

## **TRADE REFORMS AND BREAKPOINTS IN AUSTRALIA'S MANUFACTURED TRADE: AN APPLICATION OF THE ZIVOT AND ANDREWS MODEL**

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### **Abstract**

Trade liberalization is expected to increase imports but also exports via reduced input costs and increased domestic competition. This paper investigates whether this is the case for Australian manufactured goods. We begin by briefly describing the trends in the effective rate of protection, imports and exports in Australia over the last 30 years and then investigate the existence of major structural breaks in the imports and exports series by applying the Zivot and Andrews (1992) test, using annual time series data from 1968/69 to 2003/2004. We find that a significant structural break occurred for imports in 1988/1989, which coincides with the introduction of major trade liberalization policy. We also find a significant structural break for exports with the three-year lag in 1992/1993.

JEL classification numbers: C12, C22, C52, F13

Key words: Unit roots hypothesis, structural breaks, trade and Australia.

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### **1. Introduction**

Trade liberalization typically results in rapid increases in imports, but can also be expected to increase exports by reducing input costs, increasing domestic competition and thus raising the productivity of the export sectors. However, the impact on the balance of trade is,  $a$

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priori, ambiguous and will depend on the relative magnitude of these effects. In particular, export volumes may not, or may be slow to, increase sufficiently if efficiencies in the economies of our trading partners also increase, and/or if intervening balance of payments difficulties have adverse domestic aggregate demand consequences.<sup>1</sup> For example, Santos-Paulino and Thirwall (2004) find that, in a sample of 22 developing countries, trade liberalization stimulated export growth more than that of import. In a similar vein, Narayan and Narayan (2004) investigated the sustainability of the current account deficits for Fiji and Papua New Guinea and concluded that only Fiji satisfies the strong form of its inter-temporal budget constraint.

From the 1950s to the early 1970s successive Australian governments pursued an import-substitution agenda. Industry policy was largely designed to protect domestic manufacturing firms from foreign competition.<sup>2</sup> Productivity was a second order consideration. Whilst this approach may have been justifiable on the grounds of ensuring jobs for Australia's growing migrant population, by the early 1970s it was increasingly being viewed as excessively interventionist and likely to retard economic growth into the future.

Significant reforms began in 1972 with reduced protection levels and the strengthening the Trade Practices Act to encourage domestic competition. Whilst protection levels for the automobile and textile, clothing and footwear (TCF) industries were subsequently raised again in the late 1970s, the reform agenda was re-invigorated in the 1980s. As well as substantial microeconomic reforms to the financial, telecommunications, aviation and labour markets, this was a period of sequenced but substantial across-the-board reductions in tariff rates and other protective measures. This was particularly so for the domestic manufacturing sector. As the data in Figure 1 illustrate, the Effective Rate of Protection (*ERP*) for manufacturing

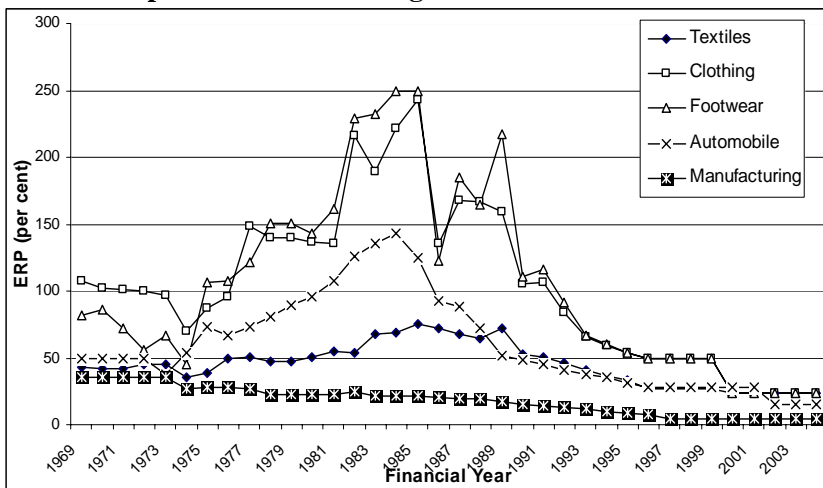
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<sup>1</sup> The recession in Australia in the early 1990's was triggered by a severe tightening of monetary policy, in part to control what was seen at the time to be a spiraling current account deficit (Pitchford, 1993, p.101).

