Agricultural Institutions, Industrialization and Growth: The Case of New Zealand and Uruguay in 1870-1940[*]

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Abstract

In this paper we apply a model of early industrialization to the case of New Zealand and Uruguay in 1870-1940. We show how differences in agricultural institutions may have contributed to the different development path of the two countries, which otherwise were similar under many respects. While in New Zealand the active role of the Crown in regulating the land market contributed to reduce land ownership concentration, in Uruguay a small group of landowners largely controlled land property. Our model shows that land concentration may have negatively influenced industrialization and growth by impeding the formation of a large group of middle-income landowners and, as a consequence, the development of a domestic demand for basic manufactures.

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1 Introduction

In this paper we investigate how institutions governing the agricultural sector may have affected the evolution of industrial production and GDP in New Zealand and Uruguay during the period 1870-1940. To this aim we apply a model of early industrialization under functional distribution and hierarchical preferences, proving that the given differences in agricultural institutions can in principle produce the observed patterns of industrialization and growth.

New Zealand and Uruguay were two countries of relatively new settlement that before the end of the 19th Century succeeded in achieving a moderately high income per capita. Both countries prospered thanks to their flourishing agricultural sectors: they were characterized by the abundance of natural resources and by scarce population, formed mostly by descendants of European immigrants. Their initial economic growth was based on exports of food and raw materials to a rapidly expanding international economy. By the last quarter of the 19th century New Zealand and Uruguay had achieved levels of income per capita higher than many leading European countries. However, their subsequent trajectories had been quite different. Although it is true that both countries found increasing difficulties to sustain growth in the first half of 20th century, the case of Uruguay was particularly disappointing. The country grew at high rates in the twenties, when the external markets were buoyant, but it could not sustain growth after 1930: its GDP per capita in 1940 was about the same as in 1912. On the other hand, New Zealand, while experiencing a fall in the rate of growth, was able to trigger a non-negligible industrial takeoff, especially if measured in terms of horsepower usage and size of productive units (Willebald and Bértola, 2007).

Our aim is to help to shed light on this puzzle by taking into account the agricultural institutions of the two countries. Indeed, although similar under many respects, New Zealand and Uruguay had rather different institutions governing their agricultural sector. In particular, they had different rules and practices for what concerns the access to land and the distribution of agricultural product among the suppliers of production factors. In New Zealand the British Crown adopted a policy of land distribution to new migrants, and in general to those entering the labor market, that rapidly expanded the number of landowners in the country. Instead, in Uruguay land ownership rapidly concentrated – as a consequence of the appropriation of public lands by a few landlords – and remained highly concentrated afterwards. Furthermore, the share of agricultural product retained by New Zealander landowners was systematically lower than that of their Uruguayan counterparts. Our basic idea is that these differences, shaping the distribution of purchasing power in the population, had a major impact on the size of the domestic markets for manufactured goods. More precisely, in Uruguay domestic demands for basic manufactures were smaller than in New Zealand, generating a systematic relative disadvantage for Uruguay in the exploitation of mass production.

In order to make precise our intuition we present a model of early industrialization based on Murphy et al. (1989). The main result of this model is that industrial takeoff depends on the composition of domestic demand for manufactures which, in turn, is shown to depend on the distribution of income. Two key assumptions give rise to such

an outcome: first, consumers have hierarchical preferences; second, industrialization in the manufacturing sector entails the substitution of an increasing return technology (with fixed start-up costs) for a constant return technology. Bilancini and D'Alessandro (2008a,b) have shown that adding the assumption of functional distribution of income is sufficient for industrial takeoff to depend on both the distribution of land ownership and the distribution of agricultural product between landowners and peasants.

The main contribution of the present paper is to apply this framework to the case of New Zealand and Uruguay. In order to keep our argument as parsimonious as possible, we suppose that the two countries were equal under any respect but the concentration of land ownership and the share of agricultural product going to workers. We show how such differences may have produced divergence in terms of both industrialization and GDP growth. In other words, we provide a theoretical argument whose implications are consistent with available historical evidence about the evolution of the two countries. Of course, we do not intend to argue that this is the only cause of the different development path followed by New Zealand and Uruguay. We only claim that the mechanism that we highlight – and that to the best of our knowledge has not being put forward in comparative studies of about these two countries – may have played a role.

In the last decades, the debate on geography and institutions revived the interest on the determinants of divergent development paths across countries. A growing body of literature has sought to compare the institutions emerging from the colonization process in different regions (Acemoglu et al., 2001; Galor et al., 2008) and particularly in the regions of new settlement (Denoon, 1983; Engerman and Sokoloff, 1997, 2005). Unlike such a literature which focuses on a kind of indirect effect of agrarian institutions on economic development, the present paper suggests that there is a direct relation going through the demand side and which has to do with the composition of manufactures' demand (Murphy et al., 1989; Willebald, 2007).[1]

We recognize that the interest in comparing the development of Uruguay with that of New Zealand is not new. By the end of the seventies two Uruguayans historians pointed out that "Uruguayans have been comparing themselves with New Zealand for at least seventy years", (Barrán and Nahum, 1978, p.191). Notwithstanding this long tradition, most comparative studies were produced in the 1960s and 1970s. Two strands of literature can be identified. The first looked at New Zealand and Uruguay within the context of the countries of new settlement, comprising a more general comparison between the River Plate and the Australasian regions (see for instance Bértola and Porcile, 2002; Williamson, 2002; Willebald and Bértola, 2007; Blattman et al., 2007). The second approach emerged from studies of the agrarian sector which emphasized the potential for the diffusion in Uruguay of the technology and productive practices that were successful in New Zealand.[2] In this direction, Kirby (1975), studying the period between 1960s and

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[1]Other authors focus on the key link between access to frontier land, institution building and growth, which has been explored by the economic history literature since the seminal work by Jackson Turner. In the case of the United States, the existence of *free* land in the frontier may have contributed to keep real wages higher in the East (Margo, 1999), encouraging the use of more advanced technology and leading to higher labor productivity growth.

[2]Our proposed explanation is independent of – though not incompatible with – those which stress

	Non-industrial exports as % of Total exports	Exports as % of GDP
Period 1870-1899		
New Zealand	99%	16%
Uruguay	100%	22%
Period 1890-1909		
New Zealand	96%	23%
Uruguay	100%	19%
Period 1920-1939		
New Zealand	99%	25%
Uruguay	100%	18%

Table 1: Share of non-industrial exports (live animals, foods, drinks, raw materials or simply prepared products) and share of GDP due to export revenues: New Zealand and Uruguay **Sources:** Blattman et al. (2007), Willebald (2007).

1970s, presents an interesting analysis of the main similarities between the two countries and investigates their land tenure systems. Although his concerns were tied to the policies which Uruguay should implement in order to promote economic development, he clearly pointed out that "the parallel development of New Zealand and Uruguay obviously stopped short, or diverged, sometime in the past" (Kirby, 1975, p. 264). In this respect, our paper focuses on a plausible explanation of this earliest divergence.

The rest of the paper is organized as follows. Next section highlights the similarities between the two countries as well as their different evolution in terms of industrialization and GDP per capita. In section 3, we review the available historical evidence about the agricultural institutions in New Zealand and Uruguay and argue about their consequences in terms of property rights and income distribution. In section 4 we apply the model developed in Bilancini and D'Alessandro (2008a,b) to the case of New Zealand and Uruguay, showing how agricultural institutions may have generated divergent industrial and GDP growth. Section 5 provides our final remarks.

2 New Zealand and Uruguay between 1870 and 1940

At the end of the 19th Century, the economies of Uruguay and New Zealand were similar under many respects. In the first place, the GDP per capita of both countries was relatively high even if compared with that of developed countries. In real terms the GDP per capita of New Zealand was slightly higher than that of United States, while the GDP of Uruguay was at about the same level (Maddison, 2003). Moreover, both countries were heavy exporters of non-industrial (mostly agricultural) goods. During the First Globalization era (1870-1914) both countries specialized in exporting foodstuffs to a dynamic international economy. As table 1 shows, such a specialization persisted

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differences in the performance of the agricultural sectors or the lack of sufficient stimuli for agricultural production – such as pointed out in the classical comparison of Davie, 1960; Duncan and Fogarthy, 1984; Álvarez and Bortagaray, 2007 between Australia and Argentina.

