literature to use the evolution of the price of land to gauge the movement of rental rates (Austin, 2007; Bértola, et al., 1999; Bohlin & Larsson, 2007; Emery, et al., 2007; Greasley & Oxley, 2005; Shanahan & Wilson, 2007; Williamson, 2000 and 2002) and we employ a similar definition. However, it is not enough to apply land price movements to estimate the rental rate because the evolution has to be corrected by the interest rate.

In the conceptual framework of "specific factor" models (see Berger & Willebald, 2011) the key relation –as a decision rule– is the following: $\frac{pa'(n)}{\phi'(N)} = \Lambda = \rho$ *(1)*

In the long run, the rate of return on clearing land (–the relation between the marginal income [*pa'(n)*] and the marginal cost [*'(N)*] of clearing land– must be equal to the interest rate (which represents the opportunity cost). The marginal income on clearing land is the value (considering the relative price of land output or agricultural good, *p*) of the marginal physical productivity of the land (*a'(n)*), and this relation equals the land rent (*q*) in the equilibrium. The marginal cost of clearing –that is, the cost for one unit of (new) land– is the land price (p_N). We can rewrite *(1)* as: $q = p_N . \rho$ *(2)*

Therefore, if we want to deduce the evolution of the rental rate (the rent for one unit of land) in the long run we need to consider the movement of land prices and the interest rate. Williamson (2007):204 gives the same warning when analyzing the recent literature about this question and Arroyo Abad (2008) proposes this empirical correction for four Latin American countries in the 19th century.[20] Data about interest rates is scarce but some partial information indicates a downward but not continuous trend during the period (see Willebald, 2010, for a survey). A proxy for the local interest rate is the yield of government bonds, a homogenous measure that quantifies the financing opportunity cost in those economies. We use data from Obstfeld & Taylor (2003) and we work with triennial averages centred in the mid-year. Usually we refer to the coefficient "price-interest rate" as the index to adjust rental rates in the long run. The amount of land used for crops and livestock grazing is agricultural census data, and where this is not available we use technical coefficients of production to estimate areas by regions (this was our procedure for Argentina, Uruguay and New Zealand). We refer to land income as total land rents or rental mass.

1.3 Labour income

To measure labour income we consider the salary mass in agrarian activity including cattle production, crops and farming, and as a reference we take the income of an unskilled day labourer. During the period, specialized work usually involved seasonal tasks (harvests or the shearing season) and paid very high (abnormal) wages. Whenever possible we take into account three components: the number of agrarian labourers (wage-earners), the wage rate (without board [21]) and the number of hours worked. Information

[20] Their conceptual reference is Jorgenson (1963), who proposes a theoretical explanation of capital accumulation within the Neoclassical Theory framework.

[21] Board is the provision of meals and lodging. Our series correspond to wages without board. If the labour contract was negotiated in terms of monetary payments, meals and lodging, we put a value on this payment-in-kind. Wages without board are higher than wages with board because wages are associated with monetary payments.

availability varies among the six countries, and depending on the data we use official statistics, index numbers, other estimates or even data from particular labour-contracts (in which case we discuss how representative they are). In several cases we obtain different levels of wages that are not consistent with the result of applying the Nominal Wage Index to our benchmark. This is not strange because the index can cover other items and involve different weights, but we can presume that the indicator correctly follows the dynamics of the variable. We interpolate intermediate values between levels with the movement of the index and so re-scale the series. The method is as follows:

We have two values of our variable (*w*): $w_{0,}$ wage rate in *t=0,* and w_j, wage rate in *t=j*.

We have an appropriate index to approach wage evolution:

NWI_t: Nominal wage index, with *t=0, …, j*

Our objective is to join w_0 and w_j with the trajectory of NWI_t, maintaining the same "shape" of the evolution but re-scaling the index to splice the series and interpolate values for specific years.

We calculate the variations for the whole period from *0* to *j*.

$$w_j \Big/ w_0 = VarW_{j/0} \qquad (3)$$

$$NWI_j \Big/ NWI_0 = VarNWI_{j/0} \qquad (4)$$

The yearly correction coefficient (*YCC*) is calculated as the (annualized) relation between the two whole variations:

$$\left(VarNWI_{j/0} \Big/ VarW_{j/0} \right)^{(1/j)} = YCC \qquad (5)$$

We adjust each annual variation in the index with the *YCC* (as the ratio of the two factors) and re-calculate variations to apply to the extreme figures of our interest variable.[22]

We refer to labour income as total wages or salary mass.

2. Argentina

Our selection of benchmarks basically depends on the availability of census data, and we supplement this with additional information. We propose the following benchmarks: 1869, 1875, 1888, 1895 and 1914.

2.1 Agrarian product

The agrarian product at constant prices (1914 million *pesos*) comes from Cortes Conde (1994):16 and covers the period 1875-1913. Previous years are estimated from Maddison (2001) considering the total GDP growth from 1870 to 1890.[23] Figures were inflated by a cost of living index presented in Williamson (1999) and commented on Williamson (1995):163. The deflator does not cover all GDP but as the share of consumption is very high we assume it is a good proxy.[24]

2.2 Rents

- ***Total land rents 1914***

The Third National Census in the Republic of Argentina (*Tercer Censo Nacional de la República Argentina*, henceforth *TCRA*) of 1914 has information about land rents (*precio del arrendamiento*) for farming and livestock establishments at the provincial level (24 provinces[25]), and it distinguishes leasing periods (less than 3, 3, 4, 5, and more than 5 years) and monetary ranges (Argentine *pesos* per hectare).

For cattle establishments,[26] the ranges are as follows: less than 0.20 Argentine *pesos*, 0.21-0.5, 0.51-1,

[22] Some similar operations are applied to land prices.

[23] Maddison (2001) presents information corresponding to 1870 and 1890.

[24] In 1913-1915, the private consumption (included changes in stocks) amounted to 76 per cent of GDP (Ferrerés, 2005:171-172) and the composition of consumption included a high proportion of food, beverages and raw materials derived from agriculture.

[25] At the time of the census, the territory of Los Andes was surveyed as a separate administrative jurisdiction. However, in our estimates this region is included in Salta.

[26] We place available or non-used plots in this category.

1.1-2, 2.1-5, 5.1-10, 10.1-15, and more than 15 Argentine *pesos*. For farming activities, the ranges are: less than 5 Argentine *pesos*, 5-10, 11-20, 21-30, and more than 30 *pesos*.[27] In addition, the ranges are presented in accordance with percentages of crops (10%, 20%, 30% and more) but this information is not considered in our calculations. By considering the simple average for total rented establishments (105,899 in 306,603 estates) we obtain rental rates by types of production for each province. The census has information about the area of total exploitation in accordance with the main activity. Our estimate of total rents in 1914 is based on farming and livestock areas valued at rental rates and the value represents the 67% of total income (1,133 million Argentine *pesos*).

- ***Land areas 1869, 1875, 1888 and 1895***

Data about rents in different regions in previous periods are not available, so we need to gauge their evolution from indirect indicators. Total rents constitute a value with two factors –quantity and price components– and we estimate the changes in both over time by using appropriate proxies. We start by looking at the quantity component by considering the land used for pastoral production.

We assume that in our period of analysis pastoral land, by bovine unity, expanded at the same rate as total factor productivity (TFP) in the agrarian activity. Pastoral production in Argentina included cattle and sheep and the "bovine unity" is the equivalent number of animals considered as if there was only cattle production. In this sense, the number of bovine unities per hectare is a measure of productivity, and we assume that this measure moved like TFP. As we know the number of animals per hectare in 1914 and the corresponding land that was used, we can calculate a technical coefficient for each province.

Considering that in terms of the use of the nutritive characteristics of grass, 8 sheep are equivalent to 1 cow (Cortes Conde, 1979:63[28]), we calculate the "equivalent cattle" per province and the ratio between this figure and land surface in 1914.[29] These are measures of productivity and we reduce them in accordance with changes in the TFP (Newland & Poulson, 1998[30]) to estimate the corresponding ratios for 1895. As the *TCRA* has information about the numbers of rural animals in 1895, we can immediately estimate the extent of land for pastoral production per province.[31] We repeat the method to estimate the 1888 (according to *TCRA*) and the 1875 values (Vázquez-Presedo, 1971: 52[32]). We took data for 1869 from Cortes Conde (1979): 277. We do not have data for all the provinces, and we assume that provinces without figures did not have sheep or cattle (non-information would be associated with low numbers of animals).

As regards agricultural activity, we approach the changes in the amount of land used for crops by gauging the amount of land used to grow plants per province. Our data for 1914 are from the *TCRA* and include cereals, industrial plants, legumes and vegetables. The data for 1895 are from the Second Republic of Argentina census (*Segundo Censo de la República Argentina*, henceforth *SCRA*) of 1895 and include trees, cereals (wheat, corn, flax, barley), industrial plants (vines, peanuts, sugar cane, tobacco, cotton),

[27] Such differences in the levels of rents between lands for livestock and for crops can be considered as differences in terms of land quality (or, equivalently, productivity). This evidence is our fundament to assume the higher rent of high quality land respect to low quality land ($q_H > q_L$ in Berger & Willebald, 2011).

[28] Cortes Conde (1979:63, Chart 2.8) uses this relation in accordance with census definitions (*Censo General de la Provincia de Buenos Aires, 1881*). In Uruguay, the relation extensively used for agrarian production is lower (1 cow = 5 sheep) (Astori et al., 1979; Moraes, 2001). Clearly the ratio changes over time –because of technological progress and changes in the regions to do with the natural conditions of the soils– although our results are no much affected by these changes. If we change the relation by 30 per cent and consider values of 5.6 instead of 8, we obtain a share of rents in total agrarian GDP of 42 per cent in 1895 instead of 41 per cent, and 50 per cent in 1888 instead of 48 per cent. The biggest difference occurs in 1869 when we obtain a share of 60 per cent instead of 54 per cent.

[29] Land intensity was greatest in Buenos Aires (0.60 equivalent cattle per hectare) and lowest in San Juan (0.02).

[30] The annual rates of change in the TFP were 0.5 per cent in 1865-1908 (2 per cent in 1825-1908). Newland & Poulson (1998): 341, Table 3.

[31] Our data for 1895 aggregate Buenos Aires province and the Federal Capital. The information about the latter is from the *Segundo Censo de la República Argentina*. Our estimates follow this criterion in all cases.

[32] The sum of provincial data differs from the total that the source reports. For total sheep, the difference is 1,000 out of 57,547,000 sheep, and was not considered. For total cattle, the difference is 502,000 out of 13,993,000 cattle, and it was proportionally distributed among the provinces that had data in 1888.

legumes and vegetables, and fodder.[33] We apply the growth rates calculated to the agricultural land area of 1914 to obtain 1895 data for each province.

For 1888 it is not possible to replicate the same method at a provincial level. Therefore we use the data for the total cultivated area of four important crops (wheat, maize, sugar cane and potatoes) in 1875, 1888 and 1895, derived from Mitchell (2007), and apply the movements to the closer figure maintaining the same provincial structure as for 1895. To estimate the land extension of agricultural activity in 1869, we maintain the rate of growth in the 1872-1888 period (1872 is the first available figure).

- ***Land prices 1869, 1875, 1888 and 1895***

Argentine Ministry of Agriculture (1926) provides information about land prices in the period 1904-1924 (annual data) and 1899-1903 (average, in Argentine pesos per hectare) for 15 provinces and for an aggregate category of 9 provinces. However, there is scant information about land prices in each province in the 19th century. Diaz Alejandro (1970):46 presents information for 1888 for 5 provinces (Buenos Aires, Santa Fé, Córdoba, Entre Ríos and La Pampa) that is compatible with the data mentioned above. The figures for 1895 were estimated by simple interpolation. We assume the evolution of land prices in the rest of the provinces to be the same as in the closer territories, and in some cases we take account of some specific characteristics of a province. We give a summary of our decisions in Table A.1.

