Resource - Rich Countries' Success and Failure in Technological Ascent, 1870-1970: the Nordic Countries versus Argentina, Uruguay and Brazil[1]

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Introduction

Overview

This paper sets out to explain the success or failure of seven countries in ascending towards the high-technology 'core' in world trade. We propose to view this process partly in the perspective of techno-economic long waves, partly in the perspective of secular, irreversible change.

We will stress the peculiarities of each of the four major Nordic countries - Denmark, Finland, Norway and Sweden - and three Latin American countries - Argentina, Uruguay and Brazil - as well as the major similarities within, and differences between, the two groups. Chronologically, the emphasis will be on those phases of each country's development that we consider to be the most critical ones - hence, roughly the 1870 - to - 1940 period in the Scandinavian countries, the 1917 - to - 1970 period in Finland, and the whole 1870 - to - 1970 period in the Latin American countries.

Starting from a peripheral position around 1870, the Nordic

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countries can be said to have reached the technological core before or soon after the Second World War, while the Latin American countries must still be labelled semi-peripheral in 1970 and still remain so today. This cannot merely be a consequence of geographical distance to the old North Atlantic axis of industrialisation, since much of Southern and Eastern Europe has failed to reach the core while countries like Australia and Japan have succeeded.

Initial positions

A peripheral position in international trade was not the only characteristic shared by our seven countries in 1870. For all of them, rich natural resources and (with the exception of Denmark) sparse population have been of decisive importance for the development of their economic structure since then. This does not mean that all of the countries were *land-abundant* in 1870, at least not in the same sense. All the Latin American countries were land-abundant at that time in the sense that land sufficient for subsistence farming was available for reclamation by creoles and immigrants at low economic cost, though naturally at the expense of the native population. There were also large areas of land which were both suitable for various types of exportable crops, and thinly populated. That was not true for most parts of the Nordic countries at that time, which helps to explain why during the late XIXth century large cohorts of smallholders and landless farm labourers emigrated, primarily to North America. The Nordic primary sector - whether in agriculture, forestry, minerals or water power - was only able to realise its potential later on by piecemeal adaptation to the shifting production and trade patterns conditioned by international technological development. This adaptation has not taken place to such an extent in Argentina, Uruguay, or Brazil. Indeed, it is plausible that initial land-abundance has played a role here, though not, we shall argue, all by itself.

In terms of income and financial capital, all of the countries were still relatively poor by 1870 in comparison with core countries like

the UK, the USA, France, or Germany. It was inherent in their backward position that an inflow of foreign capital was needed for substantial investments to be possible. According to Maddison (1991, Table 2-1) - which lacks a figure for Uruguay - Denmark was the richest of the countries, followed by Sweden, Norway, Argentina, Finland, and Brazil, in that order. Brazil's GDP per capita was roughly 65 per cent of Finland's and 40 per cent of Denmark's; Argentina's was 67 per cent of Denmark's; Denmark's was 57 per cent of Britain's.[2]

It should also be noted that although the two country groups did differ in 1870 as regards the endowment of *human* capital, conventionally perceived, the differences should not be overstated or generalised to all regions.

In Sweden, probably the most literate Nordic country at the time, reading ability was well above 90% for both sexes, while writing ability amounted to 40-70%.[3] The figures for Finland seem to have been considerably lower.[4] There is even some evidence that the percentage of fully literate persons in 1900 was slightly lower in Finland (39%) than in Argentina as a whole (47%)[5], with the reservation that measurement methods may differ. It is interesting to note that among men applying for military service exemption in the city of Buenos Aires in 1852, 81% of proprietors, 62% of wage earners and 52% of servants and day labourers were able to read and write. There is also evidence that overall levels of literacy were the same for men and women.[6] These high figures for younger people make at least the city of Buenos Aires comparable to the Nordic capitals of the same period.

Traditionally, the Nordic peoples were trained primarily to read religious texts, which did not automatically give them the ability to sign contracts or even to read the typefaces used in newspapers.

[2] See also the discussion of the Nordic figures by Krantz, 1987.
[3] Nilsson & Pettersson, 1990, p. 221.
[4] Hjerppe, 1989, p. 104.
[5] Myllyntaus, 1990, p. 153.
[6] Newland, 1990, p. 313f.

Unlike the Latin American countries, Denmark, Sweden and Norway had established compulsory schooling earlier in the XIXth century, which gradually began to work according to more modern conceptions of education. We shall argue, however, that although the Nordic countries on the whole were ahead of Argentina, Uruguay and Brazil from an educational point of view, the latter were not *hopelessly* behind in 1870, as the Finnish experience may testify.

Moreover, in Argentina and Uruguay the broad mass of people enjoyed good standards of nutrition thanks to rapidly increasing output from agriculture and pasture. Their only Nordic counterpart in this respect was Denmark, where standards were also probably clearly better than in most of Brazil. By contrast, the peasants in Norway, Sweden and Finland suffered mass starvation in 1867-8 due to crop failure. Especially in Finland, standards were poor even under normal circumstances; the average calorie intake in 1860 has been estimated at 1,900 a day, an inadequate level.[7]

Certainly, other social, economic and political features differed considerably between the countries in our study, but we shall present them as part of our story of the development after 1870. This story will be within the framework of the long-wave theory of Tylecote (1992, 1995).

The theoretical framework

Technological long waves in the world economy

The key elements of Tylecote's long-wave theory, for our purposes here, are the following.

There is a technological long wave in the world economy which involves the crystallisation, roughly every half-century, in one or more leading 'core' economies, of a new technological style: that is, "*a sort of 'ideal type' of productive organisation or best technological common sense which develops in response to what are*

[7] Hjerppe, 1989, p. 118.

perceived as the stable dynamics of the relative cost structure" (quotation from Perez, in Freeman 1986, p.31). The new technological style then diffuses within and beyond the core at rates largely determined by the degree to which the existing socio-institutional structure is well matched to it. A peripheral or semi-peripheral country whose socio-institutional structure is well matched to the latest technological style has good prospects of ascending towards or into the core.

The successive 'styles' and their approximate periods of 'crystallisation' are:
1. 'Water' style, 1780-90.
2. 'Steam transport' style, 1828-32.
3. 'Steel and electricity' style, late 1870s.
4. 'Fordist' style, 1913-18.
5. 'Microelectronics and biotechnology' style, late 1970s.
(See Tylecote, 1992, ch.2.)

Of these styles, the second, third, and fourth are relevant for the period of our study, and we shall present them more thoroughly later on.

