The Economic Journal, **110** (*April*), 456–483. © Royal Economic Society 2000. Published by Blackwell Publishers, 108 Cowley Road, Oxford OX4 1JF, UK and 350 Main Street, Malden, MA 02148, USA.

TARIFFS AND GROWTH IN THE LATE 19TH CENTURY*

Kevin H. O'Rourke

The paper estimates the correlation between tariffs and economic growth in the late 19th century, in the context of three types of growth equation: unconditional convergence equations; conditional convergence equations; and factor accumulation models. It does so for a panel of ten countries between 1875 and 1914. Tariffs were positively correlated with growth in these countries during this period.

Economic theory is ambiguous as regards the relationship between trade policy and growth. The growth literature of the past decade has produced an impressive array of models in which protection can either increase or reduce long run growth rates (Grossman and Helpman, 1991; Rivera-Batiz and Romer, 1991; Stokey, 1991; Young, 1991). Such theoretical ambiguity invites empirical research.

While new growth theory is ambiguous on the subject, the new empirical growth literature has produced a consensus that free trade is positively associated with growth, based on evidence from the late 20th century (but see Rodríguez and Rodrik (1999) for a sceptical review of the literature). The clear message which emerges from cross-country studies such as Harrison (1996), Lee (1993) and Sachs and Warner (1995) is that protection has slowed growth in the late 20th century; a conclusion bolstered by more detailed studies of countries, or entire regions such as Latin America, which have experimented with import-substitution policies (e.g. Taylor, 1998).

However, what is true of the late 20th century is not necessarily true of earlier periods. Theory identifies off-setting effects of protection on the growth rate, which leaves open the possibility that different effects may predominate in different epochs. In a recent paper, Vamvakidis (1997) has introduced a note of historical caution into the literature, finding that correlations between trade and growth do indeed differ between periods. In particular, while he confirms that a positive correlation between openness and growth characterised the twenty years between 1970 and 1990, there was no such correlation in the 1950s and 1960s. Moreover, the correlation between tariffs and growth was *positive* in the 1930s. Vamvakidis argues that individual countries could have benefited from protection in a decade when unemployment was high, and other countries were already adopting protection.

The late 19th century is a period to which proponents of protection have

* I am particularly grateful to Kevin Denny, Anthony Murphy and Jeff Williamson for many helpful discussions, and to Chris Hanes and Cormac Ó Gráda for extensive comments on an earlier draft; I also thank Bill Collins, Giovanni Federico, Evanna McGilligan of the Canadian Embassy in Dublin, Ian McLean, Michael Roche of the Australian Embassy in Dublin and Alan Taylor for making data available to me; and Bill Collins, Colm Harmon, Morgan Kelly, Elhanan Helpman, Alan Taylor, Athanasios Vamvakidis, two anonymous referees and seminar participants at Harvard and Yale for helpful comments. The usual disclaimer applies.

often pointed as offering evidence in support of their position. In particular, the United States and Germany both adopted protectionist policies, and experienced strong growth, arguably linked to the development of infant industries behind high tariff barriers. Surprisingly, however, there have been relatively few quantitative cross-country studies of the effects of protection on growth in this period; while those which do exist have typically relied upon fairly crude correlation analysis.

This paper goes further, by estimating the correlation between tariffs and growth in the late 19th century in the context of three types of growth equation: unconditional convergence equations; conditional convergence equations, associated with Mankiw *et al.* (1992); and factor accumulation models of the type estimated by Taylor (1996). The analysis uses data for ten developed countries between 1875 and 1913: Australia, Canada, Denmark, France, Germany, Italy, Norway, Sweden, the United Kingdom, and the United States. While there are inevitably problems with some of these data, hopefully the method represents an advance on earlier work in this area. The findings are quite robust, and may come as a surprise to some.

Section 1 recalls the main features of late 19th century tariff policy in the ten countries considered here. Section 2 reviews the literature on late 19th century tariffs and growth, while Section 3 presents empirical evidence on the link between the two. Section 4 tries to interpret this evidence in the light of the existing historical literature, while Section 5 concludes with some qualifications and suggestions for future research.

1. Late 19th Century Tariff Policies

The evolution of European trade policies between 1860 and 1913 is well known.[1] The Franco-British trade agreement of 1860 initiated a wave of commercial treaties involving all the main European powers. The inclusion of the most-favoured-nation clause into these treaties ensured that concessions were rapidly generalised, and Europe moved swiftly towards free trade. The turning point came in the late 1870s and 1880s, when cheap New World and Russian grain flooded Europe (Kindleberger, 1951; O'Rourke, 1997). Not surprisingly, this undermined agricultural support for free trade, although in several countries (e.g. Sweden) cleavages emerged between smaller, grain-using farmers specialising in animal husbandry, and larger, grain-producing farmers. Moreover, agricultural protection often triggered a reversion towards industrial protection. Thus, in Germany, where rye-producing Junkers were powerful, Bismark's 1879 'marriage of iron and rye' afforded protection to both agriculture and industry. In France, the protectionist breakthrough is typically taken to be the *Méline* tariff of 1892; Italy introduced moderate tariffs in 1878, and rather more severe tariffs in 1887 (Federico and Tena, 1998);

[1] This section draws on O'Rourke and Williamson (1999, ch. 6), who in turn largely follow Bairoch (1989), the standard reference on the topic.

Sweden adopted agricultural protection in 1888, much earlier than Norway, where farm sizes tended to be smaller than in Sweden, and export interests (shipping, timber and fishing) were politically powerful.

Of the major Western European powers, only Britain adhered to free trade principles, which may reflect the diminished role and political clout of agriculture in the first industrial nation. Denmark, as is well known, also adhered to free trade in agriculture throughout the grain invasion, engaging in a radical structural adjustment in the process. Whether this Danish response was due to the size distribution of farms, a high degree of social cohesion, the German defeat of 1864, or other factors, remains a topic of considerable interest (Kindleberger, 1951).

In Europe, therefore, protection was in the first instance agricultural, although industrial protection followed in several countries, and the net impact on the allocation of resources between town and country remains to be determined. In the New World, no such ambiguity as to protection's overall sectoral impact exists: the regions of recent settlement were agricultural exporters. Thus, their tariffs were designed to provide 'infant' industries with protection from European competition. In the United States, the Civil War brought about a large increase in tariffs, as part of the attempt to finance the war effort. After the War, tariffs remained high, a result not only of Republican domination of Congress, but also of the combination of specific duties and falling import prices between the 1870s and 1890s (Irwin, 1998). Canada also chose to protect its manufacturing industries, especially after 1878, when the Conservatives were elected on a 'National Policy' platform aiming 'to select for higher rates of duty those [goods] that are manufactured or can be manufactured in the country'.[2] In Australia, finally, some colonies opted for protection (e.g. Victoria), while others (e.g. New South Wales) opted for free trade. By 1893, after a succession of tariff increases, the maximum Victoria tariff rates stood at 45% (Siriwardana, 1991, p. 47). The first federal tariff of 1902 was a compromise between protectionist and free-trading colonies, but federal protection was greatly strengthened in 1906 and 1908.

2. Late 19th Century Tariffs and Growth: Sources and Methods

Over the last twenty years, a greater range of national accounts data has become available to economic historians seeking to explore the correlation between tariffs and growth. This paper exploits those data, as summarised in Angus Maddison's most recent book on the subject (Maddison, 1995). In conjunction with national sources, Maddison's data make it possible to estimate conventional growth equations using PPP-adjusted GDP data that are consistent across countries and across time.

Previous authors had to make do with country-specific national accounts data, that have in some cases been superseded by more recent estimates. The best known investigation of the link between tariffs and growth in the late 19th

[2] Leonard Tilley, the new Finance Minister, speaking in 1879 (cited in McDiarmid, 1946, p. 161).

century probably remains Bairoch (1972), updated and expanded as Bairoch (1976), and summarised in Bairoch (1993). His strategy was to compare aggregate growth rates in free trade and protectionist periods, for the major European countries. For example, using the work of Marczewski, Toutain, Lévy-Leboyer and Crouzet, he examined the growth rates of French agricultural, industrial and total output in the free trade era of 1860–91, as compared with the protectionist periods 1824–59 and 1892–1913. Sectoral and aggregate growth rates were lower during the free trade period, and especially the growth rate of agricultural output. Moreover, innovation was if anything slower during the free trade period: Bairoch's conclusion was that free trade was bad for French growth.

Broadly speaking, the same picture emerged when Bairoch examined other Continental countries, although there were important exceptions (most notably, German industrial and aggregate output grew *more* rapidly during the liberal period, defined for that country as 1862–79). On the other hand, the leading European economy, Britain, did relatively well during the 1860s and 1870s: for Bairoch, liberalism was associated with divergence, not convergence.

Bairoch's pioneering work can be criticised on several grounds. First, the method relies on a *post hoc ergo propter hoc* logic: differences in growth rates between periods are ascribed to differences in trade regimes, when other factors might have been important. Second, the method requires deciding what constituted the 'free trade' and 'protectionist' eras in different European countries. This is not always obvious; for example, Bairoch takes the *Méline* tariff of 1892 as marking the end of the 'liberal interlude' in France, although wheat duties were raised significantly in 1885 and 1887. Different starting and end points for the liberal period, which inevitably reflect an element of judgement, would produce different growth rates.

The second comparative, quantitative study of which I am aware is Capie (1983), whose results are summarised in a later survey (Capie, 1994). Capie argues that there is no evidence that tariffs boosted growth in late 19th century Europe. First, average tariffs (i.e. the ratio of customs duties to total imports) were fairly low in all countries bar Russia, and there was not much variation in tariffs across countries. 'Protection does not appear to have been sufficiently high to make any significant impact on performance' (Capie, 1983, p. 9). Second, simple country-by-country regressions of growth rates on tariffs, using annual data from Germany, Italy, the United Kingdom and Russia, found no relationship between tariffs and growth.