	New Zealand	Uruguay
Latitude of southern-northern extremities	$35 - 47^o$	$30 - 35^o$
Annual average temperature (Celsius)	12.8	17
January mean temperature (Celsius)	18.0	24.5
July mean temperature (Celsius)	8.0	10.9
Annual frost days	15	21
Average annual rainfall (mm)	992	1005
Lowest monthly rainfall (mm)	61 March	65.6 July

Table 2: A comparison of climate indicators for areas of intensive pastoral activity: San José de Mayo (Uruguay) and Palmerston North (New Zealand). **Sources:** Kirby (1975).

up to the Second World War. Moreover, for both countries exports represented a very significant fraction of GDP – between one-sixth and one-fourth – though for New Zealand it had been increasing and for Uruguay it has been somewhat decreasing.

Another element of similitude is factor endowments, in particular population and land. In 1870 New Zealand and Uruguay had a similar population mostly made of early European colonizers. After 1870 and up to the Second World War, both countries experienced a rapid population growth and received massive inflows of European immigrants.[3] Overall, between 1824 and 1924 the temperate regions of new settlement received about 43 million of people emigrated from Europe; New Zealand and Uruguay made no exception to this (Kenwood and Lougheed, 1990). Between 1870 and 1940 the population of New Zealand increased from 291.000 to 1.633.645 inhabitants, to which immigration contributed with 413.847 people.[4] In the same period Uruguay increased its population from 420.000 to 1.980.000 inhabitants, being the contribution of immigration of about 297.185 people (Álvarez, 2005).

Given the available technologies, the total amount of potentially productive land in the two countries was remarkably similar. It was about 17 millions of hectares. However, such a potential was actually occupied in different periods by Uruguayans and New Zealanders. Uruguay had 17 millions of hectares already in 1870 and this amount remained almost constant thereafter. New Zealand reached 17 million hectares by 1911, while in 1870 only about 8 millions hectares were occupied. This was a relative advantage for Uruguay. Furthermore, the climate was quite similar in the two countries. As shown by table 2, in the typical area of intensive pastoral activities the relevant climate indicators were very close. Finally, although the quality of land was not exactly the same in the two countries, the literature points out that this factor could not account for the different economic performance (see Álvarez and Bortagaray, 2007).

Notwithstanding such similarities, in the early 20th Century New Zealand was developing faster than Uruguay and substantially increased the gap during the last decade

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[3]The First Globalization era witnessed massive emigration of Europeans to many regions of the globe, spurred by rapid population growth in Europe and migration from rural areas (Williamson, 2002). Substantial increase in transports productivity in the last quarter of the 19th Century allowed a dramatic fall in transportation costs and the integration to world markets of new regions supplying food and raw materials.

[4]The small Maori population is considered in the population figures of New Zealand.

	New Zealand	Uruguay
GDP per capita, PPP Dollars 1995		
1870	3100	2225
1938	6463	3723
Relative GDP per capita, New Zealand = 100		
1870	100	77
1938	100	58
Annual rate of growth		
1870-1938	1.05%	0.75%
1870-1913	1.20%	1.00%
1913-1938	0.90%	0.35%

Table 3: GDP per capita and annual growth rates in 1870-1938: New Zealand and Uruguay. **Sources:** Maddison (2003), Willebald and Bértola (2007) .

before the Second World War. Table 3 reports the annual rate of growth experienced by the two countries during the whole period as well as in the two subperiods 1870-1913 and 1913-1940. As mentioned above, the income per capita of New Zealanders was higher than that of Uruguayans already in 1870. However, the gap increased during the following seventy years. While in 1870 GDP per capita in Uruguay was only 23% less than that of New Zealand, in 1938 it was 42% less than the latter (Maddison, 2003). Both countries lost ground with respect to the faster industrializing countries such as the United States, but Uruguay lost substantially more than New Zealand.

The most striking difference is the asymmetric development of industrial production and, in general, the asymmetric adoption of industrial technologies. As shown in the upper part table 4, New Zealand and Uruguay had a small industrial sector in the early 20th Century – the countries' production was largely made of non-industrial goods. During the second decade New Zealand had been producing relatively more machinery and metallic products than Uruguay, which is often seen as an indication of greater application of industrial technology. Moreover, a relatively greater fraction of Uruguay's production was related to food, drink and tobacco. However, in the fourth decade Uruguay's manufacturing sector seems to had adjusted towards a more capital intensive production and, in this regard, it somewhat kept up with New Zealand. The relevant difference here is the kind of technology applied. As shown in the lower part of table 4, New Zealand productive units were in larger number, employed a larger number of workers and used a greater amount of horsepowers than their Uruguayan counterparts. Moreover, such a difference markedly increase from the first to the fourth decade of the 20th Century. This is especially true for the amount of horsepowers per productive unit – a reasonable proxy for the diffusion of industrial technologies.

Summing up, at the end of the 19th Century New Zealand and Uruguay were remarkably similar but this did not suffice to grant them a similar development in the following seventy years. More precisely, although the two countries had similar GDPs, productions, exports, populations and land stocks, New Zealand managed to grow moderately faster and to develop a quite larger industrial sector. The last fact is especially

	New Zealand	Uruguay
Share of gross manufactures values in	1915-1916	1919
Foods, drinks and tobacco	59.8	69.1
Textile, clothing and leather	18.8	7.6
Machinery and metallic products	7.4	0.0
Other	14.0	23.3
Share of gross manufactures values in	1937-1938	1936
Foods, drinks and tobacco	57.4	57.0
Textile, clothing and leather	9.8	19.2
Machinery and metallic products	12.6	8.7
Other	20.2	15.1
Horsepower and employment in	1910	1908
Thousands of horsepower	100	23
Horsepower per production unit	28.4	16.8
Total employees	45965	22224
Employees per production unit	13.1	9.2
Horsepower and employment in	1939	1936
Thousands of horsepower	903	115
Horsepower per production unit	142.4	10.9
Total employees	108722	65962
Employees per production unit	17.1	6.3

Table 4: Data on manufacturing in the first half of the 20th Century: New Zealand and Uruguay. Note: data for 1908 refer only to the Montevideo district. **Sources:** Willebald and Bértola (2007) and references therein.

surprising if one considers that neither country exported a substantial amount of industrial goods. Actually, New Zealand's larger demand for industrial goods must had been sustained by domestic demand. This in turn testimonies that the two countries had different patterns of domestic demand. In next two sections we explore how differences in agricultural institutions between New Zealand and Uruguay can be responsible for this.

One last comment is worth doing. The described process of increasing differences in the economic performance of New Zealand and Uruguay did not stop after the Second World War. On the contrary, the gap between the two countries deepened with respect to both industrial development and GDP growth (Maddison, 2003; Willebald and Bértola, 2007). In this paper we do not try to explain such a later divergence. However, if one follows Kirby (1975) in suspecting that what happened after the Second World War has its roots in what happened during the period 1870-1940, then the analysis that we carry out in the next two sections may be of some interest even for understanding more recent facts.

3   Institutional Differences in the Agricultural Sector

So far we have contrasted the similarities between New Zealand and Uruguay at the end of the 19th Century with the differences showed in their subsequent GDP growth and

industrial development. However, if one looks at the institutional framework governing the agricultural sector, the two countries did show significant differences already in 1870.

Although the productive capacity of the potential land stock was very similar, land occupation followed rather different patterns in New Zealand and Uruguay. This resulted in major institutional differences in the ruling agricultural institutions. In New Zealand the British Crown strictly regulated the land marked, facilitating a steady increase in the number of landowners. In Uruguay land was early appropriated by a small number of landowners, resulting in a great difficulty for newcomers and newborns to access land and, hence, maintaining the number of landowners small. Furthermore, the two countries were characterized by a different distribution of the agricultural product between landowners and landless peasants. More precisely, the share of agricultural product appropriated by landowners was higher in Uruguay than in New Zealand.

