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The Failure of Export-Led Growth in Brazil and Mexico, c. 1870–1930

Luis Catão

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Institute of Latin American Studies
31 Tavistock Square London WC1H 9HA

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Luis Catão is Research Officer in the Department of Applied Economics, University of Cambridge. He was a Research Fellow at the Institute of Latin American Studies in 1990-91.

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Introduction

The 1980s have witnessed a sharp reversal in the mainstream development doctrine in Latin America. The 'foreign trade scepticism' of the Prebish-ECLA doctrine, which prevailed in Latin America for nearly three decades, has given way to a new orthodoxy which postulates across-the-board trade liberalisation and the need to pursue an export-led growth path (Balassa, 1981; Sachs, 1985, 1989). State intervention, protectionism and import substitution industrialisation are now seen as the roots of the recent debt crisis, widespread X-inefficiencies and a slowdown in economic growth.

Curiously enough, the new mainstream doctrine shares with its predecessor a rather one-sided view of previous development experiences. Inspired largely by the dramatic repercussions of the world depression of the 1930s in Latin America, the Prebish-ECLA school attributed the failure of economic development in most of the region to the asymmetries of world trade for primary producing countries and to export-led growth. Likewise, the new orthodoxy – inspired by the development crisis of the 1980s – attributes such a failure to the previous development strategy which, in this case, is import-substitution industrialisation guided by state intervention. The problem with these opposite paradigms is that both fail to provide a balanced analysis of the advantages and disadvantages of import-substitution v. export-led growth strategies in different historical contexts.

In this respect, the development process from the 1950s has recently received a more balanced treatment (Wells, 1987; Fanjzylber, 1990; Ocampo, 1990 and Sunkel, 1991). The pre-1930 period, however, remains little studied. This paper aims to fill this lacuna, focusing on the cases of Brazil and Mexico during the period between the early 1870s and the Great Depression of the 1930s.

During that period, Brazil and Mexico, like many other Latin American countries, followed an export-led growth path which can be characterised as a relative failure. The unprecedented expansion of world trade during the period allowed new settlement countries such as the USA and Canada to achieve relatively high rates of per capita real GDP growth (around 2% per annum) and raise real wages and productivity to a point that enabled them to embark upon the 'virtuous circle' of economic development. In contrast, Brazil and Mexico, also large economies, well-endowed with natural resources, performed rather poorly: their per capita real GDP growth rates averaged about 0.9% and 1.2%,[1]

respectively, and displayed marked cyclical instability. This was a binding constraint on rapid industrialisation in a way whose extent was, by 1929, rather limited (Fishlow, 1972; Suzigan, 1986; Cárdenas, 1987; Haber, 1989).[2]

In order to understand the process of economic development in these countries and some of its current problems, an analysis of the causes of such a failure is clearly important. Yet the existing literature on the topic is deficient in several respects. In the first place, there is a dearth of thorough statistical analysis of the determinants of exports in these countries. In the case of Brazil, for instance, the only detailed quantitative study on the topic is still Delfim Netto's classic work (1959) on coffee exports. This study, while discussing a number of factors which shaped coffee export cycles, does not provide a general econometric model to measure the relative importance of these factors and is mainly concerned with proving the deleterious effects of the coffee valorisation policies upon Brazil's competitiveness in the world coffee market. Systematic studies on other commodities are lacking.[3]

There is also a lack of comprehensive work on the determinants of Mexico's exports. Rosenzweig's pioneering research (1960, 1965) on Mexico's exports during the Porfiriato is mainly descriptive. Moreover, it focuses on the role of international demand and the depreciation of the silver peso, while fails to consider a number of other important supply-side influences. The absence of a solid empirical analysis also plagues regional case studies on the development of certain export crops, such as sisal in Yucatán and coffee in Chiapas (Wells, 1985; Joseph, 1986; Spenser, 1984). The only systematic attempt to measure the influence of relative price and other supply-side stimuli on Mexico's exports is that by Zabludowsky (1984). Yet, under the simplifying assumption of an infinitely elastic world demand for Mexico's exports, Zabludowsky overlooks potentially important demand-side influences. Furthermore, none of the studies mentioned above deal with the period of the Mexican revolution (1910-20) and its aftermath, on the assumption that there was a major discontinuity in exports and other economic trends during the Revolution – a fact which remains to be fully documented.

As far as the impact of exports on the rest of the economy is concerned, the existing literature is contradictory. Furtado (1963) and Fishlow (1972), for instance, posit an inverse relationship between export growth and industrialisation in Brazil. In contrast, Dean (1969) and Suzigan (1986) contend that this relationship is a direct one. At the heart of this contradiction lies the the role played by relative price *vis-à-vis* income effects and the nature of the linkages of the export sector within the economy. The problem with these studies is that the former two concentrate on relative price effects, while the latter focus on income effects. A more balanced approach, which jointly considers price, income and linkage effects, is missing. Such an integrated analysis is also absent in the literature on Mexico. Although most authors

contend that Mexico's economic performance before the revolution was highly responsive to export-led growth (Rosenzweig, 1965; Zabludowsky, 1984; Solís, 1985), this is at variance with the evidence available. In fact, it has been shown, on the one hand, that a spurt in output growth and industrialisation took place in the 1890s (Haber, 1989; Catão, 1991) – a period during which exports did *not* grow more rapidly than before. On the other hand, the slowdown in domestic output growth and industrialisation in the 1900s was not accompanied by a slowdown in export growth (Catão, 1991).

This paper addresses these issues in the light of new historical data. It provides an extensive statistical analysis of export performance and its macroeconomic repercussions in Brazil and Mexico during 1870-1930. Focusing on the differences between the supply-side structures of the Brazilian and the Mexican economies, I argue that the export growth-led growth failed not so much due to the slow growth and instability of international demand for some of their export commodities, but owing to a number of domestic structural factors peculiar to these countries.

The paper is divided into four sections. Section I documents the growth patterns of Brazilian and Mexican exports. It shows, on the one hand, that Brazilian exports moved along a relatively slow growth trend and displayed marked cyclical instability. Mexico's exports, on the other hand, are shown to have grown much more rapidly overall and without displaying significant cyclical variations.

Section II examines the causes of these trends and cycles. It presents a disaggregated analysis of the commodity composition of exports and then looks at both supply- and demand-side influences upon them. In this connection, I show that international demand and the domestic structure of these economies were *both* important to explain the observed export performance. This rules out a number of one-side views on pre-1930 export-led growth in Brazil and Mexico.

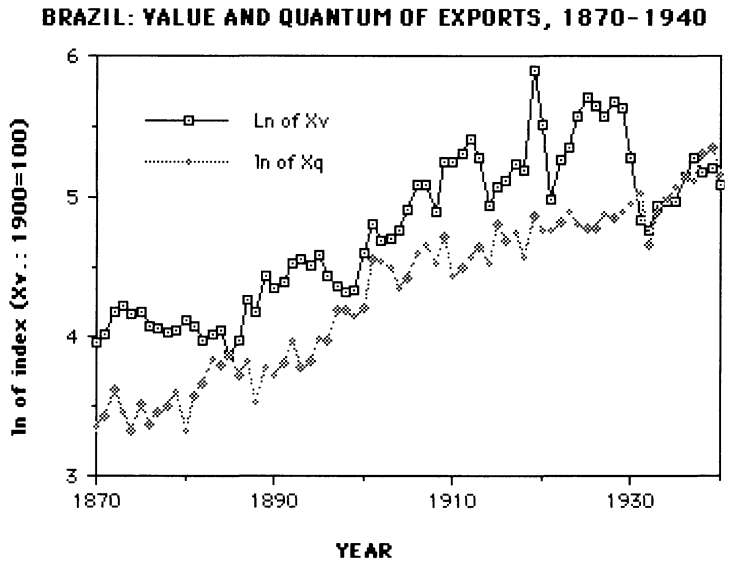
Section III addresses the relationship between exports and domestic output growth. The size as well as the linkages of the export sector within the macroeconomy are then considered. Section III shows that the relatively slow growth of domestic real income in Brazil and its considerable instability over the 1870-1930 period were mainly due to the substantial backward linkages of her export sector. In contrast, the failure of export-led growth in Mexico – in spite of the rapid growth and stability of her exports – can be explained by the enclave nature of the country's export sector.

Section IV concludes the paper by summarising its previous arguments and pointing out their relevance in the context of the existing literature.

I. Describing Export Trends

Graph 1 and table 1 both show that Brazilian export value displayed marked cyclical instability. Long swings of about 20 years length were a major feature of export growth during the period 1870-1912, with downswings in 1873-84 and 1893-99 and upswings in 1884-93 and 1899-1912. As growth measures presented in table 1 indicate, the difference between the average growth rate in these downswings and the upswings ($\Delta\ \bar{g}_x$) were dramatic.[4] From the 1912 peak onwards, such long swings are no longer observed. Between 1912 and 1929, the pattern of export earnings was punctuated by marked short-term variations associated with the World War I shock and the boom-and-slump of 1919-21.

Graph 1



On the other hand, measures over longer periods indicate that the long-term growth trend of exports was relatively low. As shown in table 1, the value of Brazil's exports grew at only 2.9% p.a. during 1873-1912 and at 1.6% p.a. over 1912-28. Thus, they lagged behind the expansion of world trade, the value of which grew 3.5% p.a. during 1880-1913 and 3.2% p.a. over 1913-29 (Lewis, 1949, 1978). Brazil also fared much worse than other main primary producers. Argentina and Canada, for instance saw their exports expand at annual rates of 6.1% and 4.2%, respectively, during 1873-1913 and at 4.9% and 7.6% in 1913-28; Australian exports grew at 3.9% p.a. over 1913-1929.[5]

Table 1
Brazil: Growth Measures of Export Value (% per annum)

	$\bar{g}_x$	$\Delta \bar{g}_x$		$\bar{g}_x$	$\Delta \bar{g}_x$
Long-swing phases:			*Shorter periods:*		
1873-1884	-1.7	–	1912-1914	-21.3	–
1884-1893	6.0	7.7	1914-1919	21.1	42.4
1893-1899	-3.7	-9.6	1919-1921	-36.7	-57.8
1899-1912	8.7	12.4	*Longer periods:*		
1912-1919	7.0	-1.7	1873-1912	2.9	–
1919-1928	-2.4	-9.4	1912-1928	1.6	-1.3

Source: IBGE (1987, pp. 523-4).

Similar conclusions hold for the volume of Brazilian exports (table 2). Although considerably less volatile,[6] its overall growth rate was low in relative terms. During 1872-1913, for instance, Brazilian exports grew at 3.4% p.a., while Argentine and Canadian exports grew at 5.2% and 4.0% p.a. The gap is even larger for the period 1913/14-1928: Argentine and Canadian exports expanded at rates of 5.5% and 6.8% p.a. over that time, whereas Brazil did not exceed a meagre 2.2% growth rate.[7]

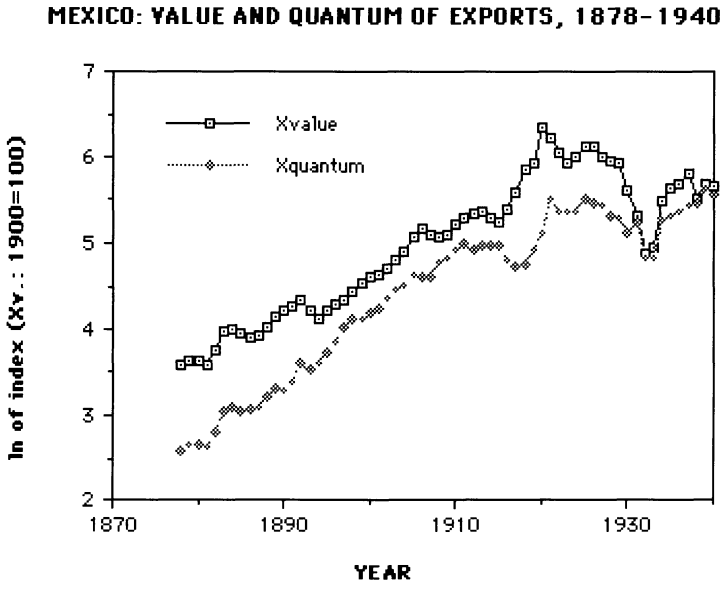
Table 2
Brazil: Growth Measures of the Export Quantum (% per annum)

	$\bar{g}_x$	$\Delta \bar{g}_x$		$\bar{g}_x$	$\Delta \bar{g}_x$
Long-swing phases:			*Shorter periods:*		
1872-1883	2.1	–	1913-1914	-11.0	–
1883-1892	1.5	-0.6	1914-1919	7.0	-4.0
1892-1901	6.8	5.3	1919-1921	-5.1	-12.1
1901-1913	0.7	-6.1	*Longer periods:*		
1913-1919	3.8	3.1	1873-1912	3.4	–
1919-1931	0.8	-3.0	1912-1928	2.2	-1.2

Source: IBGE (1987, pp. 551-3).

In sharp contrast with the Brazilian experience, Mexico's export earnings grew rapidly through 1883-1912/3[8] without displaying long-swing variations, as we can see from graph 2 and table 3.[9] Although short-period measures reveal some degree of cyclical instability during certain sub-periods, in overall terms Mexico's exports also fared quite well in this regard: the coefficient of variation of exports for the pre-World War I period is only 1.49 for Mexico, whereas for Canada it is 2.15, for Argentina 2.63 and for Brazil 3.56.[10]

Graph 2



The impressive growth performance of Mexico's exports before World War I stands out even more clearly when the quantum indicator is considered (table 4). The average growth rate of 7.2% and the absence of major cyclical instability for the period 1878-1911 is no doubt outstanding by any international standards. During World War I and the Mexican Revolution, an absolute decline is observed up to 1917, but this was followed by a sharp recovery. Hence the average growth rate for the period 1911-21 as a whole was not substantially lower than that for 1883-1911. Only from 1921 onwards did a persistent downswing in export volume take place.

Table 3
Mexico: Growth Measures of Export Value (% per annum)

	$\bar{g}_x$	$\Delta \bar{g}_x$		$\bar{g}_x$	$\Delta \bar{g}_x$
Long-swing phases:			*Shorter periods:*		
1883-1892	4.1	–	1900-1906	9.7	–
1892-1900	4.6	0.5	1906-1912	3.0	-6.7
1900-1912	6.3	1.7	1912-1915	-3.5	-6.5
1912-1920	13.4	7.1	1915-1920	25.0	28.5
1920-1928	-4.9	-18.5	*Longer periods:*		
			1883-1912	4.8	–
			1912-1928	3.7	-1.1

Source: Catão (1991, pp. 231-2).

Table 4
Mexico: Growth Measures of the Export Quantum (% per annum)

	$\bar{g}_x$	$\Delta \bar{g}_x$		$\bar{g}_x$	$\Delta \bar{g}_x$
Long-swing phases:			*Shorter periods:*		
1883-1892	6.4	–	1900-1906	7.3	–
1892-1900	7.7	1.3	1906-1911	7.6	0.3
1900-1911	7.4	-0.3	1911-1917	-4.4	-12.0
1911-1921	5.5	-1.9	1917-1921	22.2	26.6
1921-1928	-2.8	-8.3	*Longer periods:*		
			1883-1911	7.2	–
			1911-1928	2.0	-5.2

Source: Catão (1991, pp. 233-4).

In short the evidence of this section leaves us with two main questions. First, what accounted for the slow growth and instability of Brazil's exports compared with other primary producing countries? Secondly, why did the Mexican economy as a whole grow much slower than its exports? We shall now turn to these questions.

II. Explaining Export Trends

Brazil

Tables 5 and 6 show how Brazilian exports were very little diversified in terms of both commodity composition and export markets: throughout 1870-1939 overall export growth relied crucially on the performance of coffee exports to the US market.

Table 5
Brazil: Commodity Composition of Exports (% of value in current price)

	Coffee	Cotton	Rubber	Sugar	Others	Total
1870-79	56.3	9.6	5.2	12.8	17.1	100
1880-89	64.1	3.6	5.6	10.0	16.7	100
1890-99	67.8	2.4	8.3	6.2	15.3	100
1900-09	59.0	3.5	19.6	3.8	14.1	100
1910-19	62.4	1.4	15.1	1.1	20.0	100
1920-29	71.5	0.9	1.5	0.5	25.6	100
1930-39	42.3	18.9	1.5	0.0	37.3	100

Source: IBGE (1941, pp. 89-90).

TABLE 6
Brazil: Geographical Distribution of Exports (% of value in current price)

	UK	USA	Germany	France	Others	Total
1870-79	27.0	32.1	7.6*	8.5	24.8	100
1880-89	22.2	43.6	12.1**	9.4	12.7	100
1890-99	11.8	45.2	16.6	8.8	17.6	100
1900-09	14.3	35.2	13.3	7.6	29.6	100
1910-19	12.8	40.0	6.7	12.6	27.9	100
1920-29	6.2	46.5	8.7	12.0	26.6	100
1930-39	9.0	39.9	12.6	7.8	30.7	100

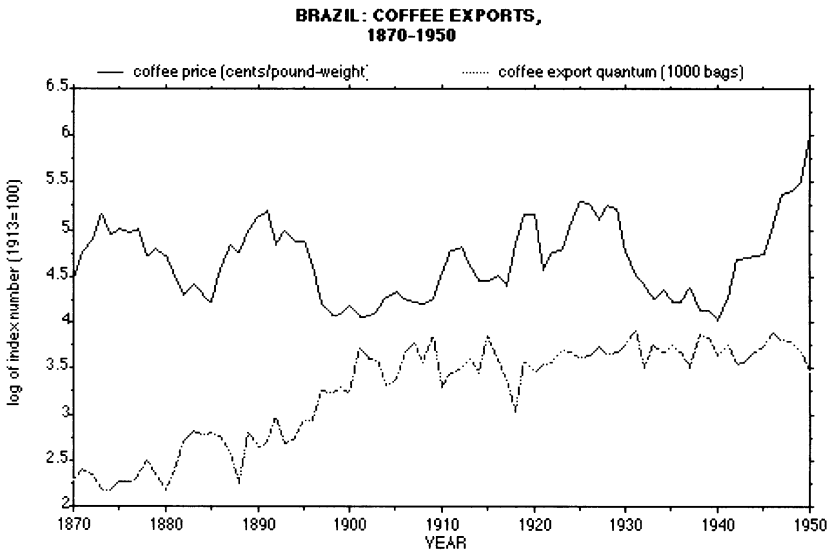
* 1872-73 ** obtained by interpolation

Sources: computed from Gonçalves (1982, p. 48) and IBGE (1987, pp. 526-8).

Because of the high contribution made by coffee in total exports, this section will concentrate on the demand and supply influences on the coffee sector. The role of other main export products such as cotton, rubber and sugar will also be considered, though in much less detail, at the end of this section.

Most of Brazil's coffee exports went to the USA.[11] Hence, the growth and fluctuations in US national income had a clear impact on Brazil's coffee exports. In fact, as graph 3 and table 7 both show, the price and value of Brazil's coffee exports followed long swings with the same timing as those of US national output: a downswing in 1873-83, an upswing to 1891, a downswing in 1891-99 and the 1899-1906 upswing; only between 1906 and 1912 did this positive correlation break down, with coffee prices rising substantially between the peaks of 1906 and 1912, whereas US national output underwent a downswing.[12] A positive correlation between long swings in coffee prices and those in US real income is again observed throughout 1912-1937.

Graph 3



Source: prices – Delfim Netto (1959, pp. 245-6); quantum – IBGE (1987, p. 312).

