International Influences on the Australian Economy in the Interwar Years

Tom Valentine
Visiting Professor, MGSM and UIC Research Foundation

JEL N17, N37, N47, F41

Abstract

This paper examines the role of global factors in the causes and duration of the Depression in Australia. It is shown that inflation in Australia was affected by export prices. A macroeconometric model shows that export prices affected the unemployment rate which also depended on wages and on the tariff rate. The increase in the latter was a particularly poor policy option.
1. **Introduction**

It is generally accepted that the Australian economy is a commodity based economy in which the level of domestic economic activity is highly dependent on the global economy. It is the purpose of this paper to analyse the nature of this dependence in the interwar years. The nature of the commodities which Australia exports has changed over time. At present the economy depends heavily on the export of mining products, whereas in earlier times, exports consisted mainly of agricultural products.

The second section of the paper considers measures of the influence of overseas economic developments on the Australian economy. The major one is the terms of trade. However, this measure must be related to the overseas prices of exports and imports, the exchange rate and the level of tariffs.

The third section of the paper examines the causes of changes in Australian prices in the interwar years. Special emphasis is given to external influences on the Australian rate of inflation.

The fourth section of the paper describes a simple econometric model of the Australian economy for the years 1919 to 1939. The model is an ad hoc one, unlike the models used in Valentine (1988), Valentine (2003) and Valentine (2004) which are based on neo-classical microeconomic theory. The model is formulated in terms of rates of change rather than levels and it shows that in the period considered the Australian economy can be well-represented by a simple model. That is, the model provides a high level of explanation of actual developments. It also illustrates the ubiquity of global factors in determining economic activity in Australia over the period considered.

The section also includes some counter-factual simulations which examine the effect of different paths in global factors. For reasons to be discussed below, this experiment is done in terms of export prices. Also, the model is used to evaluate the effect of adopting alternative policies to deal with the depression—in particular, wage reductions and lower tariff barriers.
2. Measuring the Impact of the Global Economy on Australia

The terms of trade are often used as a measure of the effect that the global economy has on the domestic economy. For example, Gruen and Clarke (2010) use this measure in analysing the depression of the thirties and the Global Financial Crisis. The terms of trade are:

\[ TT = \frac{\text{PEX}}{\text{PIM}} \]

where \( \text{PEX} = \) index of export prices
\( \text{PIM} = \) index of import prices

Both indices are in Australian prices.

Therefore, \( TT = \frac{\text{PEXF}/ER}{\text{PIMF}(1-t)/ER} \)

where \( \text{PEXF} = \) export prices in foreign currency
\( \text{PIMF} = \) import prices in foreign currency
\( ER = \) exchange rate (in indirect form)
\( t = \) tariff rate

In this analysis, the proxy for \( t \) used is the average duty (AD) calculated by Lloyd (2007, p 66). Tariff rates were increased sharply in 1930/31 and 1931/32 in reaction to the large increase in unemployment that occurred in those years. There is a debate over the role of tariffs in the Great Depression (see, for example, Crucini and Kahn (2003). There is no doubt that increases in tariff rates were reactions to the onset of the Depression rather than an initiator of it. However, the increases appear to have deepened and extended the Depression.

The equation above indicates that the terms of trade are not affected by the exchange rate.

In the statistical analysis described below, it was found that PEX gave superior statistical results to those obtained by using TT. Consideration of this outcome suggests that it is not surprising given that:
• PIM did not change very much through the thirties. Import prices were affected by changes in offshore prices, but these were offset by changes in the exchange rate and the tariff rate; and

• The correlation between TT and PEX is 0.703.

The latter result arises from the fact that import prices changed very slowly over the depression.

3. Determinants of Australian Inflation 1919/1939

The interwar period was one of considerable variability in price levels. In particular, it included some substantial and prolonged falls in prices which are not found in other periods. Valentine (1980) presents a price equation for this period which is based on a neo-classical microeconomic model and this equation was used in the macro-econometric models in Valentine (1988) and Valentine (2004). A more ad hoc version of the equation is used in Valentine (2003). However, an alternative approach is used here.