<sup>2</sup> See Freedman and Stonecash (1997) for a more detailed account of Australian industry policy after the Second World War.

fell from around 35% in 1970 to less than 5% by 2000/01.<sup>3</sup> Note that extensive trade liberalization (reductions of both tariff and non-tariff barriers) covering all manufacturing sectors occurred in 1988/1989 and this resulted in lowering average ERP for the manufacturing sector as a whole to 17% (Jayanthakumar, 2002).<sup>4</sup>

**Figure 1: Effective rates of protection for the manufacturing sector and specific manufacturing industries: 1968/69-2003/04**



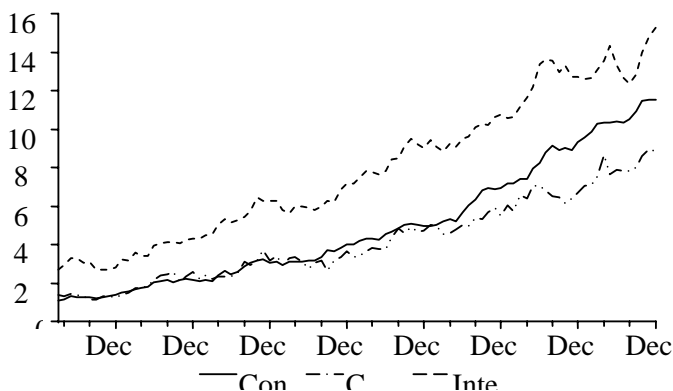
Source: Industry Commission (1995) and National Office for the Information Economy (NOIE) (2004)

<sup>3</sup> In general, the effective rate of protection may be defined as the ratio of domestic price value-added to world price value-added. Hence changes in the effective rate of protection will reflect changes in both the mean level of protection and the exchange rate.

<sup>4</sup> A general program of phased reductions in nominal tariffs for most imports, except in the automotive and TCF industries, was announced in 1988. Import quotas for the manufacturing sector were phased out, terminating for the automotive industry in 1988 and the TCF industries in 1993. The reductions for the two traditionally most heavily protected industries, automobiles and TCF, have been much more substantial, and especially since the second half of the 1980's.

These policies likely increased the competitiveness of the Australian manufactured sector in at least two ways. Firstly, domestic firms have had access to cheaper imported intermediate inputs which now represent 73% of all imports (see Figure 2). Some of these inputs have given domestic firms access to the latest technology and so have been an important source of technology transfer. Secondly, finished manufactured imports have also increased substantially as the data in Table 1 attests<sup>5</sup>. Six of the nine industries witnessed annual import growth rates in excess of 4% over the 11-year period. This resulted in a near doubling of imports of food and beverages, petroleum and coal products, metal products and other manufactures. The weighted mean annual growth rate for the sector as a whole of 4.6% means that over this twelve year period manufactured imports increased in real terms by 74%. Thus increased competition has likely forced domestic firms to seek greater technical and scale efficiencies to survive.

**Figure 2: Components of imports in current \$ million (1982–2004)**



Source: ABS, DX database (2005).

<sup>5</sup> Comparisons prior to 1989 may be misleading because of changes to industry classification schemes.

These forces have contributed to an increase in manufactured exports, but at even more impressive rates, as the data in Table 2 indicates. Five of the nine industries more than doubled their exports over this twelve year period. Exports of wood and paper products experienced a particularly rapid growth rate, quadrupling in real terms. Exports of machinery, and petroleum and coal products also increased substantially. The sector as a whole experienced an annual export growth rate of 6.5%, so that real Australian manufactured exports increased by 118% from 1989/90 to 2000/01. Hence our hypothesis is that the reduced protection levels have contributed to increases in manufactured imports which, by way of increased competition and reduced costs, have contributed to the increases in manufactured exports. We now test this hypothesis using the procedure suggested by Zivot and Andrews (1992).