Table 7 also highlights two phenomena: on the one hand, it shows that variations in coffee prices and revenues were far larger than the amplitude of output swings observed for the USA; on the other hand, the above measures indicate that the average growth of the coffee export quantum over 1873-1937 was considerably inferior to that of US real income. This suggests that a substantial part of the growth and fluctuations in coffee exports cannot be explained by international demand; supply-side factors must also be considered.

Table 7
Growth Measures of World Coffee Price and of the Value of Brazil's Coffee Exports (%)

	$\bar{g}_p$		$\bar{g}_q$		$\bar{g}_{ous}$
1873-83	-7.0	1873-83	6.1	1873-82	4.0
1883-91	10.0	1883-92	1.7	1882-92	5.3
1891-1900	-12.7	1892-1901	7.6	1892-99	3.1
1900-12	5.7	1901-13	-0.8	1899-1906	5.1
1912-29	2.3	1913-31	1.7	1906-12	3.1
				1912-29	3.1
1873-1929	0.1	1873-1931	2.7	1873-1929	3.8

Sources: $\bar{g}_p$ = average geometric growth rate of world coffee prices in US$, as from Delfim-Netto (1959, pp. 245-6); $\bar{g}_q$ = average geometric growth rate of the export quantum according to IBGE (1987, pp. 312); $\bar{g}_{ous}$ = average growth rate of US real GDP, as from Solomou (1987, p. 49) and Maddison (1982, pp. 173-4).

Coffee production presents three outstanding features. First, a coffee grove does not bear its first commercial crop until its fourth or fifth year.[13] Its productivity reaches an apex when the tree is around ten years old; then, the coffee tree continues to bear fruit with declining productivity for thirty to forty years more (Laërne, 1885, pp. 296-7; Wellman, 1961, pp. 145-51: Holloway, 1975, p. 8).[14]

A second important feature of coffee production is the substantial amount of fixed investment required on land clearing and planting. According to Rowe's estimates (1932, pp. 41-5), fixed costs account for about 75% of total production costs. Thirdly, a tree with ripening berries must be harvested if its life expectancy is not to be shortened considerably (Holloway, 1975, p. 13). This requirement, together with the outstanding importance of fixed costs relative to harvesting costs, means that the producer's optimal response is invariably to harvest the current crop, notwithstanding declines in price. Hence, no significant correlation between current price and current output of coffee is expected.

The point to be made here is that these structural characteristics *alone*, under free market conditions, give rise to cycles of coffee prices with a similar length as the long swing. In order to show this, consider the coffee supply function

$$S_t = \sum_{i=5}^{40} C_{t-i}\phi(i) + v_t$$

Equation 1

where C_t, $\phi(i)$ and v_t stand, respectively, for the number of coffee trees planted during the period t, the average productivity of these trees and random shocks, including weather variations.[15] The investment function C_t is a function of the expected coffee price and the price of coffee ('Pc') relative to that of alternative cultures ('Pa'),[16] i.e.,

$$C_t = \alpha_0 + \alpha_1 Pc^{e}_{t+5} + \alpha_2 (Pc^{e}_{t+5}/Pa^{e}_{t+5})$$

Equation 2

Substituting Equation 2 back into Equation 1 and assuming that price expectations are static,[17] that producers are capable of holding stocks for a period t and that perfect arbitrage holds, we have

$$S_t = \sum_{i=5}^{40} [\alpha_0 + \alpha_1(1-tr)e_{t-i}Pc^{*}_{t-i} + \alpha_2(Pc^{*}/Pa^{*})_{t-i}]\phi(i) - \Psi(1-tr)e_{t-1}Pc^{*}_{t-1} + v_t$$

Equation 3

where e, tr, P_c* and P_a* stand, respectively, for the mil-réis/US$ exchange rate, the transportation cost ratio between the coffee producer and the consumer, the world coffee price in US$ and the world price of those primary products that constitute alternative possibilities of investment for the coffee producer – which in the case of Brazil was cotton.

The world coffee demand can be represented by the following demand function:

$$D_t = \beta_0 - \beta_1 Pc^{*}_{t} + \beta_2 Y_1^{*} + \beta_3 TREND + \epsilon_t$$

Equation 4

where Y^* stands for income in the main coffee consuming countries.[18] Substitution effects need not be considered insofar as goods such as tea are highly imperfect substitutes for coffee. The term 'TREND' accounts for factors such as population growth, the rise in overseas competition and life cycle effects, whereas ε accounts for erratic demand shocks.

A reduced form estimate of the world coffee price can be obtained by equating Equation 3 and Equation 4 Solving for the market clearing price of coffee we obtain the following expression:

$$Pc^*_t=\gamma_0+\gamma_1 Y^*_t+\gamma_2 TREND-\sum_{i=5}^{40}[\rho_0+\rho_1(1-tr)_{t-i}e_{t-i}Pc^*_{t-i}+\rho_2(Pc_{t-i}/Pa_{t-i})]\phi(i)+\gamma_3(1-tr)_{t-1}e_{t-1}Pc_{t-1}+\xi_t-\zeta_t$$

Equation 5

where $\gamma_0 = \beta_0/\beta_1$, $\gamma_1 = \beta_2/\beta_1$, $\gamma_2 = \beta_3/\beta_1$, $\gamma_3 = \Psi/\beta_1$, $\rho_0 = \alpha_0/\beta_1$, $\rho_1 = \alpha_1/\beta_1$, $\rho_2 = \alpha_2/\beta_1$, $\xi_t = \varepsilon_t/\beta_1$, $\zeta_t = \nu_t/\beta_1$

Under free market conditions, the homogeneous solution of Equation 5 gives us the cyclical instability generated by the gestation lag in coffee supply. Letting $\gamma_1=\gamma_2=\gamma_3=tr=\rho_2=\xi_t=\zeta_t=0$ and $e_t=1$, it follows that

$$Pc^*_t=\gamma_0-\rho_1\sum_{i=5}^{40}Pc^*_{t-i}\phi(i)$$

Equation 6

Thus, the problem is reduced to one of unilateral dynamic coupling, originally discussed by Goodwin (1947). Since the average productivity of a coffee tree follows a slowly changing path, it is reasonable to assume that $\phi(i) \simeq \phi(i-1)$. Recalling that $\phi(40) = 0$ by assumption, we can lag Equation 6 one time period, subtract it from Equation 6 and re-arrange it, so as to get

$$Pc^*_t-Pc^*_{t-1}+\rho_1\phi(5)Pc^*_{t-5}=0$$

Equation 7

Another way of obtaining a simplified equation, also similar to Equation 7, is to disregard the slight rise in the productivity of the coffee tree between its fifth and tenth year of life. Instead, it can be assumed that the productivity of the coffee tree reaches its peak when the tree is five years old and then declines according to a geometric progression.[19] In this case, where $\phi(i)$ can be written as ku^i, the resulting equation is as follows

$$Pc^*_t-Pc^*_{t-1}+\rho_1 k\, u^5 Pc^*_{t-5}=0$$

Equation 7[a]

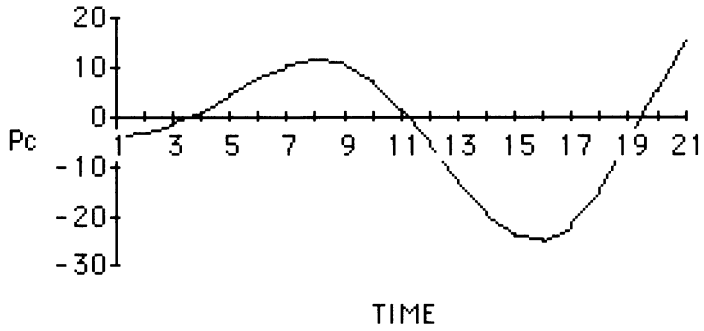
Although there do not exist any precise estimates of ρ_1 or ϕ for the pre-World War II period, reasonable guesses can be made. As regards the

parameter ρ_1, note that it corresponds to the absolute value of the price elasticity of supply of coffee divided by its price elasticity of demand. The world demand for coffee possesses a very low price-elasticity – something in the range of 0.2 to 0.5, according to econometric works dealing with the post-1940 period (Delfim Netto, 1959, p. 201; Parikh, 1974, p. 40; Ford, 1978, p. 119). With reference to price supply elasticity, it has been suggested that it was about 0.5 for the pre-1906 period (Delfim Netto, 1959, p. 19). On the other hand, OLS estimates to be provided below suggest a price supply elasticity of 0.3. So, a figure in the range of 0.3 to 0.5 is representative.

Undertaking simulations of Equation 7 for values of ρ ranging from 2.0 to 0.8 and supposing a productivity function $\phi(i)$ with various different shapes, coffee prices displayed cycles of 14 to 16 years length.

Diagram 1

Simulation: coffee price, for $\phi(5)=0.9$, $\phi(10)=1$, $\phi(40)=0$, $\rho=1.4$



The simulation results also show that the higher the supply price elasticity relative to demand, the larger the amplitude but the lower the cyclical period. This has a clear intuitive explanation: for a given increase in supply, *ceteris paribus*, prices have to drop substantially so as to make demand equal to supply; the lower the demand price elasticity, the sharper the price fall must be. On the other hand, if coffee tree productivity evolves along a more pronounced downward trend, the lower the cyclical period and the lower the cyclical amplitude. In any case, the cyclical period remains within 14-16 years under realistic assumptions about the parameters' value.

The above simulations therefore show that long swings in coffee prices may be caused by a once-and-for-all shock upon our structural model. Clearly, income fluctuations in the core countries are a major source of such shocks. If income fluctuations in the core countries (Y_1) display a similar cyclical periodicity and phase as given by the homogeneous solution pc_{ht}, a price cycle

of that periodicity but of higher amplitude will emerge.[20] The evidence presented in both graph 3 and table 7 supports the hypothesis that these supply and demand influences were both present.

Yet our analysis would be incomplete if it did not give an account of other factors that may have either enhanced or reduced the growth and fluctuations of world coffee prices. Since Brazil's coffee production accounted for 50% to 70% of world supply, variations in local weather conditions, exchange rates, transportation costs and stock policy all had major repercussions on the world price of coffee and consequently on Brazil's export earnings.

The influence of weather shocks on Brazilian coffee production during some years (e.g. 1870, 1886, 1902 and 1918) is acknowledged in the literature (Delfim Netto, 1959, *passim*; Peláez, 1971, p. 67). However, no attention has been paid to climatic shock as a possible cause of cyclical variations in coffee prices. Given the propagation mechanism, a once-and-for-all weather shock is capable of generating cycles in production and prices, as Frisch (1933) has demonstrated. Besides, there exists evidence about the existence of climatic cycles of some 20 years length (Lamb, 1982), which may themselves generate long swings. In the British case, for example, agricultural long swings were generated *inter alia* by climatic changes throughout 1856-1913 (Solomou, 1987, pp. 122-3). As regards Brazil, it is likely that such systematic climatic variations were partly smoothed by the rapid expansion of the agricultural frontier. This is, however, a hypothesis that needs to be carefully tested based on metereological data available in primary data sources, a task which is beyond the scope of the present work.

That variations in the Brazilian exchange rate influenced world coffee prices with some five year lag is clear from equation 5. However, the value of the exchange rate is not a purely exogenous factor. As discussed elsewhere (Catão, 1991), the exchange rate is, inter alia, a positive function of coffee prices. Throughout 1870-1930, export earnings were highly correlated with coffee export prices. So, on the one hand, rising export revenues lead to exchange rate appreciation, *ceteris paribus*. In other words, as P_c is high in equation 7, the level of **e** is low, so that the impact of past coffee prices (Pc_{t-i}) on the current price (Pc_t) is attenuated. Hence exchange rate variations caused by fluctuations in coffee prices played a counter-cyclical role.

On the other hand, however, this exchange rate mechanism had a major negative effect on the long-term growth of Brazil's overall exports. By keeping the domestic coffee price high during periods of falling world prices, such counter-cyclical variations of the exchange rate contributed to a faster growth of supply relative to the world demand for coffee in the long-run. Hence, the stagnant trend of world coffee prices between 1873 and 1929 (table 7). Also, by keeping the price of coffee high relative to that of other domestic crops, this

mechanism reinforced the monocrop character of Brazilian agricultural production. This is clearly at variance with claims that the Brazilian coffee market worked efficiently before the post-1906 policy interventions (Delfim-Netto, 1959, p. 44).

The other important influence on coffee exports was the long-term decline in transportation costs. Ocean freight rates, for instance, displayed a downward trend between the early 1870s and the beginning of World War I, only interrupted by erratic short-term fluctuations (North, 1958, p. 554). Although freight rates added some 8% to 18% to the FOB price of Brazilian coffee,[21] it appears that their variations had a minor influence on the cyclical pattern of international coffee prices.[22] Besides not displaying long cycles, variations in ocean freight rates were relatively mild when compared with those of coffee prices. Not surprisingly, therefore, the correlation coefficient between the two is very low, 0.38.

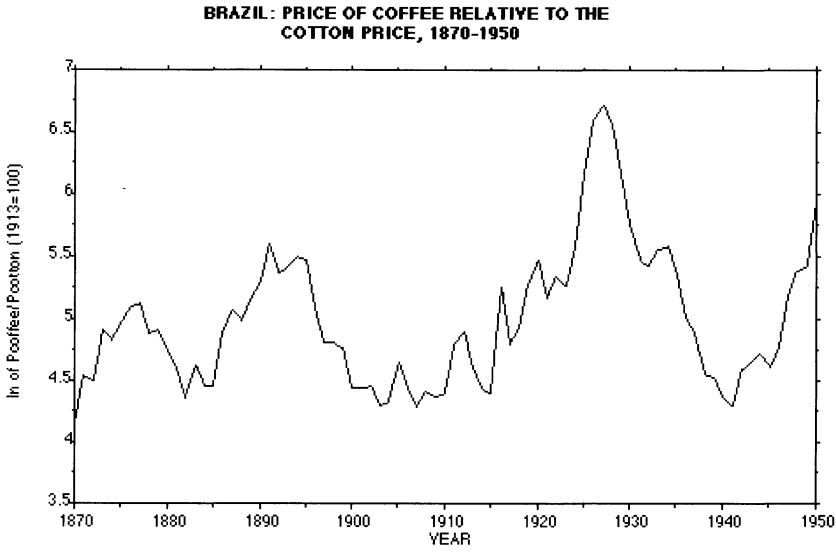
The influence of domestic transport costs, however, was much more pronounced. Their importance has been duly underlined by contemporaries, as a thorough report on the Brazilian coffee sector reveals:

> 'The costs of transport are so heavy that many *fazenderos* in the far interior have to keep up with their inferior crops, so as not to lower the selling price. (. . .) It is almost incredible, and yet it is a fact that the transport of this coffee by water to Rio costs more than the transport to New York or to any part of Europe' (Laërne, 1885, pp. 225 and 332).

In this sense, the expansion of the domestic railway system after the late 1860s provided a major boost to Brazilian coffee production and exports. Through a dramatic reduction in transportation costs,[23] the expansion of railways raised the profit margins of existing coffee producers and at the same time enabled new coffee producers to enter the market (Dean, 1976, pp. 40-4; Mattoon Jr., 1977, pp. 285-6). During most of the 1870-1930 period, long swings in railway mileage in Brazil coincided with those of world coffee prices (also displaying upswings in the late 1880s, the 1900s and the 1920s); thus railway construction reinforced the long-term instability of Brazil's coffee exports. Moreover, railways contributed to cyclical instability of Brazil's coffee exports through variations in the rail freight rates. Because of Brazil's lack of coal and the underdeveloped stage of her producer goods industry, the railways were dependent on imported coal and components which contributed significantly to operational costs. Therefore, most railway companies indexed their freight rates to the value of the exchange rate (Ducan, 1932, p. 10). As the latter appreciated during periods of high coffee prices, freight rates were then lower; thus, the planters' profit margins were higher and production was fostered. The opposite occurred during periods of low coffee prices.

As regards its longer-term contribution to export-led growth, the expansion of the railway network in Brazil was modest in relative terms. Argentina and Mexico, also large export-economies with a rather small railway network by the early 1870s, saw their lines expand at rates of 8.7% and 9.4% p.a., respectively, between 1873 and 1913.[24] The corresponding figure for Brazil is 7.8%. A better comparative indicator, however, is the ratio of railway kms/thousand inhabitants. While in Argentina it stood at 4.2, in Canada at 5.7 and Australia at 6.5 by the early 1910s, the respective ratio for Brazil is only 1.0. Therefore the relatively slow expansion of Brazil's transportation system also accounted for the poor growth performance of her exports.

Graph 4



Source: Coffee prices from Delfim Netto (1959, pp. 245-6); cotton prices from the US Department of Commerce (1975, pp. 207-9).

Turning to the importance of relative price effects, there existed a possibility for the agriculturalist to substitute cotton for coffee during periods when the latter's price fell below the price of cotton. In fact, graph 4 indicates that throughout 1870-1950 long downswings in coffee prices were correlated with downswings in the price of coffee relative to cotton. However, it appears that such a cross elasticity of supply was minimal. Its value cannot be estimated econometrically because of the absence of indicators of cotton production before 1900; but case studies have shown that very few coffee producers actually shifted substantial resources towards the cotton culture (Canabrava, 1951). In fact, until the 1900s, cotton in Brazil remained as a poor man's culture in spite of the rapid growth of the world demand for cotton during the period (Brazil, 1908-1909, p. 185). This was due not only to the American

comparative advantage – which certainly kept the profit margin from growing cotton in Brazil much lower than that from coffee – but also to a lack of institutional support for the domestic producer (Canabrava, 1951). Only when a systematic governmental policy of technological development and financial support for the producer was undertaken in the late 1910s and 1920s did large scale cotton production begin to emerge (Peláez, 1971, p. 173-86). Yet due to the success of the coffee valorisation policies in the 1920s and the low base it started from, the share of cotton in the total value of Brazilian exports by 1929 still stood at a meagre 0.9% (IBGE, 1941, pp. 87, 90). Hence the rapid growth of cotton production from 1910s was filtered out in terms of the aggregate export performance.

In sum, simulations of the coffee price equation as well as empirical qualitative considerations suggest that before the introduction of the post-1906 stock policies, the growth and fluctuations in coffee prices were mainly determined by variations in the US national output and in domestic railway mileage, supply lags and weather shocks. This is in fact supported by a dynamic specification of equation 5, which yields the following OLS estimates for the **1870-1906** period (all variables in logs, t-ratios in brackets):[25]

$$\underset{}{Pc^{*}} = \underset{(6.22)}{3.83} - \underset{(2.97)}{.01}\,\mathit{TREND} + \underset{(1.56)}{1.05}\,\Delta YUS_{t-1} + \underset{(8.22)}{.62}(eP^{*}c)_{t-1} -$$

$$\underset{(9.18)}{.79}(eP^{*}c)_{t-5} - \underset{(1.71)}{0.0002}\Delta rail_{t-1} + \epsilon_{t}$$

Equation 8

R^2=0.87; DW=1.66; Normality: Xsq (2)=2.11; Heterocedasticity: Xsq (1)=3.06

$$Xq = \underset{(11.6)}{7.81} + \underset{(10.4)}{.04}\,\mathit{TREND} + \underset{(3.32)}{0.31}(eP_{c}^{*})_{t-1} - \underset{(3.59)}{0.30}(eP_{c}^{*})_{t-1} + \epsilon_{t}$$

Equation 9

R2=0.89: DW=1.84; Normality:Xsq (2)=0.91; Heterocedasticity: Xsq (1)=0.00

As expected, the world price of coffee proved to be highly elastic to fluctuations in the US real GDP, followed by its five-year lagged value and then by its one-year lagged value.[26] Also in line with the qualitative evidence discussed above, the rail transportation cost proxy – Δrail – proved to be significant in explaining coffee prices, whereas ocean freight costs and the coffee/cotton relative price did not and were thus dropped from the equation. Finally, the coffee export quantum appears to have been mainly determined by lagged domestic coffee prices.