This approach involves partitioning the rate of inflation into two components. They are:

• a component representing the excess of the rate of growth of non-wage income over the rate of growth of real GDP; and

• a component representing the excess of the rate of growth of nominal wages over the rate of growth of output per head (productivity).

A simplified version of the national income identity is:

\[ P.Y = \Pi + W \]

where \( P = \) implicit GDP deflator
\[ Y = \text{output (in constant prices)} \]
\[ W = \text{wage income (compensation of employees)} \]
\[ \Pi = \text{non-wage income (of which the gross operating surplus is a major component)} \]

\[ P = \frac{1}{Y} \frac{\Pi}{Y} + \frac{W}{Y} \]
\[ = \frac{1}{Y} \frac{\Pi}{E} + \frac{W}{E} \]
\[ = \frac{1}{Y} \frac{\Pi}{\text{Prod}} \]

where \( w = \text{average earnings and Prod} = \text{output per head (productivity)} \)

Therefore,

\[ \frac{dP}{dt} = \frac{1}{P} \frac{\Pi}{P.Y} \left( \frac{1}{Y} \frac{d\Pi}{dt} - \frac{1}{Y} \frac{dY}{dt} \right) + \frac{w}{P.\text{Prod}} \left( \frac{1}{w} \frac{dw}{dt} - \frac{1}{\text{Prod}} \frac{d\text{Prod}}{dt} \right) \]

Let \( b = \text{the share of non-wage income in total income} \)

and note that \( \frac{w}{P.\text{Prod}} = \frac{w}{P.Y/E} = \frac{W}{P.Y} = 1 - b \)

where \( W \) is total wages.

Then

\[ \frac{1}{P} \frac{dP}{dt} = b \left( \frac{1}{Y} \frac{d\Pi}{dt} - \frac{1}{Y} \frac{dY}{dt} \right) + (1 - b) \left( \frac{1}{w} \frac{dw}{dt} - \frac{1}{\text{Prod}} \frac{d\text{Prod}}{dt} \right) \]
This equation partitions inflation into two sources. The first, weighted by the share of non-wage income in total income, is the extent to which the rate of growth of non-wage income exceeds the rate of growth of output. The second, weighted by the share of wages in income, is the extent to which the rate of growth of wages exceeds the rate of growth of productivity. Inflation is, therefore, divided into its sources – growth in non-wage income and growth in wage costs. The second component is a measure of *wages overhang*.

The results of this partitioning are given in Table 1. It is based on data taken from Butlin (1977). INF is the rate of inflation measured from the implicit deflator for GDP, $w$ is average weekly earnings; PCONT is the contribution of the growth in non-wage income and wcont is the contribution of the growth in wages. Specifically, the contributions are defined as:

$$ WCONT = c \left[ \frac{\text{Rate of growth}}{\text{of wages}} - \frac{\text{Rate of growth}}{\text{of productivity}} \right] $$

$$ PCONT = (1 - c) \left[ \frac{\text{Rate of growth}}{\text{of non wage income}} - \frac{\text{Rate of growth}}{\text{of output}} \right] $$

$c$ = share of wages in income

$PCONT$ was calculated by deducting $WCONT$ from the rate of inflation.

**Table 1 : Contributions to the Rate of Inflation 1919 – 1939**

<table>
<thead>
<tr>
<th>Year</th>
<th>WCONT</th>
<th>PROFCONT</th>
<th>INF</th>
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</thead>
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<td>1919</td>
<td>3.433271</td>
<td>1.980397</td>
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<td>1920</td>
<td>10.92980</td>
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<td>1921</td>
<td>3.356345</td>
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<td>4.046097</td>
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<td>1.116842</td>
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<td>4.703955</td>
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</tr>
<tr>
<td>1927</td>
<td>0.849771</td>
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<td>-0.011860</td>
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<tr>
<td>1928</td>
<td>1.532151</td>
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<td>1929</td>
<td>-0.267492</td>
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A number of comments can be made about these results. Specifically:

