LABOUR MARKET RESPONSES TO TRADE & TRADE STRUCTURE: A PANEL STUDY OF THE MALAYSIAN MANUFACTURING

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TABLE OF CONTENTS

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ABSTRACT:

Intra-industry trade (IIT) has become an important component of Malaysia's international trade in manufactured goods. This study reveals that besides trade flows *per se*, the structure of trade, particularly IIT, is also of importance to the Malaysian manufacturing labour market. The empirical findings on the contemporaneous effects of intra-industry trade on aggregate employment are found to be positive and significant. More importantly, the long run impact of intra-industry trade is greater than the corresponding short run effect. On average, there is more impact of intra-industry trade on the quantity side of the labour market (that is employment) than on the wage side. In total, there is supportive evidence that foreign trade, particularly intra-industry, has stimulated employment growth of the manufacturing sector.

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LIST OF TABLES

LIST OF FIGURES

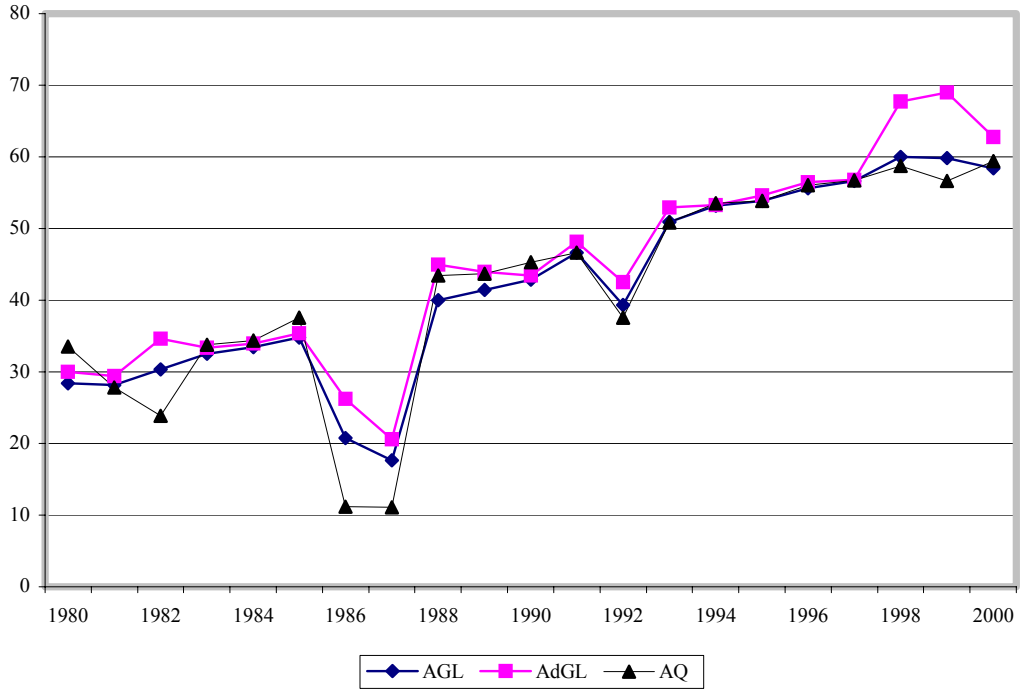
LIST OF APPENDIX

1. INTRODUCTION

At the outset, a major concern in recent years has been the impact of changing trade patterns on the labour market. The changing patterns towards intra-industry trade (IIT) is not surprising since opening of borders to international trade has resulted in industries competing on the basis of product differentiation The Malaysian manufacturing sector for one, has not only become growingly internationalized through the passage of time as dictated by volume of trade flows, but has also undergone structural transformation in terms of changing patterns in trade.

The analysis of trade data reveals that IIT has become an important component of Malaysia's international trade in manufactured goods. At the three-digit level of industry aggregation, IIT had doubled from approximately 30 per cent of all trade in manufactured goods in 1980 to 60 per cent in 2000 (see Figure 1). The growing IIT levels reflect a pattern of increased intra-industry trade specialization, particularly in the 1990s. Prior to that, trade was mainly that of inter-industry specialization (IIT indices below 50 per cent).