As we will argue, both a lower concentration of land ownership and a more equal distribution of land product contributed to produce a larger fraction of people with enough purchasing power to buy manufactures which, in turn, made the introduction of industrial technology more profitable.

3.1   The Institutional Setting in the 19th Century

New Zealand.   The New Zealand historiography has emphasized that the process of land distribution in the country was highly idiosyncratic, representing a factor that contributed to the emergence of an agrarian society with high welfare levels. The distribution of land constituted a political and economic resource that the state used widely in the 19th Century with a view to securing the efficient use of land.

In Article II of the Waitangi Treaty of 1840 the UK acknowledged the individual and collective rights of the native Maories over their territories. The Waitangi Treaty was a turning point in New Zealand economic history, as it represented the moment in which the Maories ceded the sovereignty of their territory in exchange for autonomy and property rights. In general terms, the Treaty was systematically disrespected, giving rise to a massive transfer of land to European colonizers.

Land distribution among the colonizers followed the British tradition of making explicit the Royal origin of property titles. Colonizers could not negotiate directly with the natives, but the intermediation of the Crown was required. The Colonial authorities and the representatives of the autonomous government created a juridical framework that regulated the expropriation of land from the Maories and the granting of property titles to the European colonizers. Between 1840 and 1860 the process of land distribution accompanied the arrival of new immigrants, providing for the effective occupation and exploration of the allotments of land. The state controlled land distribution rigorously in order to allow an ample sector of the population to have access to this critical asset. Public land was sold or leased by the state for long periods under certain conditions, which included the effective exploration of the allotments, measures for soil conservation as well as the improvement of eroded lands (Prichard, 1970; Hawke, 1985, 1999).

In the 1870s, in the context of the political and administrative reform that eliminated the provincial system and centralized the structure of the state, it was established

the Torrens system that highly simplified the registration of property, facilitating the formation of a market for land. The extending of the territorial frontier since 1890, the active role of the state in distributing land and the positive effects of refrigeration (that encouraged the division of the large estates with a view to adopting more capita-intensive techniques), highly contributed to the transformation of the structure of land property in New Zealand.[5]

The Land for Settlement Acts of 1892 and 1894 were key juridical pieces regulating the distribution of land between 1892 and 1912. The first established the abolition of the system of selling land in installments and incorporated the leasing of public lands (including a purchase option up top a maximum of 8.000 hectares). The initial period of leasing was 10 years with a purchase option, but the leasing could be renovated for a maximum of 25 years, after which the land was occupied in perpetuity (900 years). By means of this mechanism the producer, as a matter of fact, was the owner of the land. The same Law granted to the government a budget of 50.000 sterling pounds per year to expropriate land and promote the division of the latifundia, increasing this amount to 250.000 sterling pounds in 1894.[6] The extension of latifundia fell from 3.2 million of hectares in 1891 to 1.4 million in 1910, as a result of both the influence of the public policy and the advantages of a more capital-intensive type of exploitation. In 1907 the National Endowment Act provided for an extension of the amount of public lands for leasing, with a view to financing the system of public education and supporting the old-age pension system adopted in 1894.

In sum, New Zealand established property rights in the rural sector at the initial stages of colonization. This secured the extension of property rights for the new waves of white colonizers, while at the same time kept a tight control over the destination and uses of public land. By doing so, New Zealand facilitated the access to land to a significant part of its population, effectively preventing the control of land by small oligarchic groups.

Ururguay. In the 19th Century Uruguay showed a major vulnerability in political and institutional terms, marked by recurrent financial crisis and the lack of effective control over the national territory. Between 1830 and 1870, the successive governments that ruled the country adopted a policy of selling public land instead of offering this land for leasing contracts. Moreover, the continuous political instability that haunted the Uruguayan history in that period prevented the consolidation and effective working of a market for factors of production. The state lost its control over public lands in favor of latifundia, being unable to determine precisely their extension and localization in the national territory.

In 1830, when Uruguay adopted its first Constitution, public lands represented 80%

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[5]The 1891 Land and Income Tax established a progressive tax on land property for three categories of tax-payers. Keall (2000) suggests that income from this tax represented in 1922 about 10 % of the total income of the state.

[6]The estimation of the income received by the state out of the renting of public lands between 1982 and 1894 was high enough so as to pay for the costs of the expropriation of the large estates in this period (as shown in Álvarez, 2005).

of the territory, the national frontiers had already been occupied and the population of the country only reached 70.000 inhabitants. The access of the population to land was a highly conflicting process that the state could not organize properly, being unable to resist the pressure of large landowners, the financial demands produced by frequent fiscal crises, and the military and political power of the *caudillos*, of paramount influence among the rural population that had neither formal property titles nor leasing contracts protecting their interests.[7]

The consolidation of property rights in the rural sector was attained in the second half of the 1870s, in the context of the military regimes which begun with Colonel Latorre in March 1876. The emergence of new technologies in weaponry (the Mauser and Remington rifles), transportation (railways) and communication (telegraph) offered a decisive advantage over the rural *caudillos*. At the same time, the delimitation of the rural properties was made possible by the diffusion of the iron fence, the *alambramiento*, in the landscape of the pampas (Barrán and Nahum, 1967, 1971, 1972, 1973; Jacob, 1969; Millot and Bertino, 1996; Moraes, 2001; Franco, 1968). This consolidated the dominance of large estates in the rural sector, to which a substantial part of public lands was eventually incorporated.

In sum, property rights in the Uruguayan rural sector were fragile at the beginning. They had been consolidated only in the last quarter of the 19th Century. This coincided with the transfer of large stocks of land to a small group of landowners, which by large remained of about the same size for several decades thereafter. This type of land occupation effectively restricted the access to land and fostered land concentration.

Year	New Zealand	Year	Uruguay
1891	43808		
1896	58940	1908	43589
1911	73876	1913	58530
1930	82985		
1940	90931	1937	73414

Table 5: Number of farms in New Zealand and Uruguay. **Sources:** Uruguay - Censo de población y agropecuarios (1908, 1916, 1937) y Base de datos del Programa de Población - UM - FCS – UDELAR. Nueva Zelanda - Hawke (1985); Briggs (2003).

3.2 Distribution of Land Ownership and Agricultural Product

An rough idea of the distribution of land ownership can be obtained by looking at the average number of farms in the two countries. Table 5 shows the number of farms in New Zealand and Uruguay at different points in time. The number of farms was

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[7]The occupation of public land was such a chaotic process that at the beginning of the 20th Century, when the Batlle and Ordoñez administration sought to implement new policies for encouraging agricultural production, the amount of public lands was still unknown. It is likely that these lands did not represent at that time more than 15% of the national territory, and the state received no income from them.

Year	Total		Rural	
	Uruguay	New Zealand	Uruguay	New Zealand
1890	24	12	122	23
1895	21	18	107	35
1900	19	17	95	34
1905	17	16	65	33
1910	15	16		
1915	13	15	63	35
1920	12	14		
1925	11	13		
1930	10	11		
1935	9	11	50	35
1940	9	11		

Table 6: Hectares of Occupied Land per Population (Total and Rural), NZ and Uruguay. **Sources:** Uruguay - Censo de población y agropecuarios (1908, 1916, 1937) y Base de datos del Programa de Población - UM - FCS – UDELAR. Nueva Zelanda - Hawke (1985); Briggs (2003).

significantly greater in the case of New Zealand.[8] This is relevant especially because New Zealand had a smaller amount of available land than Uruguay until 1911. Table 6 presents the evolution of occupied land per population in the rural sector. The figures are much larger in Uruguay. In 1890 there was about half of the people per hectare in the Uruguayan rural sector than in the New Zealander one. Moreover, occupied land per rural population remained substantially stable in New Zealand, reflecting the fact that the rural population increased *pari passu* with the supply of land. These differences are also reflected in the evolution of occupied land per capita, which remained stable in New Zealand while falling sharply in Uruguay. Overall, this suggests that land ownership was more concentrated in Uruguay.