Table A.1
PROVINCES ASSUMED AND REFERRED IN LAND PRICES
1895 interpolations

Province assumed	*Same movement as*	Provinces of reference
Tucumán		Buenos Aires
Corrientes and Misiones		Avg. Entre Ríos and Santa Fe
San Luis, Mendoza and San Juan		Avg. Córdoba and La Pampa
Santiago del Estero and Catamarca		Avg. Córdoba and Tucumán
La Rioja		Avg. Córdoba and San Luis
Salta and Jujuy		Avg. Tucumán and Catamarca
Chaco		Avg. Santiago del Estero and Catamarca
Rest of the provinces		Chaco

Mulhall & Mulhall (1869), (Sec. C, Ch. II, p. 16) present a sheep-farmer budget with information from Buenos Aires and consider a land price of £3,000 per half square league (equivalent to £3.35 per hectare). We convert this value to the currency at that time (pesos papel) (Mulhall & Mulhall, 1875, p. 412 and Global Financial Data) and then to the currency used in the previous sources (*pesos moneda nacional*) (Ferreres, 2005) to obtain compatible series. We interpolate the figure for 1875 from the prices in 1888 and 1869 and adopt the same province structure as in 1888.

- ***Total land rents 1869, 1875, 1888 and 1895***

We updated the rent rates (*pesos argentinos* per hectare) of 1914 by the movement in the land prices – corrected by the change in the interest rates– and multiply by the land occupied by crops and livestock (in hectares) obtained previously.

2.3 Wages

We estimate total wages from estimates of wage-earners in agrarian activities (workers) and wage rates for each benchmark.

[33] Cultivated land increased by a factor of 3 in the period and almost 90 per cent of the expansion was in four provinces: Buenos Aires, Santa Fé, Córdoba and La Pampa.

- ***Wage rates 1914***

Information about wage rates by province is scarce and incomplete, and we assume that regional wage dispersion was low because we are mainly considering unskilled workers.

Cortes Conde (1979):226-228 presents annual data (incomplete) of agrarian wages (*porteros* and *peones*; by month) from 1882 to 1914. We assign the level of 1913-1914 –40 Argentine *pesos*– to 1914 as our initial benchmark. We compare with other source of 1912 (Boletín del Departamento Nacional de Trabajo, No. 25[34]) that provides data for two provinces and the levels are compatible. According with this source, wages per month without board were 40 and 37.50 Argentine *pesos* in Buenos Aires and Santa Fe, respectively (cattle production). We consider annual wages and therefore we multiply each figure by 12.

- ***Wage rates 1869, 1875, 1888 and 1895***

Williamson (1999) presents a Nominal Wage Index for 1864-1940 and quotes Williamson (1995) as the main reference for the data. He uses Cortes Conde (1979) to calculate the index from 1883 to 1903, so the figures are consistent with our initial benchmark. We project backwards the level of 1914 by the movement in the Williamson's Nominal Wage Index to estimate the 1895 and 1888 wage rates. For the previous period, he uses a different source that does not offer satisfactory results for our purposes, and we employ an alternative source.

Barsky et al. (2005):389 present rural wages data for 5-year periods from 1860 to 1895, and they coincide with Cortes Conde's figures for the respective years.[35] We interpolate those data to complete annual series, calculate an index, and retropolate our 1888 level (17.9 Argentine *pesos* per month) by its movement to calculate the wage rates for 1875 (14 Argentine *pesos*) and 1869 (12 Argentine *pesos*). As before, we multiply these values by 12 to obtain annual wages.

- ***Agrarian workers 1895 and 1914***

In the Fourth Republic of Argentina Census (*Cuarto Censo de la República Argentina*, henceforth *CCRA*) of 1947, there are estimates of agrarian occupation in 1895, 1914 and 1947 (552,114, 828,420 and 1,536,968, respectively). These data give us general trends but we must adjust the levels because these figures include occupiers with incomes other than wages, so we contrast them with alternative information.

The *TCRA* presents data about the economically active population in agrarian activity in 1914. It classifies the population as "director's family" or "employees", and it distinguishes among male, female and children by province. We consider that employees are wage-earners, and from the director's family only males earn wages when they are non-owners (otherwise their remuneration would be profits or rents). We assume that each establishment has one owner. Hence we consider total wage-earners as the sum of employees and director's family males minus the total of land proprietors (estimated as total agrarian real estate units, from República Argentina, 1919: 3-6) and we obtain a figure of 732,632 workers (provincial distribution). We apply to this figure the growth of occupied population from the *CSRA* and so calculate the total of wage-earners in 1895 (488,275).

- ***Agrarian workers 1869, 1875 and 1888***

The First National Census in the Republic of Argentina (*Primer Censo Nacional de la República Argentina*, henceforth *PCRA*) of 1869 and the *SCRA* of 1895 have information about the occupied population by professions, and in the second of these sources these categories are grouped into broad productive activities. We use the "production of raw material" as a reference to reproduce the same group in 1869 because it is the activity best linked to agriculture. We adjust the two groups to include only agrarian professions[36] and assume that the 50 per cent of *jornaleros* work in agriculture.[37] We discount professions

[34] Data kindly provided by Prof. Esteban Nicolini.

[35] Barsky et al. (2005) quote the following source: SEGUÍ, Francisco (1898): *Investigación parlamentaria sobre agricultura, ganadería, industrias derivadas y colonización ordenada por la H. Cámara de Diputados en resolución de 19 de junio de 1896*. Anexo B. Provincia de Buenos Aires. Buenos Aires, Penintenciaría Nacional.

[36] We include the following categories: *abastecederos, agricultores, arrieros, cazadores, estancieros, hacendados, horticultores, leñadores, mayordomos, obrajeros, pasteros, pastores, vaqueros, sericultores, reconocedores de frutos, vinicultores, alambradores, arzoneros, fusteros, arboricultores, arrendatarios, baqueanos, capataces, clasificadores de*

with earnings other than wages (*estancieros*, *hacendados* and *arrendatarios*) and obtain 481,000 persons in 1895 (very close to our previous estimate) and 229,640 for 1869; this amounts to an increase of 109.5 per cent over the period. With this growth rate we retropolate the 1895 estimate (488,275) to obtain a total of 233,117 wage-earners in 1869. The figures for 1875 and 1888 are obtained by interpolation.

- ***Total wages***

Wages for each benchmark were estimated as the product of wage rates and agrarian workers.

3. Australia

Our selection of benchmarks basically depends on the availability of census data and specific surveys. The information is more complete and systematic than for Argentina. We propose the following benchmarks: 1871, 1881, 1891, 1901 and 1911.

3.1 Agrarian product

We use data calculated by Butlin (1962). Although his estimates have been widely criticized (see for example, Haig, 2001) they are still in general use as the main statistical reference.

3.2 Rents

- ***Total rents 1911***

To our knowledge, the only study that estimates land income from the beginning of the 20th century is Dwyer (2003), who follows two studies by Robert Scott (1969 and 1986).[38] To measure land income, he uses the same methodology as Gaffney (1970). In general, when land values are stable, land income is the annual rental for the land. However, when land values increase then future rentals for the land are expected to be higher. Therefore land has two types of yields or returns; one directly associated with the productive activity and the other with land value appreciation (like for any other asset). However, reliable historical data about these types of returns are usually not available so the author adopts a conservative 5 per cent fixed rental yield plus a representative percentage of the accrual from future rentals. He calculates the latter value by considering a 30-year period (1910-11 to 1939-40) and applying an iterative process that renders an "accrual yield" of 1.9679 per cent. For 1911/12, he estimates total land rents (smoothed land income) at AUD 63.7 million (£31.6m) and total land value at AUD 914 million (£453.6m) (exchange rates from Vamplew, 1987). The share of rents in the agrarian product for that year (£80.9m) is 39 per cent, and this will be our reference ratio as the initial benchmark.

Australia has a very large surface area and it is important to bring regional differences into our estimates. Therefore we calculate the value of agrarian land in each state, on the assumption that the structure of rents coincides with the land value structure.

- ***Land areas 1871, 1881, 1891 and 1901***

Since the second half of the 19th century data on land use has been published, with differing regularity, by all the states (Vamplew, 1987), depending on the availability of information, we interpolate figures or backwards project data in accordance with the evolution in other states to complete the series. The details are shown in Table A.2.

Table A.2
STATES ASSUMED AND REFERRED IN AGRARIAN LAND AREA

	Available data	Interpolation	Backward projection	With the movement of:

frutos, chacareros, caballerizos, chancheros, cañamoneros, cañeros, colmeneros, domadores, estereros, enfardadores, gallineros, hortelanos, hueveros, labradores, medianeros, montaraces, puesteros, podadores, quinteros, segadores, tamberos, and *lecheros.*

[37] The occupation *jornalero* is a broad category that includes day labourers regardless of their type of economic activity. The conditions of this occupation varied across the country. In Buenos Aires it was very common to find *jornaleros* in port jobs but in provinces, with their greater agriculture specialization, they were mainly in the agrarian sector. We consider that our criterion is suitable because we obtain a total population occupied in agriculture that is close to the census data of 1895

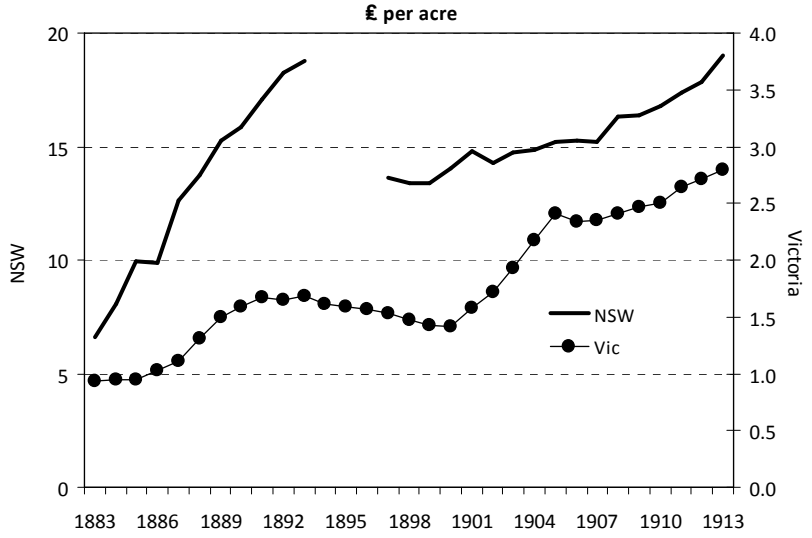
[38] We were unable to consult these studies but Dwyer (2003) presents the results, discusses them and explains clearly the differences from his own estimates.

New South Wales	1875, 1880 1883-1913	1876-1879 1881-1882	1871-1874	Victoria
Victoria	1865-1913			
Queensland	1875, 1880-1913	1876-1879	1871-1874	South Australia
South Australia	1862-1913			
Tasmania	1875, 1885...1910, 1915	1876-1879, 1886-1889, ..., 1911-1914	1871-1874	Victoria
Western Australia	1875, 1885...1910, 1915	1876-1879, 1886-1889, ..., 1911-1914.	1871-1874	South Australia
North Territory	1900, 1905...1915	1901-1904,...1911-1914		

- ***Land prices 1911***

The paper that is usually used as a basis for studying the evolution of Australian land prices during the First Globalization is Taylor (1992).[39] He presents figures for Victoria (1865-1913), New South Wales (1883-1893, 1897-1913), Queensland (1881-1913) and South Australia (1862-1913). He is cautious in his inter-state comparisons and especially so as regards New South Wales, whose data seems excessively high.[40] On the other hand, he is confident that his indicators adequately represent the trends. We agree with him in all cases with the exception of New South Wales. In Figure A.1 we present land prices in New South Wales (on the left axis) and Victoria (right axis) and compare their evolutions. The lack of information for the years 1894-1896 seems to coincide with a change in the trend and this raises doubts as to whether our calculations are suitable. Victoria's evolution shows a decline in about the same period that New South Wales declines but the magnitude of the decrease is significantly less (9 and 27 per cent, respectively). Therefore, by level and evolution, we prefer to work with alternative information for New South Wales.

