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An Empirical Assessment of the Impact of Inter-Industry Trade on Employment: Australia 1989/90–2000/01

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Abstract

This paper investigates dynamic aspects of labour market adjustment in Australia during 1989/90 and 2000/01 due to extensive trade reforms and associated developments in intra-industry trade. In view of the foregoing, it was hypothesised that trade reforms have had a positive impact on employment to the extent that trade flows are intra-industry. We do find that declining protection over this period is associated with increased employment to the extent that trade flows are intra-industry.

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**An Empirical Assessment of the Impact of Intra-Industry Trade on Employment:
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by

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1. Introduction

The movement of workers within and between sectors due to the consequences of trade reforms is of significant interest to labour economists. Labour mobility is expected as some industries expand and some contract during the implementation of trade policy reforms. Australia has extensively reduced tariffs and non-tariff barriers in the manufacturing sector since 1988. Reduced protection levels naturally induce inter-industry trade flows on the basis of comparative advantage. However, the advocates of new trade theory expect intra-industry trade to increase in response to removal of protection. The effects and impacts of intra-industry trade remain an important issue for employment research but have been subjected to little formal scrutiny. Trade economists believe that labour market adjustments to intra-industry trade are less costly than inter-industry trade; this hypothesis is widely known as 'smooth adjustment hypothesis'. In general, labour market developments in Australia show a downward trend in manufacturing employment levels (Gaston, 1998:133). A growing body of empirical research has also focused on the rise of labour productivity in response to increased competition from imports (Oczkowski and Sharma 1999, Jayanthakumaran, 2002 and Mahadevan, 2002). Of particular interest to us is the link between downward employment trends and rise in productivity levels.

This paper seeks to test the hypothesis that trade reforms have had a positive impact on employment to the extent that trade flows are intra-industry. A set of indicators of trade policy variables in combination with control variables is used to explain growth in employment in a cross-sectional regression model over the period 1989/90 and 2000/01. The following section discusses links between trade reforms, intra-industry trade and employment. The third section reveals trade policy reforms and adjustments in Australia. The fourth section outlines the methods used in this study. The fifth section reports the results. The final section draws conclusions.

2. Trade Reforms, Intra-Industry Trade and Employment

The argument behind trade liberalisation as it relates to export growth is that trade liberalisation would allow for more intermediate inputs and wider scope for domestic exports and thereby promote the efficiency of various products which had to that point been operating with higher markups due to protection. The removal of protection stimulates inter and intra-industry trade in the light of competitiveness. Intra-industry trade may be defined as export and import of goods within the same product classification categories. The argument here is that removal of protection may stimulate trade in the same product category as a result of factors such as product differentiation,

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transport costs and dynamic learning by doing. Traditional trade theory deals with inter-industry trade, but intra-industry trade clearly forms an important sub-category within national exports. It is well documented that a major part of trade in manufactured products between industrialised countries is intra-industry trade. Inter-industry trade involves different products and exploits existing comparative advantage and specialisation. The export performance of both inter and intra-industry trade may be an alternative measure of competitiveness and an indicator of market penetration.

In general, one can argue that higher imports will result in a decline in employment and higher exports will result in an increase in employment. In the case of a decline in trade barriers, Heckscher-Ohlin-Samuelson (H-O-S) theory predicts the redistribution of employment away from the contracting import-substituting industries and towards the expanding export sector. New trade theory assumes that a large proportion of international trade is involved with similar factor endowments and basically non H-O-S factors where the products concerned are likely to be horizontally (intra-industry) or vertically (similar to inter-industry) differentiated. It is extremely complicated if the expansions and contractions of employment largely take place within industries sharing the characteristics of intra-industry trade patterns. The expectation is that labour market adjustments to intra-industry trade are less costly than adjustments to inter-industry trade (known as the smooth adjustment hypothesis). This hypothesis assumes that the individuals try to find jobs that match their skills in order to ensure the associated rewards, and move sector only as this possibility diminishes.

Studies that deal with trade and employment across countries utilise factor content and growth accounting methods. Those that utilise the former try to capture the required level of workers needed to achieve a given amount of exports or determine the number of displaced workers created by a given amount of imports. Those who use the latter are concerned with breaking down the sources of employment into domestic demand, trade and productivity growth.[1] Greenaway, Hine and Wright (1999) study the effects of trade on employment in the United Kingdom in a dynamic labour demand framework using 167 manufacturing industries and trading partners. The authors find that a rise in trade, both exports and imports, resulted in reductions in the level of derived labour demand. They argue that this is consistent with a view that increased openness serves to enhance the efficiency with which labour is utilised.