Having examined the main determinants of pre-1906 coffee export trends, the role of post-1906 stock policies in the coffee market needs now to be discussed. These are relevant when explaining both the 1906-12 price upswing – when US income and imports underwent a Kuznets downswing – and the stagnation of the coffee export quantum from World War I onwards. The coffee supply control policies have been extensively studied in the Brazilian historiography (Tauney, 1939; Delfim-Netto, 1959; Peláez, 1971; Fishlow, 1972; Holloway, 1975; Silber, 1977; Fritsch, 1988). It is not the purpose of this work to analyse the short-run macroeconomic impact of those policies but, rather, to put them into a long-term growth framework.

Until 1906, producers' supply decisions were decentralised and the size of regulating stocks held by American and European trading houses were too small to influence prices significantly over a period longer than one or two years. Thus supply and demand were brought into line largely through price variations. Between 1907 and 1912, however, the Brazilian government embarked upon a grand scale policy of holding coffee stocks. This first 'valorisation policy' was quite effective: world coffee prices rose considerably in spite of the 1907-12 downswing in the American economy. There followed another episodic intervention in the coffee market during 1917-18. From 1922 onwards the valorisation programme was carried out on a permanent basis, leading to a threefold rise in the domestic stock of coffee trees between 1922 and 1929,[27] while effective supply was kept constant.

From a long-term perspective, the evidence put forward in graph 3 and in table 7 suggests that the outcome of the Brazilian valorisation policies was mixed. Such policies were by no means the basic cause of long swings in prices and certainly avoided a major price downturn during 1907-12. A positive influence on world coffee prices was also achieved by controlling supply in the 1920s. However, by keeping coffee prices artificially high, the valorisation policy of the 1920s led to an overexpansion of coffee plantations during a period when world demand for coffee was faltering. As these investments in coffee plantations matured, when real income in the core countries fell dramatically, the valorisation policy of the 1920s largely contributed to the dramatic downswing in coffee prices and in Brazil's export earnings in the 1930s. In short, in spite of their positive role during some sub-periods, the coffee valorisation policies failed to prevent Brazilian coffee exports from being highly vulnerable to the fluctuations stemming from the US economy throughout 1912-1937.[28]

* * *

Having highlighted the main supply and demand factors behind the growth and fluctuations of coffee exports, we now turn to the contribution of other

commodities to the overall pattern of Brazil's exports. Since the case of cotton has already been discussed in connection with that of coffee, I shall focus on sugar and rubber exports.

The quantity and value of Brazil's sugar exports underwent a pronounced secular decline from the early 1860s. Although the rise of European beet sugar production partly accounts for this, its main causes lie with domestic structural factors. It has been shown that the abundance of land, cheap labour and chronic scarcity of credit greatly hindered the pace of technological progress in the sector (Einsenberg, 1974, pp. 41-50). Although the government's subsidy policy from the 1880s fostered the introduction of central sugar mills and thereby of more advanced production methods, this was of limited extent and often led to inefficient resource allocation (*ibid.*, pp. 88-106, 220-1). In contrast, Brazil's main competitors in the world sugar market, such as Cuba, counted on abundant capital, scarce labour and, in some instances, richer land (*ibid.*, pp. 217-9). Compared to them, the Brazilian sugar industry remained technologically backward.

An indicator of the outstanding importance of technological backwardness in explaining the secular decline of Brazil's sugar exports is provided in table 8. Whereas cane-sugar had its share in the world market reduced by one and half times between the early 1870s and the late 1890s, Brazil's world market share underwent a fourfold reduction during the same period. After the 1890s, on the other hand, cane-sugar increased its share in world markets; yet the Brazilian share continued to fall. Exchange rate depreciation and the expansion of domestic railway services towards the sugar producing areas seem to have had a minor effect on the international competitiveness of Brazilian sugar; deep structural problems prevailed.

Table 8
Brazil: Sugar Export Quantum, Share in World Sugar Production and Share of Sugar-Cane in World Sugar Production (%)

	1871-75	1876-80	1881-5	1886-90	1891-5	1896-1900	1901-5
Xq	161.1	146.3	217.1	143.7	153.3	113.2	78.3
Br/Wo	5.7	5.3	5.3	2.8	2.1	1.4	0.8
Beet/Cane	40.0	44.2	51.2	56.5	52.0	61.0	50.0

Source: Eisenberg (1974, p. 20).

Supply-side influences also played a prominent role in the case of rubber. The rubber tree (Hervea Brasiliensis) is a typical specie of the Amazon rain forest. Its abundance and the availability of cheap labour enabled Brazilian rubber exports to rise rapidly between the early 1890s and World War I in response to the invention of rubber tyres by Dunlop in 1888 and the ensuing rise in rubber demand by the transportation industry in the core countries (Santos, 1980, pp. 200-3). Yet Brazilian rubber trees in the Amazon had long been subject to leaf-attacking fungi that rendered large plantation tracts with a yield unacceptably low for commercial exploitation (Dean, 1987, pp. 53-66). This problem, together with rising world rubber prices, induced rubber cultivation elsewhere, most notably in Southern Asia. Southern Asian plantations were highly successful both in getting rid of the Amazon-native fungi and in developing new plantation methods. As a result, the Brazilian monopolistic position in the world rubber market was gradually eroded. This is shown in table 9.

Table 9
Brazil: Share in World Rubber Market (%) and Volume of Rubber Exports

	1890	1900	1912	1919	1929
Br/World	–	53.3	43.6	8.1	3.4
Xq (10^3 tons)	15.3	24.3	42.3	33.2	19.8

Sources: Santos (1980, p. 230); export quantum figures from IBGE (1941, pp. 86-87).

By the end of World War I Brazilian rubber had lost a substantial part of its stake in the world market. The loss of competitiveness of Brazilian rubber persisted through the inter-war period. This was no doubt the main reason behind the marked decline in the rubber export quantum. The worldwide oversupply brought about by World War I and the slowdown in the international demand for most primary products further contributed to the downswing.[29]

To sum up, the dramatic long swings in price and the slow growth of the quantum of Brazilian total exports during 1870-1913 were largely due to the performance of coffee exports. Other important export items, such as sugar and rubber, reinforced these trends during specific sub-periods – namely, during the export downswing of the 1870s and the export upswing of the 1900s, respectively. Both supply- and demand-side factors were shown to account for the observed growth pattern of coffee exports. In the cases of sugar, rubber and cotton, supply-side influences played a prominent role.

Mexico

Although remaining extremely dependent on the US market throughout 1870-1940, Mexico's exports underwent dramatic diversification. As shown in table 10, the importance of silver exports had been waning since the late 1870s at the same time as the exports of agricultural and non-precious metals had increased their share in total exports.

Table 10
Mexico: Composition of the Export Bill by Main Products (% of Current Values)

	Silver	Sisal	Coffee	Copper	Lead	Oil	Others	Total
1877-80	72.6	7.0	5.8	–	–	–	14.6	100
1880-89	68.2	12.3	5.8	0.7	–	–	13.0	100
1890-99	55.0	11.7	6.0	3.9	1.0	–	22.5	100
1900-10	38.7	10.7	4.5	9.0	2.4	15.5	19.2	100
1920-29	14.7	5.0	3.1	5.6	6.4	42.0	23.2	100
1930-39	15.8	4.6	3.9	4.9	9.8	15.5	45.5	100

Sources: Mitchell (1983, pp. 621 and 623), except for the value of sisal exports which is from Martínez et al (1976, pp. 273-5).

Table 11
Mexico: Geographic Distribution of Exports (% of Total Value)

	USA	UK	Germany	France	Others	Total
1880-89	56.7	31.2	3.8	8.1	0.2	100
1890-99	74.5	13.6	3.9	3.8	4.2	100
1900-10	74.0	11.3	5.6	2.9	6.2	100
1920-29	69.8	6.5	3.7	2.1	17.9	100
1930-39	61.6	11.1	7.6	2.6	17.1	100

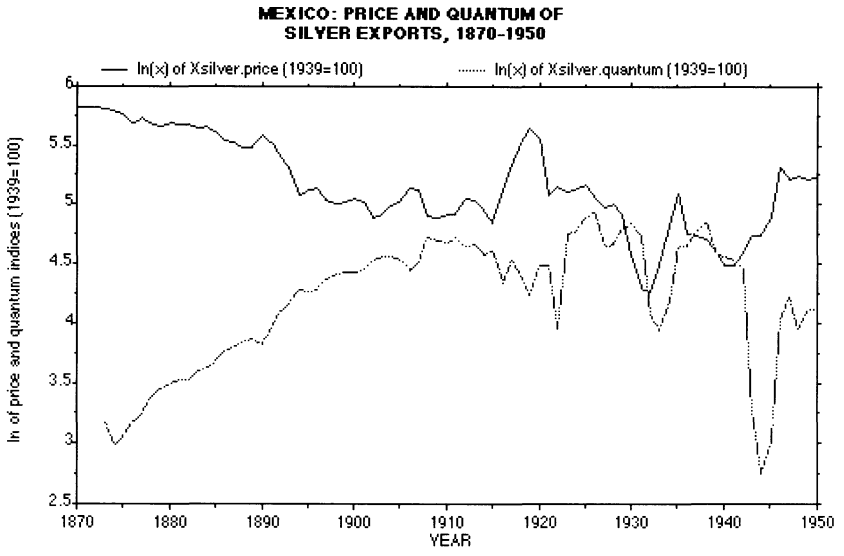
Sources: El Colegio de México (1960a, pp. 532-54) and Mitchell (1983, pp. 567, 576, 586).

Thus, a thorough analysis of the overall export pattern requires a separate discussion of the case of each export item. Let us begin by considering the case of silver. The long-term decline in the world price of silver, observed in graph 5, was caused by the worldwide productivity rise in silver mining relative to

gold, the worldwide spread of the gold standard and the falling demand for silver coins from the eastern empires, and random discoveries (Cosío Villegas, 1965, p. 205; Torres Gaytán, 1988, pp. 241-3).

It is striking, however, to observe from graph 5 and table 12 a rapid growth of the silver export quantum between 1873 and 1913 – a period of falling prices. The reasons for the phenomenon should be sought on the supply side. Since Mexico remained on the silver standard during 1870-1904, the secular fall in the price of silver relative to gold (and therefore relative to the dollar or the pound) was accompanied by a proportional exchange rate depreciation. The negative effects of a fall in the international price of silver upon production were made up for by the depreciation of the peso. As money wages and other variable costs lagged behind the exchange rate and technical progress in the sector underwent rapid change, domestic production was fostered (Pletcher, 1958; Bernstein, 1965, pp. 29-30). Moreover, the tariff structure prevailing throughout 1870-1913 provided mining enterprises with the benefit of importing explosives and mining machinery free of duty or any sort of quantitative restrictions.[30]

Graph 5



Source: US$ silver prices from the US Department of Commerce (1975: 606); quantum exports by dividing the value of silver exports by the US$ silver price. The 1913-18 value of silver exports were obtained by interpolation based on the value of Mexico's silver exports to the US, taken from US Trade Statistics, 1913-18 issues.

Table 12
Mexico: Growth Rates of Silver Export Quantum

	$\bar{g}$
1873-1880	4.6
1880-1891	4.4
1891-1900	5.3
1900-1911	2.7
1911-1921	-2.3
1921-1926	9.7
1926-1937	-0.7
1873-1926	3.4

Source: as for graph 5.

Finally, the expansion of the railway network from the late 1870s onwards brought about a substantial reduction of transportation costs to Mexico's mining sector (Bernstein, 1965, pp. 32-3). Whereas the average freight rate by rail in 1900 was 0.019 peso/km, that by wagon shipment (the nearest substitute for railways) varied between 0.104 and 0.146 (Coatsworth, 1981, p. 94 and p. 103).

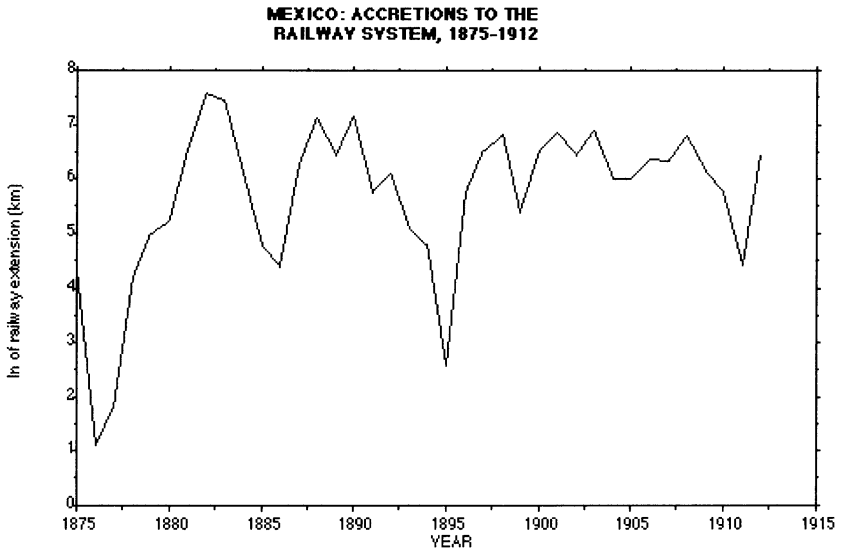
As graph 11 shows, apart from sharp short-term fluctuations in the mid-1880s and mid-1890s, railway lines expanded rapidly through 1873-1912 (g=9.4%p.a.). As such, it contributed significantly to the rapid secular growth of the quantum of silver exports.

Under the shelter of all the aforementioned supply side stimuli domestic production soared: between 1873 and 1911 the quantum of silver exports actually grew at a 4.1% annual rate in spite of the continuous fall in the international price.

After 1912, the pattern of silver exports was shaped by diverse exogenous shocks. The Mexican revolution no doubt had a disruptive impact upon silver production during 1911-1921, although its negative effects were mainly due to the interruption in railway services rather than to the destruction of the sector's productive capacity (Bernstein, 1965, p. 104). In the second place, disruptions in world trade associated with World War I also had a negative impact: the European supply of cyanide – a fundamental input for the modern process of separation of the silver from the respective ore – was cut down without being compensated for by the American supply (*ibid.*, p. 102). Yet, due partly to the contraction of Mexico's silver exports and partly to the overshooting of the international demand for silver during World War I and its immediate aftermath, silver prices rocketed. As a result, there was actually a rise in the

US$ value of Mexico's silver exports during the revolution (4.3% p.a. between 1912 and 1920).

Graph 6



Source: Mitchell (1983, pp. 656-8).

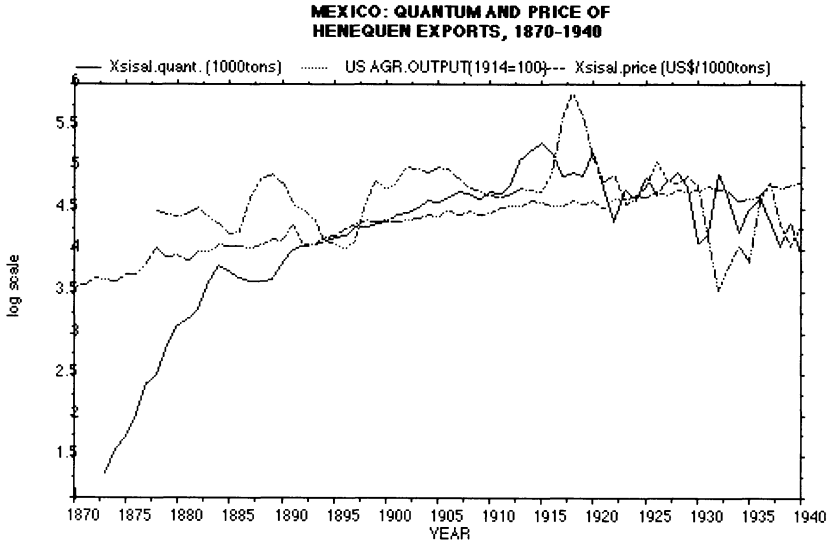
In the early 1920s, a sharp recovery in silver output and the export quantum was observed as a result of the idle capacity accumulated during the revolutionary disruptions, the reconstruction of railway lines destroyed during the revolution and the diffusion of a new extraction technique of 'ore flotation' (Bernstein, 1965, p. 127; pp. 137-42). Only after 1926 were these supply-side stimuli counteracted by the worldwide return to the gold standard from the mid-1920s onwards and the ensuing fall in the international demand for silver. Such a demand slowdown, combined with increasing world production,[31] led to a decline in world silver prices and in Mexico's silver earnings.

Turning to henequen or sisal, this became a fibre in high demand by the US cordage industry from the 1870s. After being imported from Mexico, the raw hemp was converted into binder twine and then sold to American grain farmers (Wells, 1985, p. 30). Thus, under a highly elastic supply, the demand for Mexican henequen would tend to move in line with US agricultural production. Yet, as graph 7 shows, the price and the quantum of henequen exports displayed major long-term fluctuations in relation to those of US agricultural output.[32] The main reasons for the observed fluctuations should be sought in both supply lags and the price elasticity of demand.

The henequen tree takes about seven or eight years to produce its first commercial crop. Under free market conditions,[33] such a supply lag itself can generate long cycles. Similar to that shown for coffee, the length of the henequen cycle depends on the price elasticities of supply and demand. Unfortunately, no quantitative information about these price elasticities or about the productivity function of the henequen tree is available. Although this precludes us from simulating the cyclical behaviour of henequen prices and output, some qualitative considerations shed a good deal of light on the causes of fluctuations in henequen exports.

Graph 7 points out the inverse relationship between price and quantum during most of the period.[34] This suggests that supply lags were no doubt important in generating cycles in henequen prices.

Graph 7



Sources: henequen export figures for 1873-7 from Martínez et al (1976: 273); 1877-1910 figures from El Colegio de México (1960a, p. 390); figures for 1911-20 and 1921-40 were taken, respectiveley, from the US Trade Statistics and INEGI (1986, p. 687); US agricultural output in 1929 prices from Christy and Porter (1962, p. 148).

