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NEW ZEALAND'S GROSS NATIONAL PRODUCT: 1859-1939

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In this paper the author continues the work of Hawke, who used Australian velocity of money data to estimate New Zealand's GDP for 1870-1918, and whose results have been incorporated into international studies through the work of Bairoch. He also provides an alternative set of estimates for the inter-war years to those published by Lineham. The important findings of the paper are: (i) that Australian data show a significant relationship between the velocity of money and the price level; (ii) that New Zealand's income was significantly higher in 1870 than Hawke's estimates suggest; (iii) that sustained *per capita* growth has not been New Zealand's normal experience; (iv) that previous GDP estimates for the inter-war period have failed to reflect the fluctuations of the New Zealand economy and the extent to which it was operating below its production possibilities frontier during the Great Depression of the 1930s.

I. Introduction

In 1962 Noel Butlin published estimates of Australia's gross domestic product (GDP), gross national product (GNP), and gross fixed capital formation (GFCF), covering the period from 1861 to the first official estimates of GNP in the year to June 1939. He also published price deflators for GDP and GFCF. Unfortunately Butlin's work did not extend to New Zealand, despite the fact that before Australian federation in 1901 New Zealand was an Australasian colony of Great Britain. The only published time series of New Zealand's gross product before 1918 is the GDP series of Hawke (1975). For the inter-war years, the only complete series of gross product or national income is that of Lineham (1968). The estimates presented here cover the 80 years of New Zealand's first century to the first official GNP statistic which was published for the year to March 1939.[1]

Hawke, assuming comparability between the New Zealand and Australian financial systems, used Leff's (1972) method to construct GDP estimates from monetary data. This paper utilises Hawke's technique as a means of interpolating between (and extrapolating from) independently derived national income estimates which are available from contemporary sources for a few specific years, the earliest of which is 1865. Hawke based his estimates on the Quantity of Money Identity:

$$MV = PQ = Y$$

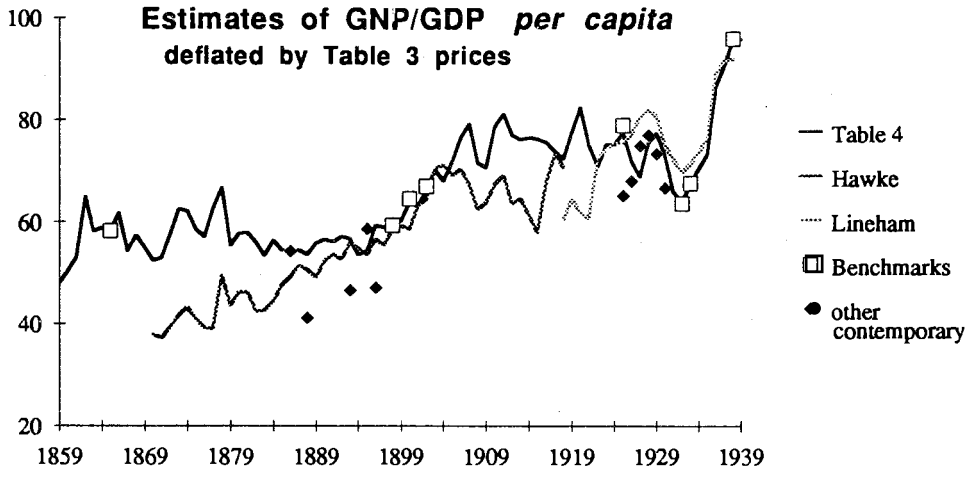
Note: These estimates were first presented to the New Zealand Association of Economists Conference, University of Auckland, on 20 August, 1990. I would like to thank Gary Hawke, Jacques Poot, Brian Philpott, Brian Easton, Tony Endres, Brendan Thompson, William Coleman, Geoff Bertram, Brad Patterson, Grant Fleming and Graeme Snooks for their comments on earlier drafts of this paper.

[1]New Zealand was annexed as a British colony, via the *Treaty of Waitangi*, in 1840.

where M = quantity of money, V = velocity of circulation of money, P = price level, Q = real gross product, Y = gross product.

When a value for velocity is available, a country's income can be computed from the size of its money stock. Since velocity data for Australia was available, Hawke assumed that Australian velocity trends would be about the same as New Zealand's, given the closeness of the two economies and the shared banking system.[2] As a check he derived independent velocity estimates for New Zealand for the years 1918-33, based on the GDP estimates of Lineham, and regressed them against Australian velocity estimates for the same years.[3] Hawke's GDP estimates were broadly in line with national income estimates produced by contemporaries between 1886 and 1903, but incompatible with an 1865 estimate to which Hawke (1985, pp. 76-77) nevertheless gives a considerable degree of credence. Comparisons with Australian incomes suggest that Hawke's data understate New Zealand's GDP before the 1880s and after the mid-1900s. Hawke's series is also suspect because New Zealand's fluctuations were not well synchronised with Australia's (Dowie, 1963).

While Hawke was careful to state that his 1975 estimates of New Zealand's GDP were no better than "plausible" (1985, p. 79) or a "stop-gap" (1975, p. 306), his series has nevertheless been utilised by national and international studies (Fairburn, 1989, pp. 98, 106-109; Bairoch, 1981, p. 10; De Long, 1988, p. 1152).[4] Bairoch's 1860 and De Long's 1870 statistics are serious underestimates of New Zealand's GDP. De Long's 1870 New Zealand *per capita* datum is only half of the value given for Australia. In the light of the estimates in this paper, New



Note: Values in 1910/11 pounds

Figure 1.

[2]Velocities were calculated by dividing Butlin's GDP estimates by monetary aggregates (bank deposits) provided by S. J. Butlin, Hall and White (1971, pp. 140-156).

[3]Hawke (1975, p. 304) obtained the formula: $\log V_{NZ} = \log 1.54 + 0.19\ V_A$ ($R = 0.52$).

[4]Bairoch only gives a reference to an unpublished paper, but it is apparent from an earlier paper, (1977, p. 185) that his 1860 New Zealand datum is estimated from Hawke's series. De Long cites Bairoch as his source.

Zealand is an excellent supporting example for Baumol's (1986) "convergence" hypothesis which De Long's study challenges.

II. Velocity Regressions

In trying to discover why Hawke's GDP estimates for the 1870s were so low, it became apparent that the Australian velocity estimates might be correlated to the general price level. With New Zealand prices falling more rapidly than Australian prices from the 1860s to the 1880s, it seemed likely that Hawke's velocity approximations for the 1870s were too low.[5] An estimation function for velocity could be improved, evidently, by including a price variable. Further examination of the Australian data showed that velocity was not particularly high in the late 1880s, the period of "Marvellous Melbourne" (Davison, 1978) in which Victoria's economy was characterised by a speculative investment boom. A reason for the low velocity statistic during the boom becomes apparent from a consideration of the quantity identity.

Strictly speaking, $MV = PT$, where T is the volume of transactions rather than output. Thus:

$$\begin{aligned} & MV = PT \\ \Leftrightarrow \quad & MV = PQ \cdot (T/Q) \\ \Leftrightarrow \quad & V' = PQ/M \qquad \text{where } V' = V \cdot (Q/T) = Y/M. \end{aligned}$$

Here, V' is regarded as the ratio of gross national product to trading bank deposits.[6] This velocity ("VEL") can be expected to be comparatively low at times in which there is much trade in existing assets. Such periods, when the volume of transactions is high relative to national income, are indicative of a high speculative demand for money.[7] The general price level also tends to rise at such times.