In a micro level study, Haynes, Upward and Wright (2000) examined the experiences of United States and United Kingdom on the issue of reallocation of workers within and between sectors. They find that workers previously employed in 'declining' sectors are more mobile than those employed in 'expanding' sectors and workers are more likely to move sector the longer they are unemployed. The authors suggest that a multisectoral model is more appropriate here, as there are significant costs associated with moving between sectors as witnessed by the longer periods of unemployment experienced by movers. This study tends to support the 'smooth adjustment hypothesis'.

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[1] Detailed empirical results are cross-country based and not appropriate for this paper. See Greenaway, Hine and Wright (1999: 489) for detailed empirical evidences linking trade-induced productivity growth and factor content methods.

There have been regression-based studies with the dynamic effects of trade and intra-industry trade flows on employment across industries in country-based studies. Brulhart (2000) tests the smooth-adjustment hypothesis for Ireland by regressing a dependent variable to represent labour-market adjustment with an independent variable marginal intra-industry trade and a set of independent variables to control for other influences on labour market adjustment. To capture the labour market adjustment Brulhart uses the index for intrasectoral job turnover of Davis and Haltiwanger (1999). This study indicates that Marginal Intra-industry Trade (MITT) on labour market adjustment is most significant in the short-run and MITT is a more appropriate measure than the Grubal-Lloyd Intra-industry Trade (GLIIT) index to show the adjustment issues.

3. Trade Policy Reforms and Adjustments in Australia

In Australia, one can see gradual reductions in trade barriers occurring for the entire manufacturing sector from 1973/74 and rapid reductions from 1988/89 (Figure 1). The average Effective Rate of Protection (ERP) for the manufacturing sector as a whole dropped from 35 per cent in 1971 to 17 per cent in 1989/90. Traditionally protected motor vehicles and parts and textiles, clothing and footwear industries (TCF) have experienced a complex range of policies and considerable volatility, leading to an ERP of 52 per cent for the motor vehicles and parts, and 113 per cent for the TCF.

A general program of phased reductions in nominal tariffs for most imports was announced in 1988, tariffs above 15 per cent to be reduced to 15 per cent and tariffs between 15 per cent and 10 per cent to be reduced to 10 per cent by 1992. A 2 per cent revenue duty on imports was removed. Import restriction by quota was no longer available to the manufacturing sector, terminating for the automotive industry in 1988 and the textiles, clothing and footwear industries in 1993. Reductions in tariff rates continued in the early 1990s. As a result of this, ERP for the manufacturing sector as a whole was reduced to 4.8 per cent in 2000/01. ERP for motor vehicles and parts and TCF industries were reduced to 14.1 and 23.2 respectively in 2000/01 (NOIE, 2004: 45). Intensive microeconomic reforms in the areas of infrastructure, industrial and workplace relations, taxation, and consumer and competition regulations were initiated during the 1990s aimed at enhancing the aggregated benefits from trade reform.
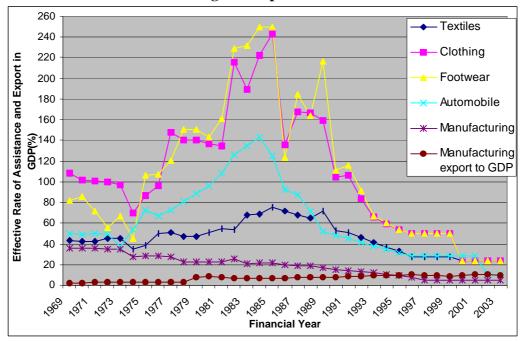
Figure 1: Assistance to Manufacturing and Exports as a share of GDP: 1968/69 to 2002/03[2]

Source: Industry Commission (1995) and NOIE (2004)

Declining protection exposed domestic manufacturing to increased global competition. This increased competition is reflected in a substantial increase in manufacturing imports. Annual average growth of current manufacturing imports and exports was 4.6 per cent and 6.4 per cent respectively during 1989/90 and 2000/01. Trade liberalisation is often linked to export growth due to the fact that domestic producers can access cheaper imported inputs and technical know-how, and must respond to challenges, all of which are necessary for improving efficiency. Export performance is one of the indicators for international competitiveness. Manufacturing export to GDP ratio at the current prices has been (a) 2 to 3 per cent during 1969 to 1978, (b) 6 to 8 per cent during 1979 to 1989 and (c) 8 to 10 per cent during 1990 to 2003 (Figure 1). The ratio of manufacturing exports to total merchandise exports has been increased from 25.4 per cent in 1989/90 to 31.3 per cent in 2000/01 (NOIE, 2004: 12). NOIE (2004:12) has further stated "despite the growing trade deficit in manufactures and the declining share of manufacturing in GDP, it should be noted that the long-term trend is toward a rising importance of manufacturing in Australian exports".