Moreover, one can also observe that oscillations in price were much more marked than those in output. This seems to have resulted from a relatively low price-elasticity of supply combined with a high price-elasticity of demand for the fibre. For while the typical henequen planter incurred substantial fixed costs and faced few alternative investment opportunities,[35] the cordage industry could easily substitute henequen with alternative fibres such as manila thus being extremely sensitive to fluctuations in henequen prices. So price variations

accounted for most of the burden of imbalances between the demand and supply of henequen. Insofar as fluctuations in price outweighed those of output, the value of henequen exports displayed long swings throughout 1873-1912 (table 13).[36]

Table 13
Mexico: Growth Measures of the Value (in US$) and the Quantum of Henequen Exports (in tons)

VALUE	$\bar{g}$	QUANTUM	$\bar{g}$
1884-1890	9.1	1884-1890	2.4
1890-1897	-3.5	1890-1897	4.3
1897-1906	14.6	1897-1907	3.9
1906-1912	-2.5	1912-1918	2.1
1912-1918	25.4	1918-1928	0.1
1918-1928	-10.2	1928-1936	-3.3
1928-1936	-6.6		

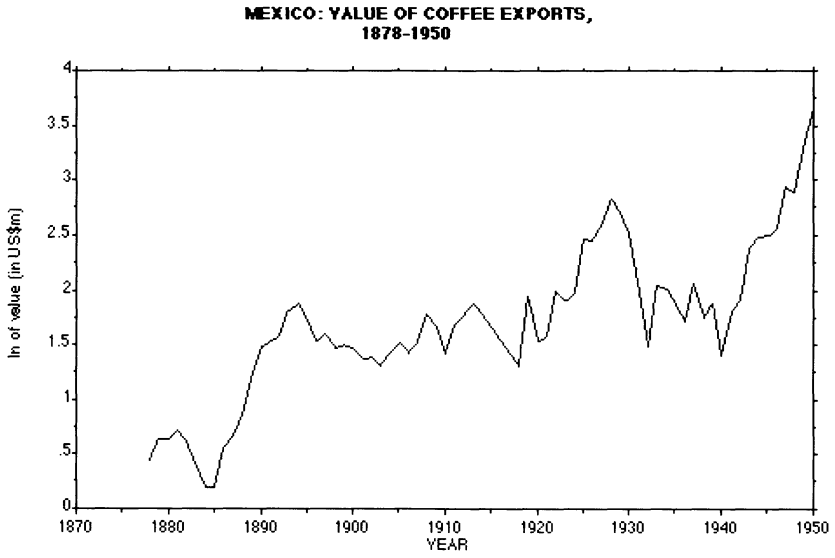
Sources: as for graph 7.

From the mid-1910s onwards, the pattern of henequen exports was shaped by far-reaching structural changes in the demand and supply of the fibre. On the demand side, the world trade in hemp was subject to depressive influences similar to those which plagued many other primary commodities, viz., the slow growth of the population in the core countries and changes in diets (Lewis, 1949; Kindleberger, 1986).[37] On the supply side, three main influences can be detected. First, the growth of the overseas supply of fibre, stimulated by World War I and unloaded in the world market thereafter, depressed fibre prices considerably during the 1920s. Secondly, cheaper synthetic substitutes for natural fibres were developed. Thirdly, there exists some evidence that Mexican henequen producers failed to break away from traditional production and management methods (Wells, 1985, pp. 142-50). This led Mexico to lose its share in the world henequen market, thus contributing to the slowing down of henequen exports during the inter-war period. In this process, the Mexican revolution played a minor role: the post-1918 decline of Mexico's henequen exports was largely induced by long-term economic forces, rather than by political ones.[38]

With reference to coffee exports, graph 8 shows that their value was subject to long-swing variations throughout 1881-1929. This was because Mexico was a small country in the world coffee market and therefore faced world prices determined by the supply and demand for Brazilian coffee. However, the

secular depreciation of the silver and hence of the peso exchange rate had a major positive impact on the growth trend of Mexico's coffee exports compared to Brazil's. Given the availability of land – opened up by railway expansion – and of cheap labour, the quantum of coffee exports rapidly responded to the exchange rate depreciation: between the late 1870s and the late 1920s the quantum of Mexico's coffee exports growth averaged 5.1% p.a. – i.e., a rate much superior to Brazil's. As in the case of henequen, the Mexican revolution had a negligible impact on the long-term pattern of coffee exports.[39]

Graph 8



Source: Mitchell (1983, pp. 621-6). As in the previous graphs, values in peso were converted to US$ and put on a calendar year basis. figures for 1914-18 were obtained from US Department of Commerce (1914-18), United Kingdom, Board of Trade (1914-18), France, Direction Générale des Daones et des Contributions Indirectes (1914-18).

Copper and lead are typical cases of a rapid supply response to profit opportunities. The rail connection between the main producing areas of the country and the main consumer markets in the USA was set up by the early 1890s (Bernstein, 1965, p. 33; Velasco Avila et al, 1988, p. 256). From producing no significant amount of copper and lead in the 1880s, Mexico had turned into the world's second major copper producer by 1901 and the second largest lead producer by 1920 (Nava Oteo, 1965, p. 194). Production expanded vigorously between 1890 and 1929, only interrupted by the US downswing of the 1930s. To explain this pattern, influences stemming from world demand and domestic supply have both to be looked at.

On the demand side, the rapid expansion of the electricity industry in the core countries led to a major rise in world demand for copper and lead. Between c. 1890 and 1913, the electrical industry in the core countries was in the early stages of development, so that demand for these metals grew briskly (see graph 9). World War I provided some boost to the US electrical industry while the overseas supply of these metals was cut short; so, the prices of copper and lead almost doubled between 1913 and 1917 (US Department of Commerce, 1975, p. 602). With the end of the war, other countries' copper and lead stocks could be unloaded in the world market and there occurred a rise in the US production of these metals, resulting in oversupply. The world price fell as a consequence. Yet supply-side influences – to be discussed below – prevented the fall in the quantum of exports until 1929, although not sufficiently to keep them up with the pre-World War I trend.

On the supply side, the expansion of the Mexican electricity network made possible the introduction of electric pumps and drilling machines into the process of mineral extraction. The use of electric pumps to suck water from the mine led to an eightfold reduction in the cost per ton of mineral extracted, whereas the use of drilling machines contributed to a threefold cost reduction per ton of metal (Nava Oteo, 1980, p. 354). Secondly, the development of new extraction techniques such as cyanidation – introduced during the 1890s and diffused in the 1900s (Nava Oteo, 1965, p. 217) – and the flotation of the 1920s (Berstein, 1965, pp. 137-142), provided a major boost to output. Thirdly, there was the positive effect of the depreciation of the early 1890s, which converted mining into a highly profitable venture by raising the domestic price of minerals *vis-à-vis* wages and non-tradable goods (Nava Oteo, 1965, p. 205; 1980, p. 374). Fourthly, pull factors in the US economy led to a spurt of US direct investment abroad from the late 1890s onwards, the effects of which spilled over into Mexico's mining industry, enhancing production (Nava Oteo, 1980; Lewis, 1938; Wilkins, 1970). Because of all these factors, the long-term response of production to the price stimuli was dramatic – with price supply elasticities well above unity, as the following set of cointegrated OLS regressions indicate (all variables in logs, t-ratios in brackets):[40]

$$Xq_{lead} = \underset{(4.16)}{-4.01} + \underset{(7.5)}{3.54}(e\ P^*_{lead})$$

(1884-1914)

R^2=0.66; DW=0.78; ADF-test for residuals: t_τ=3.19

$$Xq_{copper} = \underset{(4.01)}{-10.9} + \underset{(5.25)}{2.26}(e\ P^*_{copper})$$

(1887-1914)

R^2=0.52; DW=0.85; ADF-test for residuals: t_τ=3.49

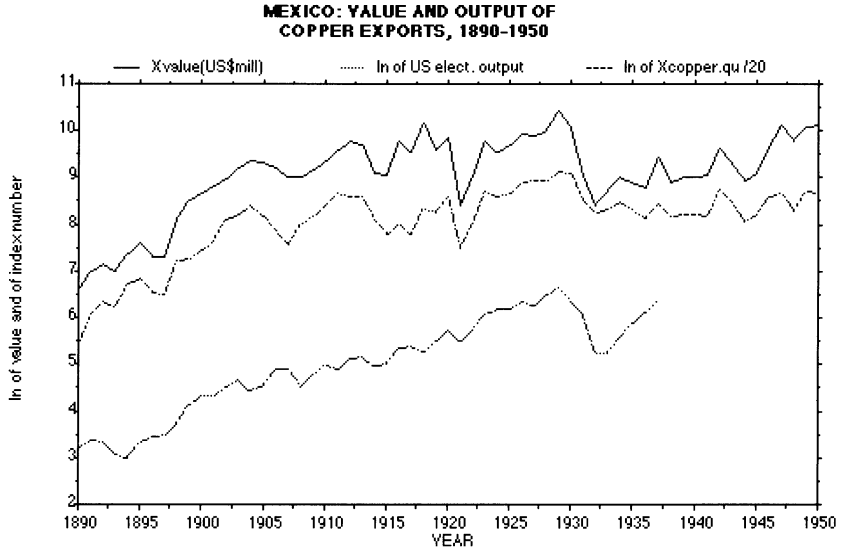
In contrast with silver, neither copper nor lead production were dramatically affected by the revolutionary struggles of the 1910s.[41] In fact, new quantum data on Mexico's exports, depicted in graphs 9 and 9a, show that the revolution had, if anything, a *minor* negative impact on the quantum of copper exports during 1914-17 and a considerable *positive* influence on the lead export quantum over the same period. The important point to be made here is that such short-term fluctuations did not affect the respective long-term trends of the quantum exports of these products. Moreover, since their world price was being boosted by World War I, the *value* of Mexico's exports of both products actually rose during those years. Finally, the effect of government taxes upon mineral production does not seem to have been significant in altering the growth trends of copper and lead exports throughout the 1870-1937 period (Bernstein 1965, p. 132). This constitutes a further case against the argument that political variables had a major long-term effect upon export trends in Mexico.

Table 14
Mexico: Growth Measures of the Value of Copper and Lead Exports

	$\bar{g}_{copper}$		$\bar{g}_{lead}$
1892-1899	21.4	1894-1901	12.4
1899-1905	14.3	1901-1912	3.2
1905-1912	6.9	1912-1920	19.9
1912-1920	5.4	1920-1926	19.3
1920-1929	6.7	1926-1937	-2.9

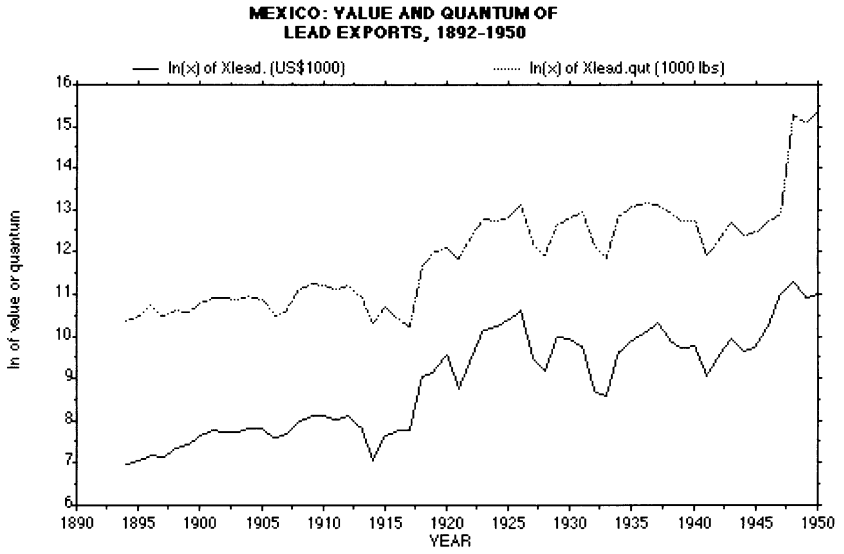
Sources: as for graph 9.

Graph 9



Sources: value figures from Mitchell (1983, pp. 621-6), except for the 1913-17 years, the source of which was the US trade statistics. Quantum figures obtained by dividing value in US$ per New York (FOB) price index of copper in US Department of Commerce (1975, p. 602).

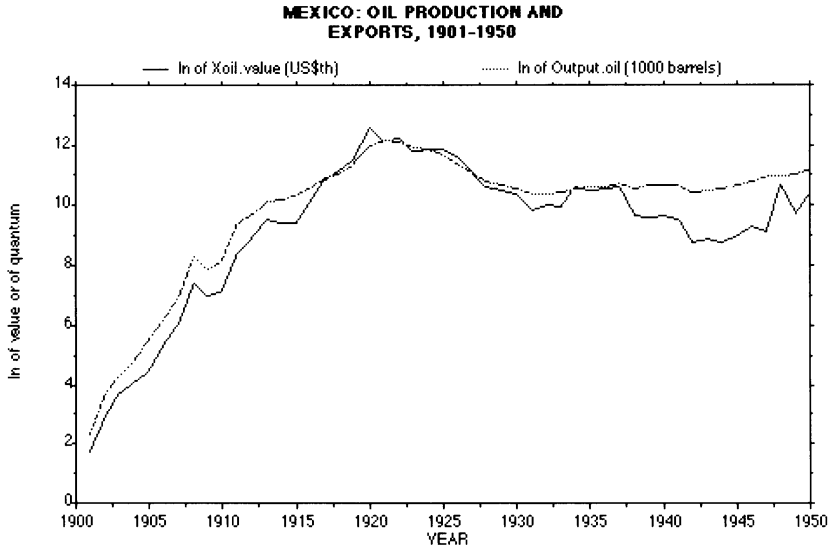
Graph 9a



Source: the same as graph 9.

From producing virtually no crude oil before 1900, Mexico achieved a level of oil output of 193 million barrels by 1921. Such a rapid growth in crude petroleum production is another case of rapid supply response to the appearance of new profit opportunities. On the demand side, four main factors account for this.[42] First, the growth of the automobile industry since the 1890s provided the required stimulus for the beginning of the search for oil. Systematic explorations by an American importing firm were undertaken during the 1890s and the first commercial output came in 1901, after which production increased dramatically. Secondly, the growth of domestic oil production was far in excess of domestic needs for refined oil for locomotives and automobiles, so that an increasing share of the domestic production was exported. This was especially true during 1913-18 because of the destruction of part of the railway network by revolutionary upheavals in central Mexico.[43]

Graph 10



Sources and methods: figures from 1921-1950 from Mitchell (1983, p. 626); before 1921 we used the production figures from Nafinsa (1977, p. 52), assuming that 90% of the domestic production was exported, based on information provided in Meyer (1968, p. 19).

Thirdly, the post-1921 decline in the value of oil exports was related to discoveries in Texas, Oklahoma, California and in Venezuela, which led to worldwide overproduction. As a consequence, prices fell by about a third between 1920 and 1929, with a negative impact on both production and the export quantum.

A number of supply-side influences were also at work. For instance, the geographic distribution of Mexico's oil deposits were concentrated along the

Mexican Gulf area, making possible an intensive exploitation over a short period of time. Once the first oil discovery was made in the late 1890s successive discoveries followed. Moreover, the oil producing areas were isolated from the regions where the revolutionary upheavals of 1913-17 took place and quite close to the main consumer market – the US. Thus, transportation problems caused by World War I had only a minor impact on oil exports.

Paradoxically, these very factors that allowed an intensive exploration of Mexico's oil wells during the 1910s also led to their subsequent exhaustion. In this connection, a thorough study by the US Department of Commerce for the years 1927-30 clearly shows that the cost of extracting oil from the relatively unexploited wells in Venezuela was 38% lower than in Mexico (US Department of Commerce, 1932, p. 49). Since oil firms operating in Mexico were multinational corporations, they could easily have sent a substantial part of their funds to be reinvested in Venezuela. Such a cost differential seems to have been the most important factor accounting for the stagnation of investment in the sector and falling oil output in Mexico after 1921. This evidence qualifies the usual view that the uncertainty about the subsoil policy of the new government was the main factor behind the contraction of Mexico's oil production from 1921 (Meyer, 1968; Solís, 1985).[44]

To sum up, the above analysis has shown that the rapid and relatively stable growth pattern of Mexico's overall exports during 1870-1930 is clearly linked to their diversified composition and to structural peculiarities of the Mexican economy. In the case of silver, supply side influences predominated during the 1870-1913 period, leading to a steady secular rise of the quantum of exports at the same time as international silver prices were falling. Only in the late 1920s did the slowdown in international demand for silver offset positive supply-side influences. In the case of sisal, supply influences predominated, generating long swings in the price of its exports during the pre-1913 period, while the quantum grew along a relatively stable path. From the mid-1910s on, although the slowdown in world demand was certainly important in explaining the decline of the quantum and price of Mexico's sisal, supply-side factors were no less prominent. With reference to coffee, international influences generated substantial price instability. However, the peculiarities of Mexico's monetary system – based on a silver standard – and the associated depreciation of the peso led to a high growth trend of coffee exports. Finally, in the cases of copper, lead and oil, the brisk pace of the international demand for these products and the substantial supply response to the international price stimuli are also behind the rapid pace of their exports.

As a result of each of these commodities being subject to diverse influences, the cyclical instability of individual products was filtered out in the aggregate. Between 1914 and 1918, although the Revolution and World War I had some

negative impact on Mexico's exports this was short-lasting and much milder than is usually assumed. Afterwards, no doubt international forces were the main factor behind the decline of Mexico's exports. But even then, the role of domestic factors in reinforcing international influences on the demand for commodities such as sisal and oil were of outstanding importance.

III. The relationship between exports and domestic economic growth

Having explained the growth pattern of the Brazilian and Mexican exports in section II, we are now concerned with what effect the observed export pattern had on aggregate economic growth. The three variables that must be analysed in this connection are the size of the export sector, the proportion of the value of exports which is retained domestically[45] and the composition of domestic expenditure. The size of the export sector is a function of a host of factors, such as natural comparative advantage, historical patterns of specialisation and the level of per capita income and its distribution. Since a proper account of all these factors is beyond the scope of the present work, I shall take the size of the export sector as a given statistical datum.

The rate of return of exports and the composition of domestic expenditure depend upon two influences: firstly, the *transmission potential* of export activities – which is, in turn, a function of their forward, backward and fiscal linkages; secondly, the *effectiveness* of such linkages, which depends on the relative prices of exportables, importables and non-tradable goods.

This section provides an analysis of these variables – the size of the export sector, its linkages and changes in relative prices. Although the size and the linkages of the export sector have been extensively discussed in the theoretical literature on economic development (Watkins, 1963; Caves, 1966; Hirschman, 1958, 1981), a careful consideration of their extent and effectiveness in the Brazilian and the Mexican contexts has not previously been undertaken.[46] This lacuna is partly due to the difficulties of pinning down the issue given the absence of an input-output matrix for the period and the previous lack of relative price data. The absence of an input-output matrix implies that the analysis of the production linkages of the export sector has inevitably to rely on indirect information gathered from sectoral case studies and indirect measurement. Yet a number of recent sectoral case studies (e.g. Holloway, 1980; Suzigan, 1986; Cárdenas, 1987; Haber, 1989) and the reconstruction of price data (Gonçalves, 1982; Catão, 1991, 1992) now allow us to shed new light on the export transmission mechanism, as will be seen below.

Brazil

An idea of the relative size of the Brazilian export sector can be gained by comparing the export share in GDP in Brazil with that in Mexico, Argentina and Canada. The respective figures are presented in table 15. Brazil, in contrast, appears to have been quite an open economy in the pre-1914 period. This scenario, however, changed somewhat. Structural changes associated with World War I and its aftermath led to a dramatic closing up of the Brazilian economy between c. 1910 and 1929.

Table 15
Export/GDP Ratios in 1929 Prices (in %)

	1900	1910	1920	1929
BRAZIL	23.2	19.6	17.8	12.8
MEXICO	6.9	10.5	17.6*	12.6
ARGENTINA	–	21.6	24.3	23.9
CANADA	24.7	18.4	29.3	19.2

* refers to 1921

Sources: Brazil: IBGE (1987, pp. 94, 111, 523-4); Mexico: Solís (1985, pp. 79-80, 92) and Catão (1991, pp. 233-34). Argentina and Canada: Mitchell (1983, pp. 540, 555, 882-90, 898-99), export price from Buckley and Urguhart (1962, p. 184), with the Argentine real GDP being set in real terms by using the price deflator provided in the same source (pp. 837-38) and the export price deflator of Di Tella and Zymelman (1967, pp. 78, 352 and 289).