It is therefore proposed that the quantity of money *per capita* is negatively related to its velocity. The essence of Hawke's technique is that the monetary data is scaled up by a velocity parameter to produce GDP estimates. With velocity inversely related to the stock of money, the derived gross product data fluctuate less than the quantity of money data. This paper's GNP estimates are based on estimating velocity ("VEL") from two regressors: trading bank deposits *per capita* ("MPC") and the price level ("PRI"). Hawke's and Lineham's GDP series are graphed in Figure 1, alongside this paper's GNP estimates. Australia's GNP is presented in Table 1 and Figure 2.[8]

[5]Hawke (1985, pp. 78–79) noted that he had, in effect, assumed that velocity decreases were less marked in New Zealand than in many other countries during the 19th century.

[6]I have chosen to estimate gross national product at market prices, rather than gross domestic product, in order to link up with the official GNP estimates for 1938/39.

[7]Kindleberger (1984, p. 365) describes such a situation: "while the overall money supply is unchanged, within the total there is a shift from what Keynes called the 'transactions circulation' to the 'financial circulation' " which is the same as "a decline in income velocity."

[8]Butlin's (1962, pp. 6–7) estimates, scaled to link with official estimates for 1938–40 (Butlin 1962, p. 468), and converted to calender years.

TABLE 1

AUSTRALIA—REGRESSION DATA

	Population (000)	Prices (1910/11) "PRI"	GNP £m	Trading Bank Deposits £m	Trading Bank Deposits £ p.c. "MPC"	Velocity "VEL"	Dummy "IW"
1861	1,157	1208	70.22	14.16	12.24	4.96	0
1862	1,188	1218	69.48	14.83	12.48	4.69	0
1863	1,233	1160	68.42	15.05	12.20	4.55	0
1864	1,292	1076	70.01	15.72	12.16	4.45	0
1865	1,358	1088	70.86	17.01	12.53	4.17	0
1866	1,417	1111	77.01	17.78	12.55	4.33	0
1867	1,464	1003	77.54	17.96	12.27	4.32	0
1868	1,512	1017	82.64	20.09	13.29	4.11	0
1869	1,566	1005	82.42	20.14	12.86	4.09	0
1870	1,620	1002	87.83	20.24	12.49	4.34	0
1871	1,674	999	84.55	21.02	12.55	4.02	0
1872	1,722	1077	100.67	24.48	14.21	4.11	0
1873	1,769	1133	116.79	27.46	15.52	4.25	0
1874	1,822	1107	117.85	29.16	16.01	4.04	0
1875	1,874	1081	127.40	33.02	17.62	3.86	0
1876	1,928	1075	126.23	36.78	19.08	3.43	0
1877	1,995	1056	129.20	41.57	20.84	3.11	0
1878	2,062	1010	134.62	42.16	20.44	3.19	0
1879	2,127	1013	136.52	42.79	20.12	3.19	0
1880	2,197	1002	142.15	44.58	20.29	3.19	0
1881	2,269	994	151.59	51.77	22.82	2.93	0
1882	2,347	1095	157.63	57.90	24.67	2.72	0
1883	2,447	1064	175.24	61.65	25.19	2.84	0
1884	2,556	1038	171.42	67.85	26.55	2.53	0
1885	2,650	1042	183.09	74.17	27.99	2.47	0
1886	2,741	1012	179.591	75.90	27.69	2.37	0
1887	2,835	978	197.84	80.99	28.57	2.44	0
1888	2,932	1031	202.82	89.03	30.37	2.28	0
1889	3,022	1045	223.09	93.24	30.85	2.39	0
1890	3,107	1050	215.55	97.89	31.51	2.20	0
1891	3,196	958	211.84	97.89	30.63	2.16	0
1892	3,273	922	178.53	98.87	30.21	1.81	0
1893	3,334	873	159.54	91.42	27.42	1.75	0
1894	3,394	818	154.88	84.28	24.83	1.84	0
1895	3,459	822	146.50	83.76	24.22	1.75	0
1896	3,522	867	167.18	85.87	24.38	1.95	0
1897	3,585	883	160.39	83.62	23.33	1.92	0
1898	3,641	887	186.70	80.50	22.11	2.32	0
1899	3,690	903	190.73	82.64	22.40	2.31	0
1900	3,741	888	199.11	87.43	23.37	2.28	0
1901	3,796	941	204.42	88.34	23.27	2.31	0
1902	3,855	947	208.02	89.59	23.24	2.32	0
1903	3,905	948	220.49	88.36	22.63	2.50	0
1904	3,956	948	233.91	88.67	22.42	2.64	0
1905	4,018	956	242.50	95.85	23.85	2.53	0
1906	4,086	979	267.53	103.59	25.35	2.58	0
1907	4,158	998	281.80	109.47	26.33	2.57	0
1908	4,236	988	288.27	110.49	26.08	2.61	0
1909	4,300	983	313.20	115.30	26.81	2.72	0
1910	4,404	999	341.63	127.21	28.88	2.69	0
1911	4,526	1045	363.85	140.49	31.04	2.59	0
1912	4,651	1086	390.00	145.14	31.21	2.69	0
1913	4,803	1121	425.86	144.48	30.08	2.95	0
1914	4,907	1217	422.62	154.18	31.42	2.74	

TABLE 1—continued

	Population (000)	Prices (1910/11) "PRI"	GNP £m	Trading Bank Deposits £m	£ p.c. "MPC"	Velocity "VEL"	Dummy "IW"
1915	4,937	1299	422.67	164.09	33.24	2.58	
1916	4,904	1384	475.93	178.89	36.48	2.66	
1917	4,905	1485	512.36	189.22	38.58	2.71	
1918	4,983	1566	540.48	210.47	42.24	2.57	
1919	5,167	1733	590.60	225.36	43.62	2.62	1
1920	5,358	1832	681.30	240.24	44.84	2.84	1
1921	5,462	1759	727.55	239.97	43.94	3.03	1
1922	5,572	1763	735.77	244.90	43.95	3.00	1
1923	5,692	1814	775.28	263.33	46.26	2.94	1
1924	5,812	1841	841.95	262.79	45.22	3.20	1
1925	5,933	1860	872.98	275.74	46.48	3.17	1
1926	6,052	1855	861.84	283.93	46.92	3.04	1
1927	6,173	1871	871.18	289.12	46.84	3.01	1
1928	6,296	1885	868.21	299.60	47.59	2.90	1
1929	6,396	1796	824.56	309.65	48.41	2.66	1
1930	6,468	1626	709.04	290.96	44.99	2.44	1
1931	6,527	1488	618.71	288.43	44.19	2.15	1
1932	6,579	1418	618.55	314.27	47.77	1.97	1
1933	6,630	1432	657.85	315.81	47.63	2.08	1
1934	6,681	1480	700.97	336.10	50.31	2.09	1
1935	6,730	1536	755.76	334.31	49.67	2.26	1
1936	6,780	1616	828.69	339.35	50.05	2.44	1
1937	6,837	1675	901.68	368.64	53.92	2.45	1
1938	6,899	1709	933.39	382.87	55.50	2.44	1
1939	6,964	1757	975.00	384.21	55.17	2.54	1

Sources: Refer to text (fn. 8, fn. 9); note, World War I years excluded from regressions.