Vamvakidis (1997) finds little or no relationship between tariffs and growth between 1870 and 1910, in a simple bivariate framework. However, he does find that the Spearman rank correlation coefficient (which eliminates the influence of extreme observations) between average tariffs and growth, using decade averages for 11 countries, is positive: 0.345, with a t-statistic of 2.438.

Finally, Foreman-Peck (1995) uses decadal data for an unbalanced panel of up to 18 European countries between 1860 and 1910, to estimate an 'eclectic' model of the level (rather than the growth rate) of output per capita, expressed as a system of equations. His reduced form estimates indicate that average tariffs were negatively related to output per capita; structural equations suggest that the result is due to the fact that output per capita was negatively related to agriculture's share of employment, and that the latter variable was positively related to tariffs. Foreman-Peck's interpretation is that tariffs were biassed towards (low-productivity) agriculture, of which more later; an alternative interpretation is that the grain invasion provoked higher tariffs in more agricultural economies (O'Rourke, 1997).

This paper aims to improve on previous studies, in three ways. First, unlike Bairoch and Capie, I use Maddison's (1995) PPP-adjusted GDP data.[3] Second, unlike Bairoch, Capie and Vamvakidis, I control for the other forces that theory says should affect growth when estimating the impact of protection.[4] Third, the growth equations estimated here are more directly comparable with the late 20th century literature cited in the introduction, than are Foreman-Peck's output level equations.

3. Tariffs and Growth: Some Cross-country Evidence

My data set covers ten countries, three in the New World (Australia, Canada and the United States) and seven in Europe (Denmark, France, Germany, Italy, Norway, Sweden and the United Kingdom). For each country, I have data on real GDP, the GDP deflator, population, agricultural land endowments, the share of agricultural output in GDP, school enrollments, investment rates, imports as a share of GDP, tariff rates, and coal consumption. The data cover the period 1875–1914, and are expressed as 5-yearly averages.

Working with late nineteenth century data naturally necessitates compromises. Theory suggests that I should be examining the behaviour of GDP per worker, not per head of population, but labour force data are not available for all countries on an annual basis. School enrollment rates are simply the total number of pupils in primary and secondary schools, divided by the total population: cohort-specific enrollment rates would clearly be preferable. When I run factor accumulation models, in which the growth of GDP per head is related to the growth in endowments per head, I am forced to use coal consumption as a proxy for the capital stock, since the latter are unavailable (following Collins *et al.*, 1997 and Vamvakidis, 1997). This short cut does at least have a venerable pedigree: see Landes (1969, p. 293). As in previous studies, average tariffs are simply defined as the ratio of customs duties to total imports, of which more below. When estimating land endowments and enrollment rates, I am occasionally forced to rely on interpolation where data are missing. Appendix 1 provides the details.

Table 1 gives the raw data on tariffs, while Table 2 reports regressions of

[3] Foreman-Peck and Vamvakidis used earlier versions of the Maddison data, for example that given in Maddison (1991).

[4] In common with the late 20th century literature, I simply enter my measure of protection as an additional explanatory variable, and am thus estimating a reduced form relationship between protection and growth. However, this paper speculates at some length (in Section 4) about the possible mechanisms that might have linked tariffs and growth in the late 19th century.

Table 1
Average Tariffs, 1875–1914
(Percent)

	1875–9	1880–4	1885–9	1890–4	1895–9	1900–4	1905–9	1910–4	Average
Australia	9.7	9.2	10.7	12.8	14.2	19.0	19.7	19.0	14.3
Canada	15.7	16.9	18.1	19.0	19.5	19.3	19.3	19.5	18.4
Denmark	11.9	11.6	12.6	9.2	9.0	8.1	6.8	5.0	9.3
France	5.2	6.0	7.9	9.7	10.4	8.6	8.5	8.9	8.2
Germany	3.7	6.1	8.2	8.9	9.3	8.4	7.6	7.0	7.4
Italy	7.9	8.3	9.0	9.6	10.2	10.8	11.7	11.7	9.9
Norway	10.2	12.6	11.1	11.2	11.6	11.7	11.5	12.8	11.6
Sweden	9.7	10.5	10.7	10.7	11.4	10.7	9.5	8.4	10.2
UK	5.3	4.8	5.3	4.8	4.8	6.1	5.3	4.8	5.1
USA	29.4	29.1	29.9	23.5	22.7	26.8	23.0	18.3	25.4
Average	10.9	11.5	12.4	11.9	12.3	13.0	12.3	11.5	12.0

Source: see Appendix 1.

Table 2
Tariff Levels Across Countries and Time
(Dependent variable is average tariff)

Variable	Coefficient	t-Statistic
C	0.120	44.776
*D*1877	−0.011	−1.558
*D*1882	−0.005	−0.652
*D*1887	0.004	0.550
*D*1892	−0.000	−0.046
*D*1897	0.003	0.485
*D*1902	0.010	1.393
*D*1907	0.003	0.434
*D*1912	−0.004	
DAUS	0.023	2.889
DC	0.065	8.047
DDK	−0.027	−3.379
DF	−0.038	−4.749
DG	−0.046	−5.686
DI	−0.021	−2.587
DN	−0.004	−0.487
DS	−0.018	−2.214
DUK	−0.068	−8.510
DUS	0.134	
No. of observations	80	
R-squared	0.879	
Adjusted R-squared	0.848	
S.E. of regression	0.024	
F-statistic	28.570	
Prob(F-statistic)	0.000	
Mean of dependent variable	0.120	
S.D. of dependent variable	0.061	
Sum of squared residuals	0.036	
Durbin-Watson statistic	0.767	

Note: coefficient on *D*1912 constrained to be equal to minus the sum of the coefficients on *D*1877 to *D*1907 inclusive. Coefficient on *DUS* constrained to be equal to minus the sum of the coefficients on *DAUS* to *DUK* inclusive. Estimation: OLS. For variable definitions, see Table 5.

tariffs on country and time dummies. As expected, the tables show that tariffs were highest in the United States, and lowest in the United Kingdom, with tariffs also being high in Australia (I use the Victorian tariffs) and Canada. Continental European countries all have average tariff rates somewhere in between these two extremes, with Scandinavian (and, in particular, Danish) tariffs being surprisingly high, and German tariffs being surprisingly low. The general increase in tariff levels in the 1880s is also apparent from the tables.

There are several problems associated with this average tariff measure. First, there is a well-known index number problem: as protection on a particular commodity increases, the weight of that commodity in the overall tariff index declines. In the extreme case of a prohibitive tariff, the weight would drop to zero. Second, and perhaps more importantly during this period, many tariffs were raised for revenue purposes, and were not necessarily directly protective: British duties on tobacco, for example. If these revenue duties were not included, British and Danish average tariffs would be much lower (Irwin, 1993). On the other hand, even revenue tariffs will have a general equilibrium impact of some sort in an open economy.

Despite the impact of revenue tariffs on average customs duties, many features of Table 1 correspond with what we know about the tariff history of the period, in particular the high United States and low United Kingdom tariffs (although the British index for 1875–9 is slightly higher than that for France, mirroring the debate between Nye (1991) and Irwin (1993)). Even features of Table 1 that seem surprising are often compatible with other evidence on relative protection levels in the late 19th century. Table 3, taken from O'Rourke and Williamson (1997), summarises various measures of protection in 1875 and 1913. First, there are Bairoch's (1989) estimates of tariffs on wheat. Second, there are several average tariffs, computed using a variety of weights, for both manufacturing and the economy as a whole. These were computed by the League of Nations in 1927, by H. Liepmann in his classic *Tariff Levels and the Economic Unity of Europe* (1938), and by Bairoch himself. Third, I report the estimates of sectoral and overall protection calculated by Estevadeordal (1997). Estevadeordal estimated a model predicting trade flows for eighteen countries in 1913.[5] He then constructed two measures of 'openness' based on the difference between countries' predicted and actual trade intensity ratios. Table 3 indicates where individual countries ranked among Estevadeordal's eighteen nations in terms of their openness (the most open being ranked 1, and the most protected being ranked 18).

These scholars also found, for example, that protection for manufacturing (although not overall protection) was higher in Denmark than in Germany: Denmark's free trade reputation is due to its refusal to protect agriculture. Contrary to popular opinion, Germany was not particularly protectionist within the context of Continental Europe, and indeed neither was Italy (Federico and Tena, 1998). The data in Table 1 are therefore not wildly out of line with

[5] Countries in the Estevadeordal sample were: Argentina, Australia, Austria-Hungary, Belgium, Canada, Denmark, Finland, France, Germany, Italy, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, the United Kingdom, and the United States.