The development literature has singled out three basic economic stimuli behind the setting up of forward linkages.[47] First, when export activities provide other sectors with inputs at a lower cost. Secondly, when there exist technical complementarities between the production of a raw material and its further processing.[48] Thirdly, when the production of the export commodity is partly channelled towards domestic consumption, thus supplying the domestic market with goods which are cheaper than their imported counterpart. The two first cases correspond to what Hirschman (1981) has called forward *production* linkages, whereas the latter constitute forward *consumption* linkages.

Let us then discuss, within this framework, whether the Brazilian export sector generated significant forward production linkages with the rest of the economy during the period 1870-1940. The case of coffee – Brazil's main export product throughout the period – is obvious: it does not constitute an input for industrial or other agricultural activities. On the other hand, the

development of coffee processing operations also seems to have been limited: before World War II almost all the Brazilian coffee was roasted in the consuming countries (Rowe, 1963, p. 26). Thus, growth variations in coffee exports did not affect the domestic economy through forward *production* linkages.

The other important export activity was rubber extraction. In contrast with coffee, rubber is an important input for the automobile, electricity and other modern industries. Yet, its production in Brazil failed to foster these industrial activities within the country during the rubber boom period (1900-10). At that time, Brazil exported rubber in its raw form to be processed in the consuming countries; domestic rubber manufacturing was then practically non-existent (Suzigan, 1986, p. 299). Only during World War I did the domestic industry of rubber artefacts begin to develop, although by 1919 it still accounted for quite a small share of the country's manufacturing output (Brazil, Ministério da Agricultura, Indústria e Comércio, 1920). In any case, these developments were only marginally stimulated by the rapid growth of exports. For by the end of World War I Brazil had already lost her comparative advantage in rubber production and hence its capacity to supply the domestic industry with rubber at low comparative costs. The development of the Brazilian rubber industry in the inter-war period was more a result of deliberate policies aimed at preventing a sharp decline in the country's rubber production (*ibid.*, p. 301) than of a genuine economic stimulus stemming from export-led growth. So, in the case of rubber as well, export fluctuations had little impact upon the domestic economy via forward production linkages.

In the case of raw cotton production, although there exists evidence that it stimulated the setting up of cotton mills near the producing areas in the 1870s (Stein, 1957, p. 108), the relevance of this linkage to the later development of domestic cotton manufacturing seems to have been quite limited. As already pointed out, the recovery of US cotton production after the Civil War reduced the world price and undermined the international competitiveness of Brazilian cotton. From then until the 1920s, cotton in Brazil assumed the features of a marginal crop. Its low quality compared to the imported counterpart and the irregularity of the domestic supply turned Brazilian cotton into a hindrance rather than an additional stimulus to the development of the domestic textile industry (*ibid.*, pp. 46-9). As late as 1909, Brazilian cotton was substantially more costly for the local producer than its imported counterpart (*ibid.*, pp. 223, fn. 25). Only from the late 1900s is there evidence that domestic cotton played a progressive role in fostering the development of domestic textiles (*ibid.*, p. 108). By that time, however, cotton textile manufacturing was already a well-established branch of Brazil's manufacturing industry.

Forward *consumption* linkages also do not seem to have been significant. The weight of coffee, rubber or raw cotton in the composition of a

representative wage goods basket was minimal. Among these three products, the most widely consumed domestically – coffee – accounted for about only 0.9% of total current expenditures in 1919 (Affonseca, 1919) and 1.2% in 1949 (Conjuntura Econômica, 1949, p. 7) – a percentage share which is much below that of staples such as beans, manioc, rice and wheat.

In short, the transmission of export growth through forward linkages – on both the production and the consumption side – can be considered negligible in Brazil during the period 1870-1930.

Turning to *backward* linkages, their relevance depends on two factors: i) the extent to which export growth induces the domestic production of the inputs used in the production of exportables (backward *production* linkages); ii) whether the expenditures of capitalists and workers employed in export activities induce the development of other sectors in the economy (backward *consumption* linkages). In order to single out these two effects, one has to look at both the basic nature of technology employed in the making of exportable goods and the propensity and composition of workers' and capitalists' expenditures.

In the case of Brazil, it has been seen that coffee was by far the main export product throughout 1870-1930. It is well known that the basic operations of coffee production – clearing the land, planting, pruning and harvesting – are highly labour-intensive (Laërne, 1885; Delfim Netto, 1959; Holloway, 1975). Although a precise quantification of the share of labour in the total cost of coffee output is not feasible for the period, due to important non-monetary benefits accruing to agricultural workers (Holloway, 1980, pp. 74-87), rough estimates are revealing. The 1907 census, for instance, reports that operations such as cultivating, harvesting and transporting the crop to the drying areas, which in most cases were undertaken by the worker with a simple hoe, accounted for 52% to 57% of the unit FOB value of the product (Brazil, 1908-9, pp. 91-92). If, on top of that, one adds labour costs associated with brokerage and packing operations, it is reasonable to say that labour costs accounted for over 70% of the final price of coffee. This percentage share did not change substantially during the period 1870-1940 due to the slow pace of technical progress in the sector (Furtado, 1963, pp. 169, 177-8; Peláez, 1971, pp. 75-6; Dean, 1975, p. 7; Holloway, 1980, pp. 29-34).[49] In these circumstances, the growth pattern we observed in coffee exports – long swings around a relatively slow growth trend – had a corresponding major impact on aggregate employment.

Having seen that exports induced substantial variations in aggregate employment, how did the latter affect domestic output? To answer this question, the coffee worker's propensity to consume as well as the composition of his expenditures must be examined.

Between 1870 and the early-1880s, slaves made up the bulk of the labour force in the Brazilian coffee sector. In this context, although slaves have to be fed and clothed, the rather low level of their subsistence requirements implied that the demand for goods produced elsewhere in the economy via workers' expenditures was clearly minimal.

This situation, however, changed dramatically from the mid-1880s onwards. A soaring demand for labour by the coffee sector and the accelerating decline of slavery induced mass immigration into Brazil (Hall, 1969; Holloway, 1980). Fostered by coffee prices, immigration growth proceeded along a long-swing path, with upswings in 1885-95, 1902-12 and 1920-9 (Graham, 1973). Its impact upon the country's labour market was considerable.[50] Between 1880 and 1913, for instance, immigration accounted for a near one-sixth increase in the country's total population and a much higher increase in the labour force (Goldsmith, 1986, p. 81).

This brought about far-reaching structural changes in the expenditure pattern of coffee workers, with important consequences for the domestic transmission of export growth. First, the immigrant's purchasing power was far superior to that of the slave. New demands consisted of foodstuffs, kerosene, simple tools and low-quality textiles (Holloway, 1980, p. 78-80). Since these goods were produced domestically, a considerable part of the demand brought about by a rise in agricultural employment and wages during export upswings did not leak abroad under the form of import growth. Rather, it fostered domestic demand for non-tradable goods and import substitution, as will be discussed in detail below.

Secondly, since a substantial part of the immigrants' wage was paid in cash, a dramatic increase in the demand for money took place. The increasing monetisation that then followed strengthened the links between the coffee sector and the rest of the economy – with the domestic manufacturing sector in particular.

Thirdly, the average immigrant had a relatively high propensity to save – between 27% to 38%, according to Holloway's estimates (1980, pp. 85-6).[51] A substantial amount of these savings was eventually invested within the country. This is in line with balance-of-payments estimates presented in table 16, which show that immigrants' remittances (included under 'transfers') were relatively unimportant in macroeconomic terms. Moreover, some of these immigrant workers themselves became coffee planters or industrialists producing for the domestic market (Holloway, 1980, pp. 139-66). Hence a positive effect on investment resulted.

Table 16
Brazil: The Structure of the Balance of Payments (% of Total Flows)

	1882/83*	1890	1899	1930
TOTAL INFLOWS	100.0	100.0	100.0	100.0
commodity exports (FOB)	87.3	78.7	72.8	79.0
long-term capital	12.5	17.5	27.2	21.0
changes in reserves	0.2	3.8	–	–
TOTAL OUTFLOWS	100.0	100.0	100.0	100.0
commodity imports (CIF)	82.8	71.7	63.0	40.9
profit remittances	0.4	1.9	1.1	–
foreign debt amortisation	4.5	1.1	4.5	4.8
interests	5.0	8.8	8.8	19.4**
others	0.3	1.9	2.6	2.3
transfers	2.3	1.1	3.2	–
changes in reserves	–	–	10.8	18.2
errors and omissions	4.7	13.6	6.0	14.4

* fiscal year ** includes profit remittances

Sources: Figures for 1880/1 and 1990 were obtained based on data from Franco (1988, pp. 25-27); 1930 figures from IBGE (1987, p. 535).

Turning now to the destination of profits generated in the export sector, there also exists persuasive evidence that they fostered the expansion of domestic activities in a most significant way. In order to show this, let us focus on three key parameters, namely the nationality of the coffee planter, his propensity to consume and to invest, and the composition of his expenditures.

In contrast with other periphery countries (such as Mexico, see below), the production and commercialisation of coffee were, by and large, under the control of Brazilian nationals. Foreign ownership of land in Brazil was minimal. Although figures for the country as a whole are not available, surveys carried out in the main coffee producing state of the country (São Paulo) for the years 1920 and 1934 indicate that Brazilian nationals owned 83.7% and 72.5% of the total cultivated area, respectively (Holloway, 1980, p. 152 and 163). These figures are certainly lower bounds for the country as a whole, since São Paulo absorbed far more immigrants-turned-into-planters than the remaining states of the Republic.[52] As regards the commercialisation of coffee exports, although the presence of foreigners (notably, the Portuguese operating as broker) was more marked, it was by no means overwhelming (Sweigart, 1980).

In any case, their foreign remittances were not so significant in macroeconomic terms, as the balance-of-payment estimates of table 16 show.

Also, in contrast with many other periphery economies,[53] Brazilian exporters spent a relatively small proportion of their profits on conspicuous consumption. Studies on the portfolio composition of their assets and on the ownership structure of large firms during the period suggest that, besides investing in the expansion of export crops, coffee planters ventured their fortunes in other activities connected with the expansion of the domestic market, notably, import-substitution manufacturing (Dean, 1975, pp. 34-48; Cardoso de Mello, 1985, pp. 131-8 and 141-2; Saes, 1986, pp. 44-64, 80-8 and 103-10).[54] Foreign currency and bonds do not seem to have absorbed landowners' savings in any significant amount (Cardoso de Mello, 1985). Hence fluctuations in export prices and therefore in capitalists' profits had a major impact on aggregate spending – a phenomenon already observed by Furtado (1963, ch. 26). Although a share of these expenditures leaked abroad due to the underdeveloped stage of domestic industry,[55] a considerable proportion consisted of investment in land, coffee trees and consumption of simpler goods, which were met by domestic supply.[56]

Summing up, qualitative evidence on the technology employed in coffee production indicates that the value added embodied in a unit of the product was very high indeed. Due to both the expenditure habits of workers and capitalists in the sector, it is clear that export growth had a substantial impact on domestic output performance.

Finally, the importance of the fiscal linkage needs to be considered. The latter represents the share of the income generated in export or import activities which is taxed and feeds back into the economy through government expenditures. This was especially important in the pre-1930 period, when most of the federal government revenues arose from tariffs on the value of imports (table 17). Imports grew in line with exports due to the operation of the transmission mechanisms above. Thus, export fluctuations tended to shape the pattern of government revenues and expenditures which, therefore, followed long swings.

The impact of government expenditures on total aggregate demand can be gleaned from table 18. From 1900 onwards, when more reliable GDP data becomes available, public expenditures accounted averaged 8% to 10% of GDP, even if we discount the leakages associated with the foreign debt service. Such a share is comparable to that of aggregate investment and, therefore, quite considerable in terms of its leverage on aggregate demand.[57]

Table 17
Brazil: Composition of Public Revenues (in % of Total)

	1890	1900	1912	1919	1937
tm/T	70	54	34	42	34
tci/T	–	12	10	20	20
ty/T	–	–	–	3	7
tothers/T	30	34	56	35	39
TOTAL	100	100	100	100	100

tm = revenues from tariffs on imports; tci = revenues from taxes on consumption of industrialised products; ty = revenues from income tax; T = total public revenues.

Sources: Villela and Suzigan (1973, pp. 404-5).

The case in point is further strengthened when one considers the shifts in the composition of public expenditures. Figures of table 18 show that, for periods of downswing in public expenditures brought about by a fall in export earnings, such as the 1890s and 1919-29, investment was sharply cut down; the opposite happened in periods of export prosperity, such as the 1900s. Since public investment consisted mainly of the opening up of ports, railways and infrastructural works, it had a clear bearing on the country's export potential. Thus, phases of lower or negative export growth coincided with periods of slow-down in export capacity and vice-versa.

Table 18
Brazil: Federal Government Expenditures as a Share of GDP and the Share of Investment in Total Government Expenditures (%)

	1890	1900	1912	1919	1928	1937
G/GDP	–	11.0	12.0	9.0	7.0	10.0
I_g/G	9.3	3.2	21.7	31.7	5.2	4.7
Discounting the foreign debt service:						
G^*/GDP	–	9.1	8.7	7.3	5.1	9.2
I_g/G^*	12.5	2.3	24.8	38.3	6.9	5.1

Sources: public expenditures from IBGE (1987, pp. 570-1); real GDP from IBGE (pp. 94, 111), deflated by the price indicator from Catão (1992) and Haddad (1978, p. 166); public investment figures from Villela and Suzigan (1973, p. 403).

To sum up, the growth and fluctuations of exports in Brazil had a potentially important macroeconomic impact via three different mechanisms. The first mechanism was related to the nature of exporters' expenditures and, in particular, their propensity to invest in domestic activities. This was reinforced by a second mechanism – namely, the propensity to consume and the composition of expenditures of the agricultural worker from the mid-1880s onwards. Thirdly, variations in export earnings affected the level of public expenditure and its composition: in periods of export upswings, government expenditures were boosted and so was government's current consumption and investment in infrastructure; the opposite occurred during export downswings.

* * *

With regard to the effectiveness of these transmission mechanisms, the extent to which such aggregate demand effects were matched by the growth of domestic production depended on two factors – the relative size of the non-tradable v. the tradable sector and changes in relative prices.

Although a clear-cut distinction between tradable and non-tradable sectors in pre-1930 Brazil is not feasible, it is well-known that a number of activities were highly protected from foreign competition by prohibitive costs of transportation, information and tariff rates (Leff, 1982; Catão, 1991). These include the production of staples such as beans, corn, manioc and rice, the service sector, government and part of industry. Back-of-the-envelope calculations thus indicate that 60% to 70% of Brazil's aggregate output was made up of non-tradable goods.[58]

In the case of these goods the expansion of aggregate demand had an unambiguously positive impact on production, irrespective of changes in the price of imports. The only constraint in this regard was the low elasticity of the domestic supply of agricultural staples – a well-documented phenomenon in 19th century Brazil (Ferreira Soares, 1977; Furtado, 1963; Leff, 1982). In fact, at the same time as the quantum of exports grew at a rate of 2.8% p.a. and imports at 2.7%, non-tradable prices were also rising at a rate of 2.1% p.a. between the early 1870s and the late 1920s. So, about three-quarters of the aggregate demand effect upon non-tradable production was offset by rising prices, the other quarter being met by the expansion of domestic production.

The impact of export growth on the tradable share of GDP, however, depended crucially on the behaviour of relative prices. The bulk of these activities consisted of manufacturing production, which faced direct competition from imports. In these circumstances, depending on how

competitive the final price of the domestic manufactures was relative to the imported similar product, aggregate demand effects of export expansion would leak abroad in the form of higher imports.

A measure of variations in the competitive power of the domestic producer is plotted in graph 11[59] This clearly shows that periods of export expansion, such as the early 1870s, the late 1880s, and the 1900s, were marked by a decline in the level of real protection for the domestic manufacturing industry. Not surprisingly, therefore, import substitution stagnated during those years, despite the high degree of 'natural protection' enjoyed by domestic industry. For instance, during 1870-1873, 1885-1893 and 1902-13, all sub-periods of rapid export expansion, import substitution expanded at the meagre rates of 1.6%, 2% and 2.4% per annum respectively, whereas between 1920 and 1929, in particular, import substitution was virtually brought to a halt.[60]

Only during the 1890s and World War I, when there was a significant improvement in relative prices for the manufacturing sector, did import substitution accelerate, having expanded at the impressive annual rates of 11% in 1893-1901 and 13% in 1913-18. Yet these years were marked by a slowdown of exports and hence of aggregate demand: rough estimates point to a fall of about 2% p.a. between 1893 and 1901 and to an expansion of only 1.4% during 1913-18.[61] So, the positive import substitution effect upon manufacturing production was *partly* constrained by a negative income effect during these sub-periods.

The upshot of this story, therefore, is that unfavourable relative prices during periods of export expansion constrained the Brazilian industrialisation to a considerable extent. The fact that industrial growth still thrived in spite of these relatively unfavourable price trends is due to a certain degree of 'natural' protection as well as a number of other factors which have been extensively discussed in the existing literature (Holloway, 1980; Leff, 1982; Suzigan, 1986). The main point of the above discussion should then be clear: export growth failed to promote more generalised industrialisation in Brazil during 1870-1930 not only because it was relatively slow and unstable but also due to the negative correlation between export expansion and the variations in the degree of real protection for the domestic manufacturing sector. Two main reasons are behind the phenomenon: firstly, the extreme dependence of exchange rate to variations in export earnings in a non-convertible paper money regime, where international reserves were too limited to stabilise the exchange rate;[62] secondly, the passive nature of commercial policy, which failed to counteract through tariff changes the relative decline in import prices. The first factor was beyond the government's control: it was due to both the structural asymmetries of the working of the international gold standard[63] and the volatile nature of coffee exports. The second factor was certainly within the reach of the government, though also under contraints of a political nature. Be

it as it may, the failure of export growth to foster industrialisation cannot by any means be attributed to excessive or misconceived policy intervention.

Graph 11

Sources: IBGE (1987) and Catão (1991).

Mexico

Mexico's case constitutes an interesting contrast with Brazil's in many respects. First of all, the degree of openness of the Mexican economy, although having increased during the Porfiriato, was still relatively low by 1910. During the 1910s the export ratio increased considerably, but even then was never as high as that of Brazil or of any other recent settlement country (table 15)

The forward linkages in Mexico were also of a different nature. The bulk of her exports (82% in 1870-1912, 60-75% in 1920-39) consisted of mining products – mainly silver, oil, copper and lead – which had major industrial applications. So, a case for the existence of potentially important forward *production* linkages has to be carefully considered.