Information about the distribution of agricultural product in the two countries can be obtained by looking at the ratio between the price of land and real wages and at the share of agricultural product going to wages. The first variable gives a rough idea of the relative value – and, hence, of the relative economic scarcity – of the two factors of production. The second variable represents a first approximation of the residual product accruing to those controlling the land stock.

Time series are available for wages and land prices for both New Zealand and Uruguay (see the Appendix for additional information on data sources). This allows us to compare the evolution of the rental/wage ratios between 1875 and 1940. We stress

[8]In this paper, we totally abstract from Uruguayan small-farm problem. Kirby (1975) reported some comparative data for minifundios in the period after the Second World War, "45 percent of Uruguayan holdings are less than 20 hectares, compared with 26 percent in New Zealand" [p. 270]. Moreover while the modal size was 20-49 hectares, the average size was 209 hectares (see also I.B.R.D./F.A.O., 1951, 62). This suggest that although the number of farms in Uruguay increases, the relevant number of landowners in 1940 was at about the same level than that in 1870. Moreover, the increase in the number of farms in Uruguay largely occurred due to the subdivision of farms which had less than 100 hectares, not due to the reduction of latifundia. Therefore, this increase did not represent an improvement in the access to land in Uruguay (Barrán and Nahum, 1978; Bertocchi, 2004).
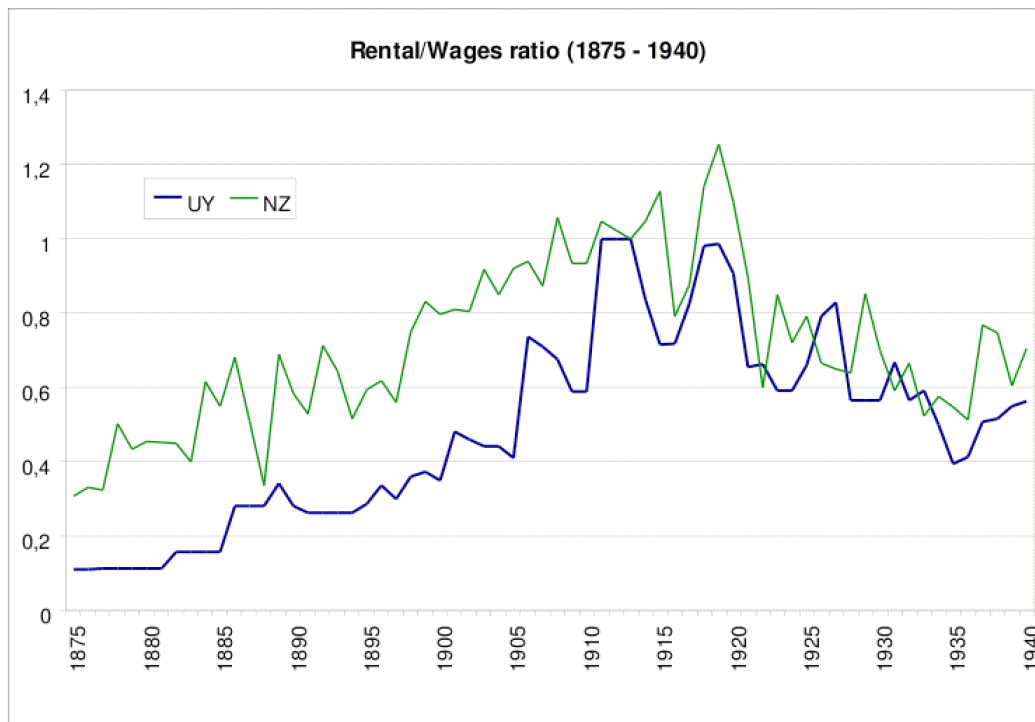
Figure 1: the Rental/Wage Ratio in New Zealand and Uruguay. **Sources:** New Zealand, Real Wages and Real Land Prices: Greasley and Oxley (2008, 27, 28); Uruguay, Real land price index estimated from the nominal land price index of Banco de Datos PHES e IPC by Bértola et al. (1998). Real wages were estimated from Bértola et al. (1998).

that comparing the absolute values of the rental/wage ratios is not safe given the nature of our data. Nonetheless, supposing that both countries were exposed to similar shocks, there are interesting insights that can be drawn from the relative movements of the two trends. Figure 1 shows that the rental/wage ratio in New Zealand and Uruguay followed a fairly similar trend: it increased until the first decades of the 20th century and declined since 1915. This trend probably expresses the impact of the higher prices for foodstuffs and raw materials in the international economy until 1915, which in turn affected land prices in the exporting countries.[9]

Interestingly, while in the 1870s New Zealand had a sensibly larger rental/wage ratio than Uruguay, in the 1930s the two were almost the same. In other words, the land rental had become more and more important in Uruguay relatively to New Zealand. This may be linked to the institutional differences mentioned above. Indeed, since the land stock is the same in the two countries, this figure suggests that control on land

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[9]One should have expected a less marked deterioration of income distribution in New Zealand than in Uruguay, to the extent that the supply of land was more elastic in the former country. However, the increase in the supply of land in New Zealand was most probably compensated by the much higher inflow of migrants, who settled mainly in the rural areas.

	New Zealand		
Year	Wage Share	Residual Rent Share	Agrarian Product
1891	33.1	66.9	100
1896	31.9	68.1	100
1911	21.4	78.6	100
1936	33.1	66.9	100

Table 7: Functional distribution of the incomes in the agrarian sector: New Zealand. **Sources:** Briggs (2003); Bloomfield (1984); Greasley and Oxley (1998, 14,33); Greasley and Oxley (2003);Prichard (1970, 137, 138, 193, 194, 335); Hawke (1985, 102,234, 235).

	Uruguay		
Year	Wage Share	Residual Rent Share	Agrarian Product
1892	22.0	78.0	100
1895	22.0	78.0	100
1908	20.3	79.7	100
1911	19.5	81.5	100
1916	24.6	75.6	100
1930	21.5	78.5	100
1937	22.8	77.02	100
1940	22.0	78.0	100

Table 8: Functional distribution of the incomes in the agrarian sector: Uruguay. **Sources:** Anuario Estadístico (1938), Censos Agropecuarios (1908, 1916, 1930, 1937 and 1943); Ardente et al. (2004); Bértola et al. (1998); Barrán and Nahum (1978); Barrán and Nahum (s/f, 319); Barrán and Nahum (1971, 637); Barrán and Nahum (1972, 430); Barrán and Nahum (1973, 467); Barrán and Nahum (1977, 429); Balbis (1995, fecha:123); Vigorito and Reig (1986, 183,184); BROU (1933, 53); Jacob (1981, 181).

was relatively more concentrated in Uruguay or that, in practice, latifundia made land available to a lesser extent.

Turning our attention to the distribution of the agricultural product we see again relevant differences between New Zealand and Uruguay. Tables 7 and 8 report estimates of the product shares. In Uruguay agricultural workers obtained about 20% of the total agricultural output. In the case of New Zealand these figures were instead about 30%.[10] This suggests that in Uruguay landowners were able to obtain a larger share of the agricultural product than their New Zealander counterparts.

4 The Model

In this section we present a simple model of industrial takeoff, based on Bilancini and D'Alessandro (2008a,b), and apply it to the case of New Zealand and Uruguay 1870-

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[10]In New Zealand the agrarian rent was made of two parts, one accruing to the government (about 4% of total output) and the other to private landowners (about 20%). Public property of land was an important difference between New Zealand and Uruguay, since it crucially affected the availability of land to be distributed and allowed the New Zealand to enjoy during most of the period a much more equilibrated fiscal situation.