The regression equations are derived from the Australian data presented in Table 1.[9] They exclude the years 1914–18, and include a dummy variable ("IW") for the inter-war years 1919–39. There were 74 observations. Three equations have been estimated, using respectively the current year's ("MPC"), the previous year's ("MPC_{-1}"), and both years' *per capita* monetary aggregates. The equations found are, with *t*-statistics in brackets:

(a) $$\ln VEL = \underset{}{-7.94} + \underset{[12.1]}{1.57} * \ln PRI - \underset{[20.8]}{0.602} * \ln MPC - \underset{[6.97]}{0.429} * IW$$
[17.5]

$$R^2 = 0.944 \quad DW = 0.99 \quad F = 394$$

(b) $$\ln VEL = \underset{}{-7.27} + \underset{[11.0]}{1.47} * \ln PRI - \underset{[21.0]}{0.608} * \ln MPC_{-1} - \underset{[5.93]}{0.371} * IW$$
[16.3]

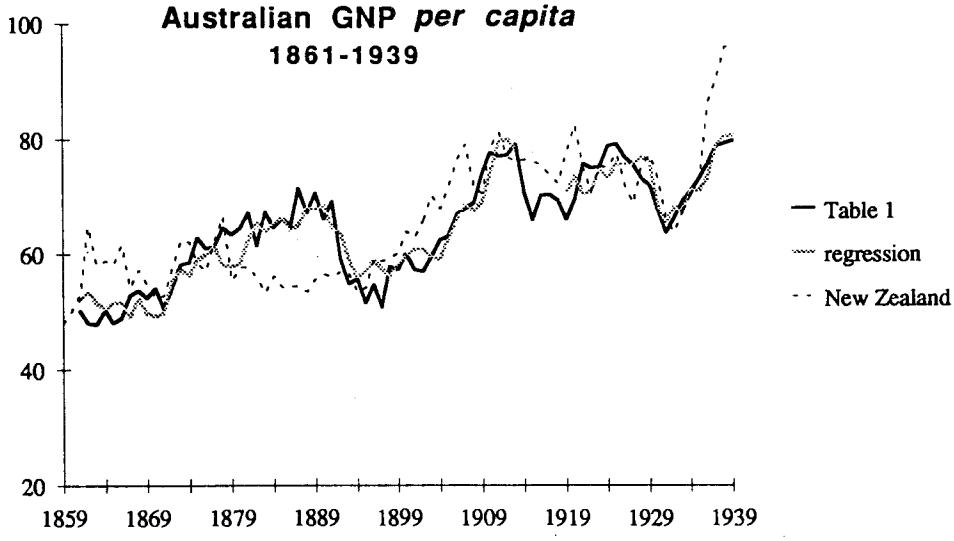
$$R^2 = 0.945 \quad DW = 1.46 \quad F = 402$$

[9]All time series relating to financial years have been converted to calendar years. I have used Butlin's price series (1962, pp. 33–34) and monetary data from Butlin, Hall and White (1971, pp. 142–157). The Australian population data—averages of the December 31 estimates—is from Maddock and McLean (1987, pp. 353–354) and the *Official Year Book of the Commonwealth of Australia* (1910, pp. 118–119).

(c) $\ln VEL = -7.52 + 1.51 * \ln PRI - 0.27 * \ln MPC - 0.34 * \ln MPC_{-1} - 0.39 * IW$
[11,2] [16.4] [1.64] [2.01] [6.20]

$R^2 = 0.947 \quad DW = 1.23 \quad F = 309$

The statistical relationship between the price level and velocity is very strong, as is the negative relationship between the quantity and velocity of money. Although the lagged money stock is a slightly better regressor than current-year stock, a more robust function for New Zealand's velocity can be constructed by including both lagged and current "MPC" series, giving them equal weight. It is also clear from the dummy variable that structural changes in the relationships between the regression variables occurred during the war. These differences between the inter-war years and the pre-World War I years raise further doubts about Hawke's adoption of a function to estimate velocity based on inter-war monetary data.



Note: Values in 1910/11 pounds

Figure 2.

New Zealand velocities are likely to reflect some structural factors that do not apply to Australia, because of possible differences in the demand for banking services due to factors such as variation in income distribution and economic geography. These differences are not likely to have been the same in 1939 as they were in 1859. Thus, more accurate New Zealand velocity estimates can be found by using separate regression equations for separate periods, and by scaling the resulting estimates to fit independently derived New Zealand benchmarks. The 80 year time-frame was divided into three sub-periods, and separate regressions on the Australian data were taken for each.

The periods chosen for the three regressions were 1861-1900, 1900-13, and 1919-39. The fitted equations are as follows:

(d) 1861-1900

$$\ln \text{VEL} = -6.10 + 1.33 * \ln \text{PRI} - 0.190 * \ln \text{MPC} - 0.491 * \ln \text{MPC}_{-1}$$
$$[5.75][9.23] \qquad [0.858] \qquad [2.15]$$
$$R^2 = 0.964 \quad DW = 1.48 \quad F = 320$$

(e) 1900-1913

$$\ln \text{VEL} = -7.46 + 1.32 * \ln \text{PRI} + 0.097 * \ln \text{MPC} - 0.238 * \ln \text{MPC}_{-1}$$
$$[2.21][2.08] \qquad [0.058] \qquad [0.478]$$
$$R^2 = 0.670 \quad DW = 1.28 \quad F = 6.76$$

(f) 1919-1939

$$\ln \text{VEL} = -8.35 + 1.47 * \ln \text{PRI} - 0.594 * \ln \text{MPC} + 0.167 * \ln \text{MPC}_{-1}$$
$$[8.52][14.5] \qquad [2.20] \qquad [0.592]$$
$$R^2 = 0.935 \quad DW = 0.74 \quad F = 81.5$$

The relative importance of the current and lagged monetary aggregates varies for each function. But when they were used as substitute rather than complementing regressors—as in equations (a) and (b)—the coefficients were similar whichever monetary series was used. Serial correlation is present. The effects are shown in Figure 2. In the 1920s, the lack of randomness of the deviations is marked, but their amplitudes are generally small. There are a few short periods where the predicted Australian GNP deviates by about 10 percent from the Table 1 series. This suggests that Australia experienced some events for which dummy variables would raise the regression R^2; periods such as the early 1860s, 1879-81, mid-1890s, early 1920s. Similar periods for New Zealand must also have occurred. A likely candidate would be the late-1880s—analogous to the mid-1890s in Australia—when GNP may have been significantly lower than has been estimated.

III. Benchmark Estimates

Independent estimates for New Zealand's gross national product have been derived for the years 1865, 1898/99-1902/03, 1925/26, 1932-33, and 1938/39.

TABLE 2

Benchmark Estimates of New Zealand's GNP

Year	GNP (£m)
1865	15.8
1898/99	36.8
1900/01	43.3
1902/03	46.2
1925/26	175.7
1932	117.0
(1932/33	113.7)
1933	123.7
1938/39	231.1

The first benchmark is a contemporary estimate of national income by Charles Knight (1866), a senior public servant. Dowie (1966), in assessing Knight's estimate of £15.8 million, has concluded that any errors which may have lead to overstatement appear to be balanced by factors which would lead to understatement.[10] Dowie concluded that Knight's effort was one of great intellectual merit, overcoming a lack of data and an absence of methodological precedent. His national income total has therefore been taken as a valid estimate of New Zealand's GNP for 1865. Knight's work indicated that New Zealanders' incomes were significantly higher than Australians' which in turn were well above prevailing incomes in any other country. This conclusion has to be seen, however, in the context of higher prices in New Zealand, the low population base, and by the fact that average incomes had been temporarily boosted by the gold rushes of 1861/62 and 1865/66. The data shown in Figure 2 suggests that there was income parity between Australia and New Zealand in 1860 and 1870.