Impact on the core-periphery relationship

There are complex effects of the technological long wave on the key economic and social variables of the world economy. Notably, it affects the core-periphery relationship, which is essentially a relationship of high-technology economies with low-technology ones (Tylecote, 1992, ch.7). Once a new technological style is diffusing rapidly it makes a mark on the trade relationships between the two. New patterns of comparative advantage become apparent: certain types of high-technology products are exchanged by the core for certain types of low-technology products from the periphery. Thus the diffusion of the 'steam transport' style unlocked the grain potential of the Americas - with railways to get the grain to port and steamships to get it across the oceans. During periods

when such an exchange relationship clearly suits them, peripheral countries are likely to over-commit themselves to it. 'Overcommitment' can take the form of risking too much on high relative prices for primary products, and/or borrowing too much on the strength of expected export earnings. In the first case disappointment comes if the terms of trade turn against them - as those for European grain producers did in the 1870s, with overseas grain flooding in, and as those for virtually all primary products did in the 1920s and 30s. In the second case even a downturn in absolute prices (such as took place between the early 1870s and the early 1890s) is a severe setback, since nominal earnings fall relative to interest and repayment commitments. In either case they face a crisis, which may be taken as a challenge - to reposition themselves in the world order. At the very least their balance of payments difficulties drive them, for a time, to economise on foreign exchange by increasing the degree of protection of import-competing industries. However, unless they manage to raise their technological level substantially, they will not find the pattern of comparative advantage altered to a sufficient degree, and when 'normality' returns they will return to their previous dependence on the core for markets for them and supplies of high-technology products.

A key factor in determining their capacity to respond successfully is, Tylecote argues, the degree of internal *inequality* in economic and social structures: the lower the better, and the advantage of low inequality has tended to increase over time. One major advantage of low inequality - especially, low inequality of wealth - is that it tends to improve educational standards.[8] Furthermore, a combination of relatively good formal education of workers, and relatively low social distance, facilitates

[8] This is because the poor, if less poor, have more opportunity to get educated; the rich, if less rich, and facing more competition from the better-educated poor, have more incentive. A fall in pay differentials may offset this by reducing the return to education; this does not apply when there has been a reduction in inequality of wealth. See the dramatic improvements in educational standards in Japan, S.Korea and Taiwan after the land reforms in those countries in the late 1940s. (The land reforms are described in Tylecote, 1992, ch.7.)

communication between workers on the one hand and managers and entrepreneurs on the other. This helps both sides to participate actively in the kind of incremental learning process that is characteristic of technologically progressive enterprise. As we shall see below, this was more important under the 'steel and electricity', style than under the steam transport style, and has been even more important under the 'Fordist' style. Besides the learning-on-the-job aspects, low inequality tends to widen domestic markets for the leading industries under each technological style. Again, this tendency was most pronounced for 'Fordist' products (as it is for the products of the new microelectronics and biotechnology style).

The periodicity of the technological long wave - about 50 years on average - clearly resembles that of the much-debated Kondratieff cycle in world output and prices. In this paper we will take a rather 'minimalist' position on the Kondratieff cycle. During this century the movement of world growth rates, and the relative prices of core and peripheral exports, have followed the sort of pattern to be expected from most long-wave theories: a downswing period of some 20-25 years of low growth of output and generally poor terms of trade for the periphery, followed by an upswing period of similar length with relatively fast growth and favourable terms of trade. During the late XIXth century, from the early 1870s to the mid-1890s, there was a 'downswing' period in terms of the general price level, though it is debatable whether it was one of low growth of output or of poor terms of trade for the periphery (Tylecote, 1992, chs.1 and 7). (It is easy to see that if there *is* a long wave downswing in growth, it is likely to affect core-periphery terms of trade. Clearly, high aggregate world demand benefits primary and other low-tech production relatively more than high-tech production, the latter being generally less subject to price competition.)

The worsening of periphery terms of trade in the downswing provides a 'push' factor for import substitution in the peripheral countries in these periods; so does a fall in the price level, to the

extent that they are indebted. (We shall see that the 'shock' of the First World War did likewise; the Second World War came as less of a shock in this sense because it followed ten years or so of clear-cut downswing.) Thus the peripheral country has roughly 20-25 years at its disposal for its repositioning in the world economy, before the initial push-pull mechanism for technological development weakens. If the development is sufficiently pervasive, it will not be reversed at this point, because comparative advantage will have moved in the country's favour, making it more profitable than before to export higher-tech products - and import lower-tech ones. As we have suggested above, how pervasive such technological change will be, depends on a number of socio-institutional factors, and how well they suit, or are quickly changed to suit, the current technological style. The achievement of social change generally requires co-operation between social groups, which (we predict) is most likely to take place in the long-wave downswing, which has economically adverse effects for everyone so that the need for *some* kind of change is generally recognized. The change often needs to be completed through the defeat of remaining reactionary interests in the following upswing. (A briefer period of crisis like the First World War is less likely to have such a 'functional' outcome.)

We shall begin our analysis at a point of time - 1870 - when the diffusion of the steam transport style had just begun to influence peripheral development.

The aftermath of the 'steam transport' style

The transport factor

The development of a railway network and steamship traffic was of central importance for two characteristic processes affecting both of our country groups.

The first one has already been mentioned: the emigration from the Nordic countries and the immigration to Argentina, Brazil and Uruguay. The Nordic overseas emigration from 1870 to the outbreak

of the First World War, expressed as percentages of the respective population figures of 1870, amounted to about 15% from Denmark and Finland, 25% from Sweden, and more than 30% from Norway.[9] The majority of these early emigrants, principally representing the rural poor, were never to return. Population continued to grow rapidly in their home countries, but the acute pressure on arable land had been relieved and the long-term growth of the rural proletariat had been dampened. Peasant farming continued to dominate, although there was still a want of measures to reduce poverty.