There have been a number of Australian based studies that examine the determinants of Grubal-Lloyd (GLIIT) intra-industry index using the data prior to 1988 in an econometric framework, but

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[2] Effective rate of assistance represents the ratio of domestic price value-added to world price value-added. The estimates during 1969/70 and 1995/96 are obtained from Industry Commission (1995). The data post 1996 is from NOIE (2004: 45) and is slightly different to that from the Industry Commission (1995). NOIE defined ERP as the percentage change in the returns per unit of output to an activity's value-adding factors due to the tariff assistance structure.

only a few focus on trade reforms and adjustment in less than general terms.[3] Ratnayake and Jayasuriya (1991) study the simultaneous determination of GLIIT trade and tariffs and conclude that while GLIIT is influenced by tariffs, the reverse relationship does not hold. Ratnayake and Authukorala (1992) conclude that a long-standing protectionist trade policy stance and high transport costs tend to show a significant negative influence on the extent of intra-industry trade.[4] Menon (1994) focuses on the analysis of trends in GLIIT in Australia's foreign trade rather than on the determinants in the context of trade liberalisation.[5] The results of this study point to a sharp increase in the share of intra-industry for both multilateral and trans-Tasman trade. Matthews (1998) concludes that while a reduction of trade controls between Australia and traditional trading partners would increase the proportion of intra-industry trade with Australia, a reduction of trade controls is not likely to increase the proportion of intra-industry trade for Australia with Asia Pacific countries.[6] Only Sharma (2000) has made an effort to investigate the determinants of GLIIT at the four-digit Australian Standard Industry Classification (ASIC) in the context of trade liberalisation by using pre and post-liberalisation periods. Sharma establishes a sharp rise in intra-industry trade from the mid 1980s with the outward-orientation and concludes that a sharp fall in protection is associated with a higher level of intra-industry trade.[7]

The majority of the above studies measure GLIIT to represent intra-industry trade, which is often referred as static and cannot be used to make inferences about the importance of intra-industry trade during an adjustment process over time (Brulhart 1994, Hamilton and Kniest 1991 and Menon and Dixon 1996). Adjustment costs are a dynamic phenomenon involving trade flows between the periods of study. Brulhart's dynamic index, based on the concept of marginal intra-industry trade (MIIT), may be useful in this context. Brulhart's (1994) index measures the proportion of changes in total trade flows attributable to intra-industry trade.[8] Australian studies mainly focus on the

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[3] GL index measures the ratio of intra-industry trade to total trade in a given period, mostly for a year, by not taking into account the adjustment process due to liberalisation (Thom and McDowell 1999: 51). If industry $_j$ has N sub-industries, then GL is defined as;

$$GL = 1 - \frac{\left| X_j - M_j \right|}{X_j + M_j} \qquad (1)$$

Where X_j and M_j are home country exports and imports of industry $_j$. If $X_j = M_j$, then GL becomes 100 revealing that all trade is IIT. If either $X_j = 0$ or $M_j = 0$, GL becomes zero showing no IIT at all. The higher the value of the index the greater the degree of IIT.

[4] The model was estimated with GLIIT as a dependent variable and proxies for product differentiation, economies of scale, market structure, direct foreign investment, trade barriers, transport costs and economic links with New Zealand as independent variables.

[5] GLIIT indices are estimated for 1981 and 1991 for 132 industries using data at the 3 and 4-digit level for SITC.

[6] GLITT indices are estimated for the period 1978-1993 and related with a range of independent variables in a time and cross-section analysis.

[7] Author studied GLIIT for 1979/80, 1989/90 and 1992/93 using proxies for product differentiation, economies of scale, research and development intensity, foreign direct investment, close economic integration and effective rate of assistance.

[8] Brulhart index is defined as,

reforms that were implemented in the 1980s, which were relatively minor in scope, compared to the 1990s.