**Table 1: Growth rates of manufactured imports by 2-digit ANZSIC code 1989/90-2000/01**

ANZSIC Code	Industry Descriptor	Annual Growth (%)	Aggregate Growth (%)
21	Food and beverages	5.5	93
22	Textiles and clothing	3.6	54
23	Wood & paper	0.9	11
24	Printing and publishing	2.8	40
25	Petroleum and coal	5.2	87
26	Non-metallic products	1.5	20
27	Metal products	5.4	91
28	Machinery	4.6	74
29	Other	5.5	93
<b>Overall</b>	<b>Mean</b>	<b>4.6</b>	<b>74</b>

Notes: 1989/90 prices have been used. Data computed from ABS data obtained on request.

**Table 2: Growth rates of manufactured exports by 2-digit ANZSIC code 1989/90 - 2000/01**

ANZSIC code	Industry descriptor	Annual Growth (%)	Aggregate Growth (%)
21	Food and beverages	5.6	96
22	Textiles and clothing	2.9	42
23	Wood & paper	14.0	437
24	Printing and publishing	6.9	129
25	Petroleum and coal	8.0	161
26	Non-metallic products	6.4	116
27	Metal products	4.9	80
28	Machinery	10.4	248
29	Other	1.6	21
Overall	Mean	6.5	118

Notes: 1989/90 prices have been used with re-exports omitted. Data computed from ABS data obtained on request.

## 2. Testing for Structural Breaks

Structural breaks can occur in a time series because of policy changes such as trade liberalisation. Zivot and Andrews (1992) propose a testing procedure in which the time of the break is estimated, rather than assumed as an exogenous phenomenon. The null hypothesis in this procedure is that the variable under investigation contains a unit-root with drift that excludes any structural break, while the alternative hypothesis is that the series is a trend stationary process with a one-time break occurring at an unknown point in time. By endogenously determining the time of a structural break, Zivot and Andrews argue that the results from earlier tests such as the ADF test may be invalid.

With the Zivot and Andrews procedure  $T_b$  (the time of break) is chosen to minimize the one-sided  $t$ -statistic of  $\alpha=1$  in equation 2 below. In other words, a break point is selected which is the least favorable to the null hypothesis (see Pahlavani, 2005). The Zivot and Andrews model endogenizes one structural break in a series (such as  $y_t$ ) as follows:

$$H_0: y_t = \mu + y_{t-1} + e_t \tag{1}$$

$$H_1: y_t = \hat{\mu} + \hat{\theta} DU_t(\hat{T}_b) + \hat{\beta} t + \hat{\gamma} DT_t(\hat{T}_b) + \hat{\alpha} y_{t-1} + \sum_{j=1}^k \hat{c}_j \Delta y_{t-j} + \hat{e}_t \tag{2}$$

As can be seen this model accommodates the possibility of a change in the intercept as well as a broken trend.  $DU_t$  is a sustained dummy variable capturing a shift in the intercept, and  $DT_t$  is another dummy variable representing a break in the trend occurring at time  $T_b$ .  $DU_t=1$  if  $t > T_b$ , and zero otherwise,  $DT_t$  is equal to  $(t-T_b)$  if  $(t > T_b)$  and zero otherwise. The null hypothesis is rejected if the  $\alpha$  coefficient is statistically significant. Table 3 summarizes the result of the Zivot and Andrews procedure in the presence of structural break allowing for a change in both the intercept and trend.