In the same period, huge immigration took place in Latin America. The immigrants were primarily Southern Europeans and, like the Nordic emigrants, some of them went into farming in their new countries, e.g., in the districts of Sao Paulo, Santa Catarina and Rio Grande do Sul in Brazil, and Santa Fe in Argentina. In other places, however, a highly unequal distribution of land was already cemented, in many cases with low ownership mobility. In Argentina, the land area available for immigrant settlement never exceeded 15% of the total area of the country.[10]

The second important process facilitated by steam transport was the opening of new markets, especially export markets. New staples like timber from Norway, Sweden and Finland entered the world market, as did Brazilian rubber and (to an increasing extent) coffee and sugar. Argentina and Uruguay, like Denmark, could participate in fresh-meat trade once the refrigerated ship had been introduced; the *Frigorifique* made its maiden voyage in 1876.[11]

It was not until this time - the 1870s - that the South Atlantic was crossed by regular cargo steamship lines. This gave the Latin American countries an initial disadvantage in trade, also indirectly by delaying the full recognition of the bottlenecks which could strengthen incentives to railway development. In 1870, Uruguay had

[9] Calculated from Mitchell, 1975.
[10] Rojas, 1988, p. 72.
[11] Hanson, 1938, p. 43.
[12] Oddone, 1986, p. 453.

only one railway line with a length of 20 kms[12]; Argentina had 732 kms and Brazil not much more.[13] (By contrast, little Denmark had 905 kms in 1874, which efficiently served the export of meat and live animals.[14]) By 1892, the Uruguayan network had grown to 1,600 kms. Argentina had 33,500 kms in 1914 and Brazil 32,000 kms in 1930.[15] The railways made major inland areas of these countries part of the world economy, but this was roughly the only thing they did. This is especially clear in the case of Brazil, which has hardly ever achieved an efficient intra-national transport system, and definitely did not have one in 1930. Also in the cases of Argentina and Uruguay, it has been argued in several studies that the inadequacy of the railway network gave the transport system a bias in favour of large landowners' interests, working against the viability of small commercial farms.[16] We must understand this as a combined effect of a quickly-moving frontier of inland colonization, a large share of foreign finance and foreign direct investment, and a close connection between the landed oligarchy and public policies with regard to railway construction and transport (including private enterprises). In the case of Brazil,

"The federal government set freight rates, which were kept low, mainly to appease landowners, so that only those lines intensively used to ship export crops were able to earn profits." (Dean, 1986, p. 713)

With one notable and well-known exception - the state of Sao Paulo - the railways and the export incomes they generated contributed very little to sectoral and technological change, and they tended to augment the existing structures of land ownership.

[13] Cortés Conde, 1986, p. 331; Viotti da Costa, 1986, p. 731.
[14] Hansen, 1972, p. 174.
[15] Oddone, 1986, p. 460 (Uruguay); Ford, 1962, p. 195 (Argentina); Dean, 1986, p. 713 (Brazil).
[16] Cortés Conde, 1986, p. 332 and Ferns, 1960, p. 314ff (Argentina); Senghaas, 1985, p. 109 (Uruguay).

The British-dominated undertakings in Uruguay - and, partly, Argentina - seem to provide only another variation on the same theme: priority was given to the cheap transport of established export goods from producers with foreign or political contacts.[17]

Now, how was it possible for the Nordic countries to escape this peripheral type of transport system? Like other poor countries - and despite the domestic supply of iron in Sweden and Norway - they all faced the need for foreign capital in the initial phase of railway growth. Finland constituted a special case in this respect, since it was part of Tsarist Russia. In Denmark, domestic capital (private and public) had already begun to dominate by the 1860s.[18] Swedish railroad construction remained heavily but indirectly dependent on foreign loans. The income levels of these countries were slightly higher than those of the Latin American regions where railways developed. However, the main difference between the Nordic and the Latin American group seems to be related to the social structure and institutional features of enterprise and financial systems (see below).

In order to make a fair comparison, however, we must also remember that the relative importance of railways was generally not quite as great in the Nordic countries as in Brazil, Argentina, or (eastern) Uruguay. One important export product of Norway, Sweden and Finland, timber, could be efficiently floated down the rivers and lakes and shipped out. These means of transport, which remained important right into modern times, were accessible for a large part of the forest owners. Combined with the reasonably decentralized ownership, this meant that export earnings were distributed between a large number of enterprises whose means of securing profits - unlike those of many Latin American *estancias* and plantations - were mainly economic rather than political. The situation was slightly different in another growing branch of exports, the mining and metal industries in the far north, to which we shall return below. Here, the railways were of decisive importance but only arrived around the turn of the century.

[17] Ferns, 1960, p. 315; Senghaas, 1985, p. 109.
[18] Hansen, 1972, p. 177.

On the whole, however, the Nordic railway networks (disregarding the Norwegian one, hampered by topographical difficulties) were able to serve not only the needs of the export sector, but also the integration of the national economies. In addition, their construction created considerable backward linkages to domestic production of inputs. This was a natural consequence of domestically-controlled railway construction, but also of responsive management in the input industries. Even in Denmark, which lacked iron ore and had a scarce supply of wood, the railway construction helped to set sawmills and the engineering industry in motion as early as in the 1870s.[19] By contrast, the railway companies in Brazil - including the domestically-owned ones - imported virtually all inputs well into our century.[20]

The primary sector in the Nordic ascents

It seems that at least Denmark, Sweden and Norway had already started their drive towards the technological core by the end of the XIXth century. But how, in the first place, could an initial rise in the exports of food and raw materials help them in this process?

In the case of animal products, the evident success story is that of Denmark; it contrasts sharply with the stories of Argentina and Uruguay. An excellent comparison between the Danish and the Uruguayan long-run developments, as regards the economic structure, has been made by Senghaas (1985). We agree with Bértola (1990, p. 43) on the need to supplement his analysis with a sketch of technological development, which we shall try to do, taking institutional conditions into account.

Seen in a longer perspective, the development of Denmark is remarkable. Unlike the other Nordic countries, it was long characterised by an absolute monarchy combined with a widespread semi-feudal system of land ownership; both survived well into the XIXth century. At this time, the peasants and cottagers

[19] Hansen, 1972, p. 199.
[20] Dean, 1986, p. 713.

of the manors (*faestegods*) were no longer serfs; they were allowed to take decisions like moving away or buying the farms they tilled. While remaining attached to the manor, however, the farms could not be divided, and in many cases their holders were obliged by contract to work on the demesne. The political climate had long been in favour of peasant ownership and the peasants were increasingly economically capable of achieving it. The *faestegods*, which in 1835 had covered about half the cultivable land area, constituted only 23% in 1860 and 8% in 1885.[21] The urbanisation and overseas emigration continued to work for a scarcer supply of rural workers, which may reasonably have improved their status.

Moreover, the access to education in the countryside was drastically improved in a relatively short time, thanks partly to improved elementary schooling and partly to N. F. S. Grundtvig's invention of the 'folk high school' or residential college (*folkehojskole*), where adult men and women had the opportunity to receive theoretical and practical knowledge from guest lecturers in the off-peak season. From its first introduction in 1844, this form of schooling grew into a mass movement in the latter half of the century.[22] When new promises emerged on export markets, the new large class of independent farmers and part-time-farming cottagers could participate in exploiting them.

Having noted for some decades that the export prices were more stable for animal products than for grain, many estate owners and larger farmers had switched over production to live pigs, fresh meat, bacon, and butter. The severe slump in grain prices after 1873 gave the smaller farmers the push to follow them. Between 1866/70 and 1910/14, the exported volume of beef rose fivefold, of pork, 17-fold and of butter, 18-fold.[23] (The other Nordic countries also greatly increased their exports of animal products, especially butter.)

