

**A Tale of Two Peripheries: Real Wages in Denmark and
New Zealand 1875-1939.**

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Abstract. Denmark achieved dramatic real wage growth after 1870 compared to other European economies and to those of the New World. The ingredients of Denmark's success are gauged by comparison with one its major competitors in the British food-products markets, New Zealand. Faster Danish productivity growth explains only part of Denmark's faster real wage growth. Open economy forces, chiefly international capital flows before 1913, and most especially Danish trade union militancy around the end of World War I, influenced income distribution and especially favoured wage over property income in Denmark. Denmark's GDP per capita equalled New Zealand levels between the world wars but her real wages surged past those of New Zealand as distributional shifts favoured Denmark's wage earners.

1. Introduction

The European periphery experienced varied real wage convergence with Europe's economic leader, Great Britain, before World War I. Scandinavia's catch-up was the most spectacular, with real wage growth there around two and one-half times faster than in Britain 1870-1913. Articulating the ingredients of Denmark's, Sweden's, and Norway's

success has informed the wider debates on the effects of globalization. The key forces are well-known, and the out-migration of labour, the inflow of capital, and commodity trade flows, all raised Scandinavia's real wages compared to Britain, with capital flows playing the dominant role. Yet, collectively, these open economy forces accounted for only around one-half of the faster real wage growth of Scandinavia compared to Britain 1870-1913, and technological catch-up and human capital formation played equally important roles.¹

Whether the chief impetus behind Scandinavia's real wage catch-up was from country-specific productivity forces or from cross-country factor and commodity flows does not emerge very clearly from the comparison with Europe's leader, Britain. Comparisons with the world leader, the USA offer more support for open economy forces narrowing gaps, principally because the mass inflow of labour into USA reduced real wage differentials with Scandinavia.² Interpretations of Scandinavia's real wage catch-up are thus influenced by the economic leader chosen as the comparator. Here we adopt a different type of economic leader as the comparator, namely New Zealand. It is well-known that some New World countries had particularly high real wages around 1870.³ The case of New Zealand reinforces that the "western off-shoots" had high real wages, for example Denmark's hourly real wage (for unskilled urban labour) was half that of New Zealand in 1873, and Sweden's and Norway's real wages were lower still.⁴

Comparing real wages in Denmark with those of a small, peripheral New World economy, New Zealand has the potential to further inform the discussion surrounding the consequences of globalization. The two countries share the characteristics of being small

¹ O'Rourke, K. H. and J. G. Williamson, Around the European Periphery 1870-1913: Globalization, Schooling and Growth. *European Review of Economic History*, vol. 1, 1997: 2, 153-190.

² O'Rourke and Williamson, Around the European Periphery, 170.

³ Williamson, J. G., The Evolution of Global Labour Markets since 1830: Background Evidence and Hypotheses, *Explorations in Economic History*, vol. 32, 1995:2, 141-196.

⁴ Greasley, D. and Oxley L., Globalization and Real Wages in New Zealand 1873-1913, *Explorations in Economic History* vol. 41, 2004: 1, 26-47.

generally open economies with similar economic structures, whose main export market was Britain. Using two economies that share these features as comparators has the advantage that any convergence that might have been engendered by differences in structure is lessened, and accordingly the role of international forces will be highlighted. New Zealand's economic development resembled that of Denmark, despite their different factor endowments, once refrigeration made possible the long distance export of dairy-products and meat.

As in Denmark, farming efficiency in New Zealand was fostered by state-sponsored education and, in the case of butter and cheese manufacture, by co-operative enterprises.⁵ The two countries became major competitors in the British marketplace. In 1891 New Zealand's butter exports to Britain were around 3% of the Danish level, but this ratio had reached 75% by 1924. Yet while New Zealand made substantial inroads into the Dane's share of the British dairy market, Denmark achieved a dramatic real wage catch-up with its distant competitor. By World War I New Zealand's real wage lead had been substantially eroded, and Denmark's real wages surged ahead thereafter.

Conversely, land prices fell relatively in Denmark. Shifts in the wage-rental ratio have potentially powerful influence on income distribution and thus on real wages in the two countries. Distributional shifts appear to have been strong both before World War I and most especially during its immediate aftermath, and they favoured wage earners in Denmark and landowners in New Zealand. Dairy land prices in New Zealand were around 68% of the Danish level in 1924, but the rural land price ratio had been around 14% in the 1870s.⁶ Income distribution shifts driven by the open economy forces of migration, capital flows and trade, may thus have influenced relative real wages. Our analysis also considers

⁵ Condliffe, J. B., *New Zealand in the making*. London: Allen and Unwin, 1930.

⁶ See Figure 2, and footnote 5 below.

the effects of productivity catch-up and country-specific distributional shifts associated with labour militancy, on relative Denmark-New Zealand real wages.

2. Real Wages and Income Distribution

Williamson has argued that global trade expansion after 1870 was accompanied by transport-driven commodity price convergence, and that the concomitant magnified shifts in relative factor prices unleashed powerful and ubiquitous distributional forces.⁷ Wage-rental ratios fell in the land abundant countries of the periphery, and rose in land scarce Europe. Shifts in real wages were thus influenced by the income distributional effects of rises or falls in the wage-rental ratio. For less industrialized countries like Denmark and New Zealand, real wages 1875-1939 were influenced by the share of income accruing to landowners. Commodity and factor price equalization thus tended to augment real wages in land scarce European economies, including Denmark.

There appears little doubt that trade, and the migration of capital and labour, by affecting relative factor prices, had potentially important consequences for income distribution around the world economy 1875-1914. Generally, the price of labour fell relatively in the New World, and rose in the Old, and conversely the price of land rose relatively in the New World, and fell in the Old. Denmark and New Zealand fit broadly into this characterization, although each country had peculiarities, which may have tempered the shifts in relative factor prices, and influenced their real wages. Most obviously worker-militancy was strong in Denmark especially in the years around World War One and this may have had powerful distributional effects.

Moreover, while Denmark experienced labour outflows and New Zealand labour inflows, both were recipients of capital inflows. And while Denmark largely adhered to

⁷ Williamson, J. G., Land, Labor and Globalization in the Third World, 1870-1940, *Journal of Economic History*, vol. 62, 2002: 1, 55-85, p. 81.

free trade for agricultural goods and reduced tariffs on manufactures, New Zealand imposed modest tariffs on manufactured imports, including on goods from Britain. Further, Denmark remained a major farm goods exporter, despite refrigeration eventually facilitating competition from New World economies in dairy and meat products. The myriad of forces shaping the relative factor price shifts are further complicated by the uncertain effects of technological progress. Generally, technological progress is anticipated to raise the wage–rental ratio.⁸ For New Zealand however, refrigeration and dairy-related technology appears to have principally benefited the returns to landowners.⁹

Intuition offers only limited guidance to the magnitude of likely shifts in relative factor prices, and thus of how Denmark’s and New Zealand’s real wage movements were influenced by open economy forces in the years to 1914. Subsequently, the effects of World War I severely disrupted the factor and product prices of both countries, which powerfully influenced income distribution and real wages. Denmark, with a German land border, was neutral, and continued to export, at rising prices (although volumes fell), bacon and butter to Britain and horses to Germany.¹⁰ Distant New Zealand was a belligerent, and eventually all of its pastoral exports were commandeered, at high prices by Britain.¹¹ The British Dominion also experienced labour shortages resulting from high rates of military participation, which may have ameliorated the fall in the wage-rental ratio in New Zealand during the war. In contrast, Denmark encountered trade union militancy toward the war’s end and in the immediate post-war years, and concomitantly experienced a sharp increase in its wage-rental ratio.

⁸ O’Rourke, K., Taylor, A. and J. G. Williamson, Factor Price Convergence in the late Nineteenth Century, *International Economic Review*, vol. 37, 1996: 3, 499-530. These authors set out a model which shows the wage-rental ratio influenced by the terms of trade, factor endowments and residual productivity.