- there was a wages overhang in a number of years in the twenties – particularly in 1920, 1921, 1922 and 1926. 1921, 1922 and 1926 are particularly interesting because they are years in which prices actually fell. The results indicate that a wages overhang accumulated over the 1920’s. This conclusion contradicts the view of Gregory, Ho and McDermott (1988, p. 244) that wages gaps made no contribution to the unemployment of the nineteen thirties;

- the sharp fall in prices in the early thirties arose from negative contributions from wage and non wage income growth although the fall in non wage income growth in 1930 was more important than the fall in wage growth; and

- the contribution of non wage income growth was positive from 1932 to 1937 whereas the contribution of wage growth only became positive in 1935 but thereafter continued to grow.

The next step in the analysis is to examine the factors which may have caused the contributions to inflation reported in Table 1. The following regression equations were estimated on the EVIEWS software. The figures under the coefficients are t-values and asterisks indicate the degree of significance. One asterisk indicates significance at the five per cent level and two asterisks indicate significance at the one per cent level. The t-statistics are based on the White heteroscedasticity-consistent estimates of the standard errors. $R^2$ is the coefficient of determination and $d$ is the Durbin-Watson statistic. $\Delta\%$ is the percentage change in the variable concerned.
PCONT = 0.314 + 0.201\Delta%PEX - 0.218\Delta%Ry \quad R^2 = 0.614

(0.56) \quad (5.09**) \quad (1.55) \quad d = 2.57

PEX is an index of export prices and Ry is GDP in constant prices. The CUSUM OF SQUARES test indicates that the equation is stable. TT is not significant when it is added to this equation. The equation suggests that export prices were the major determinant of the growth in non wage income. The equation also suggests that non wage income tended to fall behind when real income was changing.

WCONT = 0.402 + 0.708\Delta%w + 0.0317\Delta%PEX - 0.460\Delta%Ry

(0.38) \quad (8.17**) \quad (1.42) \quad (4.72**) \quad R^2 = 0.845 \quad d = 1.50

The CUSUM OF SQUARES TEST indicates that this equation is stable. It indicates that export prices also had an impact on the contribution of wages. However, the most important determinants of the wages contribution were wage rates and growth in real income. The wages contribution fell when there were large increases in economic growth.

Putting these equations together we obtain an equation for the rate of inflation.

\[ \text{INF} = \text{WCONT} + \text{PCONT} \]

\[ \text{INF} = 0.865 + 0.230\Delta%PEX + 0.571\Delta%w - 0.604\Delta%Ry \]

(0.36) \quad (4.49**) \quad (3.69**) \quad (2.87**) \quad R^2 = 0.650 \quad d = 2.14

This equation satisfies the CUSUM of SQUARES TEST. It shows that over the period considered Australian inflation was determined by changes in export prices and wages and economic growth. Export prices come in mainly through their impact on the non wage income contribution and wages through their impact on the wages contribution. Note that the unemployment rate is insignificant when it is added to the equation although the rate of economic growth continues to be significant.
The significance of export prices in this equation is not surprising. In the inter-war years Australia had a fixed exchange rate and in such an environment an economy is very subject to overseas influences. On this we can quote Keynes (2009, but dated 1923):

“If the external price level is unstable, we cannot keep both our own price level and our exchange stable. And we are compelled to choose.

In pre-war days, when almost the whole world was on a gold standard, we had all plumped for stability of exchange as against stability of prices, and we were ready to submit to the social consequences of a change of price levels quite outside our control, connected, for example, with the discovery of new gold mines in foreign countries or a change of banking policy abroad. But we submitted, partly because we did not dare trust ourselves to a less automatic (though more reasoned) policy, and partly because the price fluctuations experienced were in fact moderate. Nevertheless, there are powerful advocates of the other choice.”

Keynes (2009, pp. 106 – 107)

As this paper illustrates, the price fluctuations arising after this statement was written were not so moderate. Also, it should be noted that in the period considered here Australia was not on a traditional gold standard. Rather, it had Sterling Exchange Standard. Valentine (2003) shows that this mechanism was far from perfect, but the results discussed here indicates that it created a situation in which Australia was open to foreign influences.