The most interesting feature of this development is the way the

[21] Bjorn *et al* (eds.), 1988, pp. 26, 219, 222.
[22] See Borish, 1991.
[23] Bjorn *et al* (eds.), 1988, p. 347.

re-investment of earned profits embodied technological progress. This applied not only to the equipment of the live-stock farms themselves and the growing food-processing industries, but also the the grain farming that remained. Capital in agricultural machinery increased more than fourfold between 1875 and 1913, with roughly the same growth rate for different farm-sizes. The machine/land ratio was higher on the medium-sized farms of five to forty hectares than on the larger farms.[24] Before the First World War, horse-drawn threshing-machines - a Danish patent - were in use not only on farms that could afford one themselves, but also to a considerable extent on smaller holdings, which owned them co-operatively.[25] Hence, a good many of the decisions to mechanise production were taken by peasant families who would otherwise have performed the manual work themselves.

The co-operative movement had a decisive importance for the institutional features of the growing food-processing industry. The big boom for the foundation of co-operative dairies came in the latter half of the 1880s, when the need for joint ownership to finance one of the new Danish centrifuges was recognized by the individual farmer. A little later, the dairies were followed by co-operative slaughter-houses. The associations were demonstratively democratic with the principle of one share-holder - one vote.[26] Furthermore, the supply of finance through savings and credit associations had already been established among farmers since the redeeming movement a generation earlier.

At the turn of the century, the Danish economy was still dominated in many respects by agriculture. This, however, had begun to acquire many core-country characteristics, with a large number of farmers utilizing technology that was relatively modern by international standards, and producing expensive bacon and butter with a high-quality reputation for the British market. The

[24] Nuchel Thomsen & Thomas, 1966, p. 183.
[25] Bjorn *et al* (eds.), 1988, p. 273.
[26] Hansen, 1972, p. 217f.

scattered manufacturing industries employed only eight percent of the labour force in 1895, and their share of the country's exports had even declined from 14 to 10 percent in 25 years.[27] On the other hand, they provided an important part of agricultural investment goods.

The example of Denmark illustrates a tendency that was evident also in Sweden and Norway, namely, the rapid rise in the degree of refinement of export products. (The development of Finland was more problematic and will be discussed below.) In the first 14 years of our century, while timber exports declined, the exports of paper pulp doubled in Norway and quadrupled (from a lower starting-point) in Sweden; the exports of paper quadrupled in both countries.[28] Although these countries did not have a *Grundtvig*, some of the Danish socio-economic developments - for example, the co-operative movement - were present.

The Danish experience is also an example of the non-necessity of the 'inverse U-curve' as regards the secular development of income inequality. With the exception of some temporary setbacks, the secular trend of the MEC ('Maximum Equalisation Coefficient', i.e., the share of national income that would have to be transferred from the persons with incomes above the mean value to the others in order to achieve an equal distribution) has been falling. Between 1870 and 1900 it fell from 50 to 35 per cent, reflecting a substantial reduction of poverty.[29]

A peculiar feature of the Danish modernisation process – unlike, say, the Swedish - was the absence of any outspoken policy of import substitution. Tariffs on industrial goods were held largely constant at relatively low levels between 1863 and 1908 (in comparison with the pre-1863 period) while most agricultural goods were duty-free.[30] The Danish free-trade policy may be explained partly by the extraordinarily low foreign debt from the period of

[27] Hansen, 1972, pp. 229f, 287.
[28] Mitchell, 1975, p. 348.
[29] Schmidt Sorensen, 1990, p. 272.
[30] Thomsen, 1991, p. 36f.

railway growth and partly by the country's close trade relations with Britain. The fact that the Danish export sector, nevertheless transformed itself very much in accordance with the trends in relative prices is illustrated by the fact that, between 1875/6 and 1912/3, the country's foreign terms of trade rose by 26 per cent if one uses 1912/3 weights, but only by two per cent if 1875/6 weights are used. Regardless of this, the initial push mechanism is evident: a modest fall in the terms-of-trade to 1890/1 was followed by sustained improvement.[31]

The primary sector in Argentina, Uruguay and Brazil

If we compare changes in the Danish terms-of-trade with those of Argentina, the difference is not very striking as regards *trends*. According to the calculations by A G Ford (1962, pp. 144,159), the improvement of the gold-peso terms-of-trade in Argentina was considerable - roughly 40% - between the 1880s and 1910/14, but the improvement was wholly concentrated in the period after the turn of the century. The time-series between the 1880s and 1900 actually says more about the chaotic development of the Argentine currency than the real economy. During this period Argentina repeatedly failed to remain on the gold standard and financed a growing balance-of-payments deficit by a devaluation of the paper peso. The conclusion of Ford (1989, p. 245) is that

"... in bad times of balance of payments deficit, gold was readily abandoned (for example, in 1876 or 1885) and difficulties were eased for the oligarchy at the expense of wage earners and the urban middle class, while in good times of rising exports, balance of payments surplus and exchange rate appreciation, the gold standard was rapidly rejoined (for example, in 1900) to prevent further income-distribution deterioration for the exporter and landowner."

It is evident that the Argentine *estancieros* in the late XIXth

[31] Olgaard, 1966, p. 234.

century had more political power than Danish estate-owners; however, they were much worse off in terms of economic innovativeness and transformed most of their earnings into the accumulation of land and cattle. This was facilitated by legislation giving them virtually free access to reclaimed land.

The food-processing export industries - first and foremost, the growing *frigorificos* - relied more or less exclusively on foreign and Argentine urban capitalists both for capital supply and entrepreneurship, and the lower classes' innovative participation and entrepreneurial co-operation was virtually absent in the urban as well as the rural sector. Still, in 1914 Argentine industry, though home-market oriented (like the Danish), was quantitatively important, delivering, among other things, one third of the capital inputs in the country's agriculture.[32] Unlike the case of Denmark, no innovations of any importance appeared in the production of those capital goods.

Like Argentina, Uruguay was characterised by monetary chaos and an underdeveloped financial sector in the last two decades of the XIXth century. A striking difference between the countries was that Uruguay suffered much more severely from political conflict, which divided both the rural and the urban elites. Neither party was willing to adopt any land-reform measures in order to accommodate the huge inflow of immigrating peasant families from Southern Europe, or the large mass of unemployed cattlemen made superfluous by the country's fencing movement in the 1880s.[33] Under such circumstances, it is doubtful whether these groups would have been able to contribute much to technology diffusion even if the spirit of the Danish *folkehojskoler* and co-operatives had been present, which, seemingly, it was not.