Dowie also cited four estimates of New Zealand's turn of the century GNP by the New South Welsh economist and statistician, T. A. Coghlan: 1898/99, 1900/01, 1901/02 and 1902/03.[11] Coghlan's achievements have been assessed by Arndt (1949) and Butlin (1962, pp. 36–40). Dowie raised Coghlan's Australian estimates by 12.5 percent to make them comparable with Butlin's GDP estimates.[12] The benchmarks used for the years 1898/99, 1900/01, and 1902/03 are the adjusted Coghlan estimates.

Since the introduction of the Reserve Bank in 1934 created a discontinuity in New Zealand's monetary data, it is inappropriate to apply the monetary technique beyond 1933. Instead, I use semi-official estimates of GNP from 1931/32 which were reconstructed from aggregate private income data published in the 1940s.[13] The 1930s' benchmarks are taken from this series. Note that the trough of New Zealand's Great Depression was the year to March 1933, somewhat later than most countries, with an estimated GNP of only £113.7 million. The 1938/39 benchmark is the first official estimate (NZOYB, 1957, p. 716).

Fisher (1930) estimated aggregate private income for 1925/26 from census and tax data. His estimate was £137.1 million. Assuming that the Fisher estimate of aggregate private income is comparable with the earliest official estimates for the years 1931/32 to 1935/36 (NZOYB, 1938, p. 737), to convert to GNP his estimate has been scaled up by the same amount that these first official estimates have been scaled. Since estimates of GNP are produced in this paper, and because the 1932 benchmark coincides with the peak of the Great Depression, Fisher's estimate was further adjusted in line with the ratio of GNP:GDP in Butlin's

[10]Dowie discusses Knight's procedures in some detail, finding that some "double-counting" in the primary and banking sectors gives an error of about 10 percent of the total estimate. However, an allowance for house rents reduces the error to 3 percent. Knight himself believed his estimate was an understatement, because he omitted some activities for which he could find no data.

[11]Coghlan's estimates were for Australia and New Zealand, before and after Australian federation in 1901, disaggregated into colonies/states.

[12]Butlin's GNP estimates are lower than his estimates of GDP at market prices. However, the Table 1 GNP estimate for 1902 is equal to Butlin's GDP estimates for 1901/02 and 1902/03, so the 12.5 percent scale factor still applies.

[13]NZOYB (1940, pp. 782–783; 1942, p. 647; 1957, p. 717). I adjusted the series from March years to calendar years so as to make them compatible with the regression estimates. Note also the GNP/GDP series in NZOYB 1990 (p. 679) which goes back to 1935.

Australian data. In the middle of the Depression in Australia, GNP was unusually low compared to GDP. The scaled Fisher estimate (£175.7 m) serves as a useful benchmark, which can be checked against Lineham's GDP estimate of £168.8 million for 1925/26. Lineham's series is likely to be comparatively accurate for that year because it was a census year, and because it was a year of low unemployment,[14] Lineham's 1938/39 GDP estimate is 95 percent of the official GNP statistic. Similarly, his 1925/26 estimate is 96 percent of the Fisher benchmark.

IV. The New Zealand Data Series

Since prices constitute a key regressor used to determine velocity, it is necessary to have a series of prices which can be used with some confidence. A price deflator is also necessary to estimate the real GNP *per capita* series needed to evaluate economic growth and to compare New Zealand and Australian income levels. The deflator used, presented in Table 3 along with bank deposits and population, is a linked series of four segments. The principal segments are the wholesale price index for locally produced products for 1913-40,[15] and a conflation of four price indexes (McIlraith, 1911; Easton and Wilson, 1984) for 1861-1910: imports, exports, farm, non-farm. The link from 1910 to 1913 is made up by combining the official retail and wholesale price indexes (NZOYB). The 1859-60 price estimates are derived from the three series provided by Easton and Wilson: imports, all exports, and farm exports. The final deflator series has been based on 1910/11, to conform with the Australian series given in Table 1. Purchasing power parity between the two countries has been assumed for the base years. The monetary data in Table 3 is the series of trading bank deposits given by Bloomfield (1984, pp. 386-87). The population data is exclusive of indigenous Maoris.[16] The import/export data derives from Bloomfield (pp. 267-269).[17]

The functions used to estimate New Zealand velocities are constructed from the Australian regressions (equations (d) to (f)). Equal weighting is given to the current and lagged monetary aggregates. The New Zealand velocity and GNP estimates are presented in Table 4. The New Zealand equations are:[18]

(g) 1859-1897

$$\text{VEL} = 0.98 * \exp[-6.10 + 1.33 * \ln \text{PRI} + (-0.190 + -0.491) * \text{avg}(\ln \text{MPC}, \ln \text{MPC}_{-1})]$$

[14]Lineham is likely to have overstated GDP for 1935/36 another census year, because in years of high unemployment there was always a degree of underemployment, making wage rates an unreliable guide to wage incomes.

[15]NZOYB (1941, p. 710). Note other price indexes for the inter-war period in Rankin (1990a, p. 40), and that the chosen inter-war series is near to an average of these.

[16]Year-end averages from the NZOYB (1901, p. 501; 1919, p. 849; 1924, p. 726) series, and from the *New Zealand Statistics of Population and Buildings* for each year 1922/23-1939/40.

[17]Bloomfield's series have been deflated by this paper's GNP deflator. Thus, the series depicted in Figure 3 represent trade values, not volumes.

[18]For example, the coefficients of (g) are exactly the same as those for equation (d). However, the coefficients for "MPC" and "MPC-1" are added together to give a single coefficient, which is applied to the average of those two variables. The number "0.98" is the scale factor used to fit the equation to the 1865 New Zealand benchmark.