Figure 1: IIT Indices with the World for all Products



Note: AGL – Grubel-Lloyd aggregate index
AdGL - Grubel-Lloyd adjusted for trade imbalance index
AQ - Aquino index

Source: Calculated from the *Malaysia: External Trade Statistics*, various years.

Therefore the structure of trade may have profound implications for the Malaysian labour market. In order to determine the responses of labour to trade, particularly IIT, employment and wage equations are estimated in a dynamic panel data context. The estimations in the dynamic framework will account for explicitly the impact of trade on both the path of employment and wage adjustments.

The plan of this paper is organized as follows. Section two describes the trend in employment and wages within the different industrial groups. Section three examines the trade, trade-structure and labour market links in a dynamic panel context. Finally, Section four summarizes the broad empirical findings and concludes.

2. TRADE STRUCTURE AND LABOUR PATTERNS

2.1 Data and Measurement

The data on exports and imports are derived from the *Malaysia: External Trade Statistics* publications. The data is compiled for industries at the 3-digit Standard International Trade Classification (SITC level). Exports do not include re-exports. Exports are valued f.o.b. while imports c.i.f. Both exports and imports are in ringgit Malaysia at current prices. Total manufacturing imports and exports is deflated with the import price and export price index (1980 =100) for the entire economy respectively.

Based on trade flows, the aggregate Grubel Lloyd (AGL) and the marginal intra-industry trade (MIIT) indices are employed to measure the extent of trade overlap in manufacturing industries.

To obtain the level of IIT for the whole sample of industries in a given year, the AGL is calculated as shown below:

$$AGL_i = \frac{\Sigma(X_i + M_i) - \Sigma|X_i - M_i|}{\Sigma(X_i + M_i)}$$

where
X_i = exports of product i
M_i = imports of product i
If the GL index is zero, there is no intra-industry trade, which means that either exports or imports of that industry are equal to zero. If the GL index is equal to 100, all trade for the industry is intra-industry trade.

However in 1991, Hamilton and Kniest challenged the empirical analysis of IIT by suggesting a measure of marginal intra-industry trade (MIIT) since the former describes the level of trade flows in each period instead of the trade flows between time periods, for studies concerned with adjustment costs. Following that, Brulhart (1994) proposed the following index:

$$A_i = 1 - [\{|\Delta X_i - \Delta M_i|\}/\{|\Delta X_i| + |\Delta M_i|\}]$$

Positive values of A_i imply converging trends in sectoral exports and imports, and for values close to unity, a predominance of MIIT in the adjustment process. Conversely, zero values for A_i imply diverging trends in sectoral trade flows and, ceteris paribus, a higher transitional adjustment costs. The A index is defined in all cases and it can also be summed across industries (like the GL index) by applying the following formula for a weighted average.

$$A_{tot} = \Sigma_i^k w_i A_i$$

where $w_i = \{|\Delta X_i| + |\Delta M_i|\}/\Sigma\{|\Delta X_i| + |\Delta M_i|\}]$
A_{tot} = weighted average over all industries

2.2 Intra-Industry Trade and Labour Market Trends

The effects of the structure of trade on employment and wage trends are examined by classifying the industries into those with high intra-industry trade, low intra-industry trade and finally industries that have shifted from inter- to intra-industry trade.

Since the classification at the industry level contains sub-industries with substantial variation in trade characteristics, the focus will be on the overall changing trade features over the period 1983 to 2000. Appendix 1 lists the trade structure of the major industrial groups within manufacturing based on both measures of intra-industry trade.

Figure 2 presents the labour market indicators for manufacturing industries of the various trade-structural groups. Employment and wage shares in Figure 2 show an increasing trend for industries with high levels of intra-industry trade (IIT and MIIT) and *vice versa* for industries with low IIT (or MIIT) or that are basically engaged in inter-industry trade (IT).

Though there is no a prior theoretical reasoning for this relationship, it is not surprising that since intra-industry trade in Malaysian manufactures has been increasing with time, the employment and wage shares of industries engaged in this type of trade has naturally increased by 45 per cent (25 per cent for high MIIT industries) and 63 per cent (36 per cent for high MIIT industries) respectively between 1983 and 2000.

The trends in the employment and wage shares within high and low IIT (MIIT) industries have exemplified distinct patterns that set apart both categories. The significance of the impact of the structure of trade is thus tested for empirically to establish some links with the labour market.