Brazil showed, in the state of Sao Paulo, one example of successful industrial development managed by the colonial

[32] Rojas, 1988, p. 69.
[33] Senghaas, 1985, p. 107.

estate-owning class, which for a time seemed to contradict any generalised statement of the non-innovativeness of this type of society. The landowners, responded remarkably quickly to international developments and transformed a slave economy into a capitalist state, subsidising the immigration of free labourers, and turned themselves into the entrepreneurs of a great variety of industries supplementary to 'coffee and rails'. Traditional coffee production, like the Danish grain production, suffered from dramatic export price fluctuations. Making a major switch to other agricultural products may not have been feasible in the case of Sao Paulo. However, improvements in productivity could have been achieved, had the government funds for this end been more skilfully managed.[34] The fact that the oligarchy - roughly one and the same - showed such progressive behaviour in the industrial sector and such a lack of supply-side response in the coffee sector is remarkable, but, taking the political power of the oligarchy into account, we may take it that it was easier to substitute political for economic action in the latter case. It is well established that attempts at coffee price control, due to a perceived (rather than actual) monopoly situation, was a central policy on the part of the state of Sao Paulo.[35]

The growth of manufacturing

We have referred above to the manufacturing spin-offs from the development of the primary sector. Apart from the food and wood-processing industries, the most important sector for non-core countries to develop within the 'steam transport' style was textiles. This was a relatively low-technology sector which could be quite easily set up (or modernised) with imported capital goods from Britain, producing for the domestic market. Even in this sector, the Nordic countries - at least Denmark, Norway and Sweden (DNS) - had an advantage. The experiences of the three

[34] Dean, 1986, p. 697.
[35] *Ibid.*

countries are remarkably similar to each other, despite the fact that trade policies differed considerably. While Denmark and Norway had low industrial tariffs in the 1870-1900 period, Sweden maintained heavy import tariffs on textiles. The common denominator of the countries may be sought in the labour supply. Textiles mainly used semi-skilled female labour. Denmark, Norway and Sweden had the edge in terms of the education of the female labour force, and they also had an advantage in terms of availability. The ideal situation for such industries (as Galvao and Tylecote, 1990, have argued in relation to East Asia) is to have smallholding peasant families who gain an adequate level of nourishment and other income from the farm, but have surplus labour available which they are glad to supply at low wage rates. The Northern European custom of late marriage guaranteed a good supply of girls ready to work to support their parents' households, and/or accumulate their dowry. Employment in the textile industry more than doubled in Denmark, Norway and Sweden between 1870 and 1900 and the share of women increased, in the same period showing the most rapid rate of mechanisation.[36] Although research on the social structure among workers has only begun, an example from one of the largest Swedish mechanised wool factories in 1877 may be representative: half of the labourers were women, half of the women were aged 20-29, most were unmarried, and more than half had been recruited from outside the city.[37] The income effect (from the point of view of the industrialist) of this transition from male to female labour made possible an industrial expansion while at the same time the wages of female as well as male workers, taken by themselves, increased rapidly, acting constantly as a lever for mechanisation.[38]

Comparison of outcomes

It is difficult to say anything for sure about Latin American GDP growth up to the outbreak of the First World War. However, while

[36] Jorberg, 1980, pp. 50, 58; Hyldtoft, 1996, pp. 187, 342, 384.
[37] Goransson, 1990.
[38] Bagge, Lundberg & Svennilson, 1933, p. 220.

Brazil hardly grew at all in per capita terms, it seems that Argentina kept pace well with Norway and converged somewhat on Sweden and Denmark. Her performance during the 1870-1914 period was remarkable, even if we disregard population growth, with an annual per capita growth rate somewhere around two percent. The figures for the Nordic countries range from about 1.3% for Norway to about 1.6% for Denmark.[39]

However, overall technological progress seems to have been more rapid in the Nordic countries. The Argentine growth was clearly not technology-intensive, and at best it brought the country from a peripheral to a semi-peripheral position. As in Denmark, many new branches of industry grew up under import substitution; unlike Denmark, the country did not acquire a technologically advanced export sector. Instead, the main result of the *estancieros'* investments was reflected in the fact that estates of sizes larger than a thousand hectares covered 80 per cent of the cultivable land in 1914.[40]

Referring back to our theoretical framework, we can see how the terms of trade shock after 1873 accelerated Denmark's move to reposition itself in the international trade order: all the main actors in the Danish economy showed themselves capable of the technological progress necessary to establish Denmark as a major supplier of products which were able to secure a good price on core markets. Not only did they come through with the right products of the right quality, but they established the backward linkages with nascent manufacturing industries, which gave them rapidly rising productivity and before long - as we shall see - a foothold as exporters of certain engineering products. Low inequality seems to have played an important role in this dynamism. Chronologically - and, presumably, causally - the development went from increasing equality in land distribution to increasing equality in income distribution.

[39] Maddison, 1991, Table 2-1.
[40] Rojas, 1988, p. 72.

The 'steel and electricity' style: its arrival or non-arrival between 1890 and 1930

Challenge and early response

The arrival of the Bessemer, Siemens-Martin and Gilchrist-Thomas processes in the 1850s to 1870s was the next technological breakthrough which can be called revolutionary, i.e., capable of eventually transforming the entire socio-economic systems of the core countries, and thus of generating a new technological long wave. (It was accompanied by developments of similar importance in electricity production. See Tylecote, 1992, ch.2.) In the first place, they affected every branch of iron and steel production by fundamentally altering conditions for competitiveness. The iron exporters that did not have cheap coal were now in a precarious position; on the other hand, the high-phosphorus iron ore, which had up to then been entirely useless, could now be utilized for the first time.

The Nordic countries did not have any domestic resources of fuel except for traditional charcoal, and within a few decades Norwegian and Finnish iron exports had virtually ceased.[41] Sweden succeeded in adopting the Martin process with imported coal and the high phosphorus iron of Lapland was exploited thanks to the Thomas process. (Thus the prophecy of the well-known Swedish metallurgist Richard Akerman, that the Thomas process was "the last nail in the coffin of Swedish ironmaking"[42], was not fulfilled. Not only the new iron-ore fields, but also the adaptability among producers in the traditional iron-exporting regions were instrumental.) Swedish iron and steel production was able to keep its traditional high-quality profile. Among countries without domestic coal mining, this Swedish success was almost unique.[43]

As regards the other 'motive branch' of the style - the production of electricity - Norway and Sweden were in an

[41] Jorberg, 1980.
[42] Ahlstrom, 1995, p. 158.
[43] Heckscher, 1957, p. 254f.

advantageous position to exploit water power and began to do this on a large scale around the turn of the century. Sweden was only two years behind Germany in establishing the first long-distance transmission lines in the 1890s.[44] Sweden, in particular, was also successful in establishing forward linkages from (the partly public, partly private) electricity infrastructure to electricity-consuming industries.