TABLE 3

NEW ZEALAND—DATA SERIES

	Population; Ex. Maoris	Trading Bank deposits £m	£ p.c.	Prices Base; 1910/11	Value of Imports £m 1910/11	Exports
1859	65,503	0.541	8.26	1411	1.100	0.369
1860	75,652	0.645	8.53	1533	1.010	0.358
1861	89,366	0.883	9.88	1387	1.798	0.965
1862	112,417	1.596	14.20	1447	3.196	1.629
1863	144,930	2.092	14.43	1453	4.836	2.301
1864	168,103	2.480	14.75	1472	4.755	2.072
1865	181,383	2.638	14.54	1498	3.734	2.338
1866	197,361	3.097	15.69	1513	3.896	2.905
1867	211,391	2.905	13.74	1443	3.704	3.104
1868	222,643	3.103	13.94	1449	3.442	2.947
1869	231,934	3.175	13.69	1332	3.737	3.071
1870	242,825	3.128	12.88	1282	3.530	3.679
1871	257,693	3.335	12.94	1231	3.149	4.292
1872	273,273	3.920	14.34	1309	3.744	3.963
1873	287,753	4.714	16.38	1417	4.363	3.950
1874	318,903	5.564	17.45	1407	5.662	3.730
1875	358,858	5.967	16.63	1382	5.618	4.051
1876	387,466	6.238	16.10	1298	5.239	4.325
1877	403,847	7.185	17.79	1356	4.829	4.551
1878	420,569	8.960	21.30	1278	6.590	4.621
1879	448,124	8.021	17.90	1241	6.464	4.565
1880	474,297	8.538	18.00	1163	5.155	5.357
1881	492,887	9.069	18.40	1126	6.484	5.234
1882	509,309	8.945	17.56	1140	7.319	5.609
1883	529,292	8.659	16.36	1088	7.147	6.447
1884	552,591	9.643	17.45	1046	7.006	6.780
1885	569,765	10.083	17.70	977	7.449	6.897
1886	582,306	10.579	18.17	950	6.651	6.879
1887	596,374	11.031	18.50	937	6.469	7.127
1888	605,371	11.155	18.43	917	5.922	8.074
1889	611,716	11.528	18.85	987	6.060	9.306
1890	620,780	12.368	19.92	945	6.271	10.122
1891	629,783	12.796	20.32	935	6.877	10.225
1892	642,246	13.587	21.16	929	7.258	10.216
1893	661,349	14.433	21.82	892	7.281	9.732
1894	679,197	13.927	20.51	871	6.874	10.583
1895	692,417	13.544	19.56	843	7.256	10.106
1896	706,434	14.490	20.51	859	8.193	10.831
1897	721,609	14.290	19.80	846	9.449	11.514
1898	736,260	14.143	19.21	839	9.787	12.456
1899	749,984	14.591	19.46	840	10.253	14.191
1900	762,392	15.570	20.42	889	11.477	14.868
1901	777,968	16.034	20.61	838	13.541	15.350
1902	797,793	17.231	21.60	858	12.778	15.899
1903	820,217	19.011	23.18	869	13.893	17.225
1904	845,022	19.074	22.57	862	14.964	17.097
1905	870,001	20.545	23.61	904	13.802	17.297
1906	895,594	22.422	25.04	945	15.137	19.041
1907	919,105	23.517	25.59	1006	16.443	19.944
1908	945,063	21.821	23.09	987	17.477	16.290
1909	971,784	21.996	22.63	964	15.364	20.361
1910	992,803	24.968	25.15	999	16.768	22.179
1911	1,014,043	26.765	26.39	1001	18.760	18.957
1912	1,039,017	25.622	24.66	1040	19.794	20.693

TABLE 3—continued

	Population; Ex. Maoris	Trading Bank deposits £m	£ p.c.	Prices Base; 1910/11	Value of Imports £m 1910/11	Exports
1913	1,068,645	25.733	24.08	1046	20.705	21.810
1914	1,090,328	27.640	25.35	1128	18.749	23.280
1915	1,099,394	31.433	28.59	1315	15.708	23.899
1916	1,101,679	37.757	34.27	1362	18.383	24.428
1917	1,099,118	42.930	39.06	1484	13.980	21.242
1918	1,103,023	45.562	41.31	1600	15.080	17.798
1919	1,142,889	49.489	43.30	1674	18.103	32.198
1920	1,192,620	59.405	49.81	1874	32.841	24.758
1921	1,223,901	49.397	40.36	1906	22.428	23.522
1922	1,251,895	45.913	36.67	1613	21.593	26.491
1923	1,274,551	49.039	38.48	1618	26.808	28.400
1924	1,298,635	49.502	38.12	1674	28.984	31.362
1925	1,325,781	52.207	39.38	1688	31.050	32.718
1926	1,352,927	50.135	37.06	1619	30.764	27.958
1927	1,374,439	48.294	35.14	1564	28.633	31.007
1928	1,390,684	53.799	38.69	1586	28.273	35.036
1929	1,406,942	57.609	40.95	1585	30.757	34.667
1930	1,425,084	56.425	39.59	1523	29.112	29.507
1931	1,444,901	53.645	37.13	1344	19.723	26.014
1932	1,456,237	52.851	36.29	1263	19.511	28.190
1933	1,466,930	57.620	39.28	1249	20.481	32.831
1934	1,476,988			1284	24.414	36.881
1935	1,484,666			1383	26.262	33.653
1936	1,492,344			1419	31.188	39.991
1937	1,504,826			1522	36.912	43.847
1938	1,519,606			1555	35.651	37.551
1939	1,539,420			1657	29.806	35.033

Sources: Refer to text, Section IV.

(h) 1895-1913

$$VEL = 1.18 * \exp[-7.46 + 1.32 * \ln PRI + (0.097 + -0.238 * \text{avg}(\ln MPC, \ln MPC_{-1})]$$

(i) 1922-1933

$$VEL = 1.18 * \exp[-8.35 + 1.47 * \ln PRI + (-0.594 + 0.167) * \text{avg}(\ln MPC, \ln MPC_{-1})]$$

The estimates for 1895-97 are made from weighted averages of equations (g) and (h). Those years, chosen partly for the pragmatic reason that equation (h) gave a good fit to the Coghlan benchmarks, constituted a key turning point in the economic history of New Zealand. The "Long Depression" had just come to an end. Coinciding with the Liberal Government's land and labour reforms of 1893-94, the opening up of the North Island dairy industry, made liable by the introduction of refrigerated shipping, gave people with access to capital the confidence to raise investment spending. One result was an increase in the velocity of money without price stability being compromised. It is therefore appropriate that velocity estimates from 1895 should be higher than they would have been under equation (g).

TABLE 4

NEW ZEALAND GNP ESTIMATES

Calendar Years	Velocity of Money	GNP £m	Real GNP 1910/11 £m	Per Capita Real GNP 1910/11 £	Per Capita Economic Growth (%)
1859	8.20	4.4	3.1	48.0	
1860	9.04	5.8	3.8	50.3	4.7
1861	7.44	6.6	4.7	53.0	5.5
1862	6.62	10.6	7.3	64.9	22.5
1863	5.85	12.2	8.4	58.1	−10.5
1864	5.88	14.6	9.9	58.9	1.3
1865	6.00	15.8	10.6	58.2	−1.1
1866	5.95	18.4	12.2	61.7	6.0
1867	5.69	16.5	11.5	54.2	−12.1
1868	5.96	18.5	12.8	57.4	5.7
1869	5.34	16.9	12.7	54.9	−4.4
1870	5.21	16.3	12.7	52.4	−4.6
1871	5.03	16.8	13.6	52.9	1.0
1872	5.27	20.6	15.8	57.7	9.1
1873	5.40	25.5	18.0	62.4	8.2
1874	5.01	27.9	19.8	62.0	−0.6
1875	4.86	29.0	21.0	58.5	−5.8
1876	4.59	28.7	22.1	57.0	−2.5
1877	4.76	34.2	25.2	62.4	9.6
1878	4.00	35.8	28.0	66.7	6.7
1879	3.84	30.8	24.8	55.3	−17.0
1880	3.73	31.8	27.4	57.7	4.2
1881	3.54	32.1	28.5	57.8	0.2
1882	3.63	32.4	28.4	55.9	−3.4
1883	3.54	30.7	28.2	53.3	−4.6
1884	3.37	32.5	31.1	56.3	5.5
1885	3.00	30.2	30.9	54.3	−3.5
1886	2.85	30.1	31.7	54.5	0.3
1887	2.76	30.4	32.4	54.4	−0.2
1888	2.66	29.7	32.4	53.5	−1.6
1889	2.92	33.7	34.1	55.7	4.1
1890	2.68	33.2	35.1	56.6	1.5
1891	2.58	33.0	35.3	56.0	−1.0
1892	2.50	34.0	36.6	57.0	1.8
1893	2.32	33.4	37.5	56.7	−0.7
1894	2.27	31.6	36.3	53.4	−5.8
1895	2.34	31.7	37.6	54.2	1.6
1896	2.48	36.0	41.9	59.3	9.3
1897	2.51	35.9	42.4	58.8	−0.8
1898	2.59	36.6	43.6	59.3	0.8
1899	2.60	37.9	45.1	60.2	1.5
1900	2.78	43.3	48.7	63.9	6.2
1901	2.56	41.0	48.9	62.9	−1.6
1902	2.62	45.1	52.6	66.0	4.9
1903	2.63	50.0	57.6	70.2	6.4
1904	2.59	49.4	57.3	67.9	−3.3
1905	2.76	56.6	62.6	71.9	6.0
1906	2.89	64.7	68.5	76.5	6.3
1907	3.11	73.1	72.7	79.1	3.4
1908	3.06	66.7	67.6	71.5	−9.5
1909	3.01	66.1	68.6	70.5	−1.4
1910	3.12	77.9	78.0	78.5	11.3
1911	3.08	82.4	82.3	81.1	3.3
1912	3.24	83.0	79.9	76.9	−5.2