Table 3
European Tariffs 1875–1913

Manufacturing					
Country	1875 (%)	1913 (1) (%)	1913 (2) (%)	1913 (3) (rank)	1913 (4) (rank)
Denmark	15-20	14	n.a.	16	14
Norway	2-4	n.a.	n.a.	8	8
Sweden	3-5	20	25	5	6
Italy	8-10	18	20	15	17
UK	0	0	0	4	5
France	12-15	20	21	12	12
Germany	4-6	13	13	6	3

Agriculture			
Country	Wheat 1913 (%)	All Agriculture 1913 (1) (rank)	All Agriculture 1913 (2) (rank)
Denmark	0	1	1
Norway	4	16	13
Sweden	28	7	8
Italy	40	12	16
UK	0	4	2
France	38	10	12
Germany	36	6	6

Overall					
Country	Overall 1913 (1) (%)	Overall 1913 (2) (%)	Overall 1913 (3) (%)	Overall 1913 (4) (rank)	Overall 1913 (5) (rank)
Denmark	6	9	n.a.	2	4
Norway	11	n.a.	n.a.	11	12
Sweden	9	16	28	7	7
Italy	10	17	25	16	17
UK	6	0	0	3	3
France	9	18	24	14	14
Germany	8	12	17	8	8

Notes:
Manufacturing 1875: average levels of duties on manufactured products in 1875, from Bairoch (1989), Table 5, p. 42.
Manufacturing 1913 (1): League of Nations estimate, as reported in Bairoch (1989), Table 9, p. 76.
Manufacturing 1913 (2): Liepmann (1938) estimate, as reported in Bairoch (1989), Table 9, p. 76.
Manufacturing 1913 (3): rank among 18 countries (1 = least protectionist, 18 = most protectionist), based on the adjusted trade intensity ratios in Estevadeordal (1997), Table 6, p. 104.
Manufacturing 1913 (4): rank among 18 countries (1 = least protectionist, 18 = most protectionist), based on the openness measures in Estevadeordal (1997), Table 6, p. 105.
Wheat 1913: levels of duties on wheat, calculated by Bairoch (1989), Table 9, p. 76.
Agriculture 1913 (1): rank among 18 countries (1 = least protectionist, 18 = most protectionist), based on the adjusted trade intensity ratios in Estevadeordal (1997), Table 6, p. 104.
Agriculture 1913 (2): rank among 18 countries (1 = least protectionist, 18 = most protectionist), based on the openness measures in Estevadeordal (1997), Table 6, p. 105.
Overall 1913 (1): import duties as % of special total imports (1909–1913), calculated by Bairoch (1989), Table 9, p. 76.
Overall 1913 (2): League of Nations estimate, as reported in Bairoch (1989), Table 9, p. 76.
Overall 1913 (3): Liepmann (1938) estimate, as reported in Bairoch (1989), Table 9, p. 76.
Overall 1913 (4): rank among 18 countries (1 = least protectionist, 18 = most protectionist), based on the adjusted trade intensity ratios in Estevadeordal (1997), Table 8, p. 107.
Overall 1913 (5): rank among 18 countries (1 = least protectionist, 18 = most protectionist), based on the openness measures in Estevadeordal (1997), Table 8, p. 107.

what other sources suggest. However, there remains the possibility that revenue tariffs were more important in some countries than in others. It will therefore be important to check that econometric results are robust to the inclusion of country-specific fixed effects.

Table 4 gives average annual per capita growth rates between successive 5-year periods. Canada, Denmark and the United States experienced relatively rapid growth, while British growth was somewhat below par, and Australia performed poorly.

Since I am using five-year averages, and there are eight five-year periods between 1875 and 1914, there are seven periods of growth to be explained. I thus have 70 observations. (For a good justification of using panel data in this context, see Harrison (1996).) Unless otherwise stated, the dependent variable is the average annual growth rate of output per capita.

Table 6 explores the impact of tariffs on growth in the context of an unconditional convergence model, with per-capita growth being related to the initial income per capita. (Table 5 provides a list of variable names used in subsequent tables.) There is little evidence of unconditional beta-convergence for this ten-country sample: the coefficient on initial income in (1) is very small, albeit negative, and insignificant at conventional levels.[6] Adding the log of the (initial) average tariff improves the fit of the equation somewhat; the coefficient on the tariff variable in (2) is positive, at 0.746, and significant at conventional levels. The coefficient implies that a 10% increase in the tariff

Table 4

Growth Rates, 1875–1914

(Percent per annum)

	1875–9 to 1880–4	1880–4 to 1885–9	1885–9 to 1890–4	1890–4 to 1895–9	1895–9 to 1900–4	1900–4 to 1905–9	1905–9 to 1910–4	Average
Australia	0.9	1.0	−2.0	−2.3	1.8	2.8	1.7	0.6
Canada	3.7	0.9	2.0	1.1	4.8	3.2	2.4	2.6
Denmark	1.2	1.1	1.9	2.0	2.1	1.9	2.1	1.7
France	1.4	0.3	2.0	1.7	0.8	1.3	1.7	1.3
Germany	0.1	1.9	1.8	2.3	1.3	1.6	1.2	1.4
Italy	0.5	1.0	−0.2	0.2	2.6	3.4	2.3	1.4
Norway	−0.0	0.8	1.7	0.9	0.8	1.3	2.7	1.2
Sweden	0.7	0.6	1.6	2.4	1.5	1.7	1.5	1.4
UK	1.0	0.9	0.9	1.9	0.6	0.4	1.0	1.0
USA	4.2	0.3	0.9	1.6	3.1	2.1	0.8	1.8
Average	1.4	0.9	1.1	1.2	1.9	2.0	1.7	1.4

Source: see Appendix 1.

[6] This fact has previously been commented on by Maddison (1994) and O'Rourke and Williamson (1997). The latter paper finds stronger evidence for convergence, conditional on education, based on fixed country-specific enrollment rates. This finding survives when enrollment rates are allowed to vary over time, as is the case here: when growth rates are regressed on enrollment rates and initial income, the coefficient on education is positive and significant at the 10% level, while the coefficient on initial income increases to −0.734 (with a p-value of 0.118).

Table 5
List of Variables Used in Regressions

Variable	Description
C	Constant
*D*1877	Dummy variable: 1 if period is 1875–79, 0 otherwise
*D*1882	Dummy variable: 1 if period is 1880–84, 0 otherwise
*D*1887	Dummy variable: 1 if period is 1885–89, 0 otherwise
*D*1892	Dummy variable: 1 if period is 1890–94, 0 otherwise
*D*1897	Dummy variable: 1 if period is 1895–99, 0 otherwise
*D*1902	Dummy variable: 1 if period is 1900–04, 0 otherwise
*D*1907	Dummy variable: 1 if period is 1905–09, 0 otherwise
*D*1912	Dummy variable: 1 if period is 1910–14, 0 otherwise
DAUS	Dummy variable: 1 if country is Australia, 0 otherwise
DC	Dummy variable: 1 if country is Canada, 0 otherwise
DDK	Dummy variable: 1 if country is Denmark, 0 otherwise
DF	Dummy variable: 1 if country is France, 0 otherwise
DG	Dummy variable: 1 if country is Germany, 0 otherwise
DI	Dummy variable: 1 if country is Italy, 0 otherwise
DN	Dummy variable: 1 if country is Norway, 0 otherwise
DS	Dummy variable: 1 if country is Sweden, 0 otherwise
DUK	Dummy variable: 1 if country is UK, 0 otherwise
DUS	Dummy variable: 1 if country is US, 0 otherwise
LY	Log of initial income
LTAR	Log of average tariff (first period)
SK	Log of the savings rate
SH	Log of school enrollment rate
NGD	Log of population growth rate plus 0.05
DKL	Rate of change of capital-labour ratio
DRL	Rate of change of land-labour ratio
CYC	Deviation of output from trend output (based on regressions of output on time and time squared)
SPECTAR	Log of (average tariff times implicit GDP deflator)
LTAR(+1)	Log of the second period average tariff
*LTAR*12	Log of the average of tariffs in first and second periods
GDP	Real GDP
POP	Population
DOLD	Dummy variable: 1if country is European, 0 otherwise
DNEW	Dummy variable: 1 if country is in New World, 0 otherwise

rate is associated with an increase in annual growth rates of 0.075% *per annum*, or 5.2% ($100 \times 0.075/1.443$); a one standard deviation increase in the tariff rate (0.481249) would increase average annual growth rates by 0.359% p.a., or by 24.9% ($100 \times 0.359/1.443$). These are quite large effects.

When country-specific fixed effects are introduced, the coefficient on the tariff variable *increases* to 1.538; a one standard deviation increase in tariffs is now associated with an increase of 0.74% p.a. in the average annual growth rate, or 51.3%. The coefficient is marginally smaller at 0.691 when time dummies are introduced. When both time and country dummies are introduced, the coefficient declines to 0.511, and is no longer significant at standard confidence levels. However, this is hardly surprising, given that a regression of tariffs on time and country dummies produces an R-squared of 0.879 (Table 2).[7]

[7] When the dependent variable is the log of the average tariff, rather than the average tariff, the R-squared is 0.862 (not shown).

Table 6
Unconditional Convergence Model
(Dependent variable is average annual growth rate)

	(1)	(2)	(3)	(4)	(5)
Fixed effects?	No	No	Yes	No	Yes
C	1.718	3.477		4.170	
	(4.303)	(4.576)		(4.950)	
LY	−0.286	−0.383	0.288	−0.761	−5.027
	(−0.733)	(−1.020)	(0.340)	(−1.962)	(2.833)
LTAR		0.746	1.538	0.691	0.511
		(2.679)	(2.128)	(2.566)	(0.659)
*D*1877				−0.566	−2.383
				(−1.132)	(−2.607)
*D*1882				−1.079	−2.589
				(−2.196)	(−3.304)
*D*1887				−0.913	−2.223
				(−1.877)	(−3.187)
*D*1892				−0.756	−1.841
				(−1.569)	(−2.929)
*D*1897				0.040	−0.789
				(0.084)	(−1.427)
*D*1902				0.113	−0.295
				(0.239)	(−0.632)
No. of observations	70	70	70	70	70
R-squared	0.008	0.104	0.267	0.252	0.453
Adjusted R-squared	−0.007	0.077	0.128	0.154	0.274
S.E. of regression	1.150	1.101	1.070	1.055	0.977
F-statistic	0.537	3.880	21.170	2.568	6.156
Prob(F-statistic)	0.466	0.025	0.000	0.018	0.000
Mean of dependent variable	1.443	1.443	1.443	1.443	1.443
S.D. of dependent variable	1.146	1.146	1.146	1.146	1.146
Sum of squared residuals	89.973	81.270	66.435	67.840	49.588
Durbin-Watson stat.	1.349	1.479	1.889	1.576	1.714

Note: t-statistics are in parentheses. Estimation: OLS. Omitted year: 1907. Country specific fixed effects in (3) and (5) not reported.