⁹ Greasley, D. and Oxley L., Refrigeration and Distribution: New Zealand Land Prices and Wages. *Australian Economic History Review*, vol. 45, 2005: 1, 23-44.

¹⁰ Smidt, H. R., Dutch and Danish Agricultural Exports during World War I. *Scandinavian Economic History Review*, vol. XLIV, 1996:2, 140-160.

¹¹ Hawke, G. R., *The Making of New Zealand*. Cambridge: Cambridge University Press, 1985.

Between the world wars Denmark and New Zealand became fierce competitors in the British food-products market, and both were adversely affected by unfavourable terms of trade, although New Zealand benefited from preferential tariffs during the 1930s. Land rentals tended to fall in the 1920s, especially in New Zealand, but currency manipulation in the British Dominion in 1933, which favoured the returns to landowners, probably raised the relative prices of New Zealand land.¹² Open economy forces before 1914, the disruption of World War I and its aftermath, and the difficult trade environment between the world wars, had complex and varied implications for income distribution and real wages in Denmark and New Zealand. To make progress in disentangling the forces shaping their comparative real wages we first need to consider more fully the movement of the relevant variables.

2.1 Estimates of real wages.

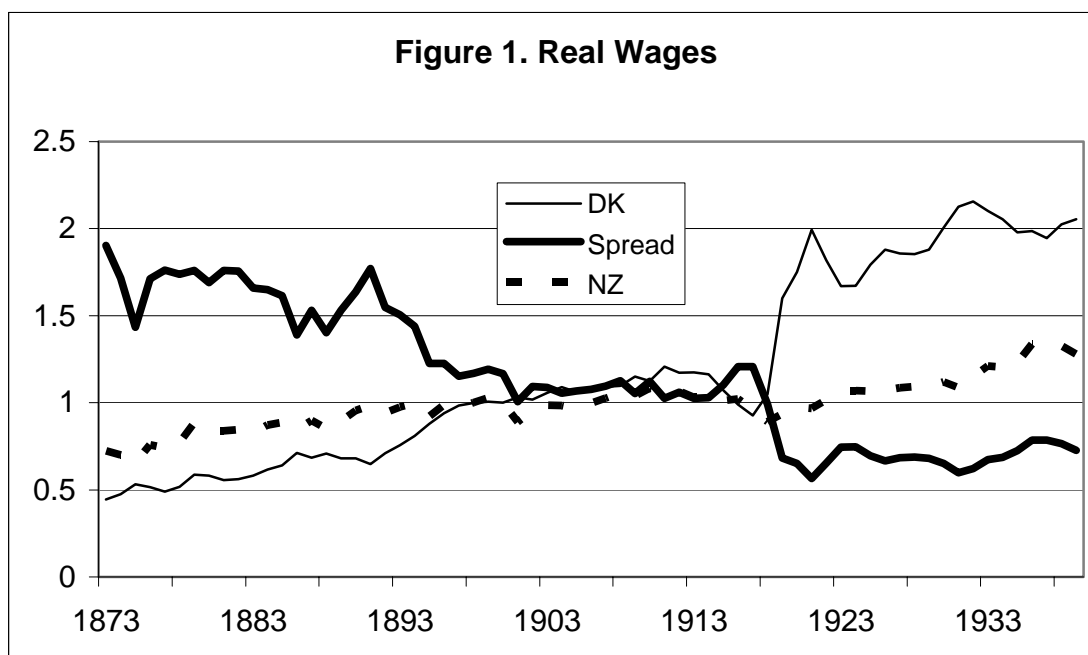
The wage series used are for urban unskilled labour, and that for New Zealand utilizes recently constructed data.¹³ For Denmark, the estimates of Williamson are modified here, to adjust for a break in the series over the years of World War I.¹⁴ Relative Denmark-New Zealand real wages, adjusted for difference in purchasing power are estimated for 1905, when, taking Britain's real wage as 100, Denmark's level is 90 and New Zealand's 109.¹⁵ New Zealand's real wage was 21.1% above Denmark's in 1905, and the ratio (spread) shown in Figure 1 project each country's real wage from this benchmark.

¹² Greasley, D. and Oxley, L., Regime shift and fast recovery on the periphery: New Zealand in the 1930s. *Economic History Review*, vol. LV, 2002: 4, 697-720.

¹³ Greasley, D. and Oxley L., Globalization and real wages in New Zealand 1873-1913, *Explorations in Economic History*, vol. 41, 2004:1, 26-47, Greasley and Oxley Refrigeration and Distribution.

¹⁴ Williamson, *The Evolution*.

¹⁵ These estimates take account of purchasing power differences, and in particular the higher prices of most consumer goods in New Zealand. The estimate of Denmark's real wage relative to Britain is from Williamson, *The Evolution*, and that for New Zealand relative to Britain is from Greasley and Oxley, *Globalization and real wages*.



Sources. New Zealand: Real Wages, Greasley and Oxley Globalization and real wages, Greasley and Oxley Refrigeration and Distribution. Denmark: Nominal wages, Johansen, H. C., *Dansk historisk statistik 1814-1980*, København: Gyldendal, 1985. Consumer prices, Pedersen, P. J., *Arbejdslønnen i Danmark Under Skiftende Konjunkturer i Perioden ca. 1850-1913*, København: Akademisk Forlag, 1930, and Johansen, *Dansk historisk statistik*.

The results show a clear real wage catching-up by Denmark 1875-1913, with New Zealand's initial real wage advantage of around 100% being largely eliminated by 1913. Then, World War I and its immediate aftermath had dramatic effects on the ratio, principally because of sharp fluctuations in Denmark, where real wages fell in the early war years but witnessed remarkably fast growth 1917-21, when hourly real wages there doubled.¹⁶ Consequentially, Denmark's real wages surged ahead, and New Zealand's real wages were around 75% of the Danish level in the 1920s. Thereafter, the real wage

¹⁶ Denmark's wage data are available on a consistent basis over the whole period except for 1915 and 1916, where we have linearly interpolated the data. The generated real wage series coincide with the real wage data of Williamson, *The Evolution*, with the exception in 1913-14, where there is a break in Williamson's series, which corresponds to a break in Johansen's *Dansk historisk statistik* consumer price series. However, Pedersen's *Arbejdslønnen i Danmark* consumer price index includes 1914. In fact three different consumer price indexes are available before 1914 inclusive, and they all show the same increase in consumer prices over the period from 1913 to 1914 (see Table 7.1 in Christensen, J. P., *Lønudviklingen inden for dansk håndværk og industri 1870-1914*, København: Akademisk Forlag, 1975. Accordingly, the pre-1913 and post-1914 real wage data for Denmark can be linked.

relatively was broadly stable between the world wars, with Denmark sustaining most of its lead. Inspection of the data indicates three broad phases of Danish real wage movements compared to New Zealand: catching-up 1873-1913, surging ahead 1914-21, and sustaining the lead 1922-39.

2.2 Estimates of Land Rentals

The estimates of land rentals utilize data for land prices, using a series recently constructed for New Zealand.¹⁷ The Denmark series extends that reported for occasional years by O'Rourke *et al* to 1939, making use of the annual data.¹⁸ Russell and Macklin in their comparison of dairying in New Zealand and Wisconsin, report dairy land prices for New Zealand in 1925 at US\$225 per acre (or 50% higher than dairy land prices in Wisconsin in that year).¹⁹ Danish dairy land prices averaged 1550 kroner or US\$326 per acre in 1925.²⁰ The relative series shown in Figure 2 use these data as a benchmark, and show that the New Zealand land price was 68.8% of the Danish level in 1925.²¹

Real land prices did rise in Denmark 1875-1913, but only by around one-quarter, while New Zealand real land prices rose by over five times. New Zealand land prices reached around 75% of the Danish level in the decade prior to 1914. A collapse in real land prices in Denmark occurred in the trans-war period 1913-20, of around 40 per cent. In

¹⁷ Greasley and Oxley, Refrigeration and Distribution.