TABLE 4—continued

Calendar Years	Velocity of Money	GNP £m	Real GNP 1910/11 £m	Per Capita Real GNP 1910/11 £	Per Capita Economic Growth (%)
1913	3.30	84.9	81.2	76.0	−1.2
1914	3.40	94.0	83.3	76.4	0.6
1915	3.50	110.0	83.7	76.1	−0.4
1916	3.00	113.3	83.1	75.5	−0.8
1917	2.80	120.2	81.0	73.7	−2.3
1918	2.80	127.6	79.7	72.3	−1.9
1919	3.00	148.5	88.7	77.6	7.4
1920	3.10	184.2	98.3	82.4	6.2
1921	3.54	174.9	91.8	75.0	−9.0
1922	3.11	143.0	88.7	70.8	−5.6
1923	3.16	155.0	95.8	75.2	6.1
1924	3.30	163.2	97.5	75.1	−0.1
1925	3.32	173.5	102.7	77.5	3.2
1926	3.14	157.5	97.3	71.9	−7.2
1927	3.06	147.8	94.5	68.7	−4.4
1928	3.09	166.5	105.0	75.5	9.8
1929	2.99	172.3	108.7	77.3	2.4
1930	2.81	158.4	104.0	73.0	−5.6
1931	2.38	127.9	95.2	65.9	−9.8
1932	2.22	117.2	92.8	63.7	−3.3
1933	2.15	123.7	99.0	67.5	6.0
1934		133.5	104.0	70.4	4.3
1935		150.5	108.8	73.3	4.1
1936		183.1	129.0	86.4	18.0
1937		207.0	136.0	90.4	4.6
1938		226.3	145.6	95.8	6.0
1939		244.5	147.6	95.9	0.1

Velocity for the World War I years has been estimated arbitrarily, with the aim of producing GNP estimates which are consistent with other information about economic activity. The war period is something of an enigma in New Zealand's economic history. New Zealand and Australia both seem to have had a recession that was disguised by inflation and the fact that both countries' labour surpluses were in Europe. In contrast to World War II, the number of factories and factory workers in New Zealand fell (AJHR H-11, 1919, p. 4) and the volume of farm production was static. Condliffe (1924/25, p. 231) claimed that "during the war and . . . immediately following, production fell off considerably in New Zealand." He describes the period around 1920 as a "post-war boom," and it is clear that a strong multiplier effect, which was not in operation in 1918, was boosting New Zealand's GNP in 1920. There was no war-time labour shortage despite the big fall in labour supply.[19] The Labour Department Report (AJHR H-11, 1918, p. 1) for 1917/18 states that "despite anticipations to the contrary, there were more men available during harvest time than were required."

[19]New Zealand's manpower losses to World War I were very large (Neale, p. 76).

An increase in female employment between the 1916 and 1921 censuses appears to be related to falling real disposable household incomes in the face of inflation; that is, an increase in female labour supply rather than in any demand for substitute female workers. Indeed, the 1918/19 Report (AJHR H-11, 1919, p. 5) indicates that the increase in teenage factory employment at the end of the war coincided with falls in overtime.

Equation (i), when applied to 1919–21, gives an unrealistically high GNP, especially for 1920. The New Zealand economy did not fully settle into its new pattern until 1922. Post-war money growth was much sharper in New Zealand than Australia. It was linked to land speculation as well as restocking and fixed capital formation. For those years the predicted velocity values have been adjusted to give more plausible estimates. That is somewhat arbitrary, but gives a boom/bust phase for 1918–22 that is sharper than 1905–09 and less pronounced than 1876–79. This conforms with the general impressions of these periods in the historical literature.

V. Discussion of the Estimates

The new estimates of real GNP *per capita,* compared to contemporary estimates of national income cited by Dowie (1966, p. 127) and Lineham (1968, p. 25) are shown in Figure 1. The 1886 estimate of £30 million by Otago University's Professor Mainwaring Brown fits the GNP estimate of this paper almost exactly. Dowie (1966, pp. 130–131) regarded Brown's work as an important contribution, although not of the same significance as Knight's.

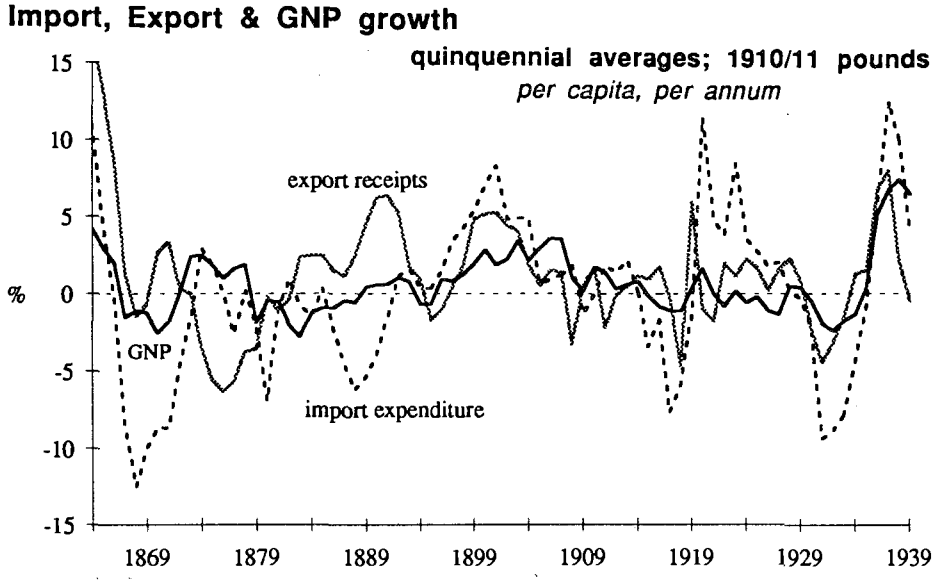
Mulhall produced estimates for 1888 and 1895 for inter-country comparisons for the London *Dictionary of Statistics* (1892, 1909). He used two formulae which are of some interest (Dowie, 1966, n15), but his own estimates derived from those techniques cannot be taken with any degree of precision because the data used were taken from a variety of different years. For example, for his 1895 estimate, data were taken from various years in the early 1890s. Mulhall's 1895 estimate for Australia of £179 (Butlin 1962, p. 37) exceeds the Australian GNP (given in Table 2) for 1891–95 by 5 percent, while his New Zealand estimate of £34.2 for 1895 exceeds the Table 4 New Zealand average for those years by a similar 4 percent. Therefore, this paper's GNP estimates for the early 1890s are fully consistent with his 1895 estimate of Australia's gross product. Mulhall's 1888 aggregate of £22.5 million appears to be well short of New Zealand's true GNP for that year, although the GNP estimate given here is probably too high. 1888 was the year of the New Zealand "Exodus;" the trough of the Long Depression and a period of mass emigration to Australia.