A few Australian-based studies attempt to address the labour market adjustments that occur due to trade reforms but fail to incorporate the nature of trade flows. Gaston (1998) examines the labour market consequences of trade and protection by using regression-based studies across industries in Australia, defining change of industry employment as a dependent variable and trade and macroeconomic variables as independent variables. Gaston concludes that a decline of industry employment appears to have been associated with lower levels of industry assistance: about a one per cent reduction in employment for each ten per cent reduction in the effective rate of protection. Jayanthakumaran and Frank (2004) test the hypothesis that trade reforms have had a positive impact on manufacturing exports, using both time series and cross-sectional data, confirming a link between declines in protection and export growth especially among the manufacturing branches (at ANZSIC 4-digit level) where there are growing imports. The association between export growth and intra-industry trade is stronger among the manufacturing branches where imports increased. Increased competitiveness that has been acquired through increases in the ability to add value and through increased intra-industry trade have contributed to export growth in the manufacturing branches where there are growing imports. Our conclusion that manufactured exports expand more rapidly in a period of more active trade liberalisation and in industries with more intra-industry trade flows highlights the need of research on the impact of manufactured employment.

Figure 2 shows the annual average growth of exports, MIIT and employment across industries during the period 1989/90 and 2001/02 at a 2-digit level. In general, most of the branches experienced an upward trend in exports and intra-industry trade and a downward trend in employment levels. The liberalisers, such as the textiles clothing and footwear industries (ANZSIC-22) and machinery (ANZSIC-28), have experienced around -5 per cent and -1.5 per cent annual average growth of employment (both negative) respectively. Positive annual average growth in employment has been recorded in food, beverages and tobacco (ANZSIC-21), printing and publishing (ANZSIC-24) and petroleum and coal products (ANZSIC-25). The manufacturing sector as a whole experienced -0.7 per cent growth in employment during 1989/90 and 2000/01.

$$MIIT_j = 1 - \frac{\left| \Delta X_j - \Delta M_j \right|}{\left| \Delta X_j \right| + \left| \Delta M_j \right|} \tag{2}$$

$MIIT_j$ is defined as the proportion of changes in total trade flows in industry j caused by intra-industry trade. If $MIIT_j$ is close to unity then it indicates the higher intensity of MIIT in the adjustment process. Zero values indicate diverging trends in sectoral trade flows that result in higher adjustment costs. Zero value shows all trade is inter-industry trade.
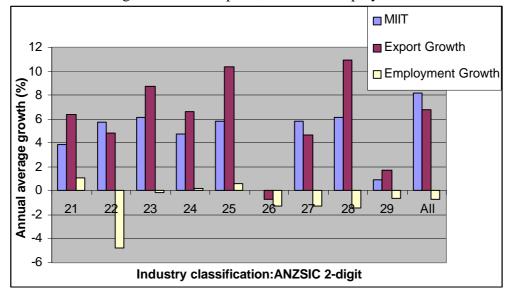
Figure 2: Annual Average Growth in Exports, MIIT and Employment: 1989/90 to 2000/01

Source: see text

4. Methods

As documented in the previous section, the factor content and accounting decomposition methods for across countries, intrasectoral studies at plant level for individual countries and country-based regression across-industries are widely used in investigating the employment effects of international trade. We adopt a cross-sectional regression analysis based on a dynamic model of labour demand to quantify possible employment growth resulting from intra-industry trade. Our expectation is that the labour market adjustments to intra-industry trade are less costly than adjustments to inter-industry trade. The adjustment pressures induced by trade reforms would be neutralised to the extent that trade flows are intra-industry. In view of this clear theoretical background, we tested a hypothesis that trade reforms have had a positive impact on manufacturing employment to the extent that trade flows are intra-industry.