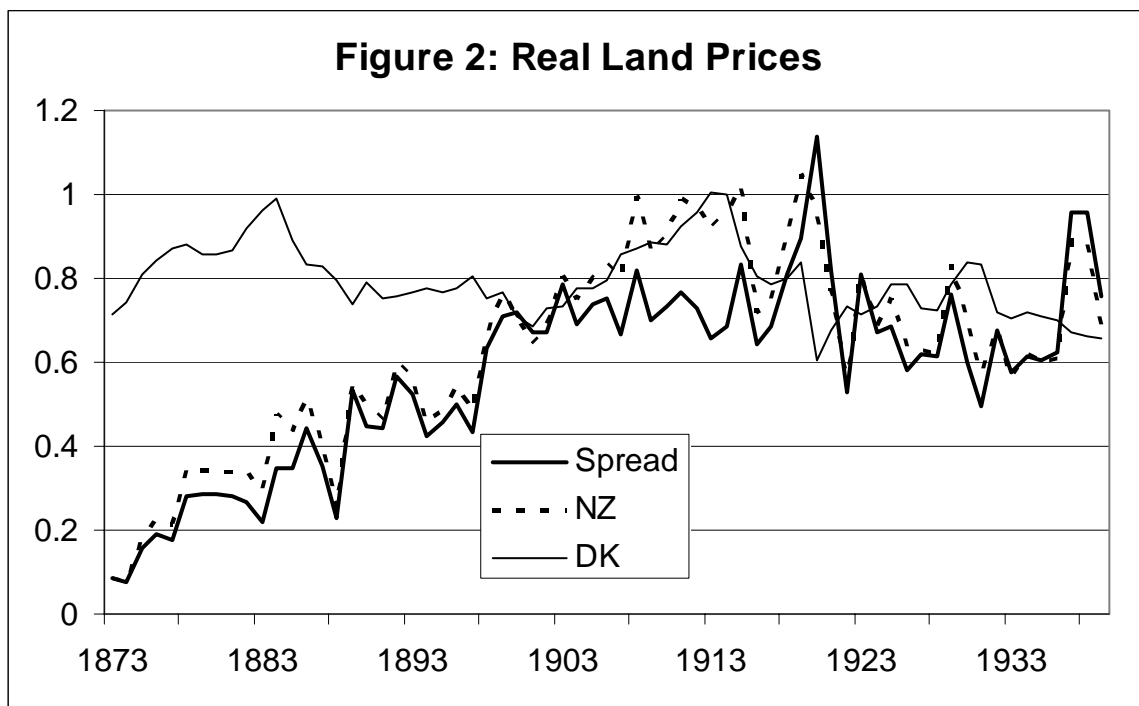
¹⁸ O'Rourke, Taylor, and Williamson, Factor price convergence.

¹⁹ Russell, H. L. and T. Macklin, Intensive Dairying in New Zealand and Wisconsin. *Agricultural Experiment Station Bulletin 377*, University of Wisconsin, Maddison, 1925.

²⁰ Denmark land prices are from Christensen, J., *Landbostatistik: Håndbog I Dansk Landbohistorie, Statistik 1830-1900*, København: Landbohistorisk Selskab, 1985 and various issues of *Statistisk Årbog*. The data are listed in kroner per "barrels of land" (Tønder land). The data are converted to acre, where one Tønde land = 1.363 acre.

²¹ US\$ prices are not adjusted for PPP when comparing dairy land prices in Denmark and New Zealand. Such a comparison may understate the relative Danish price in the 1920s. For example, for 1929 L. Prados de la Escosura, International comparisons of real product 1820-1990: An alternative data set, *Explorations in Economic History*, vol. 37, 1990: 1, 1-41 reports New Zealand GDP per capita based on nominal exchange rates was 128% of the Danish level, but adjusting for PPP and taking the average of the three reported measures shows the ratio of New Zealand to Denmark GDP per capita was 110%. Applying the same average PPP adjustment to 1925 land prices suggests the ratio of New Zealand to Denmark land prices in that year may have been as low as 59.1%.

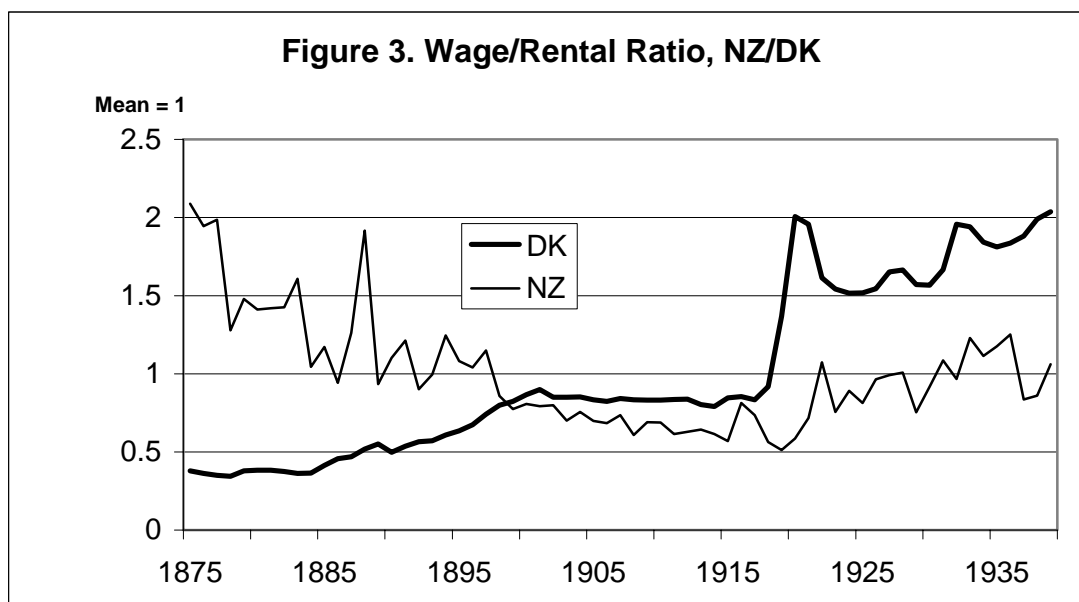
contrast, New Zealand experienced land price inflation during and in the aftermath of World War One. Temporarily, in 1919, dairy land prices in New Zealand exceeded those in Denmark, but the rural land market in New Zealand collapsed in 1920. Subsequently, Denmark's real land price rose relative to that of New Zealand in the 1920s and early 1930s, but then fell in the later 1930s when currency manipulation in New Zealand contributed to the improving position of land-owning farmers. New Zealand's real land price recovered to around 96 per cent of its 1913 level by 1938. While real wages in Denmark caught-up and surged ahead of those in New Zealand over the years 1875-1939, New Zealand land prices rose from 10% to around 80% of Denmark's level over the same period.



Sources. New Zealand: Real land prices, Greasley and Oxley Globalization and real wages, and Refrigeration and Distribution, Russell and Macklin Intensive Dairying. Denmark: Consumer prices, Pedersen, *Arbejdslønnen i Danmark* and Johansen, *Dansk historisk statistik*, land prices Christensen, *Landbostatistik* and *Statistisk Årbog*.

2.3 Wage-Rental Ratio

Over the years 1875-1939 the wage-rental ratio fell in New Zealand, but rose sharply in Denmark, see Figure 3. The low point of New Zealand's wage-rental ratio was in 1919, and the shifts in income distribution towards land owners were powerful over the years 1875-1919. Subsequently, the wage-rental ratio rose in New Zealand. This did not fully restore the 1875 ratio, but distributional shifts in New Zealand over the longer period 1875-1939 were comparatively modest. Distributional shifts in Denmark were sustained over a longer period, and strongly favoured wages.²² Urban wage earners did relatively well in Denmark before 1914, but rural wealth as measured by the capital value of land did not collapse. The more dramatic income distribution shift in Denmark occurred in the aftermath of World War I, when land prices fell sharply while real wages showed remarkable growth. Denmark's wage-rental ratio increased, by more than 100% 1918-38.