4. An Econometric Model of the Australian Economy

1919/1939

The individual equations of the model and the variables included in it are described in Table 1. the data were largely obtained from Butlin (1977).
Table 1: A Model of the Australian Economy 1919 – 1939

### Prices

\[
\begin{align*}
INF &= 0.031 + 0.179 \Delta%PEX + 0.362 \Delta%w \\
&= 0.031 + 0.179 (\text{PEX}) + 0.362 (w) \\
R^2 &= 0.456 \\
(0.04) & \quad (3.65**) \\
& \quad (1.36) \\
\end{align*}
\]

\[
P = P_{-1} + \frac{(INF) \cdot P_{-1}}{100}
\]

### Income

\[
\Delta%y = 1.892 + 0.146\Delta%AO + 0.176\Delta%PEX - 0.187\Delta%AD \\
&= 1.892 + 0.146 (AO) + 0.176 (PEX) - 0.187 (AD) \\
R^2 &= 0.795 \\
(1.55) & \quad (2.22*) \\
& \quad (3.15**) \\
& \quad (2.67**) \\
+0.286\Delta%y_{-1} & \quad \text{d} = 2.55 \\
(2.42*) & \\

Ny = Ny(-1) + \frac{\Delta%y}{100} . Ny(-1)
\]

\[
Ry = \frac{Ny}{p}
\]

\[
\Delta%Ry = 100(Ry - Ry_{-1})/Ry_{-1}
\]

### Unemployment

\[
UR = 0.066 - 0.0034R_y + 0.0093Rw + 0.544AD \\
&= 0.066 - 0.0034 (R_y) + 0.0093 (Rw) + 0.544 (AD) \\
R^2 &= 0.958 \\
(0.03) & \quad (7.92**) \\
& \quad (6.47**) \\
& \quad (12.75) \\
\]

### Share Prices

\[
\Delta%AO = 5.51 + 0.144\Delta%DJ + 0.308\Delta%PEX \\
&= 5.51 + 0.144 (DJ) + 0.308 (PEX) \\
R^2 &= 0.378 \\
(1.90) & \quad (1.87) \\
& \quad (2.09*) \\
\]

### Variables

\[
\begin{align*}
\text{AD} &= \text{average duty obtained from Lloyd (2007, p. 66)} \\
\text{AO} &= \text{All Ordinaries share price index} \\
\text{DJ} &= \text{Dow Jones share price index} \\
\text{INF} &= \text{rate of inflation based on GDP inflator} \\
\text{Ny} &= \text{nominal GDP} \\
\text{P} &= \text{GDP deflator} \\
\text{PEX} &= \text{index of export prices} \\
\text{Ry} &= \text{GDP in constant prices} \\
\text{Rw} &= \text{real wage} \\
\text{UR} &= \text{unemployment rate}
\end{align*}
\]
\[ W = \text{average weekly earnings} \]

All the estimated equations have been tested for stability by considering the CUSUMS OF SQUARES test and recursive coefficient estimates. These tests indicate that they are stable. In all cases, PEX gave superior results to TT.

Let us now consider the individual behavioural equations making up the model.

**Inflation:**
The inflation equation is a simplified version of the one derived in the third section of the paper. The equation reported in Table 1 indicates that the rate of change of export prices was the major determinant of inflation in the inter-war period.

**Nominal GDP:**
The income equation shows that the rate of growth of income in the interwar period depended (with a lag) on the rates of growth of Australian share prices export prices, and the level of the tariff. The first two indicate that foreign influences had a significant impact on economic activity in the interwar period. The rate of growth of the share price index has been included because share prices have an impact on investment spending. This impact was tested in Valentine (1980) and found to be significant. The highly significant negative co-efficient of AD in this equation suggests that the policy of sharply increasing tariff rates was counter productive.