These results were sufficiently surprising to me that I ran equations relating tariffs and growth using many different specifications, in an attempt to see how robust this correlation was. I first explored the link between tariffs and growth in the context of an augmented Solow model, of the sort associated with Mankiw *et al.* (1992): consistent with the findings of Taylor (1996), this model performs extremely poorly in the late 19th century.[8] Most notably, the savings rate and population growth coefficients have the wrong signs, while the coefficient on initial income has the wrong sign in several specifications. Once again, the tariff coefficient is large, positive and statistically significant, unless both time and county dummies are included.

In Table 7, I run factor accumulation models of the sort favoured by Taylor (1996): growth in output per worker is related to growth in the land-labour and capital-labour ratios (recall that capital stocks are proxied by coal consumption). This specification reflects the important role that expanding frontiers

[8] The results (not shown) are available on request from the author.

Table 7
Factor Accumulation Model
(Dependent variable is average annual growth rate)

	(1)	(2)	(3)	(4)	(5)
LY				1.464	−3.796
				(1.832)	(−2.300)
DKL	18.361	19.528	21.809	22.527	18.55
	(2.869)	(3.225)	(3.392)	(3.660)	(2.928)
DRL	10.913	14.189	22.933	18.235	22.748
	(0.750)	(1.030)	(1.669)	(1.333)	(1.724)
LTAR		1.853	1.142	1.737	0.570
		(2.845)	(1.669)	(2.708)	(0.810)
*D*1877			−0.990		−2.589
			(−2.070)		(−3.108)
*D*1882			−1.166		−2.508
			(−2.714)		(−3.510)
*D*1887			−0.736		−1.892
			(−1.786)		(−2.958)
*D*1892			−0.561		−1.527
			(−1.364)		(−2.648)
*D*1897			−0.279		−0.940
			(−0.650)		(−1.869)
*D*1902			−0.089		−0.397
			(−0.214)		(−0.938)
No. of observations	70	70	70	70	70
R-squared	0.331	0.414	0.524	0.447	0.569
Adjusted R-squared	0.204	0.291	0.355	0.319	0.405
S.E. of regression	1.023	0.965	0.920	0.946	0.884
F-statistic	28.701	20.154	7.004	15.110	7.338
Prob(F-statistic)	0.000	0.000	0.000	0.000	0.000
Mean of dependent variable	1.443	1.443	1.443	1.443	1.443
S.D. of dependent variable	1.146	1.146	1.146	1.146	1.146
Sum of squared residuals	60.664	53.119	43.210	50.117	39.074
Durbin-Watson stat.	1.462	1.612	1.853	1.801	1.693

Note: t-statistics are in parentheses. Estimation: OLS with fixed effects. Fixed effects omitted. Omitted year: 1907.

played in the late 19th century Atlantic economy, as well as the greater role of agriculture in that period. In (4) and (5) a catch-up term is added to the specification. Since both specification tests (not shown) and common sense suggest that country fixed effects should be included, all regressions in this and subsequent tables incorporate them. The model performs much better than the augmented Solow model, and the positive relationship between tariffs and growth survives (but note that the coefficient on initial income is positive in (4)). The tariff coefficient ranges from 0.57 to 1.853. Again, adding country fixed effects alone to the specification increases the size of the tariff coefficient, while adding time dummies as well as country dummies lowers both the size of the coefficient and the significance level (to below conventional levels).[9]

Finally, it should be noted that controlling for import shares strengthens the

[9] In response to a referee's suggestion, I tried replacing the log of the average tariff with the average tariff itself. The qualitative results remain unchanged; for example, when the average tariff is used in (3), the tariff coefficient is 10.82, with a t-statistic of 1.860; when it is used in (5), the tariff coefficient is 5.41, with a t-statistic of 0.881.

correlation between tariffs and growth. For example, when the simple factor accumulation model with country dummies is re-estimated, the coefficient on tariffs increases to 2.374, up from 1.853 (equation (2) in Table 7). The import share is positively and significantly related to growth, consistent with findings for the late 20th century.

Clearly my prior, which was that tariffs should be negatively correlated with growth, is not supported by the data. The data are far more comfortable with the hypothesis that tariffs boosted late 19th century growth. What could be driving the results?

One possibility is that the results are driven by one or two countries: the United States, for example, was both a high-growth and a high-tariff economy. On the other hand, Australia was a low-growth country; using high Victorian tariffs, as I do, rather than tariffs reflecting the free trading New South Wales, should have reduced the correlation between growth and tariffs. The fact that my results are robust to the inclusion of country dummies indicates that something more than country fixed effects is going on. Indeed, in all cases, the tariff coefficient *increases* in size when country dummies are introduced.

In Table 8, I let the tariff variable interact with country and time dummies, in the context of a simple factor accumulation specification. With country dummies already included, I am using up many scarce degrees of freedom; the hope is that such an exercise will yield some insight into what is driving the overall result. For the sake of comparison, the coefficient on tariffs was 1.853 in equation (2) of Table 7.

F-tests clearly reject the null hypothesis that tariff coefficients are equal across countries, while there seems to be a tendency for the tariff coefficient to fall over time. The tariff coefficient was 'larger than average' (i.e. greater than 1.853) for Australia, Canada, Germany, Italy and Norway.[10] Reassuringly, the tariff coefficient was (insignificantly) negative for the two free-traders in the sample, Denmark and the United Kingdom, as well as for the United States. The fact that no positive correlation emerges for Denmark and Britain, countries whose histories contain no suggestion that tariffs boosted growth, suggests that the overall correlation is more than a spurious by-product of the way these data are generated.

At this point, a skeptic might well ask whether the causation could be going the other way round, from growth to tariffs. One could argue as follows: in depressions, tariff rates increase. This could be because duty rates are raised (which is what the endogenous tariff literature emphasises), or it could be because specific duties translate into higher rates of protection in periods of low prices (Crucini (1994); see also Thornton and Molyneux (1997)). In either event, tariffs are higher when output is low, and thus about to grow more

[10] The Italian coefficient seems absurdly high; inspection of Tables 1 and 4 reveals that Italian tariffs did indeed increase after 1895, at the same time that the economy's growth rate accelerated significantly. There are also severe problems regarding the data on Italian land inputs (see Appendix 1). Reassuringly, the positive correlation between tariffs and growth does not depend on these Italian observations. Excluding Italy, a simple factor accumulation model with country dummies produces a tariff coefficient of 1.424, with a p-value of 0.027. This is lower than the coefficient in equation (2) of Table 7, but it is large and positive nonetheless.

Table 8
Tariffs and Growth in Different Countries and Periods
(Dependent variable is annual average growth rate)

	(1)	(2)
DKL	23.761	22.992
	(4.091)	(3.633)
DRL	22.766	25.238
	(1.728)	(1.802)
DAUS × *LTAR*	2.836	
	(2.390)	
DC × *LTAR*	4.297	
	(0.955)	
DDK × *LTAR*	−1.600	
	(−0.985)	
DF × *LTAR*	1.096	
	(0.760)	
DG × *LTAR*	2.317	
	(2.049)	
DI × *LTAR*	10.664	
	(3.987)	
DN × *LTAR*	3.633	
	(0.643)	
DS × *LTAR*	0.789	
	(0.138)	
DUK × *LTAR*	−3.110	
	(−0.743)	
DUS × *LTAR*	−1.07	
	(−0.359)	
*D*1877 × *LTAR*		1.258
		(1.867)
*D*1882 × *LTAR*		1.212
		(1.719)
*D*1887 × *LTAR*		1.057
		(1.423)
*D*1892 × *LTAR*		0.975
		(1.312)
*D*1897 × *LTAR*		0.911
		(1.211)
*D*1902 × *LTAR*		0.816
		(1.072)
*D*1907 × *LTAR*		0.743
		(1.004)
No. of observations	70	70
R-squared	0.581	0.511
Adjusted R-squared	0.397	0.339
S.E. of regression	0.890	0.932
F-statistic	6.041	6.668
Prob(F-statistic)	0.000	0.000
Mean of dependent variable	1.443	1.443
S.D. of dependent variable	1.146	1.146
Sum of squared residuals	38.031	44.322
Durbin-Watson stat.	2.169	1.834
Restrictions	p = 0.042	p = 0.139

Note: t-statistics are in parentheses. Estimation: OLS with fixed effects. Fixed effects omitted. Restrictions: p-values from F-tests that tariff coefficients are equal across countries or time.

rapidly than average. There is some evidence that the latter effect may have been at work during recessions. Let *CYC* be a business cycle variable, defined as the deviation of actual output from predicted output, where predicted output is derived from a regression of annual output on time and time squared. Table 9 gives the correlation between *CYC*, the GDP price deflator, the log of the average tariff *LTAR*, and growth over the subsequent period. As can be seen, during booms (*CYC* is positive), prices are higher, tariffs are lower and subsequent growth is lower; during troughs (*CYC* is negative) prices are lower, tariffs are higher, and subsequent growth is higher. When the log of the tariff is regressed on country dummies and *CYC*, the coefficient on *CYC* is strongly negative, as predicted by the political science literature (e.g. Cassing *et al*, 1986; Gallarotti, 1985), although maybe not for the reasons suggested here.[11]

One simple and extremely crude way to check whether it is this dependence of tariffs on the business cycle that is driving the results is to regress the growth rate between five-year periods on tariffs in the second period, rather than the first period. Say the economy was in recession in the first period: first period tariffs might be higher than usual, but second period tariffs would reflect the better economic conditions that followed. Table 10 presents the results when growth is regressed on second period tariffs, and the average of first and second period tariffs, in the context of the factor accumulation model. Using second period tariffs lowers the tariff coefficient somewhat, to 1.352, down from 1.853, while using average tariffs leaves the coefficient unchanged.