Figure A.1
AUSTRALIA LAND PRICES: VICTORIA AND NEW SOUTH WALES
£ per acre



Source: Taylor (1992).

One of the most important innovations in New South Wales government land policy at the beginning of the 20th century was the Closer Settlement Acts 1904 to 1909, and the Closer Settlement Promotion Act 1910. Under this regime, land prices in New South Wales reached 52 per cent of the value in Victoria in 1910-1912 and this ratio remained relatively stable until the 1930s (see Australia Statistical Yearbooks for 1934, 1932, 1922, 1913, 1912 and 1911).[41] Therefore we use the prices from Taylor (1992) for Victoria, Queensland and South Australia, and apply the relative prices derived from closer settlement transactions

[39] Taylor (1992) is the source of Williamson (2000, 2002).
[40] For instance, the land price of New South Wales in 1900 (£14) is almost ten times higher than Victoria's figure.
[41] 1921 (57%). 1931-1933 (47%).

to calculate the New South Wales values. We employ similar criteria for Western Australia and Tasmania. North Territory was the last region in Australia to be occupied and we would have to consider the price was close to zero. Therefore, we use the lowest price (which was the price in Queensland) to give a value for occupied land in this territory. When we consider occupied land and prices by state, the exercise yields a total land value of £484m for 1911, which exceeds Dwyer's (2003) calculation by just 10 per cent. The resulting state structure of land value is applied to total rents in 1911 (strictly, to the average 1910/11-1911/12).

- ***Land rent rates 1871, 1881, 1891 and 1901***

We use the Taylor (1992) series for Victoria, Queensland and South Australia, and we assume that the movement of land prices in Western Australia and the Northern Territory was similar to Queensland's evolution, and movements in Tasmania were similar to those in Victoria. As to New South Wales in 1911, we maintain our reference of 52 per cent of Victoria's price for 1901, and in the absence of better options, we consider Victoria's land prices as a reference for the 19th century.

- ***Total land rents 1871, 1881, 1891 and 1901***

We update total rents by state in 1911 by the movement in land prices –corrected by the change in interest rates– and multiply by the area of farm holdings.

3.3 Wages

- ***Agrarian workers 1871, 1881, 1891, 1901 and 1911***

Vamplew (Ed.) (1987) provides data on employment in rural industries classified by colonies, states and territories for the years 1871, 1881, 1891, 1901 and 1911. These data represent the economically active population and include non wage earners, casual and permanent employees, and proprietors and their families, but it excludes aborigines. The lack of 1891 and 1901 data for the Northern Territory means that Australia's total is slightly underestimated. However, the share of this territory in total rural employment is very low (0.12 per cent at the beginning of the 1910s) and we interpolate the figures in accordance with the data for 1881 and 1911. Butlin & Dowie (1969) propose a division of the agricultural workforce in Australia in accordance with their grade and occupation classes (data for the whole country). They distinguish employees, the self employed, people providing assistance (unpaid) and wage-earners (receiving wages or a salary) by gender for 1891, 1901, and 1911. The total workforce differs from the total employment figures in Vamplew (Ed.) (1987) by an average of 8 per cent. We consider the wage earners in Butlin & Dowie (1969) as farm workers and we apply Vamplew's (Ed.) (1987) state structure to obtain data for 1891, 1901 and 1911.[42] We calculate data for 1881 and 1871 using the evolution of employment by colony in Vamplew (Ed.) (1987) and apply this to the figures above.

- ***Wage rate 1914***

The Commonwealth Bureau of Census and Statistics (1914) (*CBCS*) provides information on wage rates (minimums) for agriculture and livestock activities by state. There are three classes with various categories including farming (general labourers, harvesters, milkers, ploughmen), gardening –gardeners, nurserymen–, and pastoral workers –cooks, shearers (per 100), shed hands and wool pressers. We consider the simple average of all the categories except shearers because they were employed on a piecework system. There is information available for New South Wales, Victoria, Queensland, South Australia, Western Australia and Tasmania, and calculating the weighted average (in accordance with the weights presented in *CBCS*, 1914: 45) we obtain a wage for all Australia of £2.65 in 1914. This figure is consistent with Withers et al. (1985) (£2.45), who presents series of minimum weekly wage rates by industry groups (adult male), in annual data for 1891, 1896, 1901, 1906-1914. The source is the same (Labour Reports up to 1938) and we think that the difference (8 per cent) can be explained by the use of other weights or by gender differentiation.

- ***Wage rates 1871, 1881, 1891, 1901 and 1911***

We apply the structure of state wages (compared to the mean) in 1914 to the wage level that Withers et al. (1985):140 presents, and we consider the 1910-1912 average as the figure for 1911 and express the

[42] We include the Australian Capital Territory (ACT) in New South Wales.

data in annual terms.[43] Then we project these figures back in time with the changes in minimum agriculture weekly wage rates by states (adult males) presented in Withers et al. (1985):144 corresponding to the years 1901 and 1891, and with the evolution of the weekly money wage indexes presented in Butlin (1962):158 and surveyed in Withers et al. (1985):154. Indexes are not available for Western Australia and Tasmania so we apply the same movements as in the New South Wales series. For North Territory we use the same wage level as Western Australia.

- ***Total Wages***

Total wages for each benchmark were estimated as the product of wage rates and agrarian workers classified by colony and state.

4. Canada

The information available for Canada is similar to what is available for Australia except that, for some series, the coverage is better and the concepts more precise. Our selection of benchmarks is governed by census data and we propose the following years: 1871, 1881, 1891, 1901 and 1911.

4.1 Agrarian product

Urquhart (1986) gives estimates of gross domestic product by industry –at current prices in Canadian dollars– for the years 1870-1926. His estimates are commonly used in the literature and they are methodologically compatible with another source, (McInnis, 1986), who proposes agrarian value-added (constant prices and deflator) for the same period.

4.2 Rents

- ***Total land rents 1911***

Bertram (1973) discusses previous calculations of land rents for the period 1901-1921 (especially Chambers & Gordon, 1966) and proposes new estimates for the prairie regions: Manitoba, Saskatchewan and Alberta. He obtains the estimated value of farm rents by multiplying farm values by the rate of interest corresponding to the first mortgage on farm property.

We work with 1911 as our reference year and replicate Bertram's exercise. We obtain land area (in acres) from Statistics Canada (1983) (census data) and land prices from Statistics Canada (1917). Land prices –by province– correspond to the average values per acre of occupied farm land for 1908-1910 and 1914-1916 (in Canadian dollars-CAD)[44] and we obtain the figures for 1911 by interpolation. Our results exceed Bertram's estimates in 16, 8, and 17 per cent in Manitoba, Saskatchewan, and Alberta respectively, so we extend the calculations to the other provinces and correct down land values by 10 per cent, assuming that the differences between our figures and Bertram's will remain.[45] The interest rates on the first mortgage on farm property are published in Statistics Canada (1915), and they contain different numbers of observations: Prince Edward Island (5), Nova Scotia (9), New Brunswick (4), Quebec (6), Ontario (43) and British Columbia (6). We calculate total rents for Canada for 1911 by aggregating the data from the provinces (CAD 226 million, which is equivalent to 50 per cent of agrarian GDP).

- ***Land areas 1871, 1881, 1891 and 1901***

The area of land in farm holdings (census data) by province for 1871, 1881, 1891 and 1901 are from Statistics Canada (1983).

- ***Land prices 1871, 1881, 1891 and 1901***

Emery et al. (2007) were the first to try to bring regional aspects into the recent discussion about the evolution of relative factor prices in Canada during the global expansion of the late 19th and early 20th centuries. They report land prices for three locations in Ontario (Augusta-Elizabethtown, Medonte, and Wellington) to represent the "east region" and three provinces in western Canada: Manitoba, Saskatchewan, and Alberta. We correlate these places to their provinces in accordance with Table A.3.

[43] Huberman (2004) and Huberman and Minns (2007) estimate 49.6 annual weeks worked in this period.

[44] Prices are estimated by correspondents.

[45] If our assumption is correct, our estimates would be the maximum values of land rents. It is a conservative assumption that biases the results against our hypothesis because we would be working with a country with levels of land rent above those we could expect considering factor endowments quality.

Table A.3
LOCATION LAND PRICE REFERENCES TO PROVINCES OF CANADA

Province	*Referred to*	*Location*
Prince Edward Island		Augusta–Elizabethtown
Nova Scotia		Augusta–Elizabethtown
New Brunswick		Augusta–Elizabethtown
Quebec		Augusta–Elizabethtown
Ontario		Medonte-Wellington
Manitoba		Manitoba
Saskatchewan		Saskatchewan
Alberta		Alberta
British Columbia		Alberta

- ***Total land rents 1871, 1881, 1891 and 1901***

We updated total rents by province for 1911 by the movement in land prices –corrected by the movement in interest rates– and multiplied by the land area devoted to agrarian activities.

4.3 Wages

- ***Agrarian workers 1871, 1881, 1891, 1901 and 1911***

McInnis (1986) presents census data (1871, 1881, 1891, 1901, 1911 and 1921) with information about the agricultural workforce by status in terms of farmers (proprietors of farm units of 10 acres or more), family workers and paid labourers. We consider the latter two as wage-earners. No classification by provinces is available, but Statistics Canada (1983) provides data on male workers classified by province for 1891, 1901, 1911 and 1921.[46] The two series differ by an average of just 4 per cent over the period (the former exceeds the latter) and this gap can probably be explained by the presence of female workers. We project the total of male workers from Statistics Canada (1983) back in time (for 1881 and 1871) with the movement of the total agriculture workforce in McInnis (1986), and we distribute workers by province in accordance with the 1891 structure. This may be a reasonable assumption because women in agriculture in Canada worked only at peak periods of labour demand (McInnis, 1986:753). As the wheat boom started in the 1890s, and this period coincided with strong land frontier expansion, the error is not very serious in this case. Total wage-earners (family and paid labourers; McInnis, 1986) are distributed by province and gender in accordance with workforce structure (Statistics Canada, 1983). For Alberta, the number of agrarian workers is marginal from 1901 back in time, so it is considered equal to zero in benchmarks corresponding to 19th century.

- ***Wage rates 1911***

Statistics Canada (1917) provides wage information by province and gender for 1909, 1910, 1914, 1915 and 1916. These are wages per year including board, per month in the summer season including board, and the average value of board per month. We consider the first concept above and interpolate figures to obtain the data for 1911.[47] The denomination "including board" used in the source may cause confusion. We contrast this with another source (Statistics Canada, 1983, Series M78-88) and confirm that they are wages without board.

- ***Wage rates 1901***

Statistics Canada (1906) provides information on the cost of labour with board by provinces and by territories (a denomination that includes Saskatchewan and Alberta) in 1901. We assign the figure of the

[46] According to the source, figures for the 20th century are adjusted to a 1931 classification of occupations, and the 1891 figures are unadjusted data.

[47] We interpolate 1910 and 1914 data in all the provinces with the exception of British Columbia, for which we use 1909 and 1914 because no figures are available for 1910.

territories to Saskatchewan because we have no data about the number of agrarian workers in Alberta. According to our estimates, the ratio between wages "without" and "with" board was 1.9 in 1910-1914. In other ex-British colonies like New Zealand the ratio was 1.98 in 1900-1902. We assume a value of 2 and adjust the previous figures to calculate total wages.

- ***Wage rates 1871, 1881 and 1891***

We calculate the wage rates for 1871, 1881 and 1891 in accordance with the movement of regional wages presented in Emery et al. (2007). These data register daily wages in Toronto and Winnipeg according to two sources: salaries on the Canadian Pacific Railway and wage statistics published by the Department of Labour. We construct a triennial average index (1913=100) for the two regions from the annual average of both series. We use the Toronto index to update wages for Prince Edward Island, Nova Scotia, New Brunswick, Quebec and Ontario ("East") and the index of Winnipeg to adjust wages for Manitoba, Saskatchewan, Alberta and British Columbia ("West").