Sources: as for Figures 1 and 2.

²² Phelps Brown and Browne Phelps Brown, E. H. and Browne, M. H., *A Century of Pay*. London: Macmillan, 1968 chart more generally the rise in labour's income share across the trans-war period.

3. Unconditional Convergence

Most empirical investigations of convergence have deployed cross-sectional tests to consider whether or not income or real wage growth is negatively correlated with initial values of income or real wages.²³ O'Rourke and Williamson report some evidence of unconditional real wage convergence among a group of 16 countries 1870-1913, although the negative coefficient they observe is not statistically significant at conventional levels.²⁴ Their sample of 16 countries did not include New Zealand, and ostensibly, adding a country with high 1870 real wages but relatively slow real wage growth in the sample would reinforce the evidence in favour of convergence. Our interest though concerns the specific experiences of Denmark and New Zealand, and hence we consider a bivariate time series test for convergence since cross-sectional tests do not show which, if any, of the countries among a group are converging.²⁵

The tests for real wage convergence utilize approach of Bernard and Durlauf.²⁶ Their tests of convergence are based upon the time series properties of two (or more) series. Time series test have generally rejected unconditional convergence. Greasley and Oxley though found evidence of long run real GDP per capita convergence for Denmark and Sweden 1900-87.²⁷ In the case of two countries the tests consider whether or not the differences in two series have a unit root and a non-zero mean, and thus whether

²³ Abramovitz, M., Catching up, forging ahead, and falling behind. *Journal of Economic History* vol. 46, 1986:3, 385-406, Barro, R., Economic growth in a cross-section of countries. *Quarterly Journal of Economics* vol. 106: 1991: 407-43.

²⁴ The descriptors 'unconditional' and 'conditional' refer to whether or not estimates of cross-country convergence control for country specific differences in for example levels of education. In a time series framework 'unconditional' convergence implies incomes equalize irrespective of country specific differences, say in education.

²⁵ Bernard, A. and S. Durlauf, Interpreting tests of the convergence hypothesis. *Journal of Econometrics* vol. 71, 1996: 1, 97-108.

²⁶ Bernard, A. and S. Durlauf, Convergence in international output. *Journal of Applied Econometrics* vol. 10, 1996: 1, 97-108.

²⁷ Greasley, D. and L. Oxley, Time –series based tests of the convergence hypothesis: Some positive results, *Economics Letters* vol. 56, 1997: 143-47.

movements in income differences permanently deviate from equality, which obviously precludes convergence.

Unconditional convergence requires that long run forecasts of real wages (or real GDP per capita and land prices) differences in Denmark and New Zealand tend to zero as the forecasting horizon tends to infinity. For non-stationary series this requires that the two series are cointegrated with a cointegrating vector $[1, -1]$. If unconditional convergence is rejected common forces may still have shaped the real wages (or land prices or real GDP per capita) of the two countries if long-term forecasts of real wages in Denmark and New Zealand moved proportionally, which implies the two series are cointegrated, but with a cointegrating vector $[1, -a]$. Intuitively, this implies that the real wages (or land prices and GDP per capita) of the two countries will be driven by common influences, but they will not converge unconditionally with a zero mean difference.

Table 1. Cointegration tests for convergence of real GDP per capita, real wages and real land prices. Dickey-Fuller tests.

Real Wages	Constant, No trend -3.69(-3.34)	Constant, trend -4.24(-3.78)	Cointegration Vector [1,-0.22]*
Real Land Prices	Constant, No trend -2.90(-3.34)	Constant, trend -2.59(-3.78)	
Real GDP per capita	Constant, No trend -1.84(-3.34)	Constant, trend -2.20(-3.78)	

Note. The numbers in parentheses are critical values at the 5% level. Estimation period: 1875-1939. * The hypothesis of a cointegrating vector $[1, -1]$ is rejected at any conventional significance level ($\chi^2(1) = 1706$).

Sources. See the Data Appendix.

The results in Table 1 reject unconditional real wage, real land price, and real GDP per capita convergence for Denmark and New Zealand. Faster Danish real wage growth therefore cannot therefore be simply explained by convergence to New Zealand real wage levels. However, real wages did tend to move together in New Zealand and Denmark, and the cointegration result show that common shocks drove real wage movements in the two countries. Possible common forces include technological or institutional shocks, for example transport or dairy technology innovations, or co-operative enterprise, as well as those associated with open economy influences. In contrast, in the cases of land prices and real GDP per capita no evidence is found to show that these variables tended to move together in the two countries and that they were shaped by common forces. The findings lend some support to Williamson's argument that globalization forces are more likely to be observed in real wage than in real GDP per capita dispersion, but they also add to the growing skepticism surrounding the existence of unconditional real wage convergence. The next section considers the reasons why real wage growth was faster in Denmark than in New Zealand.

4. Explaining Real Wages

Our model considers how the Denmark-New Zealand real wage ratio was shaped by productivity, and by distribution forces. Both the open economy forces of migration, capital flows, and trade, and country specific labour market influences on income distribution are investigated, with the objective of explaining the three phases of the evolving real wage spread. In particular, we consider why the real wage gap was largely eliminated 1875-1913, why Denmark's real wages surged ahead 1913-21, and why the Danish real wage lead was largely sustained 1921-39.

4.1 The Model and the Results

The following unrestricted and restricted wage equation is estimated:

$$\ln W_t^s = \alpha_0 + \ln(Y / Pop)_t^s + \alpha_1 \ln Un_t^{DK} + \alpha_2 \ln Tot_t^s + \alpha_3 Cif_t^s + \alpha_4 \ln Emi_t^{DK} + \alpha_5 \ln Mig_t^{NZ} + \varepsilon_t$$

where W is consumer-price-deflated hourly wages, Y/Pop is GDP per capita, Un is union membership per capita, Tot is terms-of-trade, Cif is the ratio of capital inflow to GDP measured as minus the current account on the balance of payments, Emi is out-migration, Mig is in-migration, and ε is a stochastic error-term. The superscripts s , DK and NZ stand for the ratio between New Zealand and Denmark, Denmark, and New Zealand. The model is estimated over 1875-1939, or 1900-1939 in the estimates where union membership is included as an explanatory variable.

The model follows, to some extent, a standard model of wage determination where real wages depend on productivity, unemployment and various wage push factors, see for instance Layard and Nickell.²⁸ It includes roles for open economy forces influencing real wages via the effects international flows of labour and capital on factor endowments, and by shifts in the terms of trade. Unemployment is not included in our model because of the lack of data. Labour productivity is restricted to one in the preferred estimates following conventions of the literature. We have imposed the restriction in the preferred estimates because otherwise there would not be any steady state solution to the model. Labour's income share, and consequently the rate of unemployment, would otherwise increase to infinity or decrease to minus infinity as time goes towards infinity.

Given the quality of the pre-WWII data and that some important variable are not available the estimated coefficient of labour productivity will generally not be one in the

²⁸ Layard, R. and S. Nickell, Unemployment in Britain. *Economica* vol. 53, 1986: S 121-169.

estimates. To shed some light on the sensitivity of the estimated coefficient of productivity to inclusion of union membership and estimation period the cointegration estimates of the model are presented in the table below.