An alternative is to construct a 'specific tariff' variable, *SPECTAR*, defined as the log of the average tariff times the GDP price deflator. Table 9 shows that *SPECTAR* is not as strongly correlated with the business cycle as is the average tariff, while a regression of *SPECTAR* on *CYC* and country dummies reveals no statistically significant relationship between specific tariffs and the business

Table 9

Prices, Tariffs and the Business Cycle

(Correlations)

	CYC	*Prices*	*LTAR*	*SPECTAR*	*Growth*
CYC	1				
Prices	0.335	1			
LTAR	−0.224	−0.412	1		
SPECTAR	−0.160	−0.194	0.974	1	
Growth	−0.382	−0.187	0.300	0.277	1

Note: prices are the implicit GDP deflator. *CYC* is as defined in the text. *LTAR* is the log of the average tariff. *SPECTAR* is the log of (average tariff × prices). All data sources given in Appendix 1.

11 The coefficient on *CYC* in the regression (not shown) is −0.830, with a t-statistic of −2.669.

Table 10
Factor Accumulation Model, Second Period Tariffs
(Dependent variable is average annual growth rate)

Variable	(1)	(2)
DKL	16.979	17.925
	(2.688)	(2.923)
DRL	13.741	14.595
	(0.959)	(1.042)
LTAR(+1)	1.352	
	(1.838)	
*LTAR*12		1.851
		(2.493)
No. of observations	70	70
R-squared	0.368	0.397
Adjusted R-squared	0.235	0.270
S.E. of regression	1.002	0.980
F-statistic	16.627	18.748
Prob(F-statistic)	0.000	0.000
Mean of dependent variable	1.443	1.443
S.D. of dependent variable	1.146	1.146
Sum of squared residuals	57.271	54.700
Durbin-Watson stat.	1.532	1.570

Note: t-statistics are in parentheses. Estimation: OLS with fixed effects. Fixed effects omitted.

cycle.[12] Table 11 shows that when the average tariff is replaced by *SPECTAR* in a simple factor accumulation model, the coefficient on tariffs is still large and positive, if somewhat smaller than in equation (2) of Table 7.

From these exercises, it appears that the countercyclicality of tariffs cannot on its own explain my results; moreover, if the positive correlation between tariffs and growth were due to the interaction of changing price levels over the business cycle and specific tariffs, then why does a positive correlation not emerge for Britain and Denmark, the two free traders in the sample?

Another way that business cycles might matter is suggested by Vamvakidis (1997). As mentioned in the introduction, he finds some support for the theoretical suggestion that tariffs might be beneficial during recessions (due, for example, to their employment-creating effects), but not otherwise. Using pooled data from 1920 to 1990, he regresses growth on domestic tariffs, and other variables. In many specifications, the tariff coefficient is positive (if insignificant); but when he controls for unemployment, the tariff coefficient becomes negative and significant. Specifically, when he adds the unemployment rate, and an interaction term between tariffs and unemployment, to the specification, he finds: a negative and significant unemployment coefficient; a positive and significant coefficient on the interaction between tariffs and unemployment; and a negative and significant coefficient on tariffs.

Might something similar have been at work in the late 19th century? Might

[12] The coefficient on *CYC* in the regression (not shown) is −0.271, with a t-statistic of −0.862.

Table 11

Growth and 'Specific' Tariffs

(Dependent variable is average annual growth rate)

Variable	(1)	(2)
DKL	19.896	22.504
	(3.177)	(3.451)
DRL	12.382	23.627
	(0.875)	(1.697)
SPECTAR	1.467	0.796
	(2.097)	(1.154)
*D*1877		−1.089
		(−2.280)
*D*1882		−1.198
		(−2.750)
*D*1887		−0.669
		(−1.589)
*D*1892		−0.497
		(−1.179)
*D*1897		−0.196
		(−0.446)
*D*1902		−0.036
		(−0.086)
No. of observations	70	70
R-squared	0.379	0.510
Adjusted R-squared	0.248	0.337
S.E. of regression	0.994	0.933
F-statistic	17.390	6.643
Prob(F-statistic)	0.000	0.000
Mean of dependent variable	1.443	1.443
S.D. of dependent variable	1.146	1.146
Sum of squared residuals	56.319	44.410
Durbin-Watson stat.	1.584	1.839

Note: t-statistics are in parentheses. Estimation: OLS with fixed effects. Fixed effects omitted.

the overall positive tariff effect my regressions have uncovered be due solely to the positive effects of tariffs during recessions? Equation (1) in Table 12 presents the evidence, in the context of the factor accumulation model. The *CYC* variable here is identical to that used earlier; i.e. it is the deviation from trend output. There is no evidence that the growth effects of tariffs are solely due to their impact during recessions. To be sure, the coefficient on tariffs is lower than in the simpler specifications of Table 7, down to 1.066 from 1.853, and has a p-value of 0.133. On the other hand, the coefficient is still positive; moreover, the fact that the coefficient on the tariff-cycle interaction term is positive suggests that tariffs were *more* effective during expansions, not less.

If tariffs helped boost growth, this is not solely due to some recession effect.[13] The positive correlation between tariffs and growth which this section

[13] On a somewhat related note, neither is it the case that current tariffs have a positive effect on output, while lagged tariffs have a negative effect. Adding (one-period) lagged tariffs to equation (2) in Table 7 reduces the coefficient on current tariffs somewhat, while the coefficient on lagged tariffs is positive but statistically insignificant.

Table 12

Growth and Tariffs: Alternative Specifications

(Dependent variable is average annual growth rate)

Variable	(1)	(2)	(3)
DKL	20.230	19.654	20.039
	(3.469)	(3.162)	(3.235)
DRL	10.060	14.254	14.086
	(0.754)	(1.025)	(1.015)
LTAR	1.066	1.855	1.961
	(1.521)	(2.823)	(2.819)
CYC	5.910		
	(0.739)		
LTAR × *CYC*	5.062		
	(1.244)		
LTAR × *GDP*		−0.000	
		(−0.109)	
LTAR × *POP*			−0.000
			(−0.465)
No. of observations	70	70	70
R-squared	0.479	0.414	0.416
Adjusted R-squared	0.346	0.278	0.281
S.E. of regression	0.927	0.974	0.972
F-statistic	12.622	13.207	13.323
Prob(F-statistic)	0.000	0.000	0.000
Mean of dependent variable	1.443	1.443	1.443
S.D. of dependent variable	1.146	1.146	1.146
Sum of squared residuals	47.281	53.108	52.915
Durbin-Watson stat.	1.642	1.613	1.612

Note: t-statistics are in parentheses. Estimation: OLS with fixed effects. Fixed effects omitted.

has uncovered seems surprisingly robust, given the contrary evidence emerging from the late 20th century data.

4. Discussion

It appears that the Bairoch hypothesis (that tariffs were positively associated with growth in the late 19th century) holds up remarkably well, when tested with recently available data, and when controlling for other factors influencing growth. If the result is accepted, these questions naturally arise: what are the economics underlying the result, and why was the late 19th century so different from the late 20th century? Thus far, the paper has been silent on the mechanisms through which tariffs influenced growth, and it has been silent for a specific reason: partial correlations such as the ones presented above are the basis for today's conventional wisdom, almost universally accepted among economists and policy makers, that openness is good for growth. Clearly, it makes sense to see what the same methodology implies about the links between tariffs and growth in an earlier period. Nonetheless, a constant theme of O'Rourke and Williamson (1999) is that late 20th century economists should think harder about the mechanisms underlying their partial growth and convergence correlations. While answering the questions posed above is beyond the scope of this paper, in this section I make a start, by suggesting possible avenues for further research.

Bairoch himself argues that free trade was bad for French growth, as it exposed the agricultural sector to cheap New World and Ukrainian grain. This reduced agricultural incomes, and hence the demand for industrial products. While it might be possible to rationalise the argument in the context of models incorporating transport costs, in which domestic market size matters, theoretical objections to the argument are easier to envisage. If protection boosted growth, a more straightforward explanation would involve appealing either to the impact of protection on the relative price of capital goods, to learning effects, or to the structural impact of protection.

The first hypothesis is suggested by Williamson (1974), who argued that United States Civil War tariffs increased the United States savings and investment rates, by lowering the price of capital goods relative to (heavily tariffed) final goods. Williamson's argument is that construction was non-traded, and thus did not benefit from protection, while 'with the outstanding exception of railroad rails, finished capital goods were rarely traded in this phase of American development' (Williamson, 1974, p. 657). Presumably this rise in the savings rate should have boosted growth rates, other things being equal. An appealing feature of the argument is that if capital goods have become increasingly traded over time, as seems plausible, then this could explain the contrast between the late 19th and late 20th century evidence; indeed, there is considerable late 20th century evidence to suggest that the relative price of capital is inversely related to economic growth (De Long and Summers, 1991; Jones, 1994), and that protection can slow growth by reducing capital goods imports (Lee, 1995; Taylor, 1994).