- ***Total Wages***

Total wages for 1911 were estimated as the product of wages and agrarian workers classified by province and gender (CAD 94 million, equivalent to 21 per cent of agrarian GDP). The total wages with board for 1901 classified by province were obtained directly from a source and they were adjusted to obtain "without board" figures. We calculate the data for 1891, 1881 and 1871 projecting backwards the previous estimates according to the movement of the total agrarian workers and the index of daily wages.

5. Chile

Our selection of benchmarks basically depends on the availability of census information and population data. We had to consult many additional sources and propose specific assumptions to complete the picture and determine the best statistics in each case. The benchmarks are 1875, 1885, 1895, 1907 and 1915.[48]

5.1 Agrarian product

To measure agrarian income we consider the gross output or gross domestic product (GDP) of agrarian activity, as given in official data and the best available estimates. The main recent contribution in this field was Rodriguez Weber (2009), who gives an estimate of income distribution in Chile for the period 1860-1930.[49] He estimates the generation of income by industry and occupational category and considers four benchmarks (1875, 1885, 1907 and 1930) and annual income indicators (for the period 1860-1930). Thus he obtains estimates of total and sector (agrarian, industrial and services) income. However, to avoid dealing with inter-sector and international income transfers (which are associated with different sector price evolutions and with the external ownership of assets, respectively) we focus our analysis on income generated within the sector (with the productive factors employed in economic activity). Therefore we work with the agrarian product. Information at current prices is available from 1900 onwards (Haindl, 2008) and we spliced this series with figures from Díaz, Lüders & Wagner (1998) (1908-1910 constant prices) which we inflated using the Agrarian Price Index presented in Wagner (1992).[50]

5.2 Rents

- ***Land prices 1917-1921 and 1875***

Information about land prices in Chile in the 19th century is scant and incomplete. Even in the 20th century there are few systematic studies of the whole country and they do not cover long periods. Hurtado, Bustos and Galmez (1979) are an exception to this, but the information they present is just for the second half of the 1910s and only covers two specific regions.

For Coquimbo and Curicó (Regions IV and VII, north and central zones, respectively) and Talca and Bío Bío (Regions VII and VIII, central and south zones, respectively), they register land prices for agricultural land with irrigation (either with fruit trees and vineyards or without them) and dry land. The figures are in constant December 1978 dollars and they are 5-year averages (beginning in 1917-1921). We convert the data to Chilean currency (using the exchange rate) and inflate them using the Consumer Price Index (from

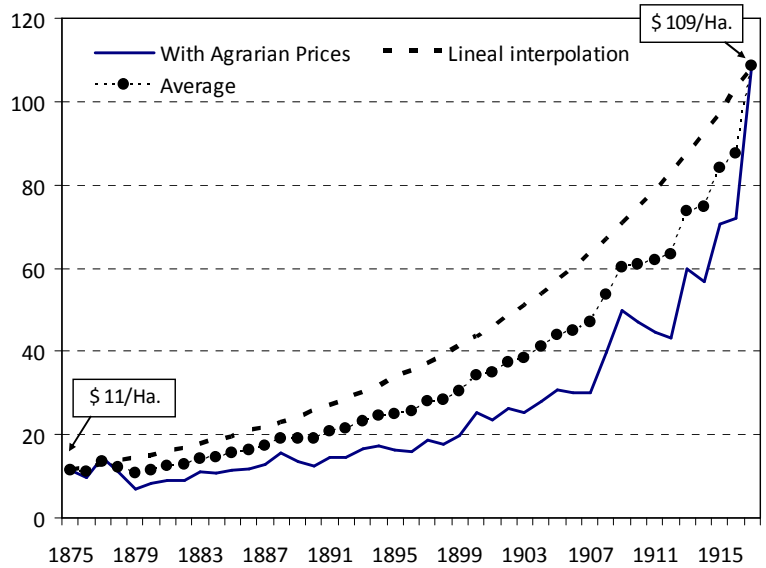
[48] Our estimates were presented in Rodriguez Weber & Willebald (2010).
[49] A previous advance had been presented in Bértola & Rodríguez Weber (2009).
[50] The Agrarian Price Index is called "*Índice de Precios Agrícolas Latorre Extendido*" (*IPALS*) from Wagner (1992).

Braun et al., 2000) to obtain land prices in "new" Chilean pesos. Our estimates are expressed in "old" Chilean pesos so we convert the figures at the rate of 1 "new" peso = 1,000,000 "old" pesos.[51] We use the symbol $ to denote "old" *pesos*.

As fruit trees and vineyards are improvements closer to the idea of physical capital (which yields profits) we calculate an average land price that excludes them, so we consider the price of irrigated land without trees or vineyards and the price of dry land, and the two types of land are weighted by their share in the total agrarian area in 1936. The *Segundo Censo Agropecuario de Chile* (1935-1936) (henceforth *SCACh1936*) has information about agrarian area with irrigated and dry land and considers four zones: north, central, south and austral (extreme south). For our calculations, the south and austral zones are considered as the south region. As we have land prices for two regions –Coquimbo and Curicó; and Talca and Bío-Bío– we rearrange the data from the census into two large regions, the North-central and South-central zones, by dividing the central region in half and adding the areas to North and South, respectively. We have the weights for land prices: North-central with irrigation (3%) and dry land (29%); South-central with irrigation (2%) and dry land (66%). We assign the average price in 1917-1921 to each year in the period ($ 109 per hectare).

Correa (1938) comments on a document written in the 19th century called "Studies of the economic state of agriculture in Chile" (*Ensayos sobre el estado económico de la agricultura de Chile)* that has various kinds of information about the situation in 1875. The value of the total land, including arable land with irrigation, dry land, pasture and woodland, was equivalent to $ 233.3 million for a total area of 11.4 million hectares and with an average price $ 20 per hectare.[52] However, at that time irrigation meant a considerable investment, and like trees and vineyards in the 20th century this was closer to the generation of profits than rents. Therefore we exclude this kind of land and consider 11 million hectares at an average price of $ 11 per ha.

Figure A.2
LAND PRICES EVOLUTION: ASSUMPTIONS AND SCENARIOS
$/Ha



Source: Braun, Braun, Briones & Díaz (2000); Correa (1938); Dirección General de Estadística - Chile (1938). Hurtado, Bustos & Galmez (1979); Wagner, (1992).

- ***Land prices 1885, 1895 and 1907***

In other instances we complete several series of land prices using lineal interpolations. However, this case is different because the period (1875-1917) is extremely long and our underestimation of the fluctuations would be excessive. Moreover, Chile had high inflation at the beginning of the 20th century and this would distort the estimation considerably (see Millar Carvacho, 1994). Agrarian prices may be conceptualized as a weighted average of the return on the productive factors that participate in agrarian production, and this can give us some clues as to how to proceed.[53] Theoretically, rentals would have increased in real terms

[51] From the 19th century up to today Chile has had three legal currencies: (i) 1830-Dec/1959: *peso chileno* or *"peso antiguo"*; (ii) 1960-Sep/1975: *escudo*; (iii) Oct/1975 to the present: *peso chileno* or *"peso nuevo"*. The relation is: 1 *peso nuevo* = 1,000 *escudos* = 1,000,000 *pesos antiguos*. See Braun et al. (2000): 88-89 for an explanation.

[52] Figures are presented in *pesos de 6 peniques,* and from the text we deduce that the relation is 1 *peso antiguo* = 4 *pesos de 6 peniques*.

[53] Considering Y as the gross domestic product of agrarian activity, we can express it as the sum of the total yield of the productive factors: $Y \equiv w\,L + \rho.K + q\,N$. Where L, K and N represent the volume of labour, capital and land used in the production and w, ρ and q the respective earn-rates (wage, profit and land rents) (see a similar representation for the

during the First Globalization (see the literature based on the H-O-S approach) and risen higher than prices in the sector (even when corrected by interest rates it is reasonable to assume $\Delta q > \Delta p_A$). Estimating the evolution of land prices –i.e. land rents– by lineal interpolation would exaggerate the intermediate points (when they were not yet affected by inflation), but doing this with agrarian prices would cause the opposite effect (land prices would have exceeded the evolution of agrarian prices). We have no criteria to prefer one approach to land prices to the other so we opt to take an average of the two series. Figure A.2 illustrates our three scenarios. Therefore, the land prices of 1885, 1895 and 1907 are estimated as the average evolution.

- ***Land areas 1875, 1885, 1895, 1907 and 1917***

According to the *SCACh1936*, the total land used for agricultural activities in 1919 was 18.2 million hectares, and we assign this area to the period referred to in the price sub-section (1917-1922). When we check this value against the number of rural properties we find that the average size of a farming establishment was 188 hectares. We consider that in 1907 this number was 69,988 (Salazar, 1985), so we estimate the total area at 13.2 million hectares (we assume that the average size of establishments did not change significantly). The area for 1875 was taken from Correa (1938) (see previous sub-section) and the figures for 1885 and 1895 were obtained by interpolation.

- ***Total rents 1907***

To calculate total rents for 1907 we follow the methodology of Dwyer (2003). Reliable historical data about land rent rates are not available and it is usual to adopt a conservative 5 per cent fixed rental yield plus a representative percentage of the accrual of future rentals. In the case of Chile, that rental rate is a reasonable percentage. Bengoa (1990):38 comments that a conservative calculation for that time is a rental ratio of 5 per cent on capital. Correa (1938):252 presents data about rents for 1834, 1854 and 1875 –probably derived from fiscal information– that, for the last year, amount to almost 5 per cent of the land value (considering the total value of the land, including investments). We calculate the accrual yield by computing the internal rate of return on an investment equivalent to the land value in 1875 (the same value used to estimate the price) which was recovered in 1907. The resulting accrual factor for this period is 5.1 per cent. Therefore we calculate total rents as 10.1% of land value in 1907, a figure equivalent to the 49 per cent of the total agrarian product.

- ***Total rents 1875, 1885, 1895 and 1915***

We update the total rents estimated for 1907 by the movement in land prices –corrected by the change in interest rates– and multiply by the area of farm holdings.

5.3 Wages

- ***Wage rates 1907***

Rodríguez Weber (2009) presents information on wage rates for each benchmark (1875, 1885, 1907 and 1930) but we make some changes to 1907 to consider regional differences. Bengoa (1990) presents daily wages[54] for several provinces around 1911, and we classify these by regions[55] and update to 1907 with an Agrarian Wage Nominal Index (Matus, 2009). Rodriguez Weber (2009) discusses the number of days agrarian workers worked per year and assumes that the number increases from 200 days in 1875 to 260 in 1930.[56] We adjust our daily wages to transform them into the annual income from 227 working days in 1907. In Table A4.4 we present our assumptions and the data.

- ***Agrarian workers 1875, 1885, 1907 and 1930***

We consider agrarian wage-earners as the income category identified with the *"gañanes"* (peasant) in Rodríguez Weber (2009). He provides information about the number of earners for each benchmark (1875,

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whole economy in Berger & Willebald, 2011, and Rodríguez Weber & Willebald, 2010). As $Y=y.p_A$ –the product of the volume produced in the agrarian activity and the prices of the sector– p_A may be interpreted as a "weighted" average of w, ρ and q.

[54] We use *"forastero/día"* because it is the category similar to *"gañán"*, the unskilled worker in agrarian activity.

[55] Rodríguez Weber (2009):44 and Willebald (2009) discuss proposals to regionalize Chile to facilitate the analysis. Here, we apply the same criterion that Willebald (2009).

[56] See Rodríguez Weber (2009), pp. 42, 45, 54 and 231.

1885, 1907 and 1930) and we use these data as a reference.