The early Swedish steel and electricity breakthrough has often been characterised as the establishment of a number of "genius industries"[45] in connection with the great contributions of individual engineers - this profession having acquired a remarkably high social status in the late XIXth century. However, we should not forget the institutional developments that made these industries viable. The new engineering industries, in this pre-Ford, pre-assembly-line period, depended heavily on the skill and initative of craftsmen using general-purpose tools in batch production (Tylecote, 1992, ch.2); they also required technologically expert entrepreneurs and managers. The relatively high level of education in Denmark, Norway and Sweden was favourable for this. They needed good relationships between management and workers, too, and as we have argued above, the low inequality level of the Nordic societies was helpful here.

The initiative and organisational capacity of the lower classes are demonstrated by the way that various workers' and consumers' co-operatives had become widespread in the Nordic countries in the latter half of the XIXth century. Naturally, a strong trade-union movement also emerged. Whether this can be described as helpful to industrial development at this point is debatable. Lazonick (1991) has argued that the craft unions in British industries like shipbuilding played a vital role in the late XIXth century in organising the accumulation of human capital

[44] Schon, 1990, p. 40.
[45] Ahlstrom, 1993, p. 3.

and technology transfer. Streeck (1991) has argued that the strength of German unions in the post-war period has forced the bulk of West German industry to follow a high-skill, high-wage, up-market strategy.

At all events, the strength of Scandinavian unions may be regarded as a by-product of social developments conducive to industrial development, and in the long-term macro-perspective it also eased the way for the mass consumption society under the next style, 'Fordism'. While this potential of the trade unions was also present in Argentina and Uruguay, the social context in which they had emerged was less favourable.

In Sweden, Denmark and Norway the growth of the engineering industries was certainly impressive. We see, once again, the overall pattern of a rapidly rising degree of refinement among export products and also, especially in the case of Denmark, the capacity to combine this with the import of strategic inputs like steel. This country's industrial exports - which had for a long time been stagnant both in relative and absolute terms in the wake of the agricultural export boom - turned sharply upward in the first decade of our century. A similar development took place in Norway; Sweden was ahead of both countries in terms of the share of high-technology industrial exports.

Once a new style has become established in the core, it diffuses everywhere in the world to some degree, in the sense that some of its products go everywhere. In that sense, of course, all our countries were participating in the 'steel and electricity' style by the end of the XIXth century: refrigerated steamships and the equipment of the major harbours were products of the steel and electricity style, for example. But it is capacity to master at least some of its key productive processes competitively which defines real participation and diffusion. In this case, we can use the development of the steelmaking and engineering industries as the criterion: and we find that, by the First World War, Denmark, Sweden and Norway all had quite well-developed engineering industries, with Sweden also competitive in steelmaking. None of the Latin American countries met this criterion.

The response to the First World War

The effects of the First World War and the subsequent deflationary crisis on economic development in the different countries have been disputed. For all seven countries of our study, it implied a need for extensive import substitution, combined, on the part of Sweden, with exports of iron and steel large enough to pay the country's huge foreign debt (a legacy of the 'steam transport' style) in its entirety. In the other countries, in particular, we can note a development analogous to the one that should be expected to follow an acute worsening of the terms of trade.

The Brazilian oligarchy responded by promoting a further stage of industrialisation, which, of course, was again concentrated in the Sao Paulo area and on the Rio - Sao Paulo axis. There was at this point the beginning of diversification into machinery, machine tools, cement and steel-making (Galvao & Tylecote, 1990, p. 85). This period of promotion of industry lasted until 1923, when the return to post-war normality prompted a corresponding return to reliance on the old pattern of comparative advantage. However, Brazil was, as a result of this six-year period, in quite a good position to respond to the crisis after 1929 by even more determined promotion of domestic industry.

This wartime 'rehearsal' of import substitution seems not to have been as conducive to long-term technological progress in Argentina and Uruguay as was the case in Brazil. These countries did not have a strong 'steel and electricity' component in their wartime development; accordingly, they were not as quick to adopt the style after the onset of the Depression two decades later. We can find part of the explanation for the less successful development of Argentina and Uruguay in the export surge for meat for Allied troops, which, unlike the Swedish steel exports, was clearly a peripheral kind of enterprise, given the fact that its existing linkages to domestic high-technological production were not sufficiently strong.

Performance, to 1930

If we sum up the development between 1910 and 1930 in GDP figures, it is evident that this is the period when Sweden and

(practically) Norway caught up with Denmark[46], Norway thereby taking the lead over Argentina. Argentina, as well as Uruguay, performed well in the 1920s, facing a favourable terms-of-trade development for their staple products, with total GDP growth rates around three percent per year.[47] This roughly corresponded to growth in the Scandinavian countries, which, however, performed better during the First World War and the Depression of the 1930s.[48] Since they also faced slower population growth, the growth rate in GDP per capita was systematically higher than in Argentina and Uruguay.[49]

The technological level of Denmark, Norway and Sweden had practically caught up with that of the European leader-countries through two major spurts, the first one under the 'steam transport' style, the second one under the 'steel and electricity' style. This could not have happened without what could be called the egalitarian modernisation of the socio-institutional structures of the countries, which made them well-matched to the next step, the adoption of the 'Fordist' style. We can take it that the three countries had almost reached the technological core by the time of the early diffusion of 'Fordism' in Europe, i.e., the 1920s. The USA now had an indisputable technological leadership, being one or two decades ahead of the leading European economies even before the outbreak of the Second World War; but the Scandinavian countries were on the edge of belonging to the European core group. The Latin American countries, as well as Finland, were now clearly lagging behind both technologically and in GDP terms; but the story is not finished yet.

The 'Fordist' style - and latecomers' adoption of steel and electricity

The 'Fordist' challenge and the response of Denmark, Norway and Sweden

The development following the outbreak of the World

[46] Krantz & Nilsson, 1974, p. 63.
[47] Rostow, 1978, p. 468 (Argentina); Bértola, 1990, p. 118 (Uruguay).
[48] Hansen, 1974, p. 234 (Denmark); SSB, 1965 (Norway); Krantz & Nilsson, 1975:159 (Sweden).
[49] Mitchell, 1975; Bértola, 1990, p. 121.