Table 2: Cointegration estimates of unrestricted models

REAL WAGE SPREAD								
----- 1874-1939 -----								
	$\ln\left(\frac{Y}{Pop}\right)_t^s$	$\ln(Un)_t^{DK}$	$\ln(Tot)_t^s$	Cif_t^s	$\ln Emi_t^{DK}$	$\ln Mig_t^{NZ}$	\bar{R}^2	DF
1.	0.78 (6.08)	-0.41 (9.01)	0.32 (2.47)	1.92 (4.48)	0.05 (3.47)	0.02 (0.93)	0.89	-3.41
2.	1.46 (8.94)		0.00 (0.00)	3.10 (4.92)	0.10 (4.28)	0.01 (0.40)	0.74	-2.87
----- 1900-1939 -----								
3.	0.34 (2.92)	-0.40 (9.09)	0.27 (2.90)	1.11 (3.63)	-0.01 (0.53)	-0.10 (2.47)	0.89	-3.61
4.	0.88 (4.74)		0.30 (1.79)	1.98 (3.76)	0.10 (2.62)	-0.07 (1.04)	0.64	-2.93
REAL WAGE DENMARK								
----- 1900-1939 -----								
	$\ln\left(\frac{Y}{Pop}\right)_t^{DK}$	$\ln(Un)_t^{DK}$	$\ln(Tot)_t^{DK}$	Cif_t^{DK}	Emi_t^{DK}	\bar{R}^2	DF	
5.	0.44 (2.07)	0.44 (4.54)	0.42 (2.78)	0.74 (2.10)	0.04 (4.54)	0.91	-3.50	

Notes: DF = Dickey-Fuller test.

Considering the estimates in the first row for 1874-1939 the variables are cointegrated. The Danish union membership is included in the estimates to account for the significance of the labour movement during the 1918-20 wage explosions. The estimated coefficient of productivity is 0.78. However, excluding union membership from the

estimates increases the coefficient of productivity to 1.46 (second row). Reducing the estimation period to 1900-39 the coefficient of productivity becomes 0.34 if union membership is included and 0.88 when union membership is excluded. Finally, the estimates in the last row show that the unrestricted coefficient of labour productivity is 0.44 for the Danish wage equation. Overall, the estimates show that the estimated coefficient of labour productivity is highly sensitive to inclusion of variables and estimation period. The most satisfactory solution to this problem is to follow theory and let the coefficient of productivity be restricted to one.²⁹

Table 3. Restricted Parameter estimates of real wages, New Zealand and Denmark.

REAL WAGE SPREAD							
----- 1874-1939 -----							
$Ln\left(\frac{Y}{Pop}\right)_t^s$	$Ln(Un)_t^{DK}$	$Ln(Tot)_t^s$	Cif_t^s	$ln Emi_t^{DK}$	$ln Mig_t^{NZ}$	\bar{R}^2	DW
1. 1.00		0.12 (1.59)	0.64 (4.07)	0.00 (0.08)	0.00 (0.11)	0.95	1.45
2. 1.00			0.61 (4.01)			0.95	1.42
----- 1900-1939 -----							
3. 1.00	-0.45 (3.06)	0.08 (0.98)	0.62 (3.56)	0.00 (0.06)	-0.05 (1.18)	0.89	1.51
4. 1.00	-0.57 (3.71)		0.49 (3.20)			0.90	1.38
REAL WAGE DENMARK							
----- 1900-1939 -----							
$Ln\left(\frac{Y}{Pop}\right)_t^{DK}$	$Ln(Un)_t^{DK}$	$Ln(Tot)_t^{DK}$	Cif_t^{DK}	Emi_t^{DK}	\bar{R}^2	DW	
5. 1.00	0.25 (3.22)	0.14 (1.58)	0.51 (2.31)	0.00 (0.54)	0.95	1.47	
6. 1.00	0.26 (3.55)		0.45 (2.06)		0.95	1.55	

Notes. The numbers in parentheses are absolute t -statistics. The coefficients of productivity are restricted to one. A constant term is included in the estimates but not shown. The Cochrane-Orcutt procedure is used to correct for first-order serial correlation.

Sources. See the Data Appendix.

²⁹ For New Zealand alone Greasley and Oxley, Refrigeration and Distribution, p. 37, report an estimated productivity coefficient of 1.039 for the years 1874-1939.

The results in Table 3 show that for the period 1875-1939 comparative productivity, measured by real GDP per capita chiefly shaped the spread of Denmark-New Zealand real wages, but that distributional forces were important during the years to 1913, and most especially in the immediate aftermath of World War I. Among the open economy forces only capital flows had a statistically significant effect on the real wage spread. In the results for the post-1900 period, country specific labour market conditions, measured by the degree of unionization in Denmark, influenced real wages in Denmark and the real wage spread.

Ideally the ratio of union membership in New Zealand and Denmark and not just the Danish union membership would be used in the estimated model. However, union data are not consistently available for the NZ. There are two reasons for maintaining the Danish union membership variable. First, the partial strike data suggest that union activity was much more significant in Denmark than New Zealand. The strike data shows a substantial larger strike frequency in Denmark than in New Zealand in the following key years as shown in Table 4.

Table 4. Ratio of strikes per employee in Denmark and New Zealand

1918	2.173416
1919	10.48494
1920	5.654549
1921	4.961018
1922	10.75564

Notes. Strikes are measured as days lost in strikes. For New Zealand the numbers of workers involved in strikes and lock-outs (as distinct from the number of stoppages) are backdated to 1918 and 1919 using the 1920 figure.

Second, we included the Danish union data because they are important in explaining the Danish wage catch-up in 1918-1920. The historical evidence, which we consider more

fully below, points towards union activity as the driving force behind the Danish wage catch-up in these years. It would, therefore, be erroneous to leave out the additional information contained in the Danish union data from the regressions. The cointegration estimates above support the inclusion of the union data. The variables are only cointegrated if the Danish union variable is included in the estimates.

4.2 Real Wages and Productivity

In the longer term 1875-1939 real wages were chiefly shaped by GDP per capita, but the real wage and productivity spreads diverge within these years. The chief longer term influence diminishing relative New Zealand productivity is likely to have been its faster rise in the ratio of labour to land.³⁰ The European population of New Zealand rose by around 500% 1874-1939, from around 0.3-1.5 million, whereas occupied land rose by around one-third over the same period. In contrast Denmark's population rose less quickly by around 95% from 1.95-3.80 million 1874-1939. New Zealand's GDP per capita adjusted for PPP was especially high in 1874 reflecting its natural resource abundance per capita, and was around 185% of Denmark's level, but the ratio fell to 120% in 1914 and 112% in 1939.³¹

The relative fall in New Zealand's land abundance was not offset, at least from the 1890s, by higher capital formation (see Figure 5 below). Capital inflows relative to GDP were remarkably similar in the two countries 1890-1939. While shifts in relative resource endowments shaped the longer term movement of New Zealand's and Denmark's GDP per capita, factor endowments were not a singular influence on their real wages. Most

³⁰ A full discussion of comparative productivity shifts is outside the scope of this paper. Condliffe, *New Zealand in the Making*, London, Allen and Unwin, 1930 provides information on occupied land and population in New Zealand.

³¹ These ratios are projected from Maddison's, *Monitoring* 1938 estimates of GDP per capita adjusted for PPP.

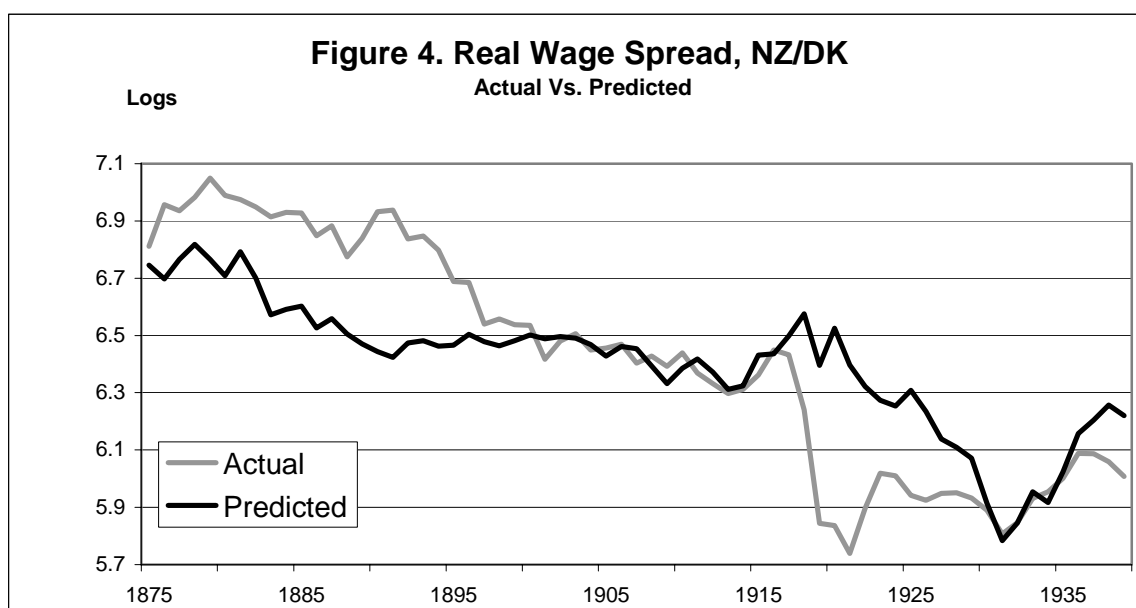
especially it was the case that Denmark's real wage advantage by 1939 exceeded that of her GDP per capita.