In a recent paper, Collins and Williamson (1999) provide more systematic evidence that tariffs lowered the relative price of capital goods during this period. They calculate the price of capital goods, relative to consumption goods, between 1870 and 1950 for eleven countries: my ten, minus France, plus Finland and Japan. They then run a series of regressions explaining the relative price of capital goods, where each observation refers to a particular country during one of the periods 1870–85, 1885–1900, 1900–13, 1913–29, 1929–39, and 1939–50. Controlling for GDP per capita and GDP, and including time dummies, they find that a 10 percentage point increase in the tariff rate was associated with a 7.6% decline in the relative price of capital goods (and a 25.6% decline in the relative price of equipment). Moreover, they find that the investment rate was negatively and significantly related to the relative price of capital. In my sample, a bivariate regression of the savings (i.e. investment) rate on the tariff (both variables measured in logs) produces a coefficient of 0.38, with a t-statistic of 6.45, consistent with Collins and Williamson. However, the relationship is sensitive to the inclusion of country fixed effects, which are not included by Collins and Williamson (incorporating them into the regression reverses the sign of the coefficient, which becomes −0.15, with a t-statistic of −1.24). The fact that the investment share is negatively related to growth when an augmented Solow model is estimated for this data set is also a problem for the hypothesis, although the argument clearly provides a promising avenue for future research.[14]

The factor accumulation model, which controls for increases in both the capital-labour and land-labour ratios, suggests that tariffs had a positive impact on total factor productivity. What might explain such a finding? Several authors have addressed the venerable argument that learning-by-doing meant that late 19th century protection was good for growth on infant industry grounds. (Again, it is possible that infant industry effects might be at work in some periods but not in others, since the infant industry argument for protection requires not only dynamic scale economies, but underdeveloped capital markets. The technological characteristics of new industries vary over time, and capital markets have clearly become better developed over the last hundred years.) David (1970) argued that there *was* evidence for learning-by-doing in the United States ante-bellum cotton textile industry, but that this did not justify protection. The reason for the latter assertion was that learning, according to David, was best modelled as being a function of the cumulative time spent producing the good, rather than a function of cumulative output. In the former case, protection, which boosts output, would not speed learning. By contrast, Head (1994) finds econometric support for the notion that learning depended on cumulative output in the late 19th century United States steel rail industry: protection had a dramatic effect on that industry, and although consumers were hurt by steel rail duties, net welfare effects were positive (if small).

These studies do not by themselves provide strong support for the notion that protection boosted growth on infant industry grounds. Nor do the data support one possible corollary of the hypothesis: that protection should have been more effective in larger countries. Equations (2) and (3) in Table 12 interact tariffs with GDP and population respectively, and find no evidence that tariffs had a bigger impact on growth in larger countries: indeed, the interaction terms, while statistically insignificant, are negative rather than positive.

A third hypothesis is suggested by the work of Broadberry (e.g. Broadberry, 1998), who finds that the shift of resources out of agriculture can account for a significant proportion of productivity growth in countries such as Germany, the United Kingdom and the United States in the late 19th century. There is overwhelming evidence that internal labour markets were not well-integrated in the 19th century: nominal wage gaps were about 51% for late 19th century industrialisers (Clark (1957) cited in Hatton and Williamson (1991, p. 382)); wage gaps were 52% in 1830s Britain (but only 9–13% in 1890s America), even after accounting for cost of living differences.[15] At first glance, the argument

[14] Note that the positive link between tariffs and growth survives if *DKL* is omitted in Table 7, as might be appropriate if *DKL* was a function of *LTAR*. For example, when *DKL* is omitted from (2), the tariff coefficient is 1.711, with a t-statistic of 2.442; when *DKL* is omitted from (3), the coefficient is 1.226, with a t-statistic of 1.635.

[15] For Britain, see Williamson (1990, p. 193); for the United States, see Hatton and Williamson (1991).

that protection can boost welfare by shifting labour into higher-productivity sectors appears to involve a purely static effect, but if it takes time for labour to move out of agriculture, then the reallocation of labour could indeed have an impact on measured growth rates in the short to medium run, assuming that initial agricultural employment was sufficiently high. Clearly industrial tariffs helped speed up this process, while agricultural tariffs retarded it: if on balance tariffs favoured manufacturing in my sample of countries, then according to this logic they would have been growth-promoting. This argument would also have the desirable effect of helping to account for the difference between the late 19th and late 20th century experiences: growth due to the reallocation of labour between agriculture and industry will by definition decline and eventually vanish as agricultural labour supplies dry up.

Table 13 regresses the change in agriculture's share of GDP on the following variables: changes in capital-labour and land-labour ratios; a dummy variable for Europe, reflecting the asymmetric impact of declining transport costs on agriculture in the Old World and the New; time dummies, reflecting changing world relative prices of agricultural goods; and average tariffs. As expected, rising capital-labour ratios and falling land-labour ratios were associated with falling agricultural shares. The results also show a moderately strong, negative association between tariffs and the change in agriculture's share of GDP (equation (1)); that is, the decline in agriculture's share of GDP was faster when tariffs were higher. This suggests that in this sample of countries, tariff protection was biassed in favour of industry. Not surprisingly, the effect was stronger in the food-exporting New World, which used tariffs to stimulate industry, than in food-importing Europe, which protected agriculture as well as industry (equation (2)). (The fact that Foreman-Peck (1995) concentrates solely on Europe may help explain the contrast between his results and mine, as may the fact that this paper studies changes in output, rather than output levels.) Clearly, distinguishing between agricultural and industrial tariffs would be necessary to pursue this line of inquiry further.

5. Research Agenda

There are several qualifications to the above exercises that need to be made, and which suggest possible avenues for further research.

First, the average tariff measure which I am using is extremely crude, and may in some cases be misleading, for reasons highlighted earlier, and stressed in recent work (Anderson, 1995; Anderson and Neary, 1994). The construction of a superior index of protection, on a uniform basis, for as many countries as possible during the late 19th century should be a major research priority. The fact that quotas were not as common during this period as they would become in the inter-war period makes the construction of such an index easier, and also more desirable.

It is not clear how developing a superior index of protection would affect these results. Germany was probably more protectionist than my tariff data suggest, resorting in some cases to quotas and export subsidies. Slow-growing

Table 13
Structural Transformation and Tariffs
(Dependent variable is change in agriculture's share of GDP)

Variable	(1)	(2)
C	−2.787	−4.282
	(−1.583)	(−1.816)
DKL	−16.658	−20.308
	(−1.402)	(−1.626)
DRL	9.893	9.460
	(0.436)	(0.416)
LTAR	−1.173	
	(−1.442)	
LTAR × *DOLD*		−0.545
		(−0.520)
LTAR × *NEW*		−2.170
		(−1.639)
DOLD	−1.047	2.121
	(−1.304)	(0.621)
*D*1877	−0.506	−0.394
	(−0.510)	(−0.394)
*D*1882	−0.762	−0.762
	(−0.826)	(−0.826)
*D*1887	0.744	0.681
	(0.827)	(0.755)
*D*1892	−0.471	0.537
	(−0.524)	(−0.595)
*D*1897	0.331	0.328
	(0.358)	(0.354)
*D*1902	0.702	0.716
	(0.775)	(0.790)
No. of observations	70	70
R-squared	0.152	0.165
Adjusted R-squared	0.008	0.007
S.E. of regression	2.011	2.012
F-statistic	1.056	1.041
Prob(F-statistic)	0.410	0.424
Mean of dependent variable	−1.621	−1.621
S.D. of dependent variable	2.019	2.019
Sum of squared residuals	238.575	234.884
Durbin-Watson stat.	2.348	2.340

Note: t-statistics are in parentheses. Estimation: OLS. Omitted year: 1907.

Britain was probably less protectionist than my data suggest, assuming that revenue tariffs were not as distortionary as more conventional tariffs. Making adjustments for these two countries would probably strengthen the positive correlation between tariffs and growth, as would replacing high Victorian tariffs with lower average Australian tariffs; on the other hand, lower levels of protection in rapidly-growing Denmark would weaken the correlation uncovered in this paper.

Second, there is always a significant sample selection issue that arises when quantitative exercises of this sort are performed with 19th century data. By and large, those countries for which data are available are countries which were already relatively prosperous. In the late 19th century, such countries were either undergoing, or had already undergone, their industrial revolutions. Several of these countries also enjoyed relatively large and prosperous domestic markets, and ample natural, administrative and educational resources. For both of these reasons, infant industry protection was more likely to work in these countries than in smaller, peripheral economies with little hope of developing a manufacturing base at that time. Indeed, in the most comprehensive study of the subject to date, Reynolds (1985) has found that the developing world benefited greatly by participating in the relatively open international economy of the years 1850–1914. Lessons from the late 19th century core cannot automatically be extended to the late 19th century periphery: as always, more research on southern and eastern Europe, as well as the developing world, should be high on the agenda of cliometricians.

Third, and as already stressed, we need further research to establish whether the mechanisms identified by theory were in operation during this period: correlation on its own is not enough. For example, it is always possible that average tariffs may be proxying in this period for the willingness of governments to get involved in the economy, something which Gerschenkron (1962) believed might be beneficial in a 'backward' society.[16] Of course, precisely the same point – that correlations are not enough – can be made about post-1945 studies which show a positive link between growth and free trade. Thus, it is equally possible that late 20th century tariffs may be proxying for a range of other policies that are *bad* for growth. The relationship between trade policies and government intervention more generally needs to be explored; and cross-country regressions need to be supplemented with more individual country and industry studies.

Finally, and related to the previous point, the theoretical papers cited in the introduction typically assume that sectors differ in important ways, and that protection matters for growth by altering the structure of the economy. The previous section ended with the suggestion that tariffs may have mattered in the late 19th century by altering the allocation of resources between agriculture and industry, which of course implies that a multi-sector model, with disaggregated tariffs, is appropriate for understanding the relationship between protection and growth. Single-sector models, of the sort suggested by much growth theory, may not be the most appropriate for the issue at hand. Of course, precisely the same comment applies to the many empirical studies finding a positive association between openness and growth in the late 20th century, on which this paper is modelled.

University College, Dublin

Date of receipt of first submission: July 1998
Date of receipt of final typescript: June 1999

[16] I am grateful to Bill Collins for raising this possibility.