In the 1894 and 1897 *Official Year Books,* the New Zealand Registrar-General presented national income estimates using both the Brown and Mulhall methods.[20] Averaging his two estimates gives £27.5 million for 1893, and £28.6 million for 1896. With both numbers being about 18 percent short of the estimates given in this paper, the Registrar-General's estimates consistently understate them.[21]

[20]Dowie (1966, p. 127); NZOYB (1894, p. 139; 1897, pp. 283–284).

[21]As the Registrar-General's 1896 estimate is based on data from the Census in April 1896, to make the comparison I adjusted my estimates to the year ended September, by taking weighted

Lineham follows a direct approach to the task of gross product estimation for the inter-war period, but his estimates have serious empirical weaknesses (Rankin, 1991, pp. 15-18). He presents contemporary national income estimates by Stephens (1936) and Clark.[22] Stephens' estimates for 1925/26-1930/31, which are too low for 1925, have been included in Figure 1. Financial, labour market and trade data indicate that the New Zealand economy was buoyant in 1925 but in sharp recession by 1927. Stephens' estimates for 1928-30 are close to those of this paper, although they show a faster slide into depression in 1930. His data are for years ending the following March, so his income estimate for 1930 will have been considerably affected by the much greater extent of depression in early 1931 than in early 1930.



Sources: Calculated from Table 3 and Table 4 data.

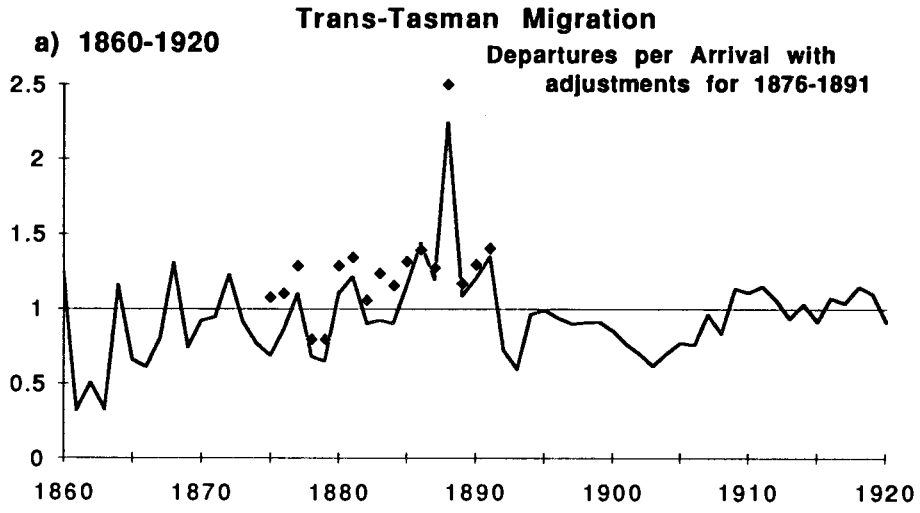
Figure 3.

To be plausible, a GNP series constructed by indirect means should be consistent with other macroeconomic data. Changes in the real value of New Zealand's import payments (shown in Figure 3) indicate the major fluctuations, with the growth in export receipts acting as a leading indicator of economic growth. Australia-New Zealand migration data show that the New Zealand GNP estimates are fully comparable with the Australian series. An inflow of Australian migrants to New Zealand would be expected to follow periods of higher GNP or economic growth in New Zealand. The data in Figure 4 shows that New

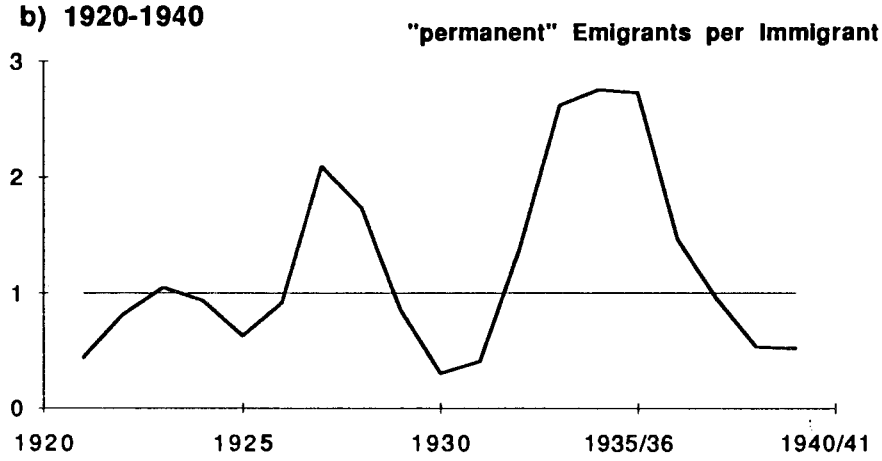
averages of that year and the previous year. His estimates are 18 percent short of my estimates for the year to September 1893 and the year to September 1896. This slight adjustment is significant because GNP recovered by over 13 percent in 1896.

[22]Lineham (p. 25) has demonstrated a high level of correlation ($R^2 = 0.97$) between Stephens' and Clark's (2nd. edn., 1951) estimates. Clark (1957, p. 173) sources his estimates to an unpublished memorandum by Stephens and himself.

Zealand experienced a net inflow of Australian migrants in years in which New Zealand incomes were higher (1860s, 1893, 1900s, 1929-31, 1937-39), and net emigration to Australia in years of comparatively low GNP (1880s, 1926-28, 1933-35).[23] For most years, *per capita* incomes in the two countries were similar. A reduced level of contact between Australia and New Zealand after 1908 can be explained by the general similarity of living standards and of comparative advantage.



sources: Statistics of New Zealand; Gandar (p.167)



sources: New Zealand Statistics of External Migration
New Zealand Statistics of Population and Buildings

Figure 4.

[23]The Gandar adjustments, which have been converted to calendar years, assume that the entire discrepancy for the years in question related to Trans-Tasman migration. Figure 4b only covers people claiming to be permanent migrants. This is because returning New Zealanders ceased to be classified by place of origin.