3. EMPLOYMENT AND WAGE RESPONSES TO TRADE

3.1 Sample Information

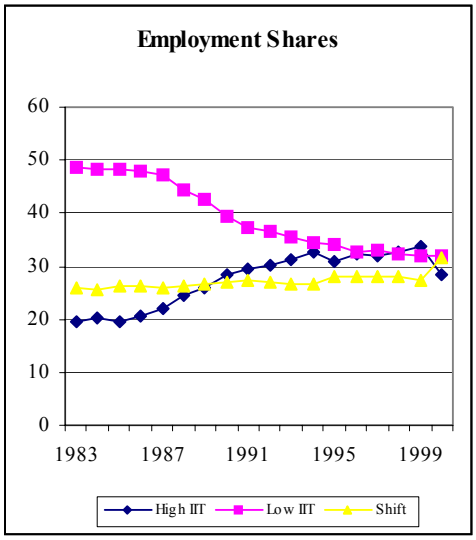
The analysis involves a panel data set of 19 major industrial groups extending over 18 years from 1983 to 2000, constructed by integrating trade, labour market and industrial statistics. Apart from the consistent yearly and industry coverage, the new data set constructed for this study has a number of unique features, which facilitate empirical enquiry.

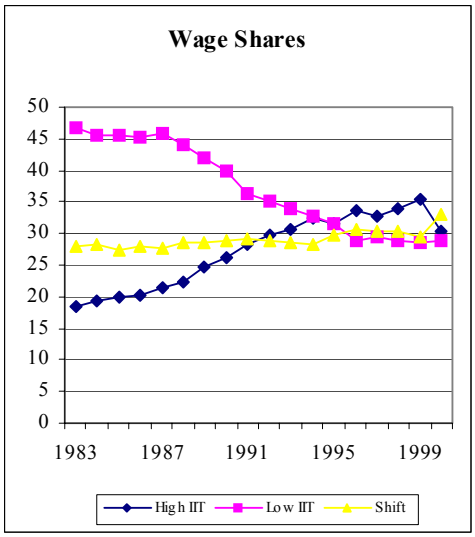
First, the cross-industry emphasis assists in identifying common experiences affecting employment and wages. Second, the calculated intra-industry trade indices by industry is a particularly attractive aspect of the data set used and these measures will serve as a proxy for the changing trade structure, which will be a key building block of the analysis.

As measures of industry employment, the numbers of full-time employees (N) in each industry are used. Similarly, only the wages and salaries of full-time employees are considered for the study. The wage variable refers to the average yearly earnings per full-time employee (W/N) in each industry. All wage variables are deflated by the Malaysian consumer price index (at constant 1980 prices).

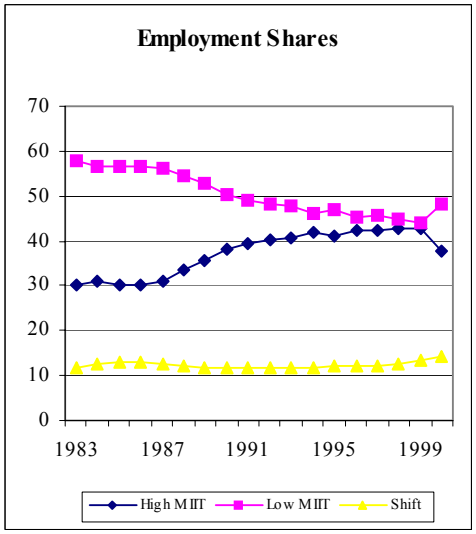
Figure 2: Employment & Wage Shares, by Trade Structure

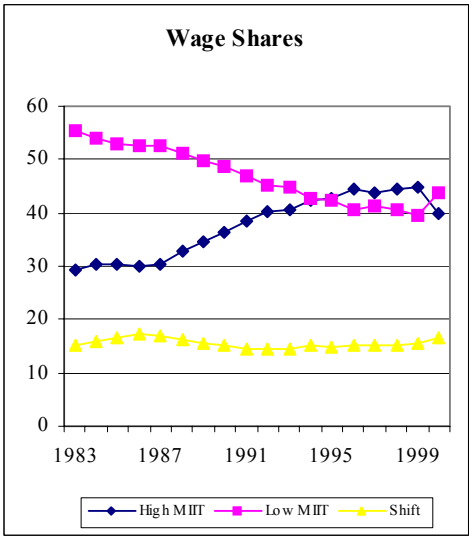
Based on AGL





Based on MIIT





Note: Classification based on Appendix 1.