- ***Total wages in 1875, 1885, 1895, 1907 and 1915***

Based on the agrarian workers and wages rates, we calculate the total wages of 1907, which come to 21 per cent of the total agrarian product (triennial average centred in 1907) and we estimate the proportions of the other benchmarks taking this year as a reference.[57] We project the total wages for 1875 and 1885 by the movement of wage rates and the number of workers from Rodríguez Weber (2009). Neither of these years distinguishes between regions so we consider the same wage for the whole country. Finally, we project total wages for 1907 backwards to 1895 and forwards to 1915 by the movement of wage rates in the Wage Nominal Index of Matus (2009) and the annual series of *"gañanes"* of Rodríguez Weber (2009).

Table A.4
WAGE RATES BY PROVINCE IN 1907
$ by day and $ by year

Year	Province	Region	$/day	$/year	1907, $/year
1910	Santiago	Central	1.0	227	204
1910	Curicó	Central	0.7	159	143
1910	Parral	Central	0.6	136	122
1910	Macul	Central	1.4	318	285
1911	San Javier	Central	1.0	227	174
1911	Malloco	Central	2.0	454	349
1912	Rancagua	Central	1.5	341	244
1912	Chillán	Central	1.2	272	195
1912	San Felipe	Central	1.5	341	244
1913	Maule	Central	0.8	182	125
		Average			***208***
1911	Copiapó	North	2	454	349
		Average			***349***
1907	Osorno	South	1.5	341	341
1910	Temuco	South	1.3	295	265
		Average			***303***

Sources: Bengoa (1990):18 and 196. Rodriguez Weber (2009).

6. New Zealand

As with the other ex-British colonies there is more information available, with periodic census data and many adequate secondary sources. We propose the following benchmarks: 1874, 1881, 1891, 1901, and 1911. The recent attempts to introduce these categories empirically into a historical perspective are Álvarez (2008), Álvarez, et al. (2011) and Álvarez & Willebald (2009), but our estimates consider a longer period and have more accurate information. Furthermore, the second article of the three mentioned above does not distinguish between land rentals and profits. Now we can improve the estimates with more sources and make our assumptions more precise.

6.1 Agrarian product

We do not have data about sector product in New Zealand before WWI. Linehman (1968) presents annual data by industry and total GDP at current prices from 1918 to 1939. There are other estimates of total GDP at current prices made with other methodologies. We use the series published in Briggs [2003 (2007)] –based on Rankin (1991)– and Easton (2004) and contrast them with Linehman's estimates.

The ratio between the Linehman and Briggs estimates of total GDP for the whole period (1918-1939) is 0.97 (average), although for some years the differences are greater. For instance, during the first 5-year period the ratio is just 0.8 and this difference is important in our study because these values are our splicing period. When we compare the sector structure with Easton's series, the compatibility with Lineham's data is marked. According to this source, the shares of nominal agriculture GDP in total GDP were 29.8, 26.2 and 23.2 per cent in 1920, 1930 and 1939, respectively, while the shares in the Lineham's series were 31, 26.3 and 23.1 per cent.

Information about agriculture for the period prior to 1918 is available for the gross value of agricultural production (GVP) for the years 1900/01, 1905/06, 1910/11, 1915/16 and 1920/21, and we assign the values to 1901, 1906, 1911, 1916 and 1921, respectively. We estimated the agrarian product (value-added) for 1916 by applying the movement in the GVP from 1916 to 1921 to the average value added of 1920-1922. The other figures are backward estimates –for 1901, 1906 and 1911– in accordance with the same

[57] We repeat our estimates with the 1907 day-wage of the agrarian worker of Matus (2009) and the result is the same.

criterion. The engine of the agrarian activity was the international market so export dynamism may be a good indicator of the evolution of the sector. However, the domestic market was developing at the same time and the result was a combination of the two processes. We expect that the share of agrarian exports –from livestock and agriculture; Bloomfield, 1984[58]– in agrarian GDP increased during the period and our methodology confirms it. When we consider triennial averages the figures are as follows: 0.84 (1901), 0.85 (1906), 0.92 (1911), 0.95 (1916), 1.08 (1921), 1.08 (1926), 1.04 (1931), 1.23 (1936).[59] We propose an exercise of lineal regression to extrapolate the shares in 1891 and 1881 and we obtain shares of 0.71 and 0.61, respectively. We applied both ratios to agrarian exports (triennial average centred in those years) to estimate the agrarian product. For 1874 we assume the same ratio as for 1881.

6.2 Rents

- ***Land areas 1874, 1881, 1891, 1901 and 1911***

Bloomfield (1984) presents series of land occupied from 1867 onwards with varying periodicity. New Zealand has a small surface area but land values are not homogenous and the differences between different establishments depend on geographic and institutional conditions. It was not possible to find different prices and rents by regions, but some institutional arrangements governing land make it possible to bring in these differences.

Gould (1969) publishes almost the same series as Bloomfield (1984) and provides a useful classification for our approach. He distinguishes between Crown land for pastoral purposes only
–that is Crown Pastoral Leases (CPL), and from 1886 onwards Small Grazing Runs– and other agrarian land that is not under CPL. CPL land was especially suited to extensive pastoral farming, it was relatively infertile and/or inaccessible and it was subject to specific tenure conditions.

In addition, farm intensity differed on non-CPL land, depending on the type of production. This difference became increasingly important as agriculture and the dairy industry (associated with refrigeration) extended their influence in the agrarian economy. Therefore we differentiate kinds of land in accordance with its productive uses (livestock and crops). Bloomfield (1984) presents data about cultivated land and we include in this category grain crops, greens, root crops, orchards and other cultivated land from 1890 to 1911. We make estimates for years prior to 1890 using the evolution of the area of major crops (wheat, oats and barley). Therefore we consider three types of land: CPL, non-CPL specialized in crops, and the rest of the non-CPL. Each type is related to different returns and prices; the lowest values for the first type, the highest values for the second and intermediate values for the third.

- ***Rental rates and land prices 1874, 1881, 1891, 1901 and 1911***

Data about rents is scarce and scattered. CPL rents are calculated as the ratio between the yearly rental (or instalment payable) and the total area held from the Crown in 1913 and 1906 including deferred payments, occupation with the right of purchase, leases in perpetuity, renewable leases, small grazing-runs and pastoral runs. The calculation covered 11.4 and 15.6 million acres, respectively, for the two years. The 1896 source does not distinguish rental categories and we consider the total amount (New Zealand Yearbook, 1897, 1907 and 1914). Non-CPL non-crop rents are calculated from the annual rental paid by selectors under the closer settlement land policy, which was actively promoted by the government from the beginning of the 20th century. The calculations cover 105,239 acres in 1906 and 1.5 million acres in 1913. Finally, Greasley & Oxley (2008) propose an estimate of per capita rental values for cultivated land that enables us to calculate an implicit rental rate for 1890, 1914, 1919 and 1929 (population data from Briggs, 2003 (2007)).[60] Therefore we have land rental rates for different types of land and periods (Table A.5).

[58] Pastoral includes meat (preserved and frozen), butter, cheese, hides and skins, tallow and wool. Agriculture includes grain, flour, meal, potatoes and seed.

[59] We take 5-year data to maintain the periodicity pre-WWI. Shares higher than 100 per cent are possible considering stock variations.

[60] The calculation of total land rents in this article exceeds the GDP of the agrarian sector, and this is an important conceptual error. However, the problem derives from considering that all cultivated land yields the same (high) rents. The implicit rental rate is derived from applying a mortgage interest rate to the price (per acre) of this type of land. We use this rental rate for our estimates.

Table A.5
LAND RENTAL RATES BY LAND CATEGORY AND YEAR

Land category	*Reference year*	*Rental rate (£/acre)*
CPL	1896	0.008
	1906	0.014
	1913	0.035
Non-CPL Crops	1890	0.98
	1914	2.27
	1919	3.81
	1929	3.10
Non-CPL Non-crops	1906	0.21
	1913	0.24

We calculate agrarian rental rates for each type of land and update by the coefficient "price- interest rate".[61] The only exception is non-CPL land specialized in agriculture for 1901, for which the land rent rate was interpolated between the 1890 and 1914 figures because the evolution turned out to be more reliable. We obtained land prices from Greasley & Oxley (2005). They present a real land price index that we inflated with the price index implicit in the relation between the nominal and the real wage (Greasley & Oxley, 2005, Data Appendix, p. 43-44). With that index we obtain the series of land prices in pounds, and update the value they give for 1915 (p. 28) (£7.4 per acre).

- ***Total land rents 1874, 1881, 1891, 1901 and 1911***

We update total rents by land category for 1911 by the movement in the estimated land rentals and multiply by the area of farm holdings.

6.3 Wages

- ***Agrarian workers***

Hawke (1979) proposes a disaggregation of the New Zealand labour force for the years 1871-1936. He corrects the census data (such as those presented in Bloomfield (1984); agricultural and pastoral occupation) in line with a modern classification of economic activities and the reallocation of residual census categories like "others" and "indefinite occupations". He presents 5-year data from 1881 onwards (1886, 1891, 1901, 1906 and 1911). For years previous to this period, when the changes are more accelerated and the labour force increased very quickly, he presents figures for shorter periods. We smooth the figures in a similar way as for GDP data. We average 1871-1874 and 1878-1881 to calculate the total labour force in 1874 and 1881, respectively. The agrarian labour force includes non wage-earners (land proprietors and family workers) so it is necessary to adjust our series. Considering that many landowners may have been registered as labour force, one way to correct our figures is to take these people out by assuming that each establishment has one owner. Bloomfield (1984) presents the number of farm holdings for the period.

- ***Wage rates***

Arnold (1982) provides information about remuneration by industry for the period 1873-1911 and considers wages paid in shillings per week. For farm or agrarian labourers the data are presented with and without board, and we use the latter category. We calculate the annual wage with the same ratio as that used for Australia (Huberman, 2004 and Huberman and Mins, 2007). Arnold (1982) does not include information about farm wages without board in 1873-1877 because his source (Statistics of New Zealand) does not report it. Greasley & Oxley (2004) propose nominal wage indexes by industry for 1873-1913 in a

[61]The source of interest rate does not present data for 1915-1924. We assume the same movement as Australia's interest rate.

way that is compatible with Arnold's data. We complete Arnold's series with the evolution of their nominal farming wages index presented.

- ***Total Wages***

We calculate the total wages by multiplying the number of wage-earners and the wage rates.

7. Uruguay

We selected our benchmarks in function of the information available about land rents. Unlike for the other countries, we have land rental series (4- or 5-year periods) and we use these data in the estimation. The first estimate of land used for agrarian activities was in 1872 and this year will be our starting point. We propose the following benchmarks: 1874, 1883, 1893, 1903 and 1912.

As in the case of New Zealand, the recent attempts to introduce these categories empirically into the historical perspective are Álvarez (2008), Álvarez et al. (2011), and Álvarez & Willebald (2009). The same comments apply to the Uruguay data; our estimates are based on broader information and we work with a longer period.

7.1 Agrarian product

Bértola (2005) proposes an estimation of income distribution in Uruguay –by productive sector and occupation classes (annual data)– from 1908 to 1966, and this is one of our starting points. However, to maintain consistency in our estimates in the sample of countries, we work with agrarian product (livestock and crops value-added) at current prices. Bértola (1998) presents these series (annual data) for 1870-1936. During the period when the two series coincide (1908-1936), the lineal correlation is close to 0.9 although agrarian income exceeds agrarian product by more than 50 per cent (54 per cent for the whole period).

7.2 Wages

- ***Total wages 1912***

Bértola (2005) presents various occupational categories: unskilled labourers (*"peon"*), foremen (*"capataz"*), servants, landowners, lessees and lessors, and considers numbers of persons and income rates. We use the three first categories as wage-earners. Total wages for the years 1911-1913 amounted to 21 per cent of total income, and we apply this proportion to agrarian GDP in the same period. We project this value back in time in accordance with movements in the wage rate and the number of farm workers.