**Unemployment Rate:**
The variables included in the unemployment rate equation are similar to those in the unemployment equations reported in Valentine (1988), Valentine (2003) and Valentine (2004). The unemployment rate fell (with a lag) as real GDP and export prices rose. A highly significant increase in the unemployment rate resulted from an increase in the real wage and an increase in tariffs.

Figure 1 shows the relationship between the unemployment rate and export prices in the interwar years. PEX* is PEX multiplied by 10. Export prices started falling in the mid-
twenties and this started a rise in the unemployment rate. The unemployment rate reached a peak in the early thirties, coincident with a low point in export prices.

**Figure 1: Unemployment Rate and Export Prices, 1918 - 1939**

Figure 2 shows the relationship between the unemployment rate and average duty paid. It is clear that this relationship was close. AD increased over the 1920's and this increase contributed to the rise in the unemployment rate at the end of the twenties. The fall in AD in the second half of the thirties contributed to the recovery over that period.

**Figure 2: Unemployment Rate and Average Duty, 1918 - 1939**

Source: Butlin (1977) and Lloyd (2007)
**Share Prices:**
The rate of growth of the All Ordinaries index was significantly related to the rate of increase of export prices, but less so to the rate of growth of the Dow Jones index. The latter result suggests that the link between the US and Australian share markets was not as strong in the interwar period as it is currently. An important implication of this result is that it was not the fall in the US share market which transmitted the Depression to Australia. Moreover, although there was a speculative bubble in the US share market in 1929, this was not the case in Australia.

The first step in analysing the model is to simulate it over the estimation period to test whether it tracks the real world accurately. When this was done, it produced acceptable results. When the unemployment rate and real GDP are regressed on their simulated values:

- the constants are insignificant; and
- the slope coefficient is insignificantly different from unity.

In the former case the $R^2$ is 0.868 and in the latter 0.704. Therefore, the model provides an accurate representation of the interwar economy.

Table 2 reports the results of three counter-factual simulations of the model. The variables reported are the unemployment rate and real gross domestic product. In each case the first series is the solution obtained from simulation of the original model.

The first simulation tests the effect of higher export prices. The value of PEX was set at 0.300 from 1930 to 1939. This value is slightly below the average value for the nineteen twenties (0.317). This change would have led to a lower unemployment rate and higher growth over the nineteen thirties, indicating that there was a substantial global influence on the great depression in Australia.
Table 2: Counter-Factual Simulations of the Model

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In the second counter-factual simulation AD was set at 21 from 1930 on, close to its 1929 value and well below the actual values in the thirties. It is clear that in this alternative scenario, the economy would have grown more strongly and unemployment would have fallen to very low levels. It is clear that by engaging in large increases in tariff rates, Australia inflicted a high degree of self-harm on its economy.

It is clear that the unemployment rate could not have fallen to levels indicated by the second simulation. One problem is that wages fell sharply in 1931 as a result of policy actions which would not have happened if the Depression had not arrived in Australia. Therefore, the
second simulation was repeated with average weekly earnings set at 485 (close to its 1930 value) throughout the thirties. The results of this third simulation indicate that the economy would have been significantly stronger without the need for a reduction in wages.

5. Conclusion

This analysis has shown that export prices were the major influence on economic activity in Australia in the interwar years. Their impact can be detected in share prices, the unemployment rate and GDP. Moreover, export prices appear to be a major channel whereby the Depression entered Australia.

Two other conclusions emerge from this analysis. First, the Australian share market did not undergo a speculative bubble in the nineteen twenties. Also, Australian share prices were not closely related to US share prices. That is, the Depression was not transmitted to Australia through changes in overseas share prices. Second, the unemployment rate was affected very significantly by real wages.

However, economic developments in the nineteen thirties were also affected by the policies adopted domestically. First, the importance of export prices indicates that a further depreciation of the Australian currency would have stimulated the economy.

Secondly, it is clear that wage reductions had the effect of reducing unemployment and stimulating the economy.

Thirdly, and most importantly, it is clear that sharp increases in tariff rates had a significant negative impact on the economy. In particular, this policy produced a significant increase in the unemployment rate.
References