The first category of forward linkages to be examined here is the development of smelting and refining plants to process the raw material. Although data on the share of the mineral production processed locally are not available until the 1929 production census, there exists ample qualitative evidence that the number of smelting plants grew rapidly after the 1880s (Nava Oteo, 1965, pp. 267-8). Yet it was during 1890-1929, when copper, lead and gold production moved onto a higher growth phase, that local melting and

refining plants proliferated (Bernstein, 1965, pp. 37-9, 49-56). Notwithstanding this, the aggregate impact of these developments on the domestic economy seems to have been much more limited than the above cited case studies suggest. First of all, not only mineral extraction but also melting and refining are both highly capital-intensive activities, so that they generate little employment opportunities.[64] Hence the share of the mining sector in GDP is so low – 3.0% in 1895, 4.7% in 1910 and 6.3% in 1929 (Solís, 1985, p. 79). Of the total 1929 mining output, about 5% was processed locally, which is equivalent to only 0.32% of the real GDP in that year.[65] Secondly, the development of these activities resulted not only from export growth *per se* but also from other autonomous forces under the form of railway expansion, the pull of US investment since the 1890s, and innovations such as the introduction of electricity, cyanidisation and the floating processes.[66] Thirdly, although production figures on processing activities are not available, the growth of local refining was constrained by the proximity of Mexico to the USA: in the period 1870-1900, before the mammoth refining plant of Monterrey was set up, Mexican lead smelters in the largest mineral producing states found it cheaper to send lead bullion by rail to Tampico and then by steamer to New York for refining (Bernstein, 1965, p. 40).[67] Fourthly, it has been shown that, because of the limited size of the domestic market for intermediate goods and because of technological indivisibilities,[68] mineral processing industries (such as the Monterrey foundry) often operated at well below 50% capacity (Haber, 1989, pp. 31-3). This precluded economies of scale, led to low productivity and hence to less output and employment.

With reference to oil, we have again the problem of a lack of data on the percentage share of the oil produced which was refined in Mexico. Yet there exists indirect evidence that the bulk of the oil extracted from Mexican fields during the 1900s and early 1910s was refined in the USA (Meyer, 1968, p. 32). Only from 1916 on, did the number of oil refining plants in Mexico grow substantially, as a result of both higher taxes on unrefined oil exports and rising production (*ibid.*). Such a rapid growth of domestic refining operations, together with rocketing oil exports and the slowdown of agricultural and manufacturing activities, led to a jump in the oil sector's share of GDP, from 0.2% in 1910 to 10.2% in 1921. Notwitstanding this, only about 30% of Mexico's oil production in the early 1920s was refined domestically[69] and, as late as 1929, oil refining actitivies accounted for a meagre 0.21% of GDP.[70]

The other type of forward linkage to be considered is the extent to which the domestic production of copper, lead and oil provided other sectors with low-cost inputs. In this respect, the evidence available also points to the relative unimportance of forward linkages. Silver, copper, lead, oil and henequen presented very high export/output ratios – all above 90% in the mid-1920s (Cárdenas, 1987, p. 25). Such ratios were higher before the 1920s and, in particular, during the revolution, when the domestic consumption of

intermediate goods decreased considerably. Before then, those ratios were even lower than in the 1920s due to the underdeveloped stage of the domestic producer goods industry, the main consumer of such inputs.[71]

The outcome, therefore, is that forward linkages of export activities in Mexico had an important macroeconomic impact only as regards oil exports during the 1910s and 1920s. The remaining mineral export activities, such as silver, copper and lead, had a negligible impact through the setting up of forward linkages throughout c.1870-1930. As for agricultural exports such as coffee and sisal, they were not used domestically as inputs for productive activities and had very high export/production ratios.[72] As such, no significant forward linkages were established through the export of these goods.

Turning to backward linkages, since mineral products employed highly capital intensive methods, the share of domestic labour force absorbed in the sector was minimal. This is clearly shown in table 19. Thus, the impact of mining workers' expenditures on total output was relatively unimportant.

Table 19
Mexico: Sectoral Distribution of the Labour Force (% of Total)

	1895	1930
Agriculture	66.5	68.7
Manufacturing	11.5	9.9
Commerce	16.0	16.4
Mining	1.8	1.0
Construction	2.3	1.9
Transport	1.6	1.9
Others	0.6	0.2
TOTAL	100.0	100.0

Source: Keesing (1969).

Secondly, the bulk of the mining and oil sectors' demand for producer goods was met by imports, for Mexico did not begin to produce oil pipes, drilling machinery and other sophisticated mining equipment until the 1940s. Only a small part of the intermediate inputs such as cement, dynamite and pig iron, began to be produced domestically from the 1900s on (Rosenzweig, 1965, pp. 318-35; Haber, 1989, pp. 27-43). Thus most of the increase in demand brought about by mineral exports leaked abroad.

This conclusion is reinforced when one notes the overwhelming foreign ownership of the mining sector. Given both the proximity of Mexico to the USA and the absence of exchange controls throughout 1870-1947, the macroeconomic importance of profit remittances was quite considerable. This is clearly shown in table 20. The most striking feature revealed in the latter is the relatively low share of commodity imports into total outflows when compared with Brazil (table 16).[73] In other words, a small proportion of the inflows associated with export earnings and foreign investment was absorbed domestically.

Table 20
Mexico: Structure of the Balance of Payments (% of Total Flows)

	1909-1910	1926	1940
TOTAL INFLOWS	100.0	100.0	100.0
Commodity exports	59.3	94.4	68.1
Gold coins and ingots	1.7	2.0	16.7
Tourism	1.6	0.3	4.6
Other	0.6	0.7	0.3
Long-term capital	26.8	2.3	10.1
Errors and omissions	–	0.3	0.2
TOTAL OUTFLOWS	100.0	100.0	100.0
Merchandise	53.9	52.1	60.2
Foreign debt service	7.7	3.6	0.9
Profit remittances	33.7	39.6	35.1
Transfers	4.4	2.4	0.9
Other	0.3	2.3	2.9

Source: Cárdenas (1987, p. 248-9).

Agricultural exports constitute another channel through which export fluctuations *might* have had a significant macroeconomic impact. This, however, seems not to have been the case either. First, the exported share of Mexico's agricultural output was not particularly large. During 1892-1908 exports accounted for 15% to 20% of total agricultural production (El Colegio de México, 1960b, p. 63),[74] then falling throughout the inter-war period: from 14.3% in 1925 and 15.5% in 1928-30, it declined to 10.5% in 1937-9.

Secondly, a substantial part of Mexico's land was owned by foreigners. The share in 1910 was 25.2%. It is true that, as a result of the land distribution policies following the revolution, foreign ownership fell to 16.2% in 1927 (Tannenbaum, 1968, p. 368). However, there exists evidence that foreign ownership was greater in the case of the land devoted to export crops such as

coffee and sugar (*ibid*). Since Americans accounted for about half of the foreign ownership of land in Mexico and given the proximity of the two countries, it is quite likely that these landlords remitted abroad a substantial part of their earnings stemming from agricultural exports. In short, although a dearth of empirical evidence on this matter prevents us from making a more definite statement, it seems plain that the share of the value of Mexico's agricultural exports returned locally was considerably lower than for Brazil.

As a third factor, one has to consider the consumption and investment propensities of Mexico's agriculturalists, since workers' demand was generally kept at a rather low level due to socio-economic influences operating throughout the pre-revolutionary period (Katz, 1974). Although general information on capitalists' expenditure habits is lacking for important sectors such as coffee and cotton, there exists valuable information on this issue concerning the henequen or sisal planter. Sisal was Mexico's most important agricultural export item before the 1930s (table 10). Moreover, the average return of investment in sisal was especially high: contemporary observers reported that during 1900-1910 it was no less than 50% and sometimes as high as 400% to 600% (Joseph, 1986, p. 57). Thus, the relevance of enquiring about the consumption and investment habits of sisal exporters is obvious.

In the first place, although the overwhelming majority of sisal planters were Mexican nationals, US engineers and technicians figured prominently in the operation of the most dynamic branches of Yucatán's economy, such as railways, telegraph, ports and public utilities (Baklanoff, 1980, p. 209). Moreover, because sisal cultivation was a large scale business, one which involved long production lags, it demanded large financial resources. Given the underdeveloped stage of the domestic capital markets, these resources had to come from abroad. Thus, dividends and amortisation payments were due. The foreign ownership factor as a cause of a high level of resources outflow certainly holds here.

Secondly, the commercialisation of the fibre was concentrated in the hands of a couple of foreign export houses throughout the 1870-1915 period. During 1902-1915, in particular, a single foreign house (International Harvest Company) had considerable control over the price of the fibre, thus reaping extra profits and remitting them abroad.[75]

Finally, the consumption habits of Mexico's henequen planters also seem to account for a substantial part of the leakage effect. In this respect, a description of their life-style is telling:

> 'Looking to the far-off capitals of the western world for inspiration and design, the prosperous *henequeneros* built ornate palaces with marble pillars, intricately carved façades, and ostentatious stained-glass enclosed porticoes. . . In addition to engaging in pleasant after-dinner conversation while sipping imported French

> wines on his shaded veranda, the henequen oligarch also spent considerable time keeping abreast of current stock quotations from the Paris *bourse* and dabbling in urban and rural real state' (Turner, *Barbarous Mexico*, as quoted in Wells, 1985, p. 61-2).

Such a vivid description clearly points to the high propensity to consume luxury goods and to the unproductive investment by the typical henequen exporter. Although Turner's view has been subject to the qualification that large henequen planters also branched out into railway building and banking connected with foreign trade (Wells, 1985, pp. 63-88), this does not affect the main point about the role of profits generated within the henequen sector, i.e., its failure to foster growth elsewhere in the economy and thus increase the value added of national output. Also, railways and foreign trade banking, besides being sectors with a very high import component and substantial foreign participation, did not contribute to import substitution and then to an eventual diversification of the domestic economy. The fact that the sisal producing state of Yucatán grew very fast between 1870 and 1910 and was by then one of the wealthiest states in the Republic (Baklanoff, 1980, p. 212), while today it is among the poorest and least industrialised, tells us a great deal about how the surplus derived from sisal exports was actually spent.

Having seen that the backward linkages of the Mexican export sector conspired against export-led growth, let us examine now the importance of the fiscal linkage. Hirschman (1981) has argued that in cases where the backward linkages of the export sector are negligible, the fiscal linkage is of outstanding importance. This is because the government has more room to tax the export sector when the latter is mainly made up of enclave industries. Hirschman's argument, however, does not fit the Mexican experience. As table 21 shows, the contribution of taxes on natural resources to total government revenues, although having risen in the post-revolution years, remained relatively low till the late 1930s.[76]

Besides the low level of direct taxation imposed on mining activities and low export taxes, across-the-board tariff exemptions were conceded on capital goods imports, the bulk of which consisted of purchases by the mining sector itself.[77] So, the total revenues generated by export activities via both direct and indirect taxation were very low indeed, contrary to what Hirschman's argument suggests. If we also consider that the value of imports was considerably smaller than the total export value, it is easy to see that overall public revenues in Mexico accounted for a relatively small share of GDP. This imposed limits upon the expansion of public expenditures throughout 1870-1930. As a result, the public expenditure percentage share of GDP was kept at a low level relative to other periphery countries. In fact, as table 22 shows, the public expenditure share of GDP in Mexico before the 1930s was distinctly low when compared with Brazil's (table 18).

Table 21
Mexico: Composition of Public Revenues (%)

	1876-7	1882-3	1890-91	1899-90	1905-6	1910-11	1925	1937
tm/T	46	57	55.0	44.0	45.0	44.0	24	23
tx/T	6	2	0.2	1.4	1.0	0.5	6	4
tnr/T	4	1	0.3	5.7	2.8	2.3	12	7
ti/T	–	–	–	8.4	8.5	8.0	11	20
to/T	44	40	44.5	48.9	42.7	38.8	47	43

tm = revenues from import taxes
tx = revenues from export taxes
tnr= revenues from taxation on natural-resource based activities
ti = revenues from consumption of industrial goods
to = revenues from other sources
T = total revenues

Sources: El Colegio de México (1960b, pp. 199, 201); INEGI (1986, p. 632).

With reference to the composition of public expenditures, the investment share was not particularly high before the 1920s (table 22). Neither was there a marked cyclical pattern as in the case of Brazil. In any case, even if public investment had a significant impact on export growth, the latter failed to be transmitted to the remaining sectors of the economy. Only the rapid rise of public investment between 1920 and 1940[78] appears to have had a very significant impact upon domestic output (Cárdenas, 1987, pp. 154-5). Yet since the bulk of these expenditures was financed through borrowing from the banking sector, through the issuing of government bonds and at the expense of administrative costs (*ibid.*, pp. 154-7), the type of fiscal linkage discussed above did not play any significant role here either.

Table 22
Mexico: Budgeted Federal Government Expenditures as a Share of GDP and the Share of Investment in Total Budgeted Government Expenditures (in %)[79]

	1883-84	1895-96	1900-01	1910-11	1925	1937
G/GDP	–	5.6	4.7	3.5	6.1	7.0
Ig/G	9.1	7.3	7.9	9.1	27.9	42.6

Source: INEGI (1986, pp. 311, 603-4, 627-8).

To sum up, the analysis of the size of the Mexican export sector as well as of its several possible linkages within the domestic economy suggests that the growth pattern of Mexican exports had a minor impact upon both employment and demand for domestically produced goods. Thus, it is *not* surprising that the long-term stability of Mexico's export growth during 1870-1912 was at variance with the domestic growth instability observed for production and investment indicators (Haber, 1989; Catão, 1991). The only important, albeit indirect, contribution of export expansion to macroeconomic growth was to provide other sectors, notably manufacturing, with foreign exchange to import the required amount of capital goods. Since the price of the latter would be exorbitant under autarky, a slow growth of exports could hamper the expansion of domestic output and thus lead to cyclical variations due to foreign exchange bottlenecks. In Mexico, this did not in fact occur because periods of rapid expansion of domestic output via import substitution, such as 1875-82 and 1891-1900 (Catão, 1991, ch. V), coincided with periods of rapid export growth.

Only in the 1920s, due to the rising weight of the export sector during the late 1900s and 1910s, did exports contribute in a significant way to the downswing in real GDP. In short, the failure of export-led growth in Mexico should be mainly attributed to the limited linkages of her export sector.

IV. Conclusions

This paper has shown that exports failed to promote generalised economic development in Brazil and Mexico for a number of different reasons. In the case of Brazil, the low growth trend and dramatic instability of her exports were associated with an extreme specialisation in a single export commodity, coffee. This is because the international demand for coffee grew slowly in comparison to other primary commodities during the period 1870-1930 while biological supply lags combined with a low price elasticity of supply generated cycles of 14 to 16 years length. In addition, a host of other domestic factors contributed to instability and lack of diversification in exports. Among these we find cases of market failure associated with compensatory exchange rate depreciation during periods of falling world coffee prices, the insufficient expansion of the domestic transportation network and the extreme dependence of both infrastructure investment and government finance on foreign investment. Therefore, any analysis which attributes the constraints of export-led growth in Brazil only to the international demand for primary products and the 'perverse' correlation between exports and foreign investment, in the spirit of the Prebish-ECLA view (e.g., Furtado, 1963), is one-sided. On the other hand, our analysis refutes claims that the market mechanism was efficient in stabilising export earnings before the post-1906 policy interventions (Delfim Netto, 1959).

Exports had a major impact on domestic output via aggregate demand and relative price effects. Aggregate demand effects stemmed from the substantial backward and fiscal linkages to the coffee sector. On this count, the impact on domestic output was positive but relatively limited due to the slow long-term growth of coffee exports. At the same time, exports had an important bearing on real exchange rate determination and hence on the level of real protection for domestic industry. On this count, the impact on output growth was ambiguous: it was certainly unfavourable during sub-periods of rapid export growth – when exchange rate appreciation led to a major fall in real protection – whilst it was clearly favourable over periods of export downswings. Over the cycle, however, the level of real protection failed to display a significant upward trend through 1870-1930. In this context, it is not surprising that pressing demand for state intervention arose. The fact that the form of state intervention which came to prevail later had major negative repercussions on X-efficiency should not offset, however, a simple truth – namely, that the free working of the export and foreign exchange markets had failed to promote rapid and stable economic growth in Brazil.

As regards Mexico, export-led growth failed for quite distinct reasons, which are largely ignored in the existing literature (Rosenzweig, 1960; Cardoso, 1980; Solís, 1985). Both the value and the quantum of Mexico's exports did not present any significant long-term fluctuations during 1870-1920 and, in fact, grew quite steadily when compared with other large primary producing economies such as Canada, Argentina and, especially, Brazil. The reasons for this phenomenon were then shown to be associated with both the diversified composition of Mexico's exports and the brisk international demand for mineral commodities abundantly available in the country. Moreover, a host of other domestic factors explain such a rapid export growth. Mexico operated a silver standard, so that the secular trend in the world price of silver from the 1870s onwards led to a corresponding exchange rate depreciation. This provided a major long-term boost to Mexico's exports. The rapid expansion of the railway services linking Mexico and its main export market (the USA), the worldwide rapid pace of technical progress in mining extraction and the dynamic role of US foreign capital further reinforced this trend. Only from the early 1920s onwards did the slowdown in the world demand for primary producing have an outstanding impact upon Mexico's exports, leading to a decline in their value and a stagnation of the exported volume.

However, I have shown that, in contrast with Brazil, the export sector in Mexico was quite small and had limited linkages with the rest of the economy. The enclave nature of the Mexican export sector implied that export growth had a very limited impact on the macroeconomy and on industrialisation in particular. Political economy constraints prevented the state from playing an effective role in re-distributing the benefits of the rapid expansion of exports.

To sum up, the failure of export-led growth in Brazil and Mexico cannot be simply attributed to asymmetries in international trade relations and to the instability of the world economy. On this ground, therefore, the argument for an interventionist policy with an anti-trade bias is weak. On the other hand, this paper has pointed out cases of market failures which prevented exports from being an efficient engine of growth in both countries. When left on their own, as they in fact were for most of the period, export markets fostered economic growth and industrialisation to only a very limited degree. This suggests that there was indeed much room for a *strategic* state intervention. This could have taken the form of a counter-cyclical tariff policy, higher taxes on enclave sectors and measures to foster export diversification towards products with greater domestic linkages. The fact that it did not happen is an open avenue for future research. In any case, these lessons from the pre-1930 development experience in Brazil and Mexico provide no support for straightforward views on the relationship between free trade, export expansion and overall economic growth.

Bibliography

1. PRIMARY SOURCES AND OFFICIAL PUBLICATIONS:

BRAZIL

Centro Industrial do Brasil. 1908-1909. *O Brasil. Suas Riquezas Naturais. Suas Indústrias*, Vols. II and III. Rio de Janeiro: Oficinas Gráficas M. Orosco.

Instituto Brasileiro de Geografia e Estatística (IBGE). 1941. *Séries Estatísticas Retrospectivas*, Vol. 1. Rio de Janeiro: IBGE.

Instituto Brasileiro de Geografia e Estatística (IBGE). 1987. *Estatísticas Históricas do Brasil*, Vol.3. Rio de Janeiro: IBGE.

Ministério da Agricultura, Indústria e Comércio. 1920. *Recenseamento do Brasil*. Rio de Janeiro: Imprensa Nacional.

Conjuntura Económica. 1949. 'O Novo Indice do Custo de Vida', Ano III, 3, pp. 6-8. Rio de Janeiro: Fundação Getúlio Vargas.

FRANCE

Direction Générale des Duanes et des Contributions Indirectes. 1870-1925. *Tableau Général du Commerce de la France*. Paris, Imprimérie Nationale.

MEXICO

Instituto Nacional de Estadística, Geografía e Informática (INEGI). 1986. *Estadísticas históricas de México*, Vols. I and II. Mexico: INEGI.

Secretaría de Economía Nacional, Dirección General de Estadística. 1933. *Primer Censo Industrial de 1930*. Mexico.

UNITED KINGDOM

Board of Trade. 1870-1906. *Monthly Accounts of the Trade of the United Kingdom with Foreign Countries and British Possessions*. London: HMSO.

Board of Trade. 1870-1925. *Annual Statement of the Trade of the United Kingdom with Foreign Countries and British Possessions*. London: HMSO.

UNITED STATES

Department of Commerce 1870-1925. *The Foreign Commerce and Navigation of the United States*. Washington, D.C.: Government Printing Office.