- ***Wages rates 1874, 1893, 1883 and 1903***

The information used to calculate total wages in 1912 may be disaggregated in terms of amount (number of workers) and price (wage rates) to estimate a weighted average wage. The result is $ 363, as the average of $ 300 (unskilled worker), $ 720 (foremen) and $ 351 (servants) (triennial averages centred in 1912). Analogously, we have data for 1909-1911 ($334).

There is scant data for agrarian wage rates in previous periods and we have to rely on partial information and indirect indicators. An initial possibility was to work with Williamson's (1999) Nominal Wage Index for 1870-1940, based on Bértola et al. (1999a, b), to update the figures, but there are some problems that make this option unsuitable. This index was constructed in accordance with the following occupational classes: unskilled public building workers (1870-1886); unskilled building workers in a particular firm (1886-1900); building sector labor cost (1900-1907); and unskilled building workers (1907-1926). Therefore the series have an urban profile that makes it difficult to apply them to our figures as we move back in the 19th century. We do not have evidence about the composition of the labour market in Uruguay but it is reasonable to suppose that integration was high on the eve of WWI. However, this assumption is doubtful for previous decades, so we look for alternatives and wage levels in accordance with agrarian payments.

Barran & Nahum (1971) analyze the agrarian profitability of a cattle and sheep establishment in 1891. For each peso ($) paid in wages (for contract and also piecework), $ 0.81 was paid for board and lodging. Therefore, by considering this ratio and the number of contracted workers, we calculate an annual wage of $ 196 ($88 with board).[62] This annual wage was applied for 1893 (the Nominal Wage Index for 1891-1893

[62]The ratio between wages without and with board is 2.2. It is close to the New Zealand value for the same year and considers official data (2.1; average 1890-1892).

has the same value, which denotes salary stability). These authors also present calculations for the returns on a sheep and cattle farm in 1868-1869,[63] and in addition they obtain information for 1871 from a specialized journal.[64] In the case of the sheep and cattle farm, we consider an annual wage of £37 that converted into pesos –Millot & Bertino (1996), Officer (2011)– and adjusted by board and lodging (in accordance with the estimates for 1891) yields a wage of $ 320. In the second case, monthly wages between $12 and $15 are reported for cattle farming wage-earners and between $15 and $17 for sheep farming wage-earners. By considering averages, annual wages and board and lodging, we get a very similar level to the previous one ($ 321), which is consistent with the high stable values in the period.

As a result we have wage levels for 1871, 1893, 1909 and 1912, and we need to estimate figures for 1874, 1883, 1893 and 1903. We rescale Williamson's (1999) Nominal Index Wage to make our data compatible with this evolution and obtain our reference values (see subsection 3.3).

- ***Agrarian workers 1874, 1883, 1893 and 1903***

We estimate the number of workers in crop and cattle farming.

The Ministry of Livestock and Agriculture's series data (Ministerio de Ganadería y Agricultura - Dirección de Agronomía, 1950) on the crop farming workforce distinguishes land proprietors, family workers and wage-earners for 1925, and Bertino & Bucheli (2000) extend the series of the total workforce of the activity to cover 1913-1924 and 1908. We project the total wage-earners from the first source with the movement in total workforce in the second source. Barran & Nahum (1967) estimate the crop farming workforce in 1892-1894 and get values compatible with those of Bertino and Bucheli (2000),[65] and we use the same above-mentioned methodology to calculate wage-earners in 1893. Before the 1890s, crop farming was not an important sector, it was related to subsistence occupations, and we do not consider wage-earners in that activity.

In addition, we follow an exercise by Rial (1982): 119 to estimate the number of labourers employed in the livestock sector in accordance with technical coefficients. According to the testimony of agrarian producers, during the 1860s one worker was employed per 300 cattle and per 1,500 sheep, and from the first decade of the 20th century one worker was employed per 580 and 1,000 animals, respectively (Barrán & Nahum, 1967, 1977). Therefore, considering the number of cattle and sheep and these technical coefficients (we assume that the coefficients changed lineally between 1860 and 1900, and maintain the last ratio in the 20th century) it is possible to estimate the number of workers.

We have data on the number of animals from Dirección General de Estadísticas (1937) (livestock census) for 1900 and 1908, and from Barrán & Nahum (1971a, b) for 1883 and 1874. We obtain the figures for 1893 and 1903 by lineal interpolation (between 1885 and 1900, and between 1900 and 1908, respectively) and the values for 1883 and 1874 are the simple averages of two estimates by these authors.[66] We use the sum of our estimates of crop cultivation and cattle farming labourers for 1908 (43,667), 1903 (37,095) and 1893 (33,409) to project Bértola's (2005) 1908 figure (47,082) back in time. For 1874 and 1883 we use our estimates of cattle farm workers (28,256 and 23,394, respectively).

7.3 Rents

Balbis (2005) presents information about land rents (Uruguayan *pesos*/hectare) by province[67] for five-year periods (with the exception for one three-year period) from 1886 to 1924. Thanks to the detailed data available we can carry out a different exercise that is more precise than for the other countries. We estimate total land rents in 1912 by considering rent rates and cattle and crop farming area by province,

[63] Barran & Nahum (1971):265 quote an English book edited by J.H. Murray in 1871.

[64] Barran & Nahum (1971):266 quote the journal of the organization representative of agrarian interests (*Revista de la Asociación Rural*) published in January, 1873. The article is a letter that answers some questions from a Portuguese citizen about the costs and returns of agrarian activity in Uruguay.

[65] 44,023 (1892), 43,409 (1894) and 41,631 (1908), respectively. They are farming workforce and not wage-earners.

[66] Barrán & Nahum (1971b) present two data items by category for 1874 –4.75 and 6.33 million (cattle) and 9.75 and 13 million (sheep)– and for 1883 –6 and 8 million (cattle) and 14.56 million (sheep)– derived from different sources. We do not have any criterion to prefer one or other figure so we opt to work with the average.

[67] Uruguay has 19 administrative jurisdictions called *departamentos,* which are equivalent to the "provinces" or "states" in other settler economies.

and we classify the provinces in accordance with their agrarian aptitude. The CONEAT index is an indicator of agrarian productivity that classifies regions in accordance with their agrarian aptitude (MAP-CONEAT, 1979) and we use it as reference. Depending on the availability of information, we apply land rents and land prices (adjusted by the interest rate) to estimate land rents for each benchmark and area devoted to cattle or crops.

Balbis (2005) presents a breakdown of the country in four zones: South (Canelones, San José, Flores), Littoral (Paysandú, Río Negro, Soriano and Colonia), North (Salto, Artigas, Rivera, Tacuarembó, Treinta y Tres and Cerro Largo), and Centre (Lavalleja, Durazno, Maldonado, Florida and Rocha). For our purposes it is more suitable to rearrange the regions so as to incorporate differing land quality and to "homogenize" the zones. We place Florida in the South region and Paysandú in the North.

- ***Land areas 1874, 1883, 1893, 1903 and 1912***

The information sources for the total cattle farming area in each year is as follows: 1872 (Jacob, 1969:11), 1900, 1908 and 1916 (Moraes, 2001:55), the crop area for 1872 (Jacob, 1969:11), 1900 and 1908 (Bertino et al., 2005:158-159). We obtained the crop area for 1912 and 1916 by considering a total agrarian area of 16.6 million hectares and taking the difference. We calculated the benchmarks by lineal interpolation. The cattle farming area was distributed proportionally among the provinces in accordance with province areas because all the land is suitable for raising cattle and sheep. We distributed the crop farming area proportionally among provinces with a CONEAT index higher than 100 as these areas were more suitable for intensive agrarian activities. These provinces or *"departamentos"* are the following: Canelones, Colonia, Flores, Florida, Río Negro, San José and Soriano.

- ***Land rent rates 1874, 1883, 1893, 1903 and 1912***

Balbis (2005) provides data for 1911-1913 and 1891-1895 and we assign these to 1912 and 1893, respectively, but we do not consider the information for 1901-1905 because it is so scant.

There is no information for 1912 for three provinces –Treinta y Tres, Maldonado and Rocha– therefore we estimate these figures by taking the changes in Cerro Largo (for the first case) and Lavalleja (for the two latter cases), from the period 1906-1910 to the eve of WWI (average of 1911-1913). There is no information for 1893 for six provinces –Colonia, Salto, Rivera, Treinta y Tres, Maldonado and Rocha– and we estimate them using a variety of criteria. We estimate Colonia, Salto and Treinta y Tres in line with the average movement in Río Negro and Soriano, Paysandú, and Cerro Largo, respectively, from 1891-1895 to 1896-1900. We assume Rivera had the same land rate as Artigas. Lastly, we estimate Maldonado and Rocha using the average growth in land rents in Lavalleja and Durazno from 1891-1895 to 1906-1910. There is no information available for the province of Montevideo so we consider the same land rent as Canelones. They are next to each other and they share similar agrarian characteristics.

We calculate the rest of the benchmark land rent rates (1903, 1883 and 1874) in accordance with movements in land prices and interest rates. For 1903 we have prices per province from Balbis (1995). The series are complete with the exception of figures for Durazno and Maldonado in 1911-1913, and we calculate these in accordance with the movement in Lavalleja. We estimate land rents by moving the 1912 figures in accordance with the evolution from 1903 to 1912. We applied the same methodology to estimate the figures for 1883 and 1874, using averages by zones (not by *departamentos*) and moving the figures from 1893 and 1883, respectively. Data by province begin in 1886-1890 and therefore we compare the average of our regional analysis in 1893 with the Balbis's (2005) regional average for the same year. The differences will not be very important and we confirm that our methodology is satisfactory.

- ***Total land rents***

We multiply our calculations of the area and the land rent rates to obtain our estimates of total land rents.

8. Our estimates

We present our agrarian GDP component estimates (current currency) in Table A4.6.

Table A.6
AGRARIAN SECTOR: FUNCTIONAL INCOME DISTRIBUTION
Agrarian GDP components in current currency

	ARGENTINA (000s pesos)				AUSTRALIA (000s pounds)		
	Wage	Rent	Profit		Wage	Rent	Profit
1869	33,718	54,038	11,782	**1871**	6,716	11,007	4,010
1875	46,371	100,192	23,899	**1881**	9,940	16,327	9,167
1888	85,856	129,327	55,726	**1891**	11,661	27,490	6,415
1895	163,802	272,953	236,296	**1901**	12,153	19,024	4,523
1914	351,663	1,132,937	200,433	**1911**	21,239	32,863	29,997
	CANADA (000s Canadian dollars)				**CHILE (000s "old" pesos)**		
	Wage	Rent	Profit		Wage	Rent	Profit
1871	31,839	70,268	43,379	**1875**	10,669	37,355	12,802
1881	43,857	82,062	61,165	**1885**	10,097	42,701	21,855
1891	50,000	102,349	35,405	**1895**	20,297	73,619	24,140
1901	48,457	90,394	104,934	**1907**	60,559	142,285	85,156
1911	94,265	225,923	129,792	**1915**	98,908	377,697	186,395
	NEW ZEALAND (000s pounds)				**URUGUAY (000s pesos)**		
	Wage	Rent	Profit		Wage	Rent	Profit
1874	1,289	1,887	2,505	**1874**	4,390	5,385	2,022
1881	2,617	3,140	1,664	**1883**	4,338	8,080	3,997
1891	3,099	4,223	2,969	**1893**	4,700	10,879	6,424
1901	3,038	5,639	3,028	**1903**	7,132	13,724	7,716
1911	5,526	9,414	3,671	**1912**	12,137	39,196	6,656

Source: see Text.