It is important to note that the *per capita* GNP data are exlusive of the indigenous Polynesian (Maori) population. A census of Maori population in 1858 (Bloomfield, pp. 37, 42) showed that Maoris comprised 43.5 percent of the total population. That proportion had fallen to 13 percent when the next Maori census was taken in 1874.[24] Knight's 1865 estimate of national income was based solely on the European population. New Zealand's total GNP would have been much higher than stated for 1860 if the full contribution of the Maori economy had been accounted for. As an example of the level of integration in 1860, the Maori warrior and prophet Te Kooti was then a coastal trader on the Auckland-Gisborne route, using two Maori-owned ships to undercut the former settler monopoly (Oliver, 1990, p. 463). As late as 1880, after much of the best Maori-owned land had been confiscated, the lands around the Taranaki town of Parihaka were farmed productively by best-known techniques (Riseborough, 1987, p. 130). Nevertheless, from the Land Wars in the 1860s until the 1940s, there was little integration between the indigenous and settler economies.

The peaks of *per capita* income in the 1860s coincided with the gold discoveries in Otago (1861), Westland (1865) and Coromandel (1868). The New Zealand economy was also growing strongly because of the high demand in Britain for wool, New Zealand's main staple. Expansion in the 1870s was boosted by a program of Government sponsored public works and immigration (the "Vogel boom") financed by borrowing on London. In the 1880s, the government and many producers were burdened by indebtedness in the face of falling land and commodity prices. In the absence of an export staple with powerful linkages into the domestic economy, New Zealand tentatively moved towards a manufacturing-based economy based in part on the availability of cheap female and teenage labour (Rankin, 1990b, pp. 11-13; Sutch, 1957, p. 25 n41), and also on the buoyancy of the Australian market. In the 1890s, the economy was boosted by a new set of staple primary industries—the processing of meat and dairy products—made possible by advances in refrigeration technology and the growth of the British market for imported food.

A feature of the New Zealand aggregates from the 1890s which was not apparent in Australia is the existence of a 3-5 year trade cycle. From 1907 to 1929, the fluctuations were very sharp oscillations around a nil-growth trend. These short period cycles were the main source of the uncertainty and "instability" that pervaded New Zealand's economic consciousness (Simkin, 1951; Hawke, 1985, p. 100). They were the price New Zealand paid for its narrowly structured economic development, based on pastoral exports to the British market. Those fluctuations explain the popular desire for an insulationist approach to economic policy-making in the years following World War II. The sharpness of some of the single-year fluctuations in GNP reflect the nature of investment activity in a small commodity-producing economy. For the whole period, the domestic money supply was essentially determined by the level of reserves held by the New Zealand banking system in London. Thus, rapid growth could result from an acceleration of domestic investment made possible by an increase in London funds. A sharp fall in the British price of one or more of New Zealand's primary

[24]The Maori population fell from 56,000 in 1858 to less than 40,000 in 1896 before it began to rise.

export commodities, or a change of sentiment towards Australia or New Zealand by British investors, would inevitably lead to a sharp contraction of the New Zealand money supply. The 1879 downturn was linked to the collapse of the City of Glasgow Bank in 1878 (Hawke, 1985, p. 80) and the 1926 recession was mainly a result of the General Strike in Great Britain.

Economic growth rates were very high for most of the 1930s, averaging as much as 8 percent from 1933 to 1938. Lineham (1968, p. 18) noted that "the massive public works program would probably have set the economy off on an exponential rather than a linear growth path." This multiplier effect is also the result of the earnings of large numbers of additional workers, mainly women and teenagers, who sought work during the Depression and who contributed to a rapid increase in household incomes during the recovery years (Rankin, 1990a, p. 123).

VI. Conclusion

In this paper I have presented a set of GNP estimates for New Zealand that can be linked to official estimates beginning in 1938/39. They draw heavily on the work of contemporary economic statisticians. Although no formal model linking monetary aggregates to GNP has been presented. (It has been possible to produce a gross product series that stands up to historical scrutiny.) An important by-product of this exercise has been the demonstration of a significant statistical relationship between the price level and the velocity of circulation of money.

It should be possible to produce improved historical estimates of New Zealand's national income by following procedures similar to those used by Butlin's team in Australia. Indeed, the statistical and archival record has yet to be mined in New Zealand to the extent it has in many other developed countries. The GNP estimates therefore remain a provisional data source against which future estimates can be checked. Their virtue is that they give a better indication of economic growth in New Zealand's first century than any alternative source. They present a macroeconomic picture containing long periods of nil trend growth; a picture which gives credence to the considerable anxiety felt by New Zealanders about their country's economic destiny. That pattern continues today. *Per capita* incomes are now little higher than they were in 1975, and many economists doubt that a growth trend will emerge before 1995.

Appendix

A. The Economic Significance of the Regression Variables

While the concept of monetary velocity provides the means to link monetary and income/product variables, in this paper I use variables contained within the quantity identity to estimate velocity. Thus it is possible to remove velocity entirely from the equation, leaving a society's gross product as a function of the money stock, the price level and the population.

From equation (a) we have

(A1) $\ln V = a + b \ln P - c \ln (M/N) \qquad b > 1; \quad 0 < c < 1;$

(A2) $V = AP^b(M/N)^{-c}$

where V = velocity, $\ln A = a$, P = prices, M = money stock, N = population. From the Quantity Identiy we have

(A3) $PQ = MV$

(A4) $Q/N = MVP^{-1}N^{-1}$

where PQ = gross product, Q = real gross product. Taking the two together:

(A5) $Q/N = AP^{b-1}(M/N)^{1-c}$

(A6) $Q/N = AP^{b-c}(M/P/N)^{1-c}$

where $M/P/N$ = real money balances *per capita*

(A7) $Q = AP^{b-1}M^{1-c}N^c$

Looked at in this way, equation (A7) shows that real gross product is positively related to population, money balances and prices. An increase of 1 percent in any of those three variables will, in itself, be associated with an increase of less than 1 percent in gross product. Equation (A6) suggests that rising real money balances are linked with economic growth only when prices are rising.

It is not possible to claim a simple causal link from prices, money or population to real incomes because of the interdependence of the variables. For example, a sharp rise in prices may induce a significant fall in real money balances. Rather, the above is a historical generalisation with respect to the Australian economy, and *ipso facto*, the New Zealand economy. Economic growth in New Zealand resulted from market situations which brought about both rising prices and a growth in the money supply.

B. The Relationship of the Quantity and Velocity of Money to Prices

As a by-product of the regressions conducted for this exercise, I performed another set of regressions on the full Australian data set (1861-1939, excl. 1914-18), this time making the price level the independent variable. The data yielded the following equations (with t-values in brackets):

(B1) $\ln \text{PRI} = 7.22 - 0.0995 * \ln \text{MPC}_{-1} + 0.604 * \text{IW}$
[63.9] [2.7] [16.2] $R^2 = 0.888$

(B2) $\ln \text{PRI} = 6.65 + 0.252 * \ln \text{VEL}_{-1} + 0.548 * \text{IW}$
[215.5] [9.0] [33.9] $R^2 = 0.942$

(B3) $\ln \text{PRI} = 5.40 + 0.314 * \ln \text{MPC}_{-1} + 0.529 * \ln \text{VEL}_{-1} + 0.32 * \text{IW}$
[45.5] [10.7] [17.0] [13.6] $R^2 = 0.979$

As the results of Equation (B1) suggest, if there is a simple causal relationship from money (narrowly defined) to prices, then it is negative. This result is contrary

to that predicted by monetarist doctrine. Instead, there is a strong positive relationship from velocity to prices in equation (B2). This is consistent with the discussion at the beginning with this paper about the relationships between monetary velocity and prices, and between the velocity of and the quantity of money. A significant direct relationship from money to prices is revealed, however, when velocity is accounted for as a separate regressor, as in equation (B3).

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