Appendix 1. Data sources

Data on population, real GDP, coal consumption and tariffs were taken from the data base underlying Collins *et al.* (1997). Collins *et al.* discuss their data sources in an appendix; the population and real GDP figures are from Maddison (1995); coal consumption and tariff data are mostly from Mitchell (1992, 1993, 1995). Italian tariff rates were kindly provided by Giovanni Federico; Australian tariff data prior to 1901 were constructed from data in the *Victorian Year-Book* (various editions). In addition, the following data were required:

Land

Australia, Denmark, France, Germany, Sweden, UK, US: the data were generously provided by Alan Taylor. In turn, those data were based on the numbers used by O'Rourke *et al.* (1996), who discuss the underlying (national) sources in some detail. The only changes made by Taylor were to convert land endowments to thousands of acres. (In addition, grazing areas were added to the US land endowment.) For details, see Taylor (1996, p. 21). Canada: area of land in farm holdings, census years, Statistics Canada (1983), series M23 (with geometric interpolations for non-census years). Italy: for 1861, 1892, 1905, 1909, statistics for total land under cultivation were generously supplied by Giovanni Federico; data for intervening years derived by geometric interpolation. The figure for 1909 was accepted for 1910–13. Norway: based on data in Statistics Norway (1995), Table 14.7. For 1900, 1907 and 1917, statistics exist for total area of fully cultivated land; data for intervening years derived by geometric interpolation. For 1865, 1875, 1890 and 1900, statistics exist for area under grain, dry peas and potatoes. The ratio of this area to the total fully cultivated area which applied in 1900 is assumed to apply in 1865, 1875 and 1890, yielding estimates for total fully cultivated area in those years. Intervening years derived by geometric interpolation.

Enrollment Rates

Enrollment rates are crude ratios of primary plus secondary enrollments divided by total population. European population figures are all taken from Mitchell (1992), Table A5. Australia: population from Mitchell (1995), Table A5; primary plus secondary enrollment from Mitchell (1995), Table I1. Canada: population from Mitchell (1993), Table A5; total school enrollment from Mitchell (1993), Table I1. Denmark: primary and secondary enrollment rates from Mitchell (1992), Table I1; data missing for 1875–79, 1880–84 and 1885–89; data for 1875–79 and 1885–89 are taken from Easterlin (1971), Table 1, p. 426; data for 1880–84 derived by geometric interpolation. France: Mitchell (1992), Table I1. Germany: Mitchell (1992), Table I1 (1910); 1875–79 and 1885–89 data from Easterlin (1971), Table 1, p. 426; intervening data derived by geometric interpolation. Italy: Mitchell (1992), Table I1. Norway: Mitchell (1992), Table I1. Sweden: Mitchell (1992), Table I1; only primary school data are available before 1890; total enrollment rates prior to 1890 were derived by assuming that the total enrollment rate was 2% higher than the primary school enrollment rate; the figure for 1880–84 was derived by geometric interpolation. UK: British enrollment rates are used. Enrollment data are from Mitchell (1992), Table I1; before 1904 only primary school data are used; total enrollment rates prior to 1890 were derived by assuming that the total enrollment rate was 2% higher than the primary school enrollment rate. USA: population from Mitchell (1993), Table A5; primary plus secondary enrollments from Mitchell (1993), Table I1; data are missing for 1875–79 and 1885–89; these are taken from Easterlin (1971), Table 1, p. 426.

Imports

Australia: Mitchell (1995), Table E1. Canada: Mitchell (1993), Table E1. Denmark: Gammelgård (1985), Table 4. France: Lévy-Leboyer and Bourguignon (1990), Table A-III. Germany: Hoffman (1965), Table 127. Italy: ISTAT (1958), Table 84. Norway: Statistics Norway (1995), Table 18.1. Sweden: Johansson (1967), Table 51. UK: Mitchell (1988), p. 453. USA: U.S. Department of Commerce (1975), Part 2, series U193.

Nominal GDP

Australia: Vamplew (1987), series ANA 64. Canada (GNP): Urquhart (1986), Table 2.9. Denmark: Johansen (1985), Table 10.1. France: Toutain (1987). Germany: Hoffman (1965), Table 248, col. 5. Italy: Rossi *et al.* (1993), Table 1B (1890–1914); the ISTAT series for 1870–1890, given in ISTAT (1958), Table 111, is spliced on at 1890. Norway: Mitchell (1992), Table J1. Sweden: Krantz and Nilsson (1975), as reported in Mitchell (1992). UK: Feinstein compromise estimates, Mitchell (1988), p. 836. USA (GNP): Romer (1989), Table 2.

Investment

Australia: Vamplew (1987), series ANA 103 (1870–1900), sum of series ANA 107 (public) and ANA 71 (private) (1901–1914). Canada: Urquhart (1986), Table 2.2. Denmark: Johansen (1985), Table 10.3. France: Lévy-Leboyer and Bourguignon (1990), Table A-III. Germany: Hoffman (1965), Table 42. Italy: Rossi *et al.* (1993), Table 2B (1890–1914); ISTAT (1958), Table 118 ('Totale') (1870–1889). Norway: Mitchell (1992), Table J1. Sweden: Mitchell (1992), Table J1. UK: Mitchell (1988), pp. 832–33. USA: Kuznets (1961), Table R-29.

GDP Deflator

These were calculated by comparing the nominal GDP figures with real GDP figures, taken from national sources. These were as follows: Australia: nominal GDP deflated by GDP deflator, Vamplew (1987), series PC 79. Canada: price deflator direct from Urquhart (1993) Table 1.6. Denmark: Johansen (1985), Table 10.2. France: Toutain (1987). Germany: Hoffman (1965), Table 249, columns 5, 7 (spliced at 1880). Italy: Bardini *et al.* (1995), Appendix Table 1. Norway: Mitchell (1992), Table J1. Sweden: older data from Mitchell (1992), based on Krantz and Nilsson (1975). UK: compromise estimate, Mitchell (1988), Table 5A. USA: Romer (1989), Table 2.

Share of Agriculture in GDP

European data from Mitchell (1992), Table J2. Australia: Mitchell (1995), Table J2. Canada: Urquhart (1993), Table 1.1. US: nominal GDP as above. Agricultural output: U.S. Department of Commerce (1975). 1870–1900: farm gross product, series K 248; 1910–13: net income of farm operators from farming, series K259; missing years interpolated.

References

Anderson, J. E. (1995). 'Tariff index theory.' *Review of International Economics*, vol. 3, no. 2, (June), pp. 156–73.

Anderson, J. E. and Neary, J. P. (1994). 'Measuring the restrictiveness of trade policy.' *The World Bank Economic Review*, vol. 8, no. 2, (May), pp. 151–69.

Bairoch, P. (1972). 'Free trade and European economic development in the 19th century.' *European Economic Review*, vol. 3, no. 3, (November), pp. 211–45.

Bairoch, P. (1976). *Commerce Extérieur et Développement Économique de l'Europe au XIX^e Siècle*. Paris: Mouton.

Bairoch, P. (1989). 'European trade policy, 1815–1914.' In (P. Mathias and S. Pollard eds) *The Cambridge Economic History of Europe, Vol. 8*, pp. 1–160. Cambridge: Cambridge University Press.

Bairoch, P. (1993). *Economics and World History: Myths and Paradoxes*. Chicago: University of Chicago Press.

Bardini, C., Carreras, A. and Lains, P. (1995). 'The national accounts for Italy, Spain and Portugal.' *Scandinavian Economic History Review*, vol. 43, no. 1, pp. 115–46.

Broadberry, S. N. (1998). 'How did the United States and Germany overtake Britain? A sectoral analysis of comparative productivity levels, 1870–1990.' *Journal of Economic History*, vol. 58, no. 2, (June), pp. 375–407.

Capie, F. (1983). 'Tariff protection and economic performance in the nineteenth century.' In (J. Black and L. A. Winters eds) *Policy and Performance in International Trade*, pp. 1–24. London: Macmillan.

Capie, F. (1994). *Tariffs and Growth: Some Insights from the World Economy, 1850–1940*. Manchester: Manchester University Press.

Cassing, J., McKeown, T. J. and Ochs, J. (1986). 'The political economy of the tariff cycle.' *American Political Science Review*, vol. 80, no. 3, (September), pp. 843–62.

Clark, C. (1957). *The Conditions of Economic Progress*, 3rd edition. London: Macmillan.

Collins, W. J., O'Rourke, K. H. and Williamson, J. G. (1997). 'Were trade and factor mobility substitutes in history?' NBER Working Paper no. 6059 (June).

Collins, W. J. and Williamson, J. G. (1999). 'Capital goods prices, global capital markets and accumulation: 1870–1950.' NBER Historical Paper no. 116 (February).

Crucini, M. J. (1994). 'Sources of variation in real tariff rates: the United States, 1900–1940.' *American Economic Review*, vol. 84, no. 3, (June), pp. 732–43.

David, P. A. (1970). 'Learning by doing and tariff protection: a reconsideration of the case of the antebellum United States cotton textile industry.' *Journal of Economic History*, vol 30, no. 3, (September), pp. 521–601.

De Long, J. B. and Summers, L. H. (1991). 'Equipment investment and economic growth.' *Quarterly Journal of Economics*, vol. 106, no. 2, (May), pp. 445–502.

Easterlin, R. A. (1971). 'A note on the evidence of history.' In (C. A. Anderson and M. J. Bowman ed.) *Education and Economic Development*, 3rd printing, pp. 422–9. London: Frank Cass.

Estevadeordal, A. (1997). 'Measuring protection in the early twentieth century.' *European Review of Economic History*, vol. 1, no. 1, (April), pp. 89–125.

Federico, G. and Tena, A. (1998). 'Was Italy a protectionist country?' *European Review of Economic History*, vol. 2, no. 1, (April), pp. 73–97.

Foreman-Peck, J. (1995). 'A model of later nineteenth century European economic development.' *Revista de Historia Económica*, vol. 13, no. 3, (Autumn), pp. 441–71.