9. References

9.1 Introduction

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Figures and Tables

Table 1
SPECIFICATIONS IN THE CALCULATIONS OF LAND INEQUALITY INDICATORS

PAÍS	YEAR	AREA RANGES	SOURCE
Argentina	1914	9 classes expressed in hectares. Less than 25 26-50 / 51-100 / 101-500 501-1000 / 1,001-5,000 5,001-10,000 / 10,001-25,000 / 25,001 and over	REPUBLICA ARGENTINA (1916): *Tercer Censo Nacional, 1914, Argentina*. Tomo V: Explotaciones Agropecuarias. Capítulo 1: Las explotaciones agropecuarias clasificadas por escalas de extensión, pp. 3-6
Australia	1911	9 classes expressed in acres. 1-50 / 51-100 / 101-500 / 501-1000 / 1,001-5,000 / 5,001-10,000 / 10,001-20,000 / 20,001-50,000 / 50,001 and over	VAMPLEW, Wray (Ed.) (1987): *Australians: historical statistics*. Fairfax, Syme and Weldon, Canberra. Table AG 19-27 Landuse, Colonies, States and Territories, 1850-1980, p. 73.
Canada	1911	7 classes expressed in acres Under 1 / 1-5 / 5-10 / 11-50 / 51-100 / 101-200 / 201 and over	STATISTICS CANADA (1914): The Canada Year Book 1913. Ottawa. V.- Production-Agriculture pp.167-169, 171; http://www66.statcan.gc.ca/eng/acyb_c1913-eng.aspx?opt=/eng/1913/191301960169_p.%20169.pdf Table 14. Distribution of Farm Holdings, 1901-1911 Table 16. Areas occupied and Areas possible of Occupation as Farm Land Canada, 1914
Chile	1929-1930	6 classes expressed in hectares. 0-5 / 5-50 / 50-200 / 200-1000 / 1001-5000 / 5000 and over	DIRECCIÓN GENERAL DE ESTADÍSTICA (1933): *Censo Agropecuario 1929-1930*, Santiago de Chile. 1. Número y extensión de los predios rústicos incluidos en el Censo del año 1929-1930, por comunas, departamentos y provincias, pp. 4-7
New Zealand	1911	12 classes expressed in acres 1-10 / 11-50 / 51-100 / 101-200 / 201-320 / 321-640 / 641-1,000 / 1,001-5,000 / 5,001-10,000 / 10,001-20,000 / 20,001-50,000 / 50,001 and over	CENSUS AND STATISTICS OFFICE OF THE DOMINION OF NEW ZEALAND (1919): *The New Zealand Official Year-Book, 1919.* Wellington. Section XVII - Land tenure, settlement, etc. Subsection D - Occupation and Ownership of land Occupation of land, pp. 506-507.
Uruguay	1908	12 classes expressed in hectares. 0-10 / 11-100 / 101-500 / 501-1,000 / 1,001-2,500 / 2,501-2,750 / 2,751-5,000 5,001-7,500 / 7501-10,000 / 10,001 and over	BARRÁN, José y NAHUM, Benjamín (1977): *Historia Rural del Uruguay Moderno. Tomo VI: "La civilización ganadera bajo Batlle (1905-1914)"*. Ed. EBO, Montevideo, p. 277, based on DIRECCIÓN GENERAL DE ESTADÍSTICAS (1910): *Censo General de 1908*, Montevideo. MILLOT, Julio y BERTINO, Magdalena (1996): *Historia Económica del Uruguay*. Tomo II (1860-1910). Ed. Fundación de Cultura Universitaria. Montevideo. Cuadro III, p. 95. DIRECCIÓN GENERAL DE ESTADÍSTICA: Anuario Estadístico de la República Oriental del Uruguay. Tomo II - Parte II, Montevideo, Propiedades rurales clasificadas por superficie, p. 1149 (total holdings exclude 285 estates with activity non-specified).

Table 2
LAND OWNERSHIP IN SETTLER ECONOMIES: INEQUALITY INDICATORS

Percentile ratios

	p90/p10	p90/p50	p10/p50	p75/p25
Argentina	73.4	9.2	0.13	20.9
Australia	129.3	6.6	0.05	17.4
Canada	155.6	3.1	0.02	4.9
Chile	64.3	5.6	0.09	11.5
New Zealand	180.3	10.4	0.06	9.3
Uruguay	148.6	9.9	0.07	6.7

Generalized Entropy indices (GE), Gini coefficients and holding average size

	GE(-1)	GE(0)	GE(1)	GE(2)	Gini	Avg. Size (Hectares)
Argentina	11.11	1.99	2.07	14.37	0.85	531
La Pampa	*4.51*	*1.36*	*1.61*	*9.78*	*0.76*	*355*
North East	*10.76*	*2.23*	*2.13*	*12.08*	*0.88*	*515*
North West	*19.22*	*2.56*	*2.06*	*9.84*	*0.88*	*621*
Cuyo	*38.83*	*3.34*	*3.06*	*30.48*	*0.94*	*666*
Patagonia	*20.50*	*1.71*	*1.22*	*2.91*	*0.74*	*3,285*
Australia	6.87	1.52	1.50	10.30	0.76	552
New South Wales	*9.83*	*1.89*	*1.95*	*15.26*	*0.82*	*591*
Victoria	*3.31*	*1.04*	*0.95*	*3.22*	*0.65*	*426*
South Australia	*5.63*	*1.25*	*0.97*	*2.92*	*0.66*	*550*
Western Australia	*10.74*	*1.31*	*0.95*	*3.55*	*0.64*	*993*
Tasmania	*4.96*	*1.56*	*1.93*	*21.71*	*0.80*	*417*
Federal	*7.30*	*1.52*	*1.58*	*5.43*	*0.78*	*1,232*
Canada	5.42	0.74	0.46	0.52	0.50	154
Prince Edward Island	*1.64*	*0.42*	*0.30*	*0.35*	*0.40*	*84*
Nova Scotia	*3.62*	*0.84*	*0.60*	*0.78*	*0.57*	*98*
New Brunswick	*2.25*	*0.58*	*0.46*	*0.58*	*0.50*	*119*
Quebec	*4.42*	*0.62*	*0.32*	*0.29*	*0.42*	*98*
Ontario	*4.78*	*0.75*	*0.47*	*0.58*	*0.50*	*97*
Manitoba	*6.07*	*0.51*	*0.26*	*0.22*	*0.35*	*271*
Saskatchewan	*0.86*	*0.20*	*0.16*	*0.15*	*0.27*	*297*
Alberta	*2.01*	*0.29*	*0.21*	*0.21*	*0.32*	*289*
British Columbia	*10.73*	*1.59*	*1.10*	*1.73*	*0.73*	*138*
Chile	25.16	2.85	3.48	49.99	0.93	187
New Zealand	16.75	2.01	2.13	21.44	0.83	220
Uruguay	7.73	1.52	1.37	4.31	0.77	394

Regions of Argentina: (i) La Pampa: Buenos Aires, Córdoba, Entre Ríos and Santa Fe; (ii) North East: Corrientes, Chaco, Formosa and Misiones; (iii) North West: Catamarca, Jujuy, La Rioja, Los Andes, Salta, Santiago del Estero, Tucumán; (iv) Cuyo: Mendoza, San Juan and San Luis; (v) Patagonia: Chubut, Neuquén, Río Negro, Santa Cruz and Tierra del Fuego.

Source: see Table 1.

Table 3
AGRARIAN SECTOR: FUNCTIONAL INCOME DISTRIBUTION
Shares on the total Agrarian GDP (%)

ARGENTINA

	Wage	Rent	Profit
1869	34%	54%	12%
1875	27%	59%	14%
1888	32%	48%	21%
1895	24%	41%	35%
1914	21%	67%	12%
Average	**28%**	**54%**	**19%**

AUSTRALIA

	Wage	Rent	Profit
1871	31%	51%	18%
1881	28%	46%	26%
1891	26%	60%	14%
1901	34%	53%	13%
1911	25%	39%	36%
Average	**29%**	**50%**	**21%**

CANADA

	Wage	Rent	Profit
1871	22%	48%	30%
1881	23%	44%	33%
1891	27%	55%	19%
1901	20%	37%	43%
1911	21%	50%	29%
Average	**23%**	**47%**	**31%**

CHILE

	Wage	Rent	Profit
1875	18%	61%	21%
1885	14%	57%	29%
1895	17%	62%	20%
1907	21%	49%	30%
1915	15%	57%	28%
Average	**17%**	**57%**	**26%**

NEW ZEALAND

	Wage	Rent	Profit
1874	23%	33%	44%
1881	35%	42%	22%
1891	30%	41%	29%
1901	26%	48%	26%
1911	30%	51%	20%
Average	**29%**	**43%**	**28%**

URUGUAY

	Wage	Rent	Profit
1874	37%	46%	17%
1883	26%	49%	24%
1893	21%	49%	29%
1903	25%	48%	27%
1912	21%	68%	11%
Average	**26%**	**52%**	**22%**

Source: see Appendix.

Figure 1
SETTLER ECONOMIES: INCOME SHARES IN AGRARIAN SECTOR
Ratio Land Rents/Profits (1870-1913)

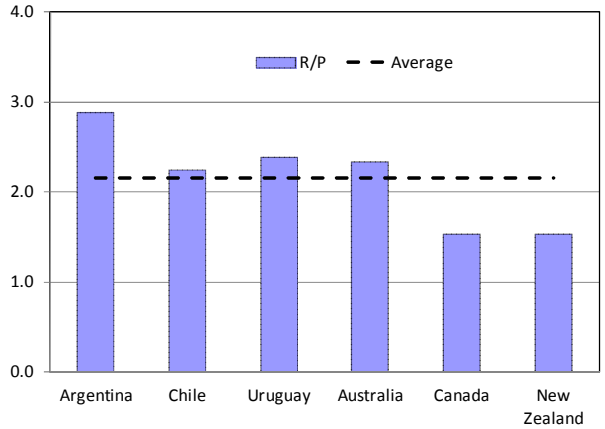


Figure 2
SETTLER ECONOMIES: INCOME SHARES IN AGRARIAN SECTOR
Ratio Wages/Land Rents (1870-1913)

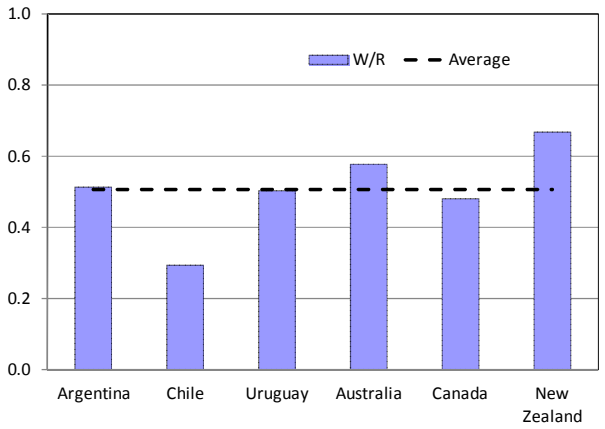
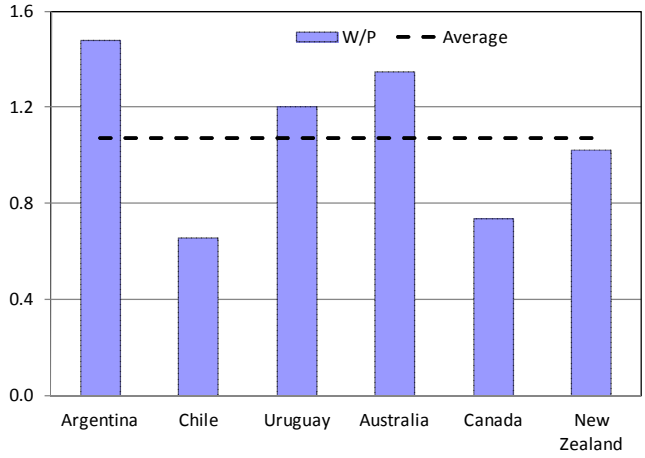


Figure 3
SETTLER ECONOMIES: INCOME SHARES IN AGRARIAN SECTOR
Ratio Wages/Profits (1870-1913)



Source: see Appendix.