1940.[11] We proceed in three steps. First, we give a brief description of the model assumptions. Second, we characterize industrialization as an equilibrium outcome. Third, we particularize the model for the case of New Zealand and Uruguay, showing that institutional differences in the agricultural sector can lead to different equilibria in terms of both industrialization and income.

4.1 Assumptions

There are two sectors, agriculture and manufacture. Agriculture produces a single homogeneous divisible good, named *food*, which is used as numeraire. In the other sector, there is instead a continuum of manufactured goods represented by the open interval $[0, \infty) \in \Re$. Each good is denoted by its distance q from the origin. Individuals follow the same consumption pattern. There is a subsistence level of food consumption $\bar{\omega}$ and a minimum amount of food z which is preferred to the consumption of any manufacture, with $z > \bar{\omega}$. Beyond z any unit of income is spent to buy the manufactured goods following the indexed order. Such a consumption pattern is intended as a simple way of introducing a common ranking of necessities: people first need to buy food up to the level z, then basic manufactures and durables which allow better life standards and, only after that, they buy luxuries. For simplicity, we assume that only one unit is bought of any manufactured good. In other terms, any individual with income $\omega \geq z$ uses her first z of income to purchase food and $(\omega - z)$ to purchase the manufactured goods. Any individual with $\omega < z$ consumes only food.[12]

Food is produced using land and labor. Labor is assumed to be homogeneous. Production is given by the constant returns function $F(L_F, T)$, where L_F is the number of peasant workers and T is the amount of cultivated land. Moreover, $F_1 > 0$, $F_{11} < 0$, $F_2 > 0$ and $F_{22} < 0$, where F_i is the derivative of F with respect to the i-th argument and similarly for F_{ij}. The agricultural product is shared between peasants and landlords. Agricultural wages is equal to $w_F = \lambda F(L_F, T)/L_F$ while the total amount of rents is $R = (1 - \lambda)F(L_F, T)$, where the parameter λ denotes the peasants' share of agricultural product.[13] We assume that property rights on cultivated land are equally distributed among M landowners, thus the income of each landowner is equal to R/M. Therefore, M can be interpreted as a rough index of land property concentration. We also assume that landlords are richer than peasants, i.e. $R/M \geq w_F$, which implies that $\lambda \leq L_F/(L_F + M)$.

The manufacturing sector is constituted by a continuum of markets where each one is

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[11]In the present paper we abstract from most model details and all proofs. See Bilancini and D'Alessandro (2008b) for proofs of equilibrium existence and comparative statics about land ownership concentration. See Bilancini and D'Alessandro (2008a) for the model extension where agricultural product is exogenously distributed between landowners and peasants. Moreover, the basic underlying mechanism is largely based on Murphy et al. (1989).

[12]This behavior is a particularization of the hypothesis of hierarchical preferences. It can be easily *rationalized* by means of a utility function. See Bilancini and D'Alessandro (2008b, fn 7) for an explicit analysis of this issue.

[13]We remark that λ is exogenous to the model. It may be though of as reflecting institutional peculiarities due to the historical evolution of the country. It may also be interpreted as representing power relationships between landlords and farmers.

infinitely small with respect to the entire economy. The number of workers employed in the manufacturing sector as a whole is denoted by L_M while the ruling wage is denoted by w_M. Each commodity q con be produced with either of the two following technologies. The first, labeled *Traditional Technology* or TT, requires α units of labor in order to produce one unit of output. This represents the case in which commodities are produced by artisans who, at the same time, organize production and work like other wage-paid laborers. The second, labeled *Industrial Technology* or IT, requires k units of labor to start up plus β units of labor per unit of output produced, with $0 < \beta < \alpha$.[14] Lastly, we denote by E the number of entrepreneurs.

The market structure in the manufacturing sector is the following. A group of competing artisans operates in each market q of the economy. Artisans compete among each other so that no profits are earned using TT. Besides, in each market there exists one and only one artisan who knows the IT. If she decides to be an entrepreneur she can become a monopolist. As shown in Bilancini and D'Alessandro (2008b), she finds convenient to charge a price equal to αw_M. Hence, the profits of the monopolist operating in market q are equal to $\pi(q) = [(\alpha - \beta)D_q - k]w_M$ where D_q is demand for commodity q. Therefore, an artisan knowing the IT will decide to become an entrepreneur if and only if $D_q \geq \rho \equiv (k+1)/(\alpha - \beta)$.[15]

Finally, we assume perfect mobility of labor among sectors and markets so that $w_F = w_M = w$. The working population is denoted by $L = L_F + L_M + E$ and each worker either supplies inelastically one unit of labor or becomes an entrepreneur. The total supply of labor is hence equal to $L - E$. Total population is denoted by $N = L + M$.

4.2 Industrialization.

Industrialization is defined here as the adoption of IT in place of TT. Industrial production in this context does not mean industrial goods, but that both the agrarian and agricultural productions are based on larger-scale, increasing returns modern techniques. Recall that we assume that the two countries have access to the same technology: the critical difference between them will be, as it is argued later, in terms of the economic incentives to adopt the TT or IT technology (more precisely, in terms of their relative profitability). In other words, the model will not explain divergence based on technological asymmetries (technology-gap), but on different incentives for adopting the IT. The pattern of land ownership in turn played a key role in defining these incentives.

Consider, for the sake of the argument, an economy whose agricultural sector is already in equilibrium. Denote with Ω_m the total expenditure in manufactures and with ω the income of a generic individual. Since every consumer who has already bought z units of food spends her remaining income to get a unit of each manufacture in the specified order, the demand D_q faced by a generic market q is determined by the number of individuals who earn enough income to buy at least commodity q, namely

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[14]Note that TT shows constant returns to scale while IT shows increasing returns. The difference between these two technologies represents the economic advantage of industrialization.

[15]We also impose that $(k+1) > (\alpha - \beta)$, because if $(k+1) \leq (\alpha - \beta)$ then IT never requires more units of labor with respect to TT and, hence, it is always preferred by artisans.

the number of individuals who satisfy $(\omega - z)/\alpha w > q$.

Assume, for the moment, that λ is such that workers are poor and consume only food, i.e. $w \leq z$. Thus, the demand for manufactures is shaped by the distribution of land property rights because the latter determines the number of individuals with income greater than z. If, for instance, there are only a few rich landowners, then the extent of the manufacturing sector will be quite large and the demand faced by each market will be relatively small. If, on the contrary, landowners are many but each with a low income, then the extent of the manufacturing sector will be quite small and the demand faced by each of these markets will be relatively large. Since IT is introduced only if demand goes over a certain profitability threshold, a too concentrated land ownership may prevent the takeoff even if Ω_m is large. Otherwise if land ownership is sufficiently distributed then the profitability threshold may be exceeded. In such a case, some artisans becomes entrepreneurs, earn positive profits and the market in which they operate industrialize. The new earnings obtained by entrepreneurs start a multiplicative process of demand for manufactures. New demand generates new profits and new profits generate new demand.[16] Such a feedback process can take place several times but in each round the amount of new profits diminishes because only a fraction of the new demand becomes new profits – the remaining part going to cover production costs. The process ends when new generated profits fail to industrialize new markets or to generate new demand for markets already industrialized.

Consider now the case where λ is large enough to imply that $w > z$, that is, workers demand for manufactures is positive. Thus, if $(M + L) > \rho$ then some markets industrialize. As described above, the extra earnings obtained by entrepreneurs of industrialized markets start a multiplicative process of demand which may further expand industrialization and aggregate income. In general, under the hypothesis that $w \geq z$, a greater λ implies a larger w which in turn produces an increase in both industrialization and income by fostering demand for basic manufactures and, hence, a more intense exploitation of mass production (see Bilancini and D'Alessandro, 2008a for a proof of this). We emphasize that the latter mechanism based on workers' purchasing power and the previous one based on land distribution may trigger industrialization independently to each other. However, they may also work together in a synergic way.