Gallarotti, G. M. (1985). 'Toward a business-cycle model of tariffs.' *International Organization*, vol. 39, no. 1, (Winter), pp. 155–87.

Gammelgård, S. (1985). *Billeder af Dansk Macro-Økonomi 1818–1980, Hæfte III: Tabeller*. Copenhagen: Gyldendal.

Gerschenkron, A. (1962). *Economic Backwardness in Historical Perspective*. Cambridge, Massachusetts: Harvard University Press.

Grossman, G. M. and Helpman, E. (1991). *Innovation and Growth in the Global Economy*. Cambridge, Massachusetts: MIT Press.

Harrison, A. (1996). 'Openness and growth: a time series, cross-country analysis for developing countries.' *Journal of Development Economics*, vol. 48, no. 2, (March), pp. 419–47.

Hatton, T. J. and Williamson, J. G. (1991). 'Wage gaps between farm and city: Michigan in the 1890s.' *Explorations in Economic History*, vol. 28, no. 4, (October), pp. 381–408.

Head, K. (1994). 'Infant industry protection in the steel rail industry.' *Journal of International Economics*, vol. 37, no. 3–4, (November), pp. 141–65.

Hoffmann, W. (1965). *Das Wachstum der deutschen Wirtschaft seit der Mitte des 19.Jahrhunderts*. Berlin: Springer-Verlag.

Irwin, D. A. (1993). 'Free trade and protection in nineteenth-century Britain and France revisited: a comment on Nye.' *Journal of Economic History*, vol. 53, no. 1, (March), pp. 146–52.

Irwin, D. A. (1998). 'Changes in U.S. tariffs: the role of import prices and commercial policies.' *American Economic Review*, vol. 88, no. 4, (September), pp. 1015–26.

ISTAT (1958). *Sommario di Statistiche Storiche Italiane 1861–1955*. Rome: Instituto Centrale di Statistica

Johansen, H. C. (1985). *Dansk Økonomisk Statistik 1814–1980, Danmarks Historie, Bind 9*. Copenhagen: Gyldendal.

Johansson, Ö. (1967). *The Gross Domestic Product of Sweden and its Composition 1861–1955*. Stockholm:

Almqvist and Wiksell.
Jones, C. I. (1994). 'Economic growth and the relative price of capital.' *Journal of Monetary Economics*, vol. 34, no. 3, (December), pp. 359–82.
Kindleberger, C. P. (1951). 'Group behavior and international trade.' *Journal of Political Economy*, vol. 59, no. 1, (February), pp. 30–46.
Krantz, O. and Nilsson, C.-A. (1975). *Swedish National Product, 1861–1970: New Aspects on Methods and Measurement.* Lund.
Kuznets, S. (1961). *Capital in the American Economy: its Formation and Financing.* Princeton, NJ: Princeton University Press.
Landes, D. S. (1969). *The Unbound Prometheus: Technological Change and Industrial Development in Western Europe from 1750 to the Present.* Cambridge: Cambridge University Press.
Lee, J.-W. (1993). 'International trade, distortions, and long-run economic growth.' *IMF Staff Papers*, vol. 40, no. 2, (June), pp. 299–328.
Lee, J.-W. (1995). 'Capital goods imports and long-run growth.' *Journal of Development Economics*, vol. 48, no. 1, (October), pp. 91–110.
Lévy-Leboyer, M. and Bourguignon, F. (1990). *The French Economy in the Nineteenth Century: An Essay in Econometric Analysis.* Cambridge: Cambridge University Press.
Liepmann, H. (1938). *Tariff Levels and the Economic Unity of Europe.* London: Allen and Unwin.
Maddison, A. (1991). *Dynamic Forces in Capitalist Development: A Long-Run Comparative View.* Oxford: Oxford University Press.
Maddison, A. (1994). 'Explaining the economic performance of nations.' In (W. J. Baumol, R. R. Nelson and E. N. Wolff eds) *Convergence of Productivity: Cross-National Studies and Historical Evidence*, pp. 20–61. New York: Oxford University Press.
Maddison, A. (1995). *Monitoring the World Economy 1820–1992.* Paris: OECD Development Centre Studies.
Mankiw, N. G., Romer, D. and Weil D. N., (1992). 'A contribution to the empirics of economic growth.' *Quarterly Journal of Economics*, vol. 107, no. 2, (May), pp. 407–37.
McDiarmid, O. J. (1946). *Commercial Policy in the Canadian Economy.* Cambridge, Massachusetts: Harvard University Press.
Mitchell, B. R. (1988). *British Historical Statistics.* Cambridge: Cambridge University Press.
Mitchell, B. R. (1992). *International Historical Statistics: Europe, 1750–1988.* London: Macmillan Press.
Mitchell, B. R. (1993). *International Historical Statistics: The Americas, 1750–1988.* London: Macmillan Press.
Mitchell, B. R. (1995). *International Historical Statistics: Africa, Asia & Oceania, 1750–1988.* London: Macmillan Press.
Nye, J. V. (1991). 'The myth of free-trade Britain and fortress France: tariffs and trade in the nineteenth century.' *Journal of Economic History*, vol. 51, no. 1, (March), pp. 23–46.
O'Rourke, K. H. (1997). 'The European grain invasion, 1870–1913.' *Journal of Economic History*, vol. 57, no. 4, (December), pp. 775–801.
O'Rourke, K. H., Taylor, A. M. and Williamson, J. G. (1996). 'Factor price convergence in the late nineteenth century.' *International Economic Review*, vol. 37, no. 3, (August), pp. 499–530.
O'Rourke, K. H. and Williamson, J. G. (1997). 'Around the European periphery 1870–1913: globalization, schooling and growth.' *European Review of Economic History*, vol. 1, no. 2, (August), pp. 153–90.
O'Rourke, K. H. and Williamson, J. G. (1999). *Globalization and History: The Evolution of a 19th Century Atlantic Economy.* Cambridge, Massachusetts: MIT Press.
Reynolds, L. G. (1985). *Economic Growth in the Third World, 1850-1980.* New Haven, Connecticut: Yale University Press.
Rivera-Batiz, L. A. and Romer, P. M. (1991). 'Economic integration and endogenous growth.' *Quarterly Journal of Economics*, vol. 106, no. 2, (May), pp. 531–55.
Rodríguez, F. and Rodrik, D. (1999). 'Trade policy and economic growth: a skeptic's guide to the cross-national evidence.' *NBER Working Paper* no. 7081 (April).
Romer, C. D. (1989). 'The prewar business cycle reconsidered: new estimates of Gross National Product, 1869–1908.' *Journal of Political Economy*, vol. 97, no. 1, (February), pp. 1–37.
Rossi, N., Sorgato, A. and Toniolo, G. (1993). 'I conti economici italiani: una ricostruzione statistica, 1890–1990.' *Rivista di Storia Economica*, vol. 10, no. 1, (February), pp. 1–47.
Sachs, J. D. and Warner, A. (1995). 'Economic reform and the process of global integration.' *Brookings Papers on Economic Activity* no. 1, pp. 1–118.
Siriwardana, A. M. (1991). 'The impact of tariff protection in the colony of Victoria in the late nineteenth century: a general equilibrium analysis.' *Australian Economic History Review*, vol. 31, no. 2, (September), pp. 45–65.
Statistics Canada (1983). *Historical Statistics of Canada*, 2nd edition. Ottowa.
Statistics Norway (1995). *Historical Statistics 1994.* Oslo.
Stokey, N. L. (1991). 'Human capital, product quality, and growth.' *Quarterly Journal of Economics*,

vol. 106, no. 2, (May), pp. 587–616.

Taylor, A. M. (1994). 'Three phases of Argentine economic growth.' *NBER Historical Paper* no. 60 (October).

Taylor, A. M. (1996). 'Sources of convergence in the late nineteenth century.' *NBER Working Paper* no. 5806 (October).

Taylor, A. M. (1998). 'On the costs of inward-looking development: price distortions, growth, and divergence in Latin America.' *Journal of Economic History*, vol. 58, no. 1, (March), pp. 1–28.

Thornton, J. and Molyneux, P. (1997). 'Tariff endogeneity: evidence from 19th century Europe.' *Economics Letters*, vol. 56, no. 3, (November), pp. 345–50.

Toutain, J.-C. (1987). 'Le produit intérieur brut de la France de 1789 à 1982.' *Cahiers de l'ISMEA, Économies et Sociétés*, série AF, no. 15.

Urquhart, M. C. (1986). 'New estimates of gross national product, Canada, 1870–1926: some implications for Canadian development.' In (S. L. Engerman and R. E. Gallman eds) *Long-term Factors in American Economic Growth*, pp. 9–88. Chicago: University of Chicago Press.

Urquhart, M. C. (1993). *Gross National Product, Canada, 1870–1926: The Derivation of the Estimates.* Kingston and Montreal: McGill-Queen's University Press.

U.S. Department of Commerce. (1975). *Historical Statistics of the United States: Colonial Times to 1970.* Washington D.C.

Vamplew, W. (ed.) (1987). *Australian Historical Statistics.* Broadway, New South Wales: Fairfax, Syme and Weldon.

Vamvakidis, A. (1997). 'How robust is the growth-openness connection? Historical evidence.' Mimeo, Harvard University.

Williamson, J. G. (1974). 'Watersheds and turning points: conjectures on the long-term impact of Civil War financing.' *Journal of Economic History*, vol. 34, no. 3, (September), pp. 636–61.

Williamson, J. G. (1990). *Coping with City Growth During the British Industrial Revolution.* Cambridge: Cambridge University Press.

Young, A. (1991). 'Learning by doing and the dynamic effects of international trade.' *Quarterly Journal of Economics*, vol. 106, no. 2, (May), pp. 369–405.