In our model, dependent variables represent labour-market adjustment. By using Ordinary Least Squares (OLS) cross-sectional analysis across branches (4-digit), we attempt to explain the employment growth (GEMP) for a branch by tracking changes through variables that reflect the characteristics of individual branches. GEMP is defined as growth in the worker between 1989/90 and 2000/01. The variables are defined for 141 branches between the period 1989/90 and 2000/01. We define the models as:

$$GEMP = f(\overset{-}{CTRADE}, \overset{+}{CWAGE}, \overset{-}{TECH}, \overset{+}{MIIT})$$

where   GEMP   employment growth
        CTRADE   change in trade
        CWAGE   change in real average wage
        TECH   index of technology

   MIIT   marginal intra-industry trade

The changes in trade variable (CTRADE) is our proxy for change in the degree of 'openness' as a result of the declining level of protection and is defined as change in imports plus exports as a share of output during the period 1989/90 – 2000/01.[9] With trade liberalisation, one would expect that industries having some form of comparative advantage would expand and others contract. If the expansions were high and reflected by trade growth, then one would expect more employment in the long run. In this case it is likely that there would be a positive relationship between CTRADE and employment (Brulhart, 2000:425). However, one would expect a negative relationship if the increased openness, both in terms of imports and exports, serves to increase the efficiency by lowering the number of workers (Greenaway, Hine and Wright, 1999:499). Australian-based empirical labour productivity evidences have shown that greater 'openness' tends to increase efficiency by lowering the number of workers. If this is so, then we would expect a negative association between CTRADE and employment growth.

Change in real wage (CWAGE) is defined as the changes in real wage by branch during the period 1989/90 – 2000/01. In a competitive labour market, the dominant adjustment factor would be employment: workers respond to wages by switching industries. In other words, increased trade flows seem to be connected with increased employment in high-wage manufacturing industries and decreased employment in low-wage manufacturing industries (Gaston, 1998:121). One would expect to find a positive association between growth of employment and changes in real wages if the workers respond to wages by switching industries.

Index of technology (TECH) is a proxy for the change in the degree of knowledge and technical know-how as a result of the declining level of protection and defined as the ratio of average labour productivity in a branch to best-practice productivity by branch.[10] Technology indices reflect the range of technologies used in a branch and are expected to be negatively associated with employment. A low level of indices shows that there is scope for competition, as technologically backward or smaller firms catch up with their technologically more advanced rivals. The scope for competition serves to increase efficiency by lowering the number of workers in the short term and to expand the industry in the long term in the light of competitiveness. If so, in the long term we would expect a negative association between technology (TECH) and growth in employment.

The important variable in our model is marginal intra-industry trade (MIIT) that may be defined as the differences between total trade flows and changes in net trade. In view of the smooth adjustment hypothesis, one would expect to find a significant positive connection between GEMP and MIIT (Brulhart, 2000, p.425). Individuals try to find jobs that match their skills within industries in order gain the associated rewards, and move across industries only as this possibility diminishes. If MIIT is significantly associated with GEMP with the expected sign, then our hypothesis is supported.[11]

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[9] We have used turnover in the absence of data for output.

[10] Technology variable is for a single year on the grounds that any changes in this variable will be long-term and will not affect short-term performance. We have computed the technology ratio for the period 1996/97.

[11] The Simple correlation matrix for our set of explanatory variables is as follows:

Data relating to number of workers, wages and value-added have been obtained from surveys and censuses of ABS-Manufacturing industry. The census and surveys cover all manufacturing establishments in the states, government-owned business undertakings and private establishments. Imports and exports at the ANZSIC 4-digit level of 1989/90 and 2000/01 have been obtained from ABS-Customs on request.

5. Results

We analyse the period 1989/90-2000/01 at the ANZSIC 4-digit level using around 142 observations. The results across all 142 branches are presented in equation 1. The positive and significant association between GEMP and CWAGE indicates that real wage increases substantially influence the level of employment. This is an indication that workers respond to real wages by switching industries. The negative and significant coefficient on GEMP and TECH suggests that lower employment results from a given increase in a higher level of technology indices. The low level of indices suggests the existing scope for competition, as more technologically backward or smaller firms catch up with their technologically advanced rivals and this induces more employment. We find the expected positive association between GEMP and MIIT, but it is not significant. CTRADE is negatively but not significantly related to GEMP. At this point our results are inconclusive.

TABLE 1: Change of intra-industry trade and labour adjustment: 1989/90 – 2000/01

Equation	Sample size	Constant	MIIT	CWAGE	TECH	TRADE	$\overline{R^2}$	F
1	142	-0.005 (-1.616)	0.007 (0.201)	0.915*** (25.248)	-0.094*** (-2.812)	-0.053 (-1.483)	0.85	201***
2	56(branches with MIIT 50% and above)	-0.247** (-2.434)	0.096** (2.268)	0.884*** (18.027)	-0.127*** (-2.942)	-0.161*** (-3.249)	0.91	132***
3	86(branches with MIIT below 50%)	-0.003 (-0.802)	-0.050 (-1.127)	0.929*** (19.242)	-0.097** (-2.154)	-0.009 (-0.197)	0.83	109***

Note: *** 1% significant level, ** 5% significant level, * 10% significant level
Where CLAB = change in number of workers, CTRADE = change in trade share, CWAGE = change in average wage, TECH = technology, MIIT = marginal intra-industry trade.