4.3   New Zealand and Uruguay between 1870 and 1940

We particularize the model to the case of New Zealand and Uruguay by introducing a few additional assumptions. Our aim is to translate the stylized facts reported in section 2 and 3 into the language of the model. In order to better clarify our argument we disregard any other possible difference between the two countries.

A superscript $j \in \{NZ, U\}$ indicating the country – NZ stands for New Zealand, U for Uruguay – and a subscript $t \in \{0, 1\}$ indicating the date – 0 stands for 1870, 1 for 1940 – are added to the model variables and parameters. According to this notation we have, for instance, that N_0^{NZ} is the population of New Zealand in 1870 while N_1^{U} is the

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[16]The precise outcome depends on how profits are distributed among entrepreneurs. This issue is investigated in detail in Bilancini and D'Alessandro (2008b).

population of Uruguay in 1940. We assume that available technologies are identical in the two countries and constant over time. Hence, we drop both subscripts and superscripts for $F(\cdot)$, α, β and k.

We further assume that the two countries are identical under all respects but two: (i) the 1870 endowment of cultivated land is greater in Uruguay while the 1940 endowment is the same, and (ii) the number of landowners grows proportionally with the land stock in New Zealand while is constant in Uruguay (see footnote 8).[17] Table 9 reports our assumptions on factor endowments and land distribution for the year 1870.

Exogenous variables in 1870	New Zealand vs Uruguay
Total Population	$N_0^{NZ} = N_0^{U}$
Number of Landowners	$M_0^{NZ} = M_0^{U} < \rho$
Peasants' Share of Agricultural Product	$\lambda_0^{NZ} = \lambda_0^{U}$
Available Cultivated Land	$T_0^{NZ} = \dfrac{T_0^{U}}{k} < T_0^{U}$
Working Population	$L_0^{NZ} = L_0^{U} > \rho$

Table 9: Factor endowments and land distribution in 1870, where $k > 1$.

Since land is more scarce in New Zealand – while total rents are the same – the (rental) price of land is higher in New Zealand. Moreover, agricultural labor is more productive in Uruguay implying that Uruguayan wages are higher (consistently with retal/wage data, see figure 1). However, Uruguayan landowners are as rich as New Zealander ones since they own a larger amount of land per capita (this is consistent with, though not implied by, Tables 5 and 6).

Furthermore, since in 1870 both New Zealand and Uruguay had per capita incomes among the highest worldwide, we find convenient to assume that wages are slightly greater than z in both countries. This implies that the amount of food produced and consumed in the two countries is the same – denoted by F_t^j – although in Uruguay food is produced using more land than in New Zealand and, as a consequence, less labor. These equilibrium relations are summarized in Table 10.

Note that in both countries the number of landowners is too small to trigger industrialization while the size of the working population is sufficient to break-even in some markets. Hence, in each country an industrial sector exists though its size is very small in terms of both people employed and variety of manufactures produced. The equilibrium production of manufactures is represented in Figure 2 for New Zealand and in Figure 3 for Uruguay. The two manufacturing sectors, considered as whole, are of similar size

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[17]Later on, we will also suppose that (iii) New Zealand had a systematically higher share of agricultural product going to wages than Uruguay. Such a delay is intended to show that (i) and (ii) are enough to generate some divergence which, in turn, is fostered by (iii).

Equilibrium variables in 1870	New Zealand vs Uruguay
Food Produced	$F_0^{NZ} = F_0^U$
Wages	$w_0^{NZ} = \lambda_0^{NZ} \dfrac{F_0^{NZ}}{L_{F0}^{NZ}} < \lambda_0^U \dfrac{F_0^U}{L_{F0}^U} = w_0^U$
Total Rents	$R_0^{NZ} = \left(1 - \lambda_{NZ}^0\right) F_0^{NZ} = \left(1 - \lambda_U^0\right) F_0^U = R_0^U$
Landowners' income	$\dfrac{R_0^{NZ}}{M_0^{NZ}} = \dfrac{R_0^U}{M_0^U}$
Rental price	$r_0^{NZ} = \dfrac{R_0^{NZ}}{T_0^{NZ}} > \dfrac{R_0^U}{T_0^U} = r_0^U$
Rental-Wage Ratio	$\dfrac{r_0^{NZ}}{w_0^{NZ}} > \dfrac{r_0^U}{w_0^U}$

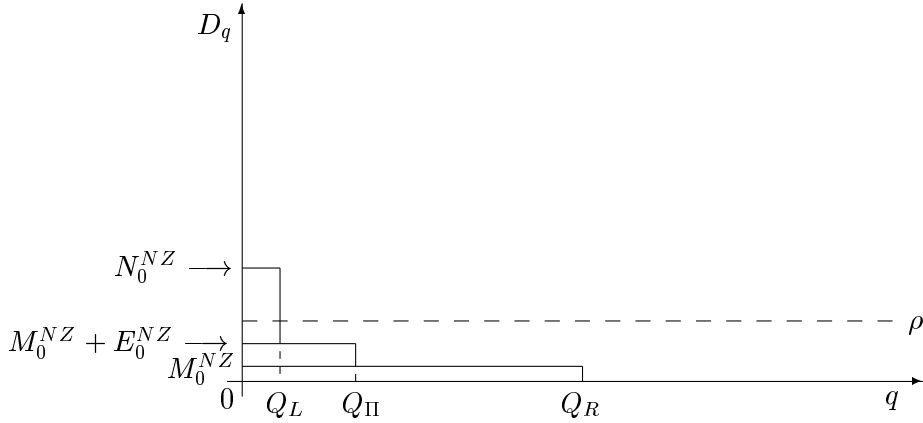Table 10: Equilibrium outcomes in 1870

Figure 2: New Zealand manufacturing sector in 1870. The vertical axis measures the amount of manufactures produced while the horizontal axis identifies the type of manufacture. The intervals $[0, Q_L]$, $[0, Q_\Pi]$ and $[0, Q_R]$ represent the types of commodities demanded by, respectively, workers, entrepreneurs and landowners.

in terms of variety of commodities produced. This is because landowners – which are the richest and hence have the most diversified consumption – earn the same income in the two countries. However, the industrial sector is slightly larger in Uruguay than in New Zealand because workers demand a somewhat lager variety of manufactures. In conclusion, under (i) and (ii) our model predicts that, if anything, in 1870 Uruguay was in a slightly better position than New Zealand for both industrial takeoff and economic
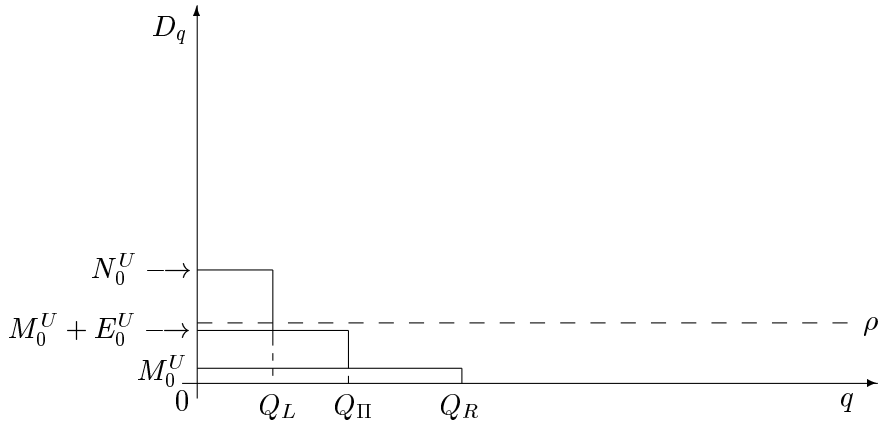
Figure 3: Uruguay manufacturing sector in 1870. The vertical axis measures the amount of manufactures produced while the horizontal axis identifies the type of manufacture. The intervals $[0, Q_L]$, $[0, Q_\Pi]$ and $[0, Q_R]$ represent the types of commodities demanded by, respectively, workers, entrepreneurs and landowners.

growth.