Department of Commerce, Tariff Commission. 1932. *Production Costs of Crude Petroleum and of Refined Petroleum Products*. Washington, D.C.: Government Printing Office.

Department of Commerce. 1975. *Historical Abstract of the United States. Bicentennial Edition*. Washington, D.C: Government Printing Office.

Department of Commerce and Labor. 1887-1940. *Statistical Abstract of the United States*. Washington, D.C.: Government Printing Office.

2. SECONDARY SOURCES:

Affonseca, L. 1919. *O Custo de Vida na Cidade do Rio de Janeiro*. Rio de Janeiro: Ministério da Agricultura.

Baklanoff, E.N. 1980. 'The Diversification Quest: a Monocrop Export Economy in Transition'. In: Moseley, E.H. and Terry, E.D. (eds.), *Yucatán: a World Apart*. Alabama: University of Alabama Press, pp. 202-44.

Balassa, B. 1981. *The Newly Industrializing Countries in the World Economy*. New York: Academic Press.

Barros, J.R.M. and Graham, D.A. 1981. 'A Recuperação Económica e a Desconcentração do Mercado da Indústria Téxtil Paulista durante a Grande Depressão: 1928/37', *Pesquisa e Planejamento Económico*, 11, pp. 79-106.

Bernstein, M.D. 1965. *The Mexican Mining Industry, 1890-1950: A Study of Interaction of Politics, Economics, and Technology*. New York: State University of New York.

Canabrava, A.P. 1951. *O Desenvolvimento da Cultura de Algodão na Província de São Paulo (1861-1875)*. São Paulo: Universidade de São Paulo.

Cárdenas, E. 1987. *La Industrialización Mexicana Durante la Gran Depresión*. Mexico: El Colegio de México. ['Mexico's Industrialization During the Great Depression: Public Policy and Private Response'. PhD dissertation, Yale University, 1982.]

Cárdenas, E. and Manns, C. 1987. 'Inflation and Monetary Stabilization in Mexico during the Revolution'. *Journal of Development Economics*, 27, pp. 375-94 .

Cardoso, C. (ed.) 1980. *México en el Siglo XIX (1921-1910). Historia Económica y de la Estructura Social.* Mexico: Editorial Nueva Imagen.

Cardoso de Mello, Z.M. 1985. *Metarmofoses da Riqueza. São Paulo, 1845-1895.* São Paulo: Hucitec.

Caves, R.E. 1966. 'Vent for Surplus Models of Trade and Growth'. In: Baldwin, R.S. et al. (eds.), *Trade, Growth and the Balance of Payments.* Amsterdam: North Holland Press.

Catão, L.A.V. 1991. 'The International Transmission of Long Cycles between 'Core' and 'Periphery' Economies: A Case Study of Brazil and Mexico, c.1870-1940', PhD dissertation, University of Cambridge.

Catão, L.A.V. 1992. 'A New Wholesale Price Index for Brazil during 1870-1913', *Revista Brasileira de Economia*, vol. 46, no. 4.

Christy, F.T. and Porter, N. 1962. *Trends in Natural Resource Commodities. Statistics of Price, Output, Foreign Trade and Employment in the United States, 1870-1957.* Baltimore: Johns Hopkins University Press.

Coatsworth, J.H. 1976. 'Anotaciones sobre la Producción de Alimentos durante el Porfiriato', *Historia Mexicana*, octubre-diciembre, pp. 167-87.

_____ 1981. *Growth Against Development – The Economic Impact of Railroads in Porfirian Mexico.* Illinois: Northern Illinois University Press.

Contador, C.R. and Haddad, C. 1975. 'Produto Real, Moeda e Preços: a Experiéncia Brasileira no Período 1861-1970'. *Revista Brasileira de Economia*, 36, pp. 407-40.

Cosío Villegas, D. (ed.) 1965. *Historia Moderna de México: El Porfiriato.* Mexico: Editorial Hermes.

Dean, W. 1969. *The Industrialization of São Paulo, 1880-1945.* Austin: University of Texas Press.

_____ 1976. *Rio Claro. A Brazilian Plantation System, 1820-1920.* Stanford: Stanford University Press.

_____ 1987. *Brazil and the Struggle for Rubber: A Study of Environmental History*. Cambridge: Cambridge University Press.

del Cueto, H. 1959. *Cuando el Peso Valía Más que el Dólar*. Mexico: Impresora Juan Pablos.

Delfim Netto, A. 1959. *O Problema do Café no Brasil*. São Paulo: IPE/USP.

Díaz-Alejandro, C.F. 1970. *Essays on the Economic History of the Argentine Republic*. New Haven: Yale University Press.

di Tella, G. and Zymelman, M. 1967. *Las Etapas del Desarollo Económico Argentino*. Buenos Aires: EUDEBA.

Dolado, J.J. and Jenkinson, T. 1987. 'Cointegration: a Survey of Recent Developments'. Applied Economics Discussion Paper no. 39, Oxford Institute of Economic and Statistics, Oxford.

Ducan, J.S. 1932. *Public and Private Operation of Railways in Brazil*. New York: Columbia University Press.

Eisenberg, P. 1974. *The Sugar Industry in Pernambuco, 1840-1910: Modernization without Change*. Berkeley: University of California Press.

El Colegio de México 1960a. *Estadísticas Económicas del Porfiriato. Comercio Exterior de México*. Mexico: El Colegio de México.

_____1960b. *Estadísticas Económicas del Porfiriato. Fuerza de Trabajo y Actividad Económica por Sectores*. Mexico: El Colegio de México.

Fanjzylber, F. 1990. *Unavoidable Industrial Reestructuring in Latin America*. Durham: Duke University Press.

Fausto, B. 1977. *Trabalho Urbano e Conflito Social*. São Paulo: DIFEL.

Ferreira Soares, S. 1977. *Notas sobre a Produção Agrícola e Carestia dos Géneros Alimentícios no Império do Brasil*. Rio de Janeiro: IPEA/INPES. First Published in 1860 under the same title by J. Villeneuve e Compania, Rio de Janeiro.

Fishlow, A. 1972. 'Origins and Consequences of Import Substitution in Brazil'. In: di Marco (ed.), *International Economics and Development. Essays in Honour of Raul Prebish*. New York: Academic Press, pp. 311- 65.

Ford, A.G. 1962. *The Gold Standard, 1880-1914: Britain and Argentina.* Oxford: Claredon Press.

Ford, D. 1978a. 'Commodity Market Modeling and the Simulation of Market Intervention: the Case of Coffee', In Adams, F.G. and Klein, S., *Stabilizing World Commodity Markets.* Lexington, Mass.: D.C. Heath & Co., pp. 35-62.

_____ 1978b. 'Simulation Analyses of Stabilization Policies in the International Coffee Market'. In Adams, F.G. and Behrman, J.R., *Econometric Modeling of World Commodity Policy.* Lexington, Mass.: D.C. Heath & Co., pp. 117-46.

Franco, G.H.B. 1983. *Reforma Monetaria e Instabilidade Durante a Transição Republicana.* Rio de Janeiro: BNDES.

_____ 1988. 'O Balanço de Pagamentos do Brasil, 1870-1896: Novas Estimativas', Texto para Discussão No.201, Departamento de Economia, Pontifícia Universidade Católica do Rio de Janeiro, Rio de Janeiro.

Fritsch, W. 1988. *Constraints on Brazilian Economic Policy, 1889-1930.* London: Macmillan.

Furtado, C. 1963. *The Economic Growth of Brazil: a Survey from Colonial to Modern Times.* Berkeley: University of California Press.

Goldsmith, R.W. 1986. *Brasil 1850-1984: Desenvolvimento Financeiro sob um Século de Inflação.* São Paulo: Harper & Row.

Gonçalves, R. 1982. 'Evolução das Relações Comerciais do Brasil com a Inglaterra: 1850-1913', Texto para Discussão nº1, Instituto de Economia Industrial, Universidade Federal do Rio de Janeiro, Rio de Janeiro.

Goodwin, R.M. 1947. 'Dynamic Coupling with Especial Reference to Markets Having Production Lags'. *Econometrica*, 15 (3), pp. 181-204.

Graham, D.H. 1973. 'Migração Estrangeira e a Questão da Oferta de Mão-de-Obra no Crescimento Económico Brasileiro - 1880-1930'. *Estudos Económicos*, 3, pp. 7-64.

Haddard, C.L.S. 1980. 'Crescimento Económico do Brasil, 1900-76'. In Neuhaus, P. (ed.) *Economia Brasileira: uma Visão Histórica.* Rio de Janeiro: Campos, pp. 21-43.

Haber, S.H. 1989. *Industry and Underdevelopment. The Industrialization of Mexico, 1890-1940.* Stanford: Stanford University Press.

Hall, M.M. 1969. 'The Origins of Mass Immigration in Brazil, 1871-1914'. PhD Dissertation, Columbia University.

Hirschman, A.O. 1958. *The Strategy of Economic Development*. New Haven: Yale University Press.

_____ 1981. 'A Generalized Linkage Approach to Development, with Special References to Staples'. In Hirschman, A. O., *Essays in Trespassing. Economics to Politics and Beyond*, pp. 59-97. Cambridge: Cambridge University Press.

Holloway, T.H. 1975. *The Brazilian Coffee Valorization of 1906. Regional Politics and Economic Dependence*. Wisconsin: The State Historical Society of Wisconsin.

_____ 1980. *Immigrants on the Land. Coffee and Society in São Paulo, 1886-1934*. Chapel Hill: University of Carolina Press.

Joseph, G.M. 1986. *Rediscovering the Past at Mexico's Periphery: Essays on the History of Modern Yucatán*. Alabama: University of Alabama Press.

Katz, F. 1974. 'Labour Conditions on Haciendas in Porfirian Mexico: Some Trends and Tendencies', *Hispanic American Historical Review*, 54 (1), pp. 1-47.

Keesing, D. B. 1969. Structural Change Early in Development: Mexico's Changing Industrial and Occupational Structure from 1895-1950, *Journal of Economic History*, pp. 716-38.

Kindleberger, C.P. 1986. *The World in Depression 1929-1939*. Berkeley: University of California Press.

Krauze, E., Meyer, J. and Reyes, C. 1977. *Historia de la Revolución Mexicana, 1924-1928. La Reconstrucción Económica*. Mexico: El Colegio de México.

Laërne, C.F. Van Delden. 1885. *Brazil and Java*. London: HMSO.

Lamb, H.H. 1982. *Climate, History and the Modern World*. London: Methuen

Leff, N. 1982. *Underdevelopment and Development in Brazil – Vol. I: Economic Structure and Change, 1822-1947*. London: George Allen & Unwin.

Lewis, C. (assisted by K.T. Schlotterbeck) 1938. *America's Stake in International Investments*. Washington, D.C.: Brookings Institution.

Lewis, W.A. 1949. *Economic Survey 1919-1939*. London: George Allen & Unwin.

_____ 1978. *Growth and Fluctuations 1870-1913*. London: George Allen & Unwin.

Maddison, A. 1982. *Phases of Capitalist Development*. Oxford: Oxford University Press.

Malan, P. et al. 1977. *Política Económica Externa e Industrialização no Brasil*. Rio de Janeiro: IPEA/INPES.

Martínez et al. 1976. 'Estadísticas Económicas de Siglo XIX', Cuadernos de Trabajo del Departamento de Investigaciones Históricas, INAH. Mexico. Mimeo.

Mattoon Jr., R.H. 1977. 'Railroads, Coffee and the Growth of Big Business in São Paulo: Brazil'. *Hispanic American Historical Review*, 57 (2), pp. 273-95.

Meyer, L. 1968. *México y Estados Unidos en el Conflicto Petrolero (1917-1942)*. Mexico: El Colegio de México.

Mitchell, B. R. 1983. *International Historical Statistics. Australasia and Americas*. London: Macmillan.

Nava Oteo, G. 1965. 'La Minería', In Cosío Villegas (ed.), op. cit., pp. 179-310.

_____ 1980. 'La Minería Bajo El Porfiriato'. In Cardoso (ed.), op.cit, pp. 339-79.

North, D. 1958. 'Ocean Freight Rates and Economic Development 1750-1913'. *Journal of Economic History*, XVIII (4), pp. 537-55.

Ocampo, J.A. 1990. 'New Economic Thinking in Latin America'. *Journal of Latin American Studies*, 22, pp. 169-182.

Palma, J.G. 1979. 'Growth and Structure of Chilean Manufacturing Industry from 1830 to 1935: Origin and Development of a Process of Industrialization in an Export Economy'. Unpublished PhD Dissertation, Oxford University.

Parikh, A. 1974. 'A Model of the World Coffee Economy: 1950-1968'. *Applied Economics*, 6, pp. 23-43.

Peláez, C. M. 1971. 'Análise Económica do Programa de Sustentação do Café – 1906-1945: Teoria, Política e Medição'. *Revista Brasileira de Economia*, pp. 5-211.

Pletcher, D.M. 1958. 'The Fall of Silver in Mexico, 1870-1910, and Its Effect on American Investments'. *Journal of Economic History*, XVIII, pp. 33-55.

Rosenzweig, F. 1960. 'Las Exportaciones Mexicanas de 1877 a 1911'. *El Trimestre Económico*, 108, pp. 394-413.

_____ 1965. 'El Comercio Exterior'. In Cosío Villegas (ed.), op.cit, pp. 635-729.

Rowe, J.W.F. 1932. *Studies in the Artificial Control of Raw Material Supplies: Brazilian Coffee*. London: the Executive Committee of London and Cambridge Economic Service.

_____ 1963. *The World's Coffee*. London: HMSO.

Sachs, J. 1985. 'External Debt and Macroeconomic Performance in Latin America and East Asia', *Brookings Papers on Economic Activity*, 2.

_____ 1989. 'New Approaches to the Latin America Debt Crisis'. Princeton Essays in International Finance, July.

Saes, F.A.M. 1986. *A Grande Empresa de Serviços Públicos na Economia Cafeeira, 1850-1930*. São Paulo: Hucitec.

Santos, R. 1980. *História Económica da Amazônia*. São Paulo: Hucitec.

Silber, S. 1977. 'Análise da Política Económico e do Comportamento da Economia Brasileira Durante o Período 1929/39'. In Versiani, F.R. & Barros, J.R.M. (eds.) *Formação Económica do Brasil*. São Paulo: Saraiva, pp. 173-207.

Solís, L. 1985. *La Realidad Económica Mexicana: Retrovisión y Perspectivas*. Mexico: Siglo Veintiuno.

Solomou, S. 1987. *Phases of Economic Growth 1850-1973: Kondratieff Waves and Kuznets Swings*. Cambridge: Cambridge University Press.

Spenser, D. 1984. 'Soconusco: The Formation of a Coffee Economy in Chiapas'. In Bejamin, T. and McNellie, W. (eds.) *Other Mexicos. Essays on Regional Mexican History, 1876-1911*, Albuquerque: University of New Mexico Press.

Stein, S.J. 1957. *The Brazilian Cotton Manufacture. Textile Enterprise in an Underdeveloped Area, 1850-1950.* Cambridge, Mass.: Harvard University Press.

Sunkel, O. (ed.) 1991. *Desarrollo desde Dentro. Un enfoque neo-estructuralista para Latinoamérica.* Mexico: Fondo de Cultura Económica.

Suzigan, W. 1986. *Indústria Brasileira. Origem e Desenvolvimento.* São Paulo: Brasiliense. ['Investment in the Manufacturing Industry in Brazil, 1869-1939'. PhD dissertation, University of London, 1984.]

Sweigart, J.E. 1980. 'Financing and Marketing Brazilian Export Agriculture: the Coffee Factors in Rio de Janeiro, 1850-1888', Unpublished PhD dissertation, University of Texas.

Taunay, A.E. 1939. *A História do Café no Brasil.* Rio de Janeiro: Departamento Nacional do Café.

Thorp, R. and Bertram, G. 1978. *Peru 1890-1977. Growth and Policy in an Open Economy.* New York: Columbia University Press.

Torres Gaytán, R. 1988. *Un Siglo de Devaluaciones del Peso Mexicano.* Mexico: Siglo Veintiuno.

Urquhart, M.C. and Buckley, K.A.H. 1965. *Historical Statistics of Canada.* Cambridge: Cambridge University Press.

Velasco Avila et al. 1988. *Estado y Minería en México (1767-1910).* Mexico D.F.: Fondo de Cultura Económica.

Versiani, F. R. 1979. 'Industrial Investment in an "Export" Economy: the Brazilian Experience before 1914', Working Paper 2, Institute of Latin American Studies, London.

Villela, A. and Suzigan, W. 1973. *Política do Governo e Crescimento da Economia Brasileira 1889-1945.* Rio de Janeiro: IPEA/INPES.

Watkins, M. 1963. 'A Staple Theory of Economic Growth'. *Canadian Journal of Economics and Political Science*, 29 (2), pp. 141-58.

Wellman, F.L. 1961. *Coffee: Botany, Cultivation and Utilization.* London: Leonard Hill.

Wells, A. 1985. *Yucatan's Gilded Age. Haciendas, Henequen and International Harvester, 1860-1915.* Albuquerque: University of New Mexico Press.

Wells, J. 1987. *Empleo en América Latina: una Búsqueda de Opciones.* Santiago, Chile: PREALC.

Wilkins, M. 1970. *The Emergence of the Multinational Enterprise: American Business Abroad from the Colonial Era to 1914.* Cambridge, Mass.: Harvard University Press.

Zabludowsky, J.H. 1984. 'Money, Foreign Indebtness and Export Performance in Porfirist Mexico'. Unpublished PhD Dissertation, Yale University.

Notes

1. Data on real per capita gross domestic product (GDP) for Brazil between 1870 and 1929 are from Contador and Haddad (1975). Note that the upper-bond figure of 1.2% is probably an overestimate since the Contador-Haddad data do not take into account the sluggish growth of the huge domestic non-tradable sector. The respective growth rate figure for Mexico refers to the period 1895-1929 and was computed with data from INEGI (1986).

2. An indicator of this is the share of labour force in manufacturing. By 1930, only 10% of the Mexican labour force was engaged in manufacturing whereas in Brazil the census of 1940 points to a share of 7.5% (Keesing, 1969; Goldsmith, 1986, p. 7). Note that a participation share of about 10% had been achieved in the US a century earlier (US Department of Commerce, 1975, p. 139). Another indicator of the limited industrialization in the two countries is the size of their capital goods industries. In Mexico, the domestic supply of capital goods accounted for only 5.7% of the value added of industry and met only 21.3% of the domestic demand for capital goods in 1929 (Cárdenas, 1987, p. 116). In Brazil, the respective figures are 4.9% of and 27%, according the census of 1939 (Fishlow, 1972, p. 334; Malan et al, 1977, p. 518).

3. There exist regional case studies about the production of certain export crops such as sugar in the state of Pernambuco (Eisenberg, 1974) and rubber in the Amazon (Santos, 1980; Dean, 1989), but they do not provide an extensive economic analysis of determinants of the exports of these commodities.

4. It can be shown that these variations are statistically significant (Catão, 1991).

5. All the long-term growth measures reported here are taken on a peak-to-peak basis, so as to be neutral to the business cycle in each country. The respective growth rates for Argentina's and Canada's exports were computed based on data from Lewis (1978) and Mitchell (1983). The figures for 1873-1913 are measured in gold, whereas the figures for 1913-28 are in US dollars. Argentina's exports were converted into US$ paper according to the paper peso-US$ parity provided in Diaz-Alejandro (1970, p. 484). Australian exports for 1873-1913 were not considered here due to the exclusion of western Australia in the official statistics prior to 1891 (see Mitchell, 1983, p. 616, fn. 30).