The disparate shifts in GDP per capita and real wages arose during Denmark's rapid real wage catch-up phase 1875-1913 and most strongly in the immediate aftermath of World War One, and in these years the real wage spread narrowed more quickly than the two countries GDP per capita. Only two-thirds of Denmark's real wage catch-up is explained by productivity catch-up for the years to 1913, see Table 5 and Figure 4. Distributional shifts thus favoured real wages in Denmark before World War I.

Table 5. Simulation results (Dependent variable: real wage spread)

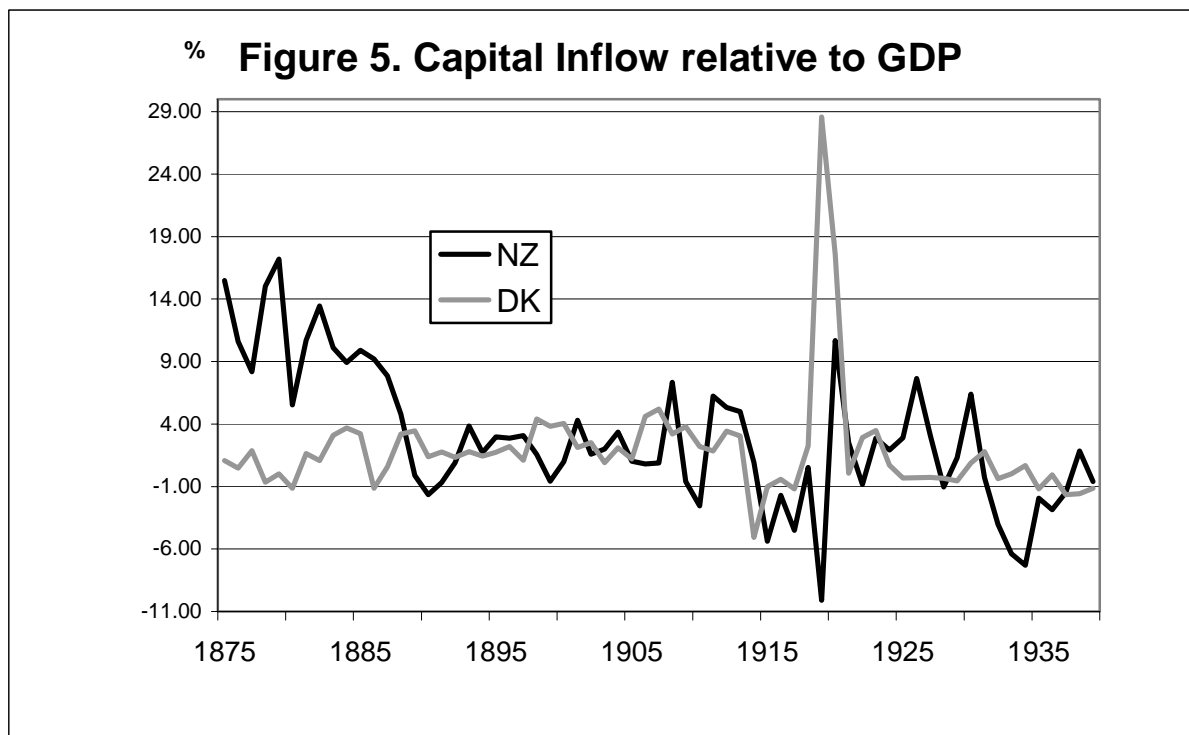
Time period	Actual change	Predicted	Productivity	Capital Flows
		%		
1875-1913	-62.5	-50.2	-41.6	-8.4
1913-1929	-36.4	-24.0	-24.0	0.0
1929-1939	7.4	14.9	15.7	-0.8

Note. The simulations are based on the estimates in the second row in Table 3.



Note. The simulations are based on the estimates in the second row in Table 3.

However, capital inflows became less important for New Zealand in the years to 1913. Her trade balance was generally in surplus from 1887 and capital inflows, necessitated in part by debt interest charges averaged 1.99% of GDP 1889-1913. In contrast, the ratio of Danish capital inflows to GDP more than doubled to average 2.59% 1889-1913. Strandskov and Pedersen discuss the composition of the capital inflow to Denmark, most especially into the food processing sector, and highlight its take-off around 1890.³⁴ Around 13.4% of the decline in the real wage ratio see Table 5, can be explained by the increasing relative tendency for international capital to flow to Denmark in the years to 1913.



Sources. Rosenberg, Capital Imports, *New Zealand Official Yearbooks*, Johansen *Dansk historisk statistik*.

Yearbooks. These data allow the annual capital inflow data reported by Rosenberg to be extended for years beyond 1913. Complete data on private debt and private debt interest are not available, and use is made of Rosenberg estimates of the ratio of private to public debt interest to gauge New Zealand overall debt interest payments. The ratio of private to public debt interest ranges from 19% for years to 1886 to 21% 1935-39.

³⁴ Strandskov, J. and K. Pedersen, Pioneering FDI into the Danish Bacon Industry, *Scandinavian Economic History Review* vol. LXVIII, 2000: 1, 42-56.

The unimportance of labour migration for relative real wages may be explained by the tendency for in-migration to become less important for New Zealand in the years to 1913. The New Zealand immigration rate averaged 47.5 per 1000 1873-77, but was negative 1888-92. Thereafter New Zealand immigration rate rose to average 6.5 per 1000 1909-13, which is less than 14% of the 1873-77 rate.³⁵ Denmark's out-migration rate was the lowest in Scandinavia, and averaged 3.67 per 1000 1870-1910.³⁶ The statistical results in Table 3 show the effects of Danish emigration and New Zealand immigration on their relative real wages was near zero.

A variety of indicators have been deployed to try and gauge how trade influenced relative real wages, including tariffs, import-GDP ratios, and the terms of trade. Denmark did not protect its grain farmers in the years to 1913, and gained from lower food prices, but the net effect on real wages is unclear. Moreover, New Zealand also gained from lower transport and manufactured good prices. Like Denmark, New Zealand did impose tariffs on manufactures, including on imports from Britain. Denmark's tariff on manufactures ranged from 14-20% in the years 1875-1913.³⁷ By 1913 New Zealand imposed a 20% tariff on many consumer goods, including on textiles, furniture, and bicycles, although machinery attracted only a 5% tariff. New Zealand also taxed the import of a variety of food products, including grains, and its tariff revenue per capita rose from £2.52 in 1893 to £3.21 in 1913 (*New Zealand Official Yearbook* 1914). Overall, the openness of the Danish and New Zealand economy to trade may have been broadly similar in 1913.

The results in Table 3 show that relative movements in Denmark's and in New Zealand's terms of trade did not statistically significantly influence their real wage spread,

³⁵ Bloomfield, G. T., *New Zealand Handbook of Historical Statistics*. Boston: G. K. Hall and Company, 1984.