Depression shows the definite settling of Sweden, Denmark and (later) Norway in the technological core through their adoption of the 'Fordist' style. It also shows one example of pervasive success in belated industrialisation (Finland), one example of superficial success (Brazil) and two examples of relatively stagnant development (Argentina and Uruguay).

It should not be imagined that success under 'Fordism' required success in the classic 'Fordist' industries, using assembly-line technology in engineering to produce mass-production consumer durables, or continuous flow technology in chemicals to produce intermediate goods, in similar volume (Tylecote, 1992, ch.2). These were, of course, technologies well worth mastering if one could, and if one had access to sufficiently large markets. The difficulty was that they were price- and income-elastic markets, and that most of the 'Fordist' period (till the 1950s at least) was one of protection. A country which did not have a large domestic market - with consumers affluent enough to buy such goods - was thus poorly placed to join in. On the other hand there were many opportunities within the 'Fordist' style to produce high quality capital and intermediate goods, which were generally produced with general-purpose rather than dedicated tools and thus did not involve large-scale economies. A country with a small domestic market could thus compete well in such industries, and even win a large export market once its quality was established and known. On the other hand, the requirements for skill and expertise at all levels of the firm were very demanding - much more so than in mass production engineering.

The international diffusion of 'Fordism' coincided (and to some extent interacted) with the onset of the first international long-wave depression after 1929. The crisis lasted at least until 1945. Only the country where 'Fordism' first crystallised, the USA, was largely unaffected, at least during the 1920s, having, sufficient domestic demand for the achievement of economies of scale in consumer durables. Certainly none of our seven countries was well placed here. The Depression and the Second World War clearly delayed any

progress within the new style, but Denmark, Norway and Sweden were already showing good progress within the 'small-scale Fordist' industries during the 1930s. As mentioned above, these countries experienced good rates of GDP growth throughout the period and never faced the most severe effects of the international Depression. Apparently, their socio-institutional advantages gave them a tendency to converge towards the income levels of the European core economies, and the dropping of the gold standard (around 1931) and the early introduction of some elements of Keynesian-style demand-side policies counterbalanced much of the largely 'imported' depressive tendencies. Furthermore, the three countries escaped most of the physical and human devastation of the Second World War, despite the German occupation of Denmark and Norway. Hence, conditions were favourable for a relatively quick switch to competitive 'small-scale Fordist' production after 1945.

The Finnish miracle

The Finnish development should be contrasted with the country's situation in the XIXth and early XXth centuries. Besides lagging behind in every respect from the beginning, Finland was subjected to at least two major dynamic disadvantages compared with the other Nordic countries. First, there was a large rural proletariat living in absolute poverty. Although the estimates vary, Hjerppe (1989, p. 96) concludes that the relative size of the landless population doubled between 1850 and 1914, partly due to rapid population growth. Unlike the situation in the Nordic neighbour countries, many of these rural poor were also homeless - living in others' houses or sheds when they were permitted to - and illiterate. Second, in 1917-18 the country went through a devastating war of independence from Russia, when also the severe class conflict between 'Whites' and 'Reds' exploded. At this point it seemed unlikely that a political integration of the country could take place within a reasonable time.

In fact this was achieved remarkably quickly. Impelled by the victorious White army's fear of Communism, the "Cottager Law" of

1918 established a land reform where tenant farmers could buy their holdings at a favourable price. (This makes a neat parallel with the similar motivation for the post-Second World War land reforms in Japan, South Korea and Taiwan (Galvao and Tylecote, 1990).) In twenty years the tenancy virtually disappeared and the share of farm labourers in the active rural population diminished from 41 to 27 percent; furthermore, some of these labourers had acquired their own allotments.[50] The social structure of the rural population was now more similar to that of the other Nordic countries, with a low-to-middle income group supplying industry with a labour force reserve, while at the same time having some independent income from farming. The educational level also rose rapidly after the *de facto* establishment of compulsory schooling in 1921. Thus, brief as the First World War crisis was, its special acuteness in Finland led to a strikingly radical and progressive outcome.

The Finnish economy now had a lot of catching up to do. As the long-wave theory predicts, the country was not very severely hit by the depression crisis after the equalising reforms of the preceding crisis. The annual growth in GDP per capita averaged 2.3% between 1929 and 1939.[51] This was not all: the foreign debt decreased from 50 to one percent of GDP[52]. Among the fastest-growing industries were engineering, chemicals and electrical power production, which indicates that the 'steel and electricity' style came as part of what was actually the country's initial industrial take-off. Still, at the outbreak of the Second World War half the labour force was employed in the primary sector, a figure which significantly exceeds the shares in the other Nordic countries (not to mention Argentina) before the *First* World War.[53]

When attacked by the Soviet Union in 1939, the Finnish army resisted with a force and unity that remains impressive, especially given the fact that some of its men belonged to the generation of

[50] Wahlback, 1967, p. 71.
[51] Hjerppe, 1989, p. 193.
[52] *Ibid.*, p. 156.
[53] Senghaas, 1985, p. 73.

poor cottagers and day-labourers lending support to the Red forces in 1917. The subsequent heavy war reparations, paradoxically, contributed to the speeding up of post-war industrialisation, since they were to be paid in kind. The Soviet Union demanded "*ships, railway wagons, machinery, cables and other goods from sectors of production which in Finland, at the time, either did not exist at all or existed in only rudimentary form*".[54]

The Finnish economy gradually began to adopt many features of 'small-scale Fordism', although it was not until the end of the next long-wave upswing - around 1970 - that the country can be said to have reached the core. In this year, the share of metal and engineering industries in total exports passed 25 percent, while the share of the postwar bulk export good - paper - had begun to decline.[55] In the forty post-war years to 1985 Finland's growth rate was the fastest in Europe and only paralleled in East Asia. It was, one might say, a case of the Nordic cork coming suddenly out of the bottle.

Brazil: a limited success

Brazil was, due to its experience from the 1917-23 period, in quite a good position to respond to the crisis after 1929 by even more determined promotion of domestic industry. Nonetheless, Brazilian industrialisation clearly showed the characteristic Latin American pattern of technological dependence. The stress was for a long time on the building up of import substitution through light industry, with scarce foreign exchange allocated preferentially to equipment and intermediate goods. When the Brazilian state, in the 1940s, decided that the 'upstream' weakness could not be allowed to persist, it attacked it through:

(1) state involvement in heavy industry as well as infrastructure: the state set up the first major steel plant in 1941, at Volta Redonda, and besides steel, state enterprises were set up in petroleum, iron ore mining and chemicals.

[54] *Ibid.*, p. 78.
[55] Hjerppe, 1989, p. 262.