We now study the equilibrium in 1940. Following (i) and (ii), we have that population is still identical in the two countries but substantially larger than in 1870. Moreover, while New Zealand has a *ratio* between the number of landowners and that of non-landowners that is the same of 1870, Uruguay has the same *number* of landowners that it had in 1870. In addition, in 1940 New Zealand has reached the same stock of cultivated land of Uruguay which, instead, has the same stock of 1870. As a consequence, land ownership is substantially more concentrated Uruguay than in New Zealand. These assumptions are formally stated in table 11.

Exogenous variables in 1940	New Zealand vs Uruguay
Total Population	$N_1^{NZ} = N_1^U = kN_0$
Number of Landowners	$M_1^{NZ} = kM_0^{NZ} > \rho > M_1^U = M_0^U$
Peasants' Share of Agricultural Product	$\lambda_1^{NZ} = \lambda_0^{NZ} = \lambda_0^U = \lambda_1^U$
Available Cultivated Land	$T_1^{NZ} = T_1^U = T_0^U > T_0^{NZ}$
Working Population	$\rho < L_1^{NZ} = kL_0^{NZ} < L_1^U = N_1^U - M_0^U$

Table 11: Factor endowments and land distribution in 1940, where $k > 1$.

Our model shows that such differences are sufficient to imply a gap in both industrialization and income growth. The intuition is the following. In New Zealand population

growth comes with the proportional growth of the land stock and the number of landowners. Since agricultural production shows constant return to scale and demand for food is proportional to population, we have that equilibrium wages remain at the same level of 1870 while total rents increase proportionally to population. This also means that the income of each landowner remains at the level of 1870 since also their number grows proportionally to population. However, mass production expands because the greater number of landowners makes the adoption of the industrial technology profitable for a greater variety of manufactures. So, also industrial employment and income grow substantially. On the contrary, in Uruguay population growth does not come with a greater number of landowners and the stock of land is constant and equal to that of New Zealand in 1940. This implies, with respect to 1870, a lower average agricultural productivity of labor – due to decreasing returns – which, in turn, implies higher rents per landowner and lower wages. Furthermore, since in 1940 food production is the same in the two countries, so are wages and total rents. Therefore, the model predicts that the rental-wage ratio of Uruguay converges to that of New Zealand during the years between 1870 and 1940 (again, consistently with what described in section 3). These equilibrium outcomes are summarized in Table 12.

Equilibrium variables in 1940	New Zealand vs Uruguay
Food Produced	$F_1^{NZ} = F_1^{U} = kF_0^{NZ} = kF_0^{U}$
Wages	$w_1^{NZ} = \lambda_1^{NZ} \dfrac{kF_0^{NZ}}{kL_{F0}^{NZ}} = w_0^{NZ} = w_1^{U} < w_0^{U}$
Total Rents	$R_1^{NZ} = kR_0^{NZ} = kR_0^{U} = R_1^{U}$
Landowners' income	$\dfrac{R_1^{NZ}}{M_1^{NZ}} = \dfrac{kR_0^{NZ}}{kM_0^{NZ}} < \dfrac{R_1^{U}}{M_1^{U}} = \dfrac{kR_0^{U}}{M_0^{U}}$
Rental price	$r_1^{NZ} = \dfrac{kR_0^{NZ}}{kT_0^{NZ}} = r_0^{NZ} = r_1^{U} = \dfrac{kR_0^{U}}{T_0^{U}} > r_0^{U}$
Rental-Wage Ratio	$\dfrac{r_1^{NZ}}{w_1^{NZ}} = \dfrac{r_1^{U}}{w_1^{U}}$

Table 12: Equilibrium outcomes in 1940, where $k > 1$

We find useful to describe in greater detail what our model predicts about the development of the manufacturing sectors. Since Uruguayan landowners becomes substantially richer than their New Zealander counterparts, Uruguay's manufacturing sector as a whole expands more than the New Zealand's one. However, Uruguay has a smaller industrial sector – both in terms of industrial employment and variety of commodities produced – because most Uruguayan manufactures are still produced with the traditional technology. Indeed, in Uruguay, the only commodities produced with the industrial technology are the few types that are demanded by workers. Thus, entrepreneurs

are few and very rich because they sell their commodities to everyone in society with the consequence that their own demand for manufactures is not sufficient to impulse mass production (see Figure 4). On the contrary, in New Zealand there are many landowners and, although they are substantially poorer than Uruguayan ones (and poorer than the richest New Zealander entrepreneurs), their number generates a demand for manufactures which is sufficient to break-even. Therefore, we have that all commodities demanded by landowners – which include those demanded by workers – are produced with the industrial technology. As mass production expands, new groups of middle-income entrepreneurs arise whose demand for manufactures further sustains the process of industrialization (see Figure 5).
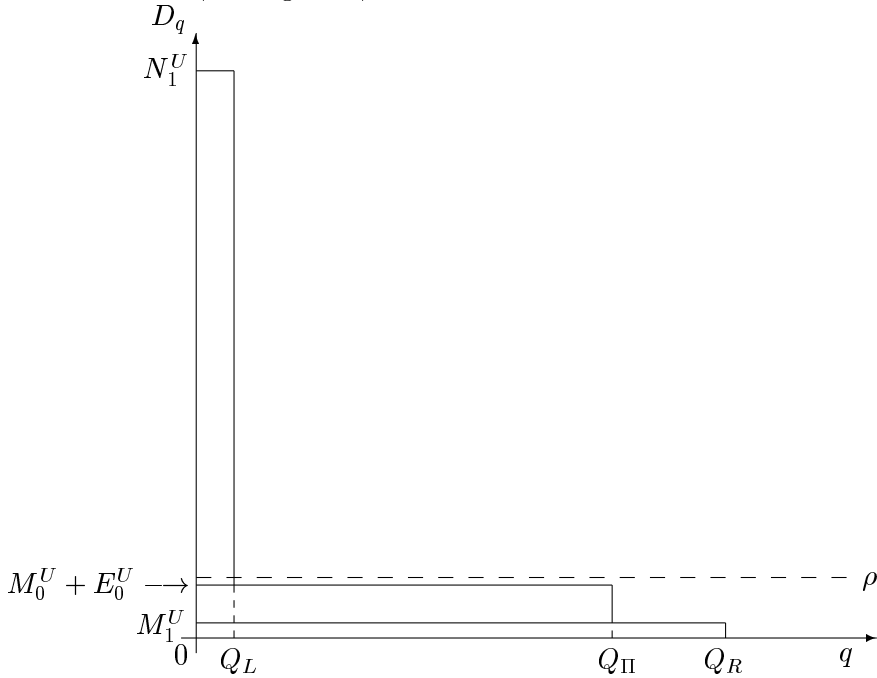

Figure 4: Uruguay manufacturing sector in 1940. The vertical axis measures the amount of manufactures produced while the horizontal axis identifies the type of manufacture. The intervals $[0, Q_L]$, $[0, Q_\Pi]$ and $[0, Q_R]$ represent the types of commodities demanded by, respectively, workers, entrepreneurs and landowners. All entrepreneurs earn the same profits.