We have also disaggregated samples into (a) those branches that experienced a rise in MIIT above 50 per cent (56 branches) and (b) those branches that experienced a rise in MIIT below 50 per cent (86 branches), re-estimated separately for each disaggregated sub-group. The branches that experienced a rise in MIIT above 50 per cent tend to show better performance. The results presented in equation (2) have a relatively high explanatory power in terms of the 't test', $\overline{R^2}$ and F tests. For growth in employment, MIIT is significantly (at 5% level) associated with the expected sign,

Variable	MIIT	TECH	CWAGE	CTRADE
MIIT	1			
TECH	-0.049	1		
CWAGE	0.068	0.195**	1	
CTRADE	-0.034	-0.107	-0.408**	1

Note: ** Correlation is significant at the 0.05 level (2-tailed)

reflecting the importance of intra-industry trade in generating employment. Real wages (CWAGE) is positively and significantly related to employment growth (GEMP), reflecting the importance of dynamic wage structure. The coefficient on CTRADE is negative and significant, implying a lower employment for a given increase in trade share. The coefficient on TECH is negative and significant, implying lower employment for a given increase in technology indices.

The sub-sample based on increase in MIIT below 50 per cent shows that CWAGE is positively and highly significantly associated with GEMP (equation 3). The coefficient on TECH is negative and significant as expected. The rest of the independent variables are not significant. We did not find support for the hypothesis in equation (3), in that the overall fit of the equation worsens.

The Chow test is used to establish whether there is any statistically significant difference in the coefficients obtained from the sub-samples, based on rise and fall in intra-industry trade. The result obtained clearly indicates that there is significant difference between the sub-samples. Sub-samples based on a rise in intra-industry trade yield a statistically significant difference at the 1 percent level.[12] Better adjusted R^2 indicates that the branches that experienced a rise in intra-industry trade give a better overall fit than the branches where intra-industry trade reduced.

6. Conclusions

This paper briefly documents the connections between trade reforms, employment and intra-industry trade, and attempts to find a link between rise in intra-industry trade and employment. The results are not convincing in our overall sample. However, there are improvements to the overall fit of the equation for those branches that experienced a rise in intra-industry trade. We have obtained a positive and stronger association between growth of employment and intra-industry in our disaggregated sample for those branches where there is growing intra-industry trade.

For growth in employment the level of real wages is strongly significant, with the expected positive sign. The result is slightly different from that obtained by Gaston (1998), in which he found that manufacturing employment is weakly linked to real wage resistance in view of the recession and trade liberalisation up to 1991/92. The coefficient on TRADE is negative and significant in our disaggregated sample where intra-industry is intensive, implying a lower growth of employment for a given increase in TRADE. Greenaway, Hine and Wright (1999:499) have obtained a similar result and argue that this is consistent with a view that increased openness serves to raise the efficiency with which workers are utilised. In the Australian case, a growing body of empirical research has found that declining protection is associated with rising productivity (Gaston 1998, Oczkowski and Sharma 1999, Jayanthakumaran 2002 and Mahadevan 2002).[13] We obtained higher growth of

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[12] For this purpose, a null hypothesis that there is no difference between the sub-samples and an alternative hypothesis that there is difference between sub-samples were formulated. The null hypothesis is rejected if calculated F statistics (calculated using residual errors of the total sample and sub-samples), is above the critical value at 1% level. F statistic based on rise in intra-industry trade is 3.787 which is significant at 5% level (critical F value is 3.48).

[13] A set of indicators of trade liberalisation in combination with branch structure and technology variables is used to explain growth in labour productivity in a cross-sectional regression model.

employment for a given lower level of technology indices and this reflects competition, as smaller firms can easily catch up with their technologically advanced rivals. One can note the similarity between our results and those of Beaumount and Schroder (1997), whose detailed survey on manufacturing in Australia found that advanced manufacturing technology is negatively associated with business success.

The above analysis rarely gives conclusive results, but the results tends to offer support for the hypothesis that declining protection is associated with increasing employment to the extent that trade flows are intra-industry nature.

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