**Table 3. The Zivot-Andrews Test Results: Break in both Intercept and Trend**

Variable		TB	K	$t_{\hat{\alpha}}$	Inference	Correspond break time
Description	Symbol					
Imports in constant price	IMPORTC	1988/89	2	-2.529	Unit Root	Trade reforms of 1988/1989
Exports in constant price	EXPORTC	1992/93	0	-3.664	Unit Root	Lags effect of trade reforms

Notes: (1) Critical Values at 1, 5 and 10% levels are -5.57, -5.08 and -4.82, respectively (Zivot and Andrews, 1992). (2) The optimal lag length ( $k$ ) is determined by SBC. (3) IMPORTC and EXPORTC indicate Australia’s manufactured imports and exports respectively at constant 1968/1969 prices.

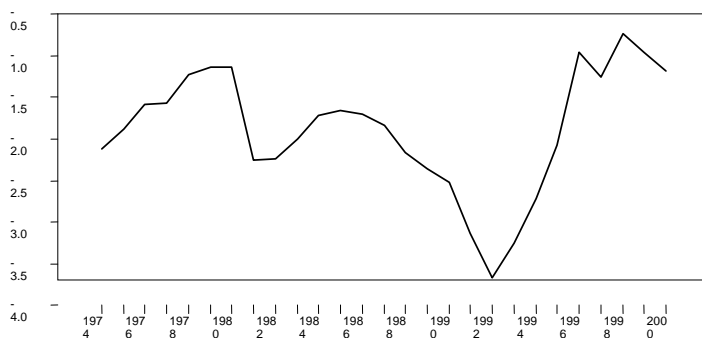
In this model,  $T_b$  is endogenously determined by running the model sequentially allowing for  $T_b$  to be any year with 15% trimming region. In other words, the ‘trimming region’ where we search for the minimum t-ratio is assumed to be within  $0.05T-0.95T$  or  $0.05T \leq TB \leq 0.95T$ . The optimal lag length is determined on the basis of the Schwartz-Bayesian Criterion (SBC). Using the Zivot and Andrews procedure, the time of the structural changes (impacting on both the intercept and the slope of each series) for

each of the variables is detected based on the most significant  $t$  ratio for  $\hat{\alpha}$ , that is  $t_{\hat{\alpha}}$ . Based on the results presented in Table 3, the Zivot and Andrews test results indicated that both Australian manufactured imports and exports are I(1).

**Figure 3: Zivot and Andrews Procedure: Imports**



**Figure 4: Zivot and Andrews Procedure: Exports**



*Notes:* Figures 3&4 are plots of the estimated timing of structural breaks from the Zivot and Andrews procedure allowing for a break in both intercept and trend. Years represent financial years. Source: Author's calculations based on the Zivot and Andrews procedure.



Table 3 and Figure 3 suggest the existence of a structural break in 1988/89, after which manufactured imports accelerated substantially after a long period of decline. Table 3 and Figure 4 suggest the existence of a structural break for manufactured exports also, but in 1992/93. So it seems that Australian trade liberalization has had an immediate impact on imports but a lagged impact on exports. How long will it take to achieve competitiveness? A literature review shows a relative void in determining the lags (Sanidas and Jayanthakumaran, 2006). Note that the Australian economy experienced a slowdown due to the profound effects of the very deep recession during 1990-1991. Recession may be one of the factors that would have influenced delayed export response. Valadkhani, Layton and Pahlavani (2005, 29) obtained structural breaks for some macroeconomic variables in the Australian economy during the 1990-1991 recession.

### **3. Conclusions**

This paper has investigated the hypothesis that reduced protection in Australia has directly contributed to increased manufactured imports and indirectly contributed to increased manufactured exports. Using Zivot and Andrews (1992) procedure for detecting breaks in the intercept and trend function of a univariate series, we found that a significant break occurred for imports in 1988/1989 which coincided with the re-invigoration of extensive trade liberalizations in Australia.

The structural break found for exports was in 1992/1993. So it seems that, in Australia's case, manufactured exports increased but with a three-year lag. While there are other factors that may have influenced these time series over the sample period, a major structural change occurred at, and shortly after, the period of major reductions in tariffs and non-tariff barriers. The determinants of time lags between trade liberalization and increased exports deserve further investigation.

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