(2) welcoming foreign investment in most areas of relatively high-technology industry.

What was conspicious by its near-absence was native Brazilian entrepreneurial capacity in the higher-technology industries, and - presumably linked to that - the capacity for technological innovation.

Galvao and Tylecote find Brazil concentrating throughout its industrialisation on the imitation of foreign technology, and indeed of foreign products: since income inequality was high, due originally and fundamentally to highly unequal ownership of land (Silva, 1983), so was consumption. The poor consumed only the most basic commodities, which were locally produced using mainly low technology, while the rich (and later the rapidly growing middle class) aped European and North American habits of consumption, and thus simply had to copy their consumption goods. There was then no pressure to develop some kind of intermediate category of mass consumption goods of a characteristic Brazilian kind using modern but native technology. Nor, accordingly, was there real scope to introduce modern industrial methods rapidly across the whole economy. In spite of the country's large population, the consequence was that the modern consumer goods (and later, capital goods) industries had difficulty in achieving economies of scale - and where they did so, achieved them through high concentration.

These problems persisted as Brazil in the 1950s and 60s began to face the challenge of the 'Fordist' style. It lacked the skills and technological expertise to succeed in the 'small-scale Fordist' industries. However, its affluent consumers were too few to provide a market of adequate size for the mass production 'Fordist' industries. Even more than in other industries, Brazil was dependent, in the 'Fordist' industries, on core multinationals, producing for a protected domestic middle-class market. In 1970 the multinationals produced 85% of consumer durables, 57% of capital goods, 43% of non-durable consumer goods, and 37% of intermediate goods (Serra, 1982, p.71).

The conclusion is that while Finland completed its route from the periphery to the core in the 1920-1970 period, Brazil only succeeded

in achieving a *semi-peripheral* status; that is (according to Tylecote, 1992, p. 150) a position where the country "participates in world trade as though it was peripheral but... does possess certain high-technology sectors, or *proto*-high-technology sectors ...". It is inherent in this position that the country would return to the periphery, should the governmental policy of import substitution be dropped. We contend that high inequality in Brazil goes a long way to explain the difference between the two countries. The inequality in Brazil also has a strong geographical element, which has its roots in the colonial time but has been retained due to the exclusive concentration of production along every new technological style in roughly the same regions, first and foremost the state of Sao Paulo. This has become the primary location of the country's *internal* core - the high-technology sectors protected by policies of import substitution, which have thus acquired an unfortunate geographical bias.

Argentina and Uruguay: failure

We conclude with the deplorable failure of the Argentinian and Uruguayan economies since the 1920s. Bértola (1996) shows that, while real GDP per capita rose at 3.8% per annum in Brazil between 1941 and 1980, in Argentina in the nearest comparable period, 1948-79, it rose at only 1.4% per annum; in Uruguay it rose at only 0.85 % between 1954 and 1994. From 1924-79 it rose at only 1.0% in Argentina; from 1928-1994 it rose at only 0.9% per annum in Uruguay. Why could these two countries not have done at least as well as Brazil even if they did not make it into the core?

One way of beginning an explanation is to point out that if they had done as well as Brazil in terms of rate of growth, they would have reached something like core levels of income, given their relatively high starting point in the 1920s. They were incapable of doing that because, by comparison with the Nordic countries, they had, as we have seen, thoroughly unsuitable socio-institutional structures. By comparison with Brazil, they had the paradoxical disadvantage of being relatively rich. That is to say, their trade relationship with the core, peripheral as it was, yielded them a

relatively high income as a consequence of their land-abundance. Political and other factors ensured that this was reflected in relatively high wages, compared to a genuinely poor country such as Brazil, certainly as of the 1920s. This is most clearly apparent after the Second World War in Argentina, when the impact of Peron's populist policy had made itself felt. Argentina's redistributive tendencies, in the face of its inequality of landownership, are shown by its Gini coefficient of 0.425 in 1961; cf. Uruguay's 0.449 in 1967 and Brazil's 0.500 in 1960 (Galvao and Tylecote, 1990, Table 3). On the other hand their technological capability was not such as to allow manufacturing, at such wage costs per hour, to be profitable unless heavily protected and/or subsidised. This was even more true in Uruguay with its very small domestic market. They were thus trapped in a relatively comfortable but nonetheless peripheral position. In Brazil, on the other hand, entrepreneurial and technological capabilities in the internal core regions were at least comparable with those in the other two countries, but due to the much greater poverty of the country, wages for unskilled workers were substantially lower. The country's large population gave it a home market comparable to Argentina's. Thus, with given rates of protection, domestic industries could be expected to be much more profitable than in Argentina. A moderately sharp terms-of-trade shock was thus enough to shake Brazil out of its peripheral equilibrium and send it on a path of manufacturing-led dynamism, even if that did not lead to the core. For Argentina or Uruguay to have done the same would have required a period of sustained trauma and immiseration far beyond anything which actually took place.

Conclusion

While all our seven countries started in 1870 from positions characterised by land abundance and/or rich natural resource endowments, the four Nordic countries have performed very much better than the three Latin American countries in technological and economic terms. We find that the most clear-cut basic difference

between the two country groups, to which can be ascribed strategic importance for secular development, is inequality, especially in the distribution of land and political power. Several other factors have been partly determined by this and have manifested themselves most clearly in the countries' different ways of responding to new technological styles and external terms-of-trade shocks. Such factors are inequality of income, social integration or disintegration, educational levels, and the extent to which landowners and industrialists have reacted to economic shocks by political measures rather than economic innovativeness.

Within the Latin American group, it is evident that the secular effects of inequality on techno-economic development have been more severe in Argentina and Uruguay than in Brazil, where land-abundance has been less marked. Our interpretation is that Brazil has been able to benefit in the long run from downturns in foreign trade by technologically progressive import substitution, while high real wages have hampered the effectiveness of such strategies in Argentina and Uruguay. It seems also to be true that the adverse effects of the economic and social structures of the latter countries in particular have increased over time, so that the adoption of the 'steel and electricity style' and the 'Fordist' style has been less successful than the adoption of the 'steam transport' style.

What have we gained by setting the comparison within the framework of a long-wave theory? Our long-wave approach draws attention to two sorts of discontinuity. The first is the succession of technological styles, each of which provides different challenges and possibilities for a country's growth and position in the world economy. The second is cyclical - the more or less regular appearance of conditions within the world economy which cause peripheral economies to reassess their international relationships. Even if, as we have argued, the main determinants of the difference in long-run performance between our Nordic and Latin American countries are deep-seated institutional factors, the 'long-wave discontinuities' we have described, appear, nonetheless, to have powerfully affected *how* the difference developed.

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