³⁶ O' Rourke and Williamson, *Around the European Periphery*.

³⁷ O' Rourke and Williamson *Around the European Periphery*.

and advantage one country over the other. The likely implication is that both countries gained in similar fashion from improvements in their terms of trade, at least to 1920.³⁸ Neither did including their respective tariff rates or their openness to imports produce statistically significant coefficients (results not shown). It was the international flow of capital, rather than labour migration or the terms of trade that reinforced productivity catch-up, to contribute to Denmark's real wage catch-up with New Zealand in the years to 1913.

4.4 Distribution Variables after 1913

Open economy forces played a less important role in shaping the Denmark-New Zealand real wage ratio after 1913. Denmark though did experience a dramatic rise in its wage-rental ratio to 1919, but this chiefly reflected the real wage bargaining success of Danish unions. Denmark's real wages surged ahead of New Zealand's, and the lead was largely sustained through the years between the world wars. The Danish real wages increased by 13% in 1918, 52% in 1919, and 9% in 1920. Much of Denmark's historiography points to worker militancy having powerful real wages effects in the aftermath of World War I.³⁹ Danish union membership increased from 152,000 in 1913 to 321,000 in 1921.⁴⁰

The Danish Syndicalism movement was founded in 1910 and fuelled by the Russian October Revolution in 1917 gained momentum over the period 1918 to 1921. In terms of members the movement was insignificant, but Hansen and Henriksen show it was highly effective in influencing wages and creating labour unrest. Their strategy was to form groups within the union movements to try and influence the direction taken by the union. The increase in the number of strikes and lockouts over the period witness an explosive

³⁸ However Greasley and Oxley, *Refrigeration and Distribution*, p. 39, show that for New Zealand that shifts in the terms of trade chiefly affected the price of land relative to labour.

³⁹ Dalhoff, J., *Krigsaarernes Lønpolitik*, *Nationaløkonomisk Tidsskrift* vol. LIX, 1921:1-36.

Hansen, S. A. and I. Henriksen, *Dansk Social Historie*, København: Gyldendal, 1984.

⁴⁰ Visser, J., *In Search of Inclusive Unionism*. Deventer & Boston: Kluwer Law & Taxation, 1990.

development in labour market conflicts. The days lost from strikes rose six-fold from 1916 (which is the first year strikes are recorded) to 1921 (*Statistisk Årbog*). The strength of the labour movement was partly due to shortage of labour in the post war period.⁴¹ The rate of unemployment decreased from 18.1% in 1918 to 10.9% in 1919 and 6.1% in 1920.⁴² The reduction in unemployment alone would have pushed up the real wage growth by approximately 7% in 1919 and 5% in 1920 using the parameter estimates of the Phillips curve during the interwar period by Madsen.⁴³

Another factor that contributed to the wage explosion was the reduction in working hours from 9½ hours a day to 8 hours a day over the period from 1919 to 1920, which was accompanied by an increase in unemployment benefits.⁴⁴ The working hours' reduction alone resulted in a 16% increase in real hourly wages. Together reductions in working hours and unemployment resulted in a real wage increase of 28% or about half of the wage explosion. That real wages rose even further might be connected to workers' dissatisfaction with the earlier real wage reduction of 21% during 1913-17, and to the leverage provided to union bargainers by higher unemployment benefits when there was an absence of strong political opposition to the wage increases in the wake of the Russian Revolution and Denmark's wildcat strikes of 1919 and 1920.⁴⁵

Fully comparable labour militancy data are not available for New Zealand, but that for the numbers of workers involved in strikes does not show a dramatic increase around the end of World War I. Around 4000 New Zealand workers were involved in strikes in 1918 and 1919, compared to around 6000 and 13,000 in 1912 and 1913 respectively. In

⁴¹ Dalhof, *Krigsaarernes Lønpolitik*.

⁴² *Dansk historisk statistik*.

⁴³ Madsen, J. B., The Length and the Depth of the Great Depression: An International Comparison, *Research in Economic History* vol. 22, 2004:2, 239-288.

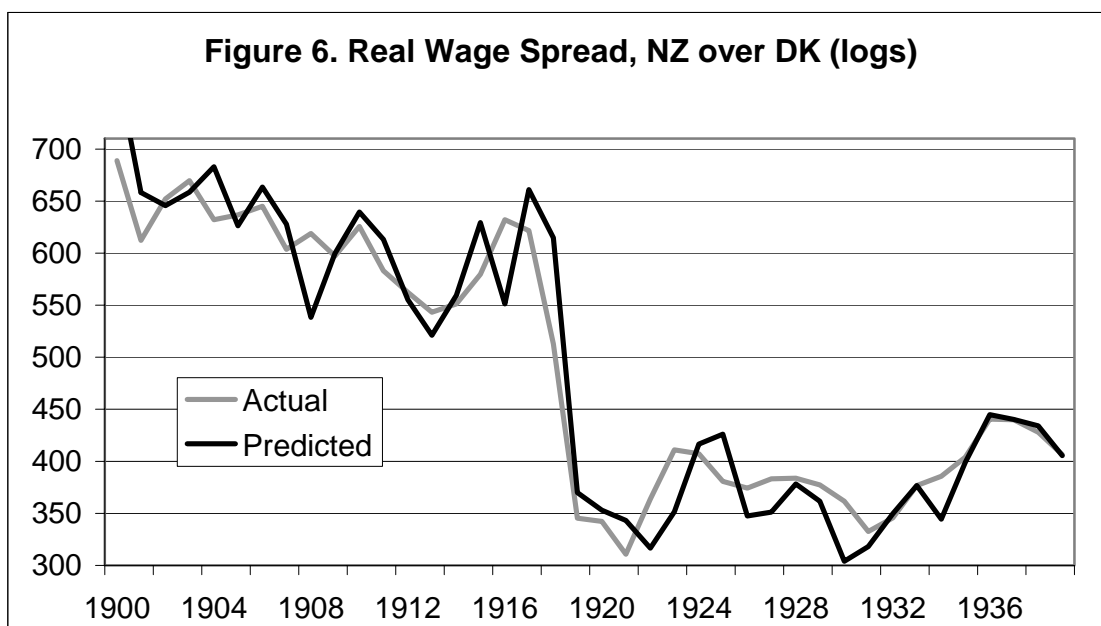
⁴⁴ It is not clear from Dalhoff, *Krigsaarernes Lønpolitik* whether it was the replacement rate that increased or the real benefits rate.

⁴⁵ Bang, *Fagoppositionens Sammenslutning 1910-1921 – De Danske Syndikalister* Aarhus: Modtryk, 1975.

contrast 36,000 Danish workers were involved in strikes in 1919, the first year such data are available. It seems clear that labour militancy was a more powerful force in Denmark than in New Zealand in the aftermath of World War I. The coefficients for the Danish union variable are statistically significant in both the real wage spread and Denmark's own real wage equation.

The inclusion of the union membership variable greatly improves the predictive power of the real wage spread equation for the years around World War I - see Figure 6. In particular, for 1919, the year Danish real wages surge ahead of those in New Zealand, around one-half of the faster growth of Denmark's real wages is accounted for by the rise in union membership. Capital inflows, reflecting a sharp jump in Denmark's current account deficit amounting to 29% of GDP when New Zealand experienced a capital outflow, explains around 46% of Denmark's faster real wage growth in 1919.⁴⁶ Capital inflows to Denmark were also substantial in 1920. In contrast capital inflows to New Zealand were neutral over the years 1919-20, reflecting a large capital outflow in 1919 as pent-up goods were released for exports, but a commensurate inflow in 1920 when imports surged. The dramatic collapse in the real wage spread around the end of World War I chiefly arose from distributional shifts on the Danish side.