Let us now turn to the other important difference between New Zealand and Uruguay: the share of agricultural product going to agricultural workers. This aspect has been neglected so far but actually it may have played a non-negligible role. As illustrated in section 3, in New Zealand the share of agricultural product going to agricultural workers had been larger, on average, of one-tenth of the total agricultural product. We translate this fact into the language of the model by positing that: (iii) $\lambda_1^{NZ} = \lambda_0^{NZ} > \lambda_0^{U} = \lambda_1^{U}$. Since in 1870 agricultural labor is more productive in Uruguay, having $\lambda_0^{NZ} > \lambda_0^{U}$ is not sufficient to make real wages in New Zealand higher than in Uruguay. However, in
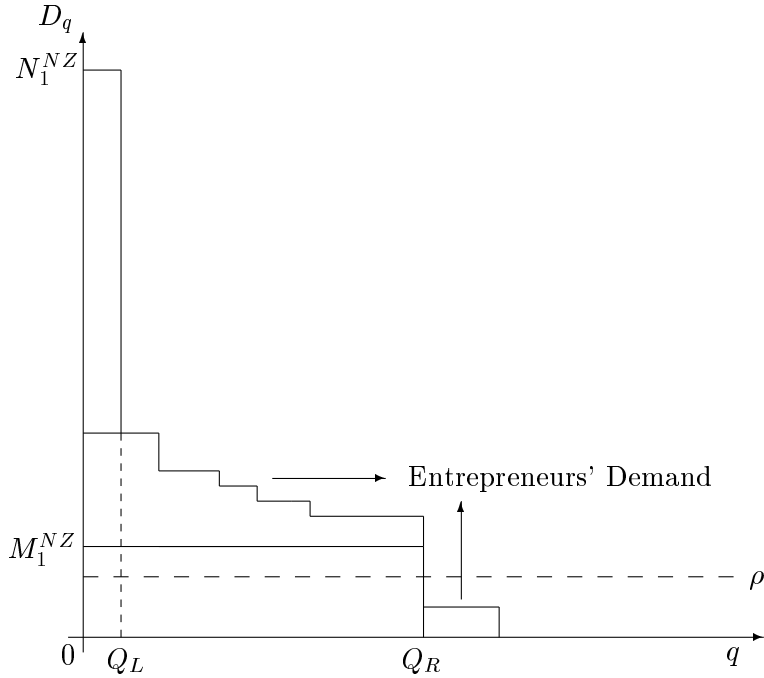
Figure 5: New Zealand manufacturing sector in 1940. The vertical axis measures the amount of manufactures produced while the horizontal axis identifies the type of manufacture. The intervals $[0, Q_L]$ and $[0, Q_R]$ represent the types of commodities demanded by, respectively, workers and landowners. Since not all entrepreneurs earn the same profits, the variety of commodities that they demand can vary across entrepreneurs.

1940 the land stock is the same in the two countries and, hence, labor productivity in agriculture is equal. Therefore, workers in New Zealand earn a higher wage which translates in a larger variety of manufactured goods demanded. Thus, more artisans becomes entrepreneurs and make positive profits. These effects further foster industrialization and growth in New Zealand. They can be easily seen by slightly modifying Figure 5: Q_L is larger and Q_R is smaller while entrepreneurs' demand for manufactures expands for most commodities.[18]

In conclusion, the predictions of our model are consistent with the facts reported in section 2 and 3.[19] In 1870 the similarities between Uruguay and New Zealand would

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[18]Note that a reduction of entrepreneurs' demand is possible for some commodities produced with the IT because a greater λ may imply a lower income for some entrepreneur. More precisely, a greater λ reduces the variety of commodities demanded by landowners and, hence, the revenue of some producers. However, this is always more than compensated by the extra revenue of the remaining entrepreneurs.

[19]Note that under assumption (i) , (ii) and (iii) the predicted rental-wage ratio in New Zealand is systematically lower than that predicted under (i) and (ii). Therefore, perfect convergence of the rental-wage ratios is lost. However, under these three assumptions, the two ratios become more and more similar between 1870 and 1940. We do not believe that this is an issue. As already noted in section 2, data on the rental-wage ratios may not be fully comparable because absolute values may not be comparable. Therefore, the important feature to match is the fact that the rental/wage ratio in

have suggested that, if anything, Uruguay was hardly going to perform worse than New Zealand. However, we have shown that the important institutional differences in the agricultural sector had the potential to generate the subsequent observed divergence.

5 Final Remarks

In this paper we have proposed a model of early industrialization which provides a theoretical argument for the different economic performances of New Zealand and Uruguay between 1870 and 1940. More precisely, we advanced the idea that differences in agricultural institutions affected industrial development and growth.

We have also provided supportive historical evidence. Indeed, though similar under many respects, Uruguay and New Zealand showed substantial differences in the institutions governing both access to land and distribution of agricultural product. In New Zealand the Crown adopted a policy that strongly facilitated the access to land to white colonizers and European descendants. This in turn allowed an increasing number of landowners, which expanded along with immigration and population growth. Instead, in Uruguay land was heavily concentrated in the hands of a small group of landowners that benefited from massive transfers of public lands. Moreover, Uruguayan landowners had been granted a larger share of the agricultural product than their New Zealander counterparts.

Our model suggests that the gap in industrial development and GDP per capita may be linked to such institutional differences. The basic intuition is that New Zealand's institutions have generated a more equal distribution of both land ownership and agricultural product. This in turn has produced a larger domestic demand for basic manufactures which has fostered New Zealand's industrial production and GDP.

We recognize that our model abstracts form many other plausible differences between the two countries. Of course, we do not claim that such other differences did not play any role. Actually, we believe that there are several additional factors that might have affected the evolution of the economies under consideration, not least the international environment to which they were exposed. A few remarks in this regard are worth doing. One potential limitation of our model is the absence of international trade, since both New Zealand and Uruguay were well integrated in the international trade system. However, we claim that this is not a serious problem. As we pointed out in section 2, both countries had been almost exclusively exporters of non-industrial goods. Therefore, the qualitative results and the predictions of our model are not affected if we allow for international trade – at least if shocks in prices are supposed to have similar impacts on the two economies.

Another potential limitation is that we abstracted from credit markets and, hence, from the role of credit rationing. Indeed, the possibility of using land as collateral in the credit market may have created relevant asymmetries in terms of access to credit (Deininger and Squire, 1996). One would expect that, thank to land ownership, New

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Uruguay performed worse than in New Zealand and not that the two ratios had become almost equal in 1940.

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Zealand's farmers have had a much easier time in obtaining credit than their Uruguayan counterparts.[20] However, this argument does not seem to contrast ours. If anything, it reinforces the idea that a more equal distribution of land ownership is likely to provide a better ground for industrialization.

Appendix: Sources for the estimation of the Agricultural Product, Wages and Land Rent

New Zealand   The estimation of total wages in New Zealand was based on:

1. Time series for the wages of rural workers as provided by Briggs (2003) (who in turn used Bloomfield (1984) series computed from census data).

2. Wages of rural workers obtained from Greasley and Oxley (1998, 2003).

The estimation of total rents was based on:

1. Land prices taken from Prichard (1970); Greasley and Oxley (2003). The series of the latter authors are deflated by the IPC series produced by Briggs (2003);

2. Total land occupied and exploited each year, identifying public and private lands in the total, as published by Prichard (1970).

The estimation of the agrarian product was drawn from Hawke (1985); Prichard (1970).

Uruguay   The estimation of total wages was based on:

1. Series for rural workers elaborated on the basis of the CIDE (1967), Anuario Estadístico (1938), Censos Agropecuarios (1908, 1916, 1930, 1937 y 1943); and the series elaborated by Ardente et al. (2004); Bértola (2005).

2. Wages series of rural workers estimated by Bértola et al. (1998); Bértola (2005); Ardente et al. (2004).

The estimation of the volume of the land rent was based on:

1. Time series data for land prices provided by the PHES data bank, elaborated from Barrán and Nahum (s/f, 319) for the period (1886-1895); Barrán and Nahum (1973) for the period 1896-1905; Barrán and Nahum (1978) for the period 1906-1913; Balbis (1995) for the period 1916 and 1930; Vigorito and Reig (1986) for the period 1931-40.

2. Prices for rural leasing elaborated on the basis of PHS databank; Moraes (2001); Barrán and Nahum (1971) for the years 1908-1911; BROU (1933) for the years 1916 and 1930;Jacob (1981) for the year 1940.

The estimation of the agrarian output was based on Bértola et al. (1998) Bertino and Tajam (1999) and Bértola (2005).

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[20]Actually, in New Zealand a specific institution – the stock and station agent – provided long term credit for buying land and equipment, as well as information about external markets, and legal and technical assistance to farmers (Ville, 2000). The situation in Uruguay was quite different in this respect.

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