6. This was due to supply lags and compensatory movements in the exchange rate, as will be discussed in section II.1.

7. Argentine data from Díaz-Alejandro (1970, p. 5) and Di Tella and Zymelman (1967, p. 78). Figures for Canada are from Maddison (1982, pp. 248-50).

8. Due to a lack of data for some years in the 1870s, a continuous annual series on Mexico's exports is not available before 1878.

9. Such a continuity is also supported by t-tests which reject the existence of trend variations before 1913 (Catão, 1991).

10. Another standard measure of instability – the R^2 of regressing exports on an exponential trend – point to the same direction: such a R^2 for Mexico is 0.96, whereas the respective R^2s for Argentina, Canada and Brazil, stand at 0.95, 0.89 and 0.83.

11. In spite of the rapid rise of German and French demand for Brazilian coffee during 1870-1913, the US was absorbing nearly 60% of Brazil's coffee exports by the early 1900s (Brazil, 1908-9, p. 102).

12. For a detailed description of US output growth trends, see Solomou (1987, ch. 3).

13. For the case of the arabica species, the one most cultivated in the western hemisphere. In the case of the robusta variety, the supply lag is about two years. However, the robusta specie should not concern us since its worldwide consumption was unimportant before the 1940s (Ford, 1978.a, p. 38-9).

14. In fact, the longevity of the coffee tree varies across regions, depending on climate, soil conditions and treatment (Laërne, 1885, p. 293-6), but something like thirty to forty years is representative.

15. The choice of i=5 instead of i=4 as the starting point of the coffee tree production cycle was based on the inspection of the correlogram of the world coffee price during the period 1870-1913. A high correlation between p_t and p_{t-5} also shows up in Parikh (1974), dealing with the 1950-68 period.

16. Under the assumption of constant or slowly growing agricultural wages – as was the case in pre-World War II Brazil (Hall, 1969) – this function implies that investment is a function of profits.

17. More complex models of expectation formation could of course be devised but the simplicity of the assumption of static expectations outweighs possible gains in technical sophistication on this point. Our purpose here is to focus on the effects of biological production lags rather than on lags associated with the process of expectation formation.

18. The effect of tariffs upon the consumer price can be neglected. Since none of the core countries was a coffee producer, Brazilian coffee was imported free

of duty. As to Brazilian taxes on coffee exports, they were minimal and so need not be considered either.

19. Such a simplified assumption is adopted by Delfim Netto (1959, pp. 152-3). In a similar vein, econometric works dealing with the post-World War II period have represented the productivity curve of the coffee tree by an exponential trend (Ford, 1978a and b).

20. To see this algebraically, let Ao r^t (cos $w_0t + \varepsilon_0$) be the homogeneous solution of Equation 7 that represents oscillations of a long-swing periodicity and A_1 r^t (cos $w_1t + \varepsilon_1$) be the particular solution that describes the demand impulses stemming from the core countries. Beginning from the same starting point ($\varepsilon_0=\varepsilon_1$) and having the same periodicity ($w_0=w_1$), these cycles add to each other so as to give the final solution $r^t(A_0 + A_1)(\cos w_1t + \varepsilon_1)$, where $A_0= Pc_o/\cos \varepsilon_0$ and $A_1= Yo/\cos \varepsilon_1$. If the 'demand generated' cycle has a slightly different periodicity from the 'supply generated' cycle, e.g., one has a 18-year period and the other 15-year period, the resulting cycle will have a period between 15 and 18 years, depending on the relative amplitudes given by A_1 and A_2. Note that the resulting phase hinges on the assumption of the exogeneity of the fluctuations in the core countries' real income. Otherwise we would have a case of dynamic coupling (Goodwin, 1947; 1985). However, the exogeneity assumption is clearly warranted in our case, since world coffee output accounts for a rather small share of the world total production.

21. Estimated based on the FOB-CIF ratio of total Brazilian exports minus 2% relative to brokerage, commissions and insurance charges, as specified in Gonçalves (1982, pp. 43 and 50).

22. Whereas the coefficient of variation for coffee prices was 1.34 during 1870-1913, that of the freight ratio was 0.012.

23. According to Tauney's (1939, pp. 405-6) estimates, rail freights were six times lower than the rates charged by muleteers. No evidence on the price of coastal shipment services is available, but it was certainly much higher than that of railways. Given that as late as the mid-1900s transportation costs by rail from the coffee hinterland to one of the country's main port – Santos – averaged some 20% of the coffee FOB price (Brazil, 1908-09, pp. 91-92), it is clear that reduction in domestic transportation costs brought about by railways greatly increased the producers' profit margins.

24. Computed on data from Mitchell (1983).

25. Based on the following data sources: US real GDP from Maddison (1982, pp. 32-5), mil-réis/US$ exchange rate from Catão (1991, appendix IV), railway

mileage from IBGE (1987, p. 411) and US$ coffee price from Delfim-Netto (1959, pp. 245-6).

26. Here I am accepting the hypothesis that variations in US real GDP explains the world price of coffee at a statistical level between 5% and 10% (one-tailed test). This is in line with the growth rate evidence on the correlation between coffee price and US GDP over long-swing phases (table 7) as well as with the fact that when the US GDP variable is dropped from the above equation, the latter displays a lower adjusted R^2 and auto-correlation problems.

27. Data on the stock of coffee trees in Brazil's most important coffee state – São Paulo – are from Fritsch (1988, p. 184).

28. Furthermore, the coffee valorisation policies had two deleterious side-effects: first, that of distorting domestic relative prices, thus hindering export diversification; secondly, they stimulated overseas competition, thereby reducing Brazil's share in world coffee trade (Delfim Netto, 1959; Furtado, 1963).

29. On the causes of this slowdown, see Lewis (1949, pp. 149-56 and 184-6) and Kindleberger (1986, pp. 74-94).

30. As regards the effect of American tariff policies on Mexico's silver exports, they were nil before the McKinley tariff (1890) and even thereafter do not seem to have been significant either (Bernstein, 1965, p. 37).

31. During the 1920s, Mexico accounted for 35% to 45% of world silver production (del Cueto, 1959, p. 344). The USA was the second largest world producer. Her silver output rose from 1758 to 1893 cubic metres between 1920 and 1929, whereas Mexico's rose from 2069 to 3386m^3 over the same period (Mitchell, 1983, pp. 438-9).

32. Although the quantum of sisal exports appears to be highly correlated with the US agricultural output during 1870-1920 (r=0.94), the former presents a much higher coefficient of variation than the latter (29.8 v. 0.82). This suggests that the bulk of the imbalance between demand and supply was adjusted through price variations. If the period 1870-1940 is taken as whole, the respective coefficient of correlation falls to 0.75. This points to the existence of important structural changes in the demand for Mexican sisal during from World War I onwards, as will be discussed below.

33. Although Mexico had a monopolist position in the world market for henequen until World War I, her producers never managed to hold henequen off the market for a prolonged period so as to boost prices (Wells, 1985, p. 142). Wells (1985, pp. 50-55) finds some evidence that the increasing monopolistic control of the henequen trade by American importers after 1902 contributed to

the decline in henequen prices during the 1900s. However, this view has not gone unchallenged (Joseph, 1986: 90-1). In fact, the evidence presented above suggests that such a monopolistic control had a minor impact on henequen prices in comparison with other long-term influences, such as the rise in planting during the late 1890s, the effect of the Phillipines war in 1898-1902, and the downturn in US agricultural production between 1906 and 1912. To be sure, world henequen prices in US$ (not the price in pesos – which was subject to variations in Mexico's exchange rate) remained high until 1905, instead of declining after 1902, as suggested by Wells's analysis of monopolistic influences.

34. Only during 1897-1902 did long-term fluctuations in output and prices coincide. This was due to the effect of the Philippines War of 1898. The latter reduced dramatically the overseas supply of the manilla fibre – a close substitute for henequen, which led to an abnormal spurt in henequen prices.

35. There existed natural constraints to the development of other cultures in henequen producing areas: soils were rocky, with an almost total lack of surface water (Wells, 1985, p. 16). At the same time, minimum profits warranted by low land and labour costs stimulated the henequen planter to expand cultivation irrespective of the price of the fibre (Wells, 1985, pp. 64-65). This tendency was partly counteracted by the fall in foreign lending during periods of low henequen prices.

36. Both the lack of data on manilla prices and the smallness of the 1878-1914 sample for a cycle of 7 to 8 year length, has limited the use of econometrics here. In fact, a reduced form econometric estimation of henequen prices was attempted and although both US agricultural output and the domestic henequen price variables proved to be significant as expected, persistent first-order autocorrelation rendered such estimates invalid.

37. Insofar as the latter led to a reduction in the US grain production and exports.

38. Recent research has shown that, although revolutionary forces occupied the henequen state of Yucatán in 1915, this had little effect on the henequen business, which continued to prosper (Wells, 1985, pp. 67-88).

39. This is because the bulk of Mexico's coffee was raised in the southern state of Chiapas, far away from the revolutionary fighting that took place in Central Mexico.

40. The DW-statistics and the ADF-test for residual stationarity in this context are testing whether the two variables are co-integrated, i.e. whether they have common long-term trends. The DW statistics for both equations and the ADF

for the copper equation support the co-integration hypothesis at a 5% level, whereas the ADF-test for the lead equation support co-integration at a 10% level. For a more detailed discussion of the concept of co-integration, see Dolado and Jenkinson (1987). Since the price variables are exogenous (internationally determined by the price of lead, copper and the peso exchange rate), their respective coefficients can be interpreted as long-term elasticities. Estimation was limited to the pre-1915 years due to a lack of exchange rate data for the years 1915 and 1916.

41. The reasons for the phenomenon are as follows: i) copper and lead mines were located in Northern states, far from central Mexico, where the bulk of the revolutionary fighting took place; ii) any negative impact of the latter was probably offset by the sharp depreciation of the peso in the wake of the monetary disorder of 1914-17; iii) the revolution may even have contributed to enhance productive efficiency by eliminating small, less productive firms which, according to Bernstein (1965, p. 105), were the main victims of the fighting in the northern producing areas; iv) finally, a negative expectational effect upon new investment in the sector – so much stressed in the current literature (e.g. Solís, 1985) – does not appear to have been specially significant. This hypothesis is supported in the words of a director of a large US mining firm operating in Mexico during the period: 'Disorder consequently suits us; mining claims are cheap, competition scarce' (as quoted in Bernstein, 1965, p. 105).

42. By the 1937 peak the value of Mexico's oil exports was only one-fifth of its 1922 (peak) value. This corresponds to an annual geometric growth of -10.16%.

43. Contrasting with manufacturing and mining (Haber, 1989; Bernstein, 1965), the transport sector was adversely affected by the revolutionary disruptions and did not begin to grow again until the early 1920s (Cárdenas, 1982, pp. 159-60).

44. Rising taxation should also be discarded as a possible cause of this downturn. For the tax burden on the total value of oil production actually fell from 24.5% in 1922 to 12.2% in 1927 (based on data from Krauze et al, 1977, p. 242).

45. The so-called 'rate of return of exports'. It can be obtained by summing all the local expenditures of the export sector or by subtracting from exports the amount of imported inputs and profit/interest remittances. For an application of this concept to the cases of Peru and Chile, see Thorp and Bertham (1977) and Palma (1979), respectively.

46. Furtado (1963) recognises the importance of the backward linkages of the coffee sector in Brazil, but his analysis overlooks the linkages between export growth and domestic industrialisation before the 1930s and lacks more

supportive empirical evidence. More recently, some studies have drawn attention to the substantial positive impact of export growth on domestic industrial production (Dean, 1975; Suzigan, 1984), but without going into the microeconomics of this process. On Mexico, the only systematic analysis of the backward linkages of the export sector is due to Cárdenas (1987). His analysis is limited to the mid-1920s/early 1930s, so that it does not take into consideration structural changes in the composition of exports and in the backward linkages of the export sector before then. Moreover, an analysis of the backward linkages of the agricultural export sector is missing in his work and the importance of the fiscal linkage is exaggerated, as will be shown later.

47. Hirschman (1958) also emphasises the stimulus brought about by political or development strategies. These, however, do not concern us here for at least three reasons. First, because the size of the Brazilian and the Mexican state was relatively small during the period 1870-1930, only rising significantly after then. Secondly, policy-making in these countries was subject to severe fiscal and monetary constraints during the period, some of which will be pointed out later in this section. Thirdly, there exists a consensus in the literature that both Brazil and Mexico lacked a consistent industrial policy before the 1940s (Suzigan, 1986; Barros and Graham, 1981; Solís, 1985; Haber, 1989).

48. This includes cases where the processing operation is currently uneconomical but may eventually lead to economies of scale and then to lower costs.

49. A study of São Paulo coffee plantations in 1952 points out the dominance of cultivation and harvest methods being essentially the same as in the nineteenth century, with the hoe and the manual winnowing tray still being the standard implements (Holloway, 1980, p. 31).

50. The impact of employment in the coffee sector on the rest of the economy can be seen clearly when one notes that coffee accounted for about 25% to 45% of the value added in agriculture during 1900-29 (estimated based on Haddad, 1978, p. 56 and 154).

51. The frugality and the concern with accumulating savings of the immigrant worker were well emphasised by contemporary observers (Hall, 1969, p. 141; Holloway, 1980, p. 141).

52. With reference to the pre-1920 period, the share of land owned by Brazilian nationals in the country as a whole was probably higher. This is suggested by the land survey of 1904-5 for São Paulo. The latter, although it does not contain data on ownership by area of cultivated land, shows that 85.2% of all the rural properties in that state belonged to Brazilian nationals (Holloway, 1980, p. 149).

53. In Argentina, for example, most landlords appear to have lacked entrepreneurial spirit and showed little interest in industry. The bulk of their astronomic earnings stemming from the extraordinarily fertile land of the 'Pampas' was used up to finance imports of sophisticated consumption goods (Diáz-Alejandro, 1970, pp. 57, 158, 214-15). A similar story is told about Chilean agricultural exporters, with their 'natural disposition to rest, tranquility and luxury' (Palma, 1979, pp. 186-90).

54. Dean (1975, p. 37), for instance, notes that the largest industrial employer in São Paulo was the planter-owned Paulista Railroad. Its repair shops with 703 employees in 1896 made railway carriages and by 1911 entire locomotives were being assembled there, substituting imports.

The entrepreneurial spirit shown by the coffee planters was not exclusive to this sector, but also manifested itself in the activities of the cotton exporters in the 1860s and early 1870s (Canabrava, 1951; Stein, 1957, p. 22) as well as from the 1930s onwards (Peláez, 1971), when a dramatic shift in relative prices turned cotton growing into a highly profitable business. Yet in other coffee planting states, such as Minas and Rio, capital accumulated in coffee planting did not play a significant role in stimulating industrial ventures (Suzigan, 1986, pp. 132-3).

55. An illustration of the underdeveloped stage of the Brazilian manufacturing sector during the period is provided in Fishlow (1972). His computations indicate that, as late as 1919 and 1939, the domestic supply of capital goods accounted for only 1.5% and 4.2% of the domestic industrial output, respectively (Fishlow, 1972, p. 323 and 334).

56. How much of this demand was met by domestic production rather than by imports was a function of relative prices.

57. For estimates of the total investment/GDP ratio, see Goldsmith (1986, pp. 64, 88, 150-153).

58. This was computed using the 1919 agricultural census, Haddad's industrial production figures (1978, pp. 121-138) and estimates of the sectoral composition of the GDP for 1918-22 from Goldsmith (1986, p. 148). This share may be even higher for the pre-1900 period, but the absence of production data for the 19th century does not allow us to estimate it.

59. This measure consists of dividing the domestic price of imports (including the tariff surcharge) by an index of domestic wholesale prices, i.e., real protection = Pm*E (1+t)/Pw. Data on these variables are from IBGE (1987), Suzigan (1986) and Catão (1992), respectively.

60. See Catão (1991) for more extensive measures and details of measurement methods and their limitations.

61. Contador and Haddad (1975) and Haddad (1980).

62. For an extensive discussion of this point, see Furtado (1963), Versiani (1979), Franco (1983), and Catão (1991).

63. See Ford (1962) for a classic account of such asymmetries.

64. The high capital-intensive nature of the processing operation can be inferred from the following productivity figures: an average worker in extraction activities produced 777 constant pesos in 1900, whereas an average worker in processing activities produced 3,304 pesos. The respective figures for 1907 are 1,327 and 5,235 pesos, respectively (Nava Oteo, 1965, p. 271).

65. Based on census data from Mexico, Secretaría de Economía Nacional (1933, vol. III/2, p. 196).

66. Among these, the importance of the railway system appears to have been outstanding. As Bernstein (1965, p. 33) notes: 'Smelters are completely dependent upon the railroads. Large central plants were not constructed until after the railway network was completed'.

67. The processing of minerals such as copper and silver brings about a substantial reduction in their weight by removing impurities. Therefore, the closer the producer is to the consumer markets, the smaller the stimulus to process the mineral locally. In the case of Chile, for example, the relatively high transportation costs of shipping unrefined copper led to a considerable expansion of domestic foundries in the mid-nineteenth century (Palma, 1979, pp. 77-80).

68. Although in geographic terms Mexico is a large country, skewed income distribution and high transportation costs led to a segmentation of the domestic market for intermediate goods.

69. Computed with data from Krauze et al (1977).

70. Based on data from Mexico (1933, Secretaría de Economía Nacional, vol. 1, p. 12). GDP data from Solís (1985).

71. It has been shown that, besides the number of producer goods firms catering for the domestic market having been low, these firms tended to operate with high installed capacity/output ratios due to the very limited size of the domestic market (Haber, 1989, pp. 27-43). The mining industry, in particular, used domestically produced oil as fuel in very limited amounts (Nava Oteo,

1965, p. 293). Only in the late 1930s, did the rapid growth of domestic manufacturing and the nationalisation of the oil sector both lead to a considerable part of Mexico's mineral and oil production being diverted to domestic industry, possibly allowing them to have a more significant impact on the latter. There does not exist supportive evidence on the magnitude of this link.

72. 78% and 90%, respectively, in the mid-1920s (Cárdenas, 1987, p. 25).

73. Except for 1930 due to the severity of the impact of the 1929 crisis upon Brazil's capacity to import and foreign capital inflows.

74. These estimates exclude cattle production and exports. If the latter are taken into account, such a share is 19.4% for 1899-1900 and 27.5% for 1904-05. Data on agricultural crops for the periods before 1892 and 1908-1920 are missing, except for an estimate of agricultural output in the 1877-78 fiscal year which is quite unreliable (Coatsworth, 1976).

75. Although the precise extent of the market control by International Harvester during 1902-1915 is debatable (Joseph, 1986, pp. 81-91), it was certainly large enough for this firm to be able to reap bulky extra-profits.

76. In this sense, Cárdenas's emphasis (1987, ch. 1) on the macroeconomic importance of this sort of fiscal linkage from the 1920s onwards is misleading. His argument is based on the share of the petroleum industry's surplus taken by the government via direct taxation, when the relevant indicator is the relative contribution of taxation on mineral activities to overall government revenues.

77. Ministerio del Fomento, 'Tariff Laws of Mexico'; several years.

78. Averaging 7.7% per annum between 1925 and 1940.

79. Leakages associated with public foreign debt service are not discount due to the lack of data on this count. However, until 1886 and for most of the 1910-1937 period, these leakages were non-existent since the country's foreign debt repayment was in arrears.

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