Figure 4
ARGENTINA AND SETTLERS: EVOLUTION INCOME DISTRIBUTION
Ratios R/W

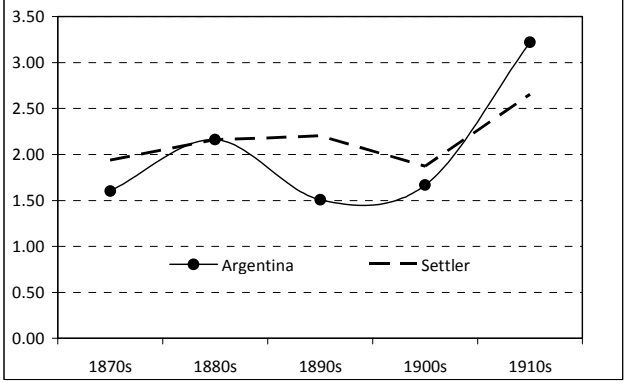


Figure 5
AUTRALIA AND SETTLERS: EVOLUTION INCOME DISTRIBUTION
Ratios R/W

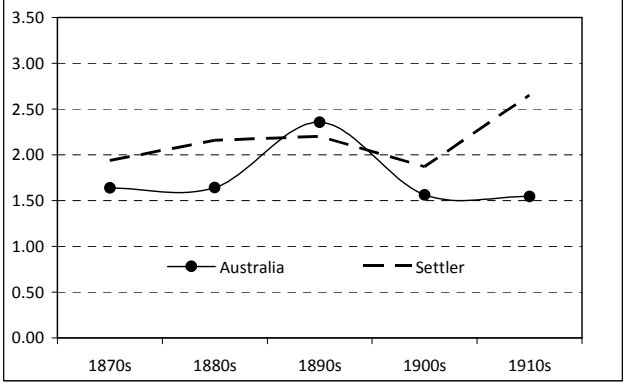


Figure 6
CANADA AND SETTLERS: EVOLUTION INCOME DISTRIBUTION
Ratios R/W

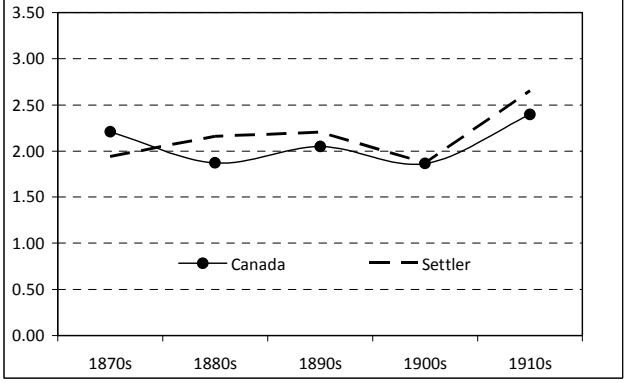


Figure 7
CHILE AND SETTLERS: EVOLUTION INCOME DISTRIBUTION
Ratios R/W

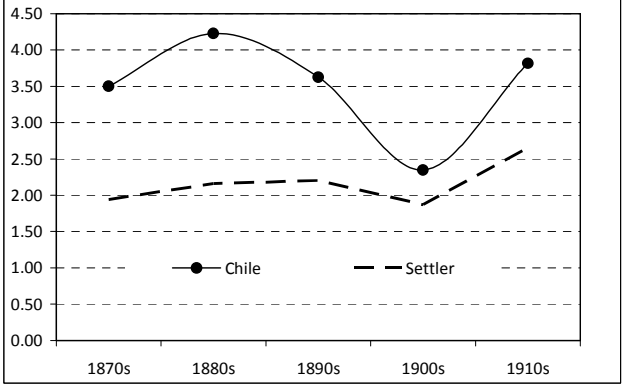


Figure 8
NEW ZEALAND AND SETTLERS: EVOLUTION INCOME DISTRIBUTION
Ratios R/W

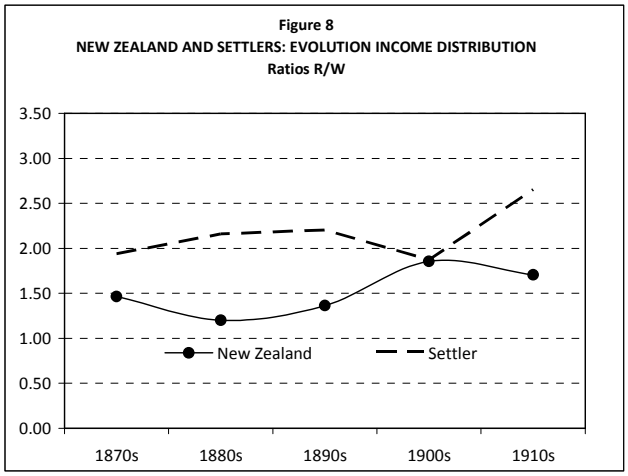
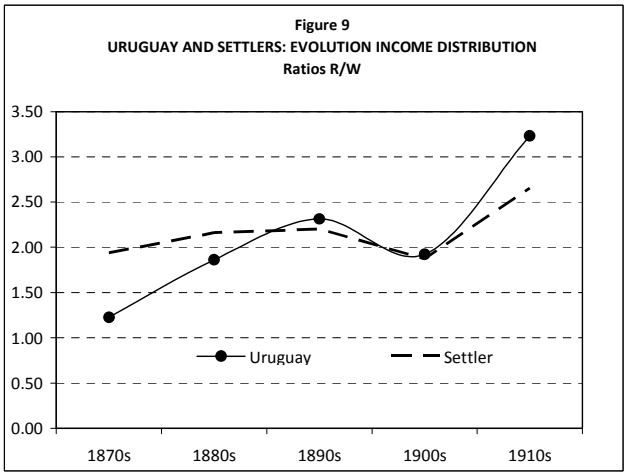


Figure 9
URUGUAY AND SETTLERS: EVOLUTION INCOME DISTRIBUTION
Ratios R/W



Source: see Appendix.

Figure 10
ARGENTINA AND SETTLERS: EVOLUTION INCOME DISTRIBUTION
Ratios R/P

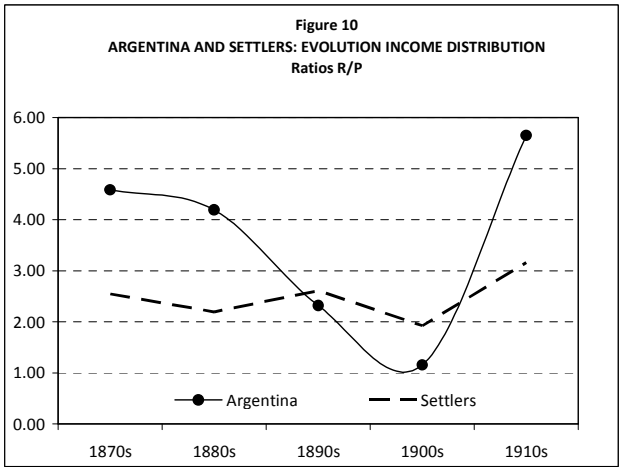


Figure 11
AUTRALIA AND SETTLERS: EVOLUTION INCOME DISTRIBUTION
Ratios R/P

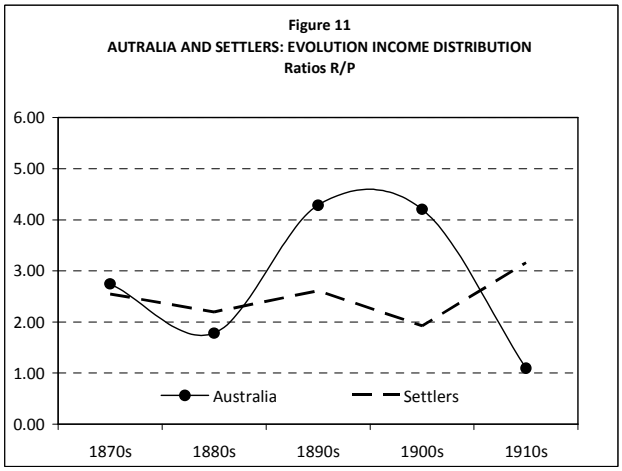


Figure 12
CANADA AND SETTLERS: EVOLUTION INCOME DISTRIBUTION
Ratios R/P

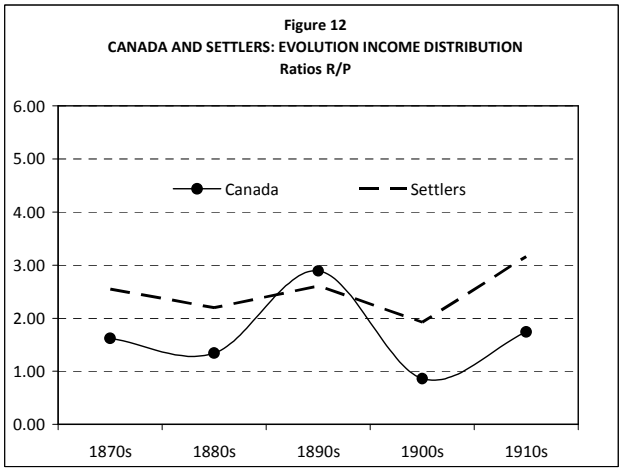
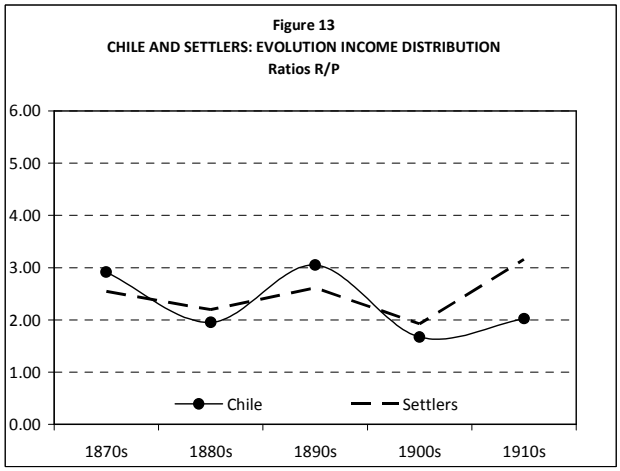
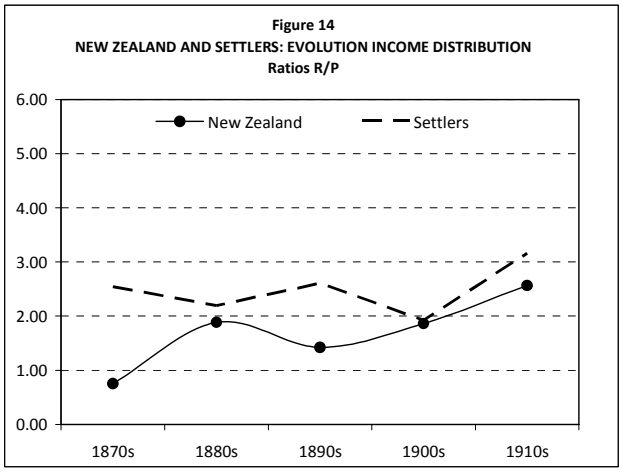
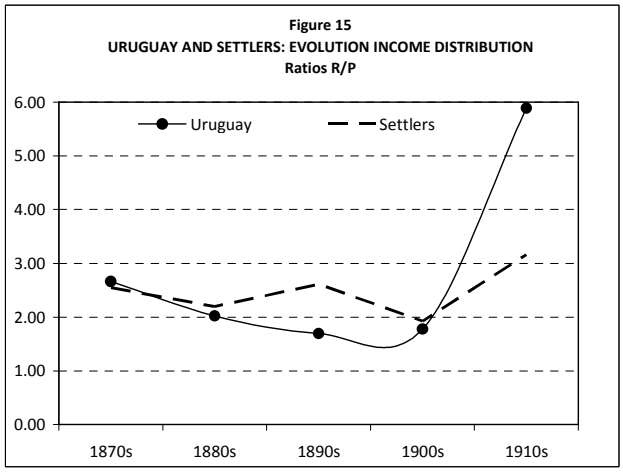


Figure 13
CHILE AND SETTLERS: EVOLUTION INCOME DISTRIBUTION
Ratios R/P







Source: see Appendix.

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