⁴⁶ A boom-induced surge in imports was primarily responsible for the current account deficits, which climbed to 28.6% in 1919 and remained at 17.6% in 1920. The increase in the economic activity was significant: GDP increased by 19.9% in 1919 and by 4.7% in 1920 and the rate of unemployment decreased from 18.1% in 1918 to 10.9% in 1919 and 6.1% in 1920, and industrial production increased by 40.6% in 1919 and by 18.4% in 1920. The economic upswing generated a strong increase in imports of manufactures and capital goods, particularly, which increased from 5.6% of GDP in 1918 to 17.0% in 1919 and remained at 14.9% in 1920.



Note. The simulations are based on the estimates in the fourth row in Table 2.

5 Concluding remarks

Denmark achieved spectacular real wage growth in the half century after 1870 and according to Williamson had the highest levels in the world in 1921. Her real wage catch-up with the “western-offshoots” was the most dramatic. In 1870 urban labour’s real wage had averaged around three times higher in Australia and the USA than in Denmark. Adding New Zealand to the comparisons reinforces that there was a remarkable Danish advance. New Zealand’s real wages was twice as high in the 1870s, but averaged around 75% of Denmark’s level between the world wars. Why this happened depended upon relatively fast productivity advance in Denmark, but also on shifts in income distribution that particularly favoured Danish workers.

Over the years 1875-1939 around two-thirds of faster Danish real wage growth can be accounted for by her higher real GDP per capita growth. Of the contribution made by distributional shifts, the open economy forces leading to faster real wage growth in Denmark were most substantial in the years to 1913. In these years the wage-rental ratio

declined in New Zealand, but rose in Denmark. Accordingly, the tendency for faster productivity growth to lead to high Danish real wages was reinforced, principally by international capital flows. In contrast, we found no evidence that the modest in-migration of labour to New Zealand or the modest outflows from Denmark affected their real wage dispersion. Neither do our results show that shifts in the terms of trade favoured real wages in one country over the other.

The most dramatic shifts in income distribution from property owners to wage earners occurred around the end of World War I, and principally favoured real wages in Denmark. The shifts were not principally driven by open economy forces, although Denmark experienced substantial capital inflows in 1919-20. More important was the rise in labour's bargaining power associated with trades' union militancy, and this led to a real wage surge in Denmark which peaked around 1921. The distributional shifts were more powerful around World I than in the open world economy era to 1913. The effect was to ratchet Danish real wages beyond New Zealand levels after World War I, and Denmark's real lead was sustained between the world wars.

Generally, the comparisons of Denmark and New Zealand temper the contribution of factor price equalization tendencies and highlight the role of productivity in explaining their real wage dispersion. Denmark's real wages caught-up and surged ahead those of its new world competitor principally because of faster productivity growth. This perspective does not necessarily diminish the contribution of international forces, related for example to the spread of dairying or refrigeration technology, possibly stimulated by international capital and trade flows, which may have raised Denmark's real GDP per capita, and thus her real wages. Nevertheless, the contribution of relative shifts in the price of labour and land in the Old World and the New, arising from trade and factor flows, was, on the basis

of a comparison of Denmark and New Zealand a comparatively modest influence on real wages, although the effects of capital flows were not inconsequential before 1913.

Data Appendix

A. Sources.

Denmark

Nominal GDP. Hansen, S. A., *Økonomisk Vækst I Danmark*, København: Akademisk Forlag, 1976.

Real GDP. Maddison, A., *Monitoring the World economy 1820-1992*. Paris: OECD, 1995.

Imports. Johansen *Dansk historisk statistik*.

Import duties, Mitchell, B. R., *European Historical Statistics 1750-1975*. London: Macmillan, 1975.

Population. Johansen *Dansk historisk statistik*.

Union Membership. Visser *In Search*.

Wages. Johansen *Dansk historisk statistik*.

Emigration. Johansen *Dansk historisk statistik*.

Capital inflow. Johansen *Dansk historisk statistik*.

Terms of Trade. Johansen *Dansk historisk statistik*.

Consumer prices. Pedersen *Arbejdslønnen i Danmark*, Johansen *Dansk historisk statistik*.

Land Prices. Christensen *Lønudviklingen inden, Statistisk Årbog*.

New Zealand

Real and Nominal GDP. Greasley and Oxley *Measuring New Zealand's GDP; Regime shift and fast recovery*.

Consumer Prices. Nesbit-Savage, *A long run consumer price index*.

Imports. Bloomfield *New Zealand Handbook*.

Import duties. Mitchell, B. R., *International Historical Statistics: Americas and*

Australasia. London: Macmillan, 1983

Wages. Greasley and Oxley, *Refrigeration and Distribution; Globalization and real wages*

Land Prices. Greasley and Oxley, *Refrigeration and Distribution*.

Immigration. Bloomfield *New Zealand Handbook*.

Capital inflow. Rosenberg, *Capital imports; New Zealand Official Yearbooks*.

Terms of Trade. Brigg, P., *Looking at the Numbers: a view of New Zealand's economic history*, Wellington, NZIER, 2003.

B. Denmark data.⁴⁷

Index, 1900 = 1

	Real Wages	Real Land Prices	Wages per hour
1873	0.443621	1.008936	0.53125
1874	0.476176	1.047335	0.59375
1875	0.532895	1.137745	0.625
1876	0.516582	1.18781	0.625
1877	0.490753	1.228482	0.59375
1878	0.517756	1.238793	0.5625
1879	0.586509	1.208415	0.59375
1880	0.581897	1.209239	0.625
1881	0.556319	1.222169	0.625
1882	0.5625	1.293662	0.625
1883	0.581897	1.355458	0.625
1884	0.617378	1.395152	0.625
1885	0.640823	1.255798	0.625
1886	0.713028	1.175114	0.625
1887	0.684122	1.169177	0.625
1888	0.70875	1.119208	0.65625
1889	0.68149	1.03738	0.65625
1890	0.68149	1.116037	0.65625
1891	0.647529	1.058697	0.6875
1892	0.709985	1.065196	0.71875
1893	0.756088	1.08087	0.71875
1894	0.81	1.094151	0.75
1895	0.878906	1.082	0.78125
1896	0.940179	1.09456	0.8125
1897	0.984375	1.130293	0.875

⁴⁷ Comparable New Zealand data can be found in Greasley and Oxley, *Refrigeration and Distribution*, p43-4.

1898	0.999178	1.061581	0.9375
1899	1.00601	1.080411	0.96875
1900	1	1	1
1901	1.03125	0.965362	1.03125
1902	1.018674	1.027822	1.03125
1903	1.057358	1.035532	1.03125
1904	1.089399	1.09185	1.0625
1905	1.0625	1.09404	1.0625
1906	1.080412	1.122144	1.09375
1907	1.09304	1.206183	1.1875
1908	1.096875	1.226644	1.21875
1909	1.150568	1.249509	1.25
1910	1.125	1.243846	1.25
1911	1.208097	1.302938	1.3125
1912	1.172368	1.350237	1.375
1913	1.174291	1.411972	1.40625
1914	1.164375	1.409106	1.4375
1915	1.072117	1.232903	1.56185
1916	0.988874	1.131651	1.696956
1917	0.927601	1.10532	1.84375
1918	1.050199	1.129759	2.4375
1919	1.600476	1.181956	4.40625
1920	1.75094	0.851072	5.75
1921	1.993639	0.949772	5.5625
1922	1.819336	1.034913	4.3125
1923	1.670625	1.005549	4.125
1924	1.67158	1.035095	4.375
1925	1.793993	1.103672	4.5625
1926	1.880357	1.106966	4.0625
1927	1.857249	1.026905	3.875
1928	1.853237	1.022373	3.84375
1929	1.879491	1.1042	3.875
1930	2.005896	1.179669	3.9375
1931	2.12625	1.174515	3.9375
1932	2.157508	1.014109	3.96875
1933	2.101103	0.990347	3.96875
1934	2.053656	1.015684	4.03125
1935	1.978977	1.002043	4.03125
1936	1.985591	0.987173	4.09375
1937	1.94599	0.945563	4.15625
1938	2.025	0.931272	4.375
1939	2.053125	0.92294	4.5625