Source: 1. Unpublished data from Department of Statistics, Malaysia.
2. Department of Statistics, *Malaysia: External Trade Statistics*, various publications.

3.2 Dynamic Specifications of Employment and Wages

The analysis is conducted within the framework of a fairly simple profit-maximizing model of firm behaviour (based upon Greenaway *et al*., 1998). The influence of foreign competition *via* the changes in trade on the demand for labour and wages is investigated directly by including trade terms (exports and imports) in the employment and wage equations. Labour demand is assumed to depend on a technology indicator, which in turn is assumed to depend on the volume of trade. The rationale for these terms is that an increase in the openness of the industry may induce either "efficiency" effects in the case of labour demand or discipline effects in the case of wages.

The trade terms are expected to exert two distinct influences on labour utilization, based on the comparative advantage position and on induced efficiency effects. Based on comparative advantage, the level of imports and exports should reflect the differences in labour intensity associated with the former. Since Malaysia's comparative advantage has generally been in labour intensive goods (though eroding with increases in wages outstripping productivity growth), the sign on imports should be negative and positive for exports. Rising imports are expected to reduce product demand and hence labour demand, while rising exports may cause faster increases in employment of affected industries.

However, based on the induced efficiency reasoning, there could be rationalization on the resources used, *via* productivity gains. This causes a negative impact of increased imports on labour and the export sector will similarly have to become more efficient to retain and capture additional overseas markets.

In the case of wages, foreign trade acts to moderate the demand for an industry's output and hence to discipline wage setting. The negative relationship between imports and exports with wages is possible if industries respond to increased competition by holding down labour costs. Conversely, rising imports may be associated with rising average wages because industries that have to compete on foreign markets tend to employ more skilled workers as well as more research and development. Similarly rising imports can also cause rising wages to vulnerable industries, or alternatively cause outsourcing of production of low skilled activities, which increases the average compensation of workers.

Greenaway *et.al* (1998) consider the dynamics of the employment equation. The dynamic relationships, characterized by the presence of a lagged dependent variable among the regressors, are considered to examine the path of employment, (and wages) the labour market moves between old and new equilibrium in response to trade. This is due to the existence of adjustment costs of changing employment (net changes), and thus wages. The dynamic specification for wages allows for the possibility of sticky adjustment through time. The important aspect related to dynamics, also concerns the interpretation of the long run and short run effects.

The employment and wage equations are differenced to transform out the industry specific fixed effects, and dynamic equations estimated are as shown below:

$$\Delta \ln N_{it} = -\mu_0 - \Sigma\mu_{1j}\,\Delta \ln M_{i,t-j} - \Sigma\mu_{2}j\,\Delta \ln X_{i,t-j} + \Sigma\varphi_{0j}\,\Delta \ln N_{i,t-j} + \Sigma\varphi_{1j}\,\Delta \ln W/N_{i,t-j} + \Sigma\varphi_{2j}\,\Delta \ln VA_{i,t-j} + \Delta\varepsilon_{it}$$

$$\Delta \ln w_{it} = -\mu_0 - \Sigma\mu_{1j}\,\Delta \ln M_{i,t-j} - \Sigma\mu_{2}j\,\Delta \ln X_{i,t-j} + \Sigma\varphi_{0j}\,\Delta \ln N_{i,t-j} + \Sigma\varphi_{1j}\,\Delta \ln W/N_{i,t-j} + \Sigma\varphi_{2j}\,\Delta \ln VA_{i,t-j} + \Delta\acute{\eta}_{it}$$

where
N_{it} = total employment in industry i in time t
W/N_{it} = average real wage per employee in industry i in time t
VA_{it} = real value added in industry i in time t
ε and ή represent error terms that pick up random measurement errors in employment and wages respectively and the effects of labour demand shocks on employment and wages, which are not picked up by the included independent variables.

Since the differencing induces a bias in the coefficient on the lagged dependent variable because of the correlation between it and the unobserved fixed effects in the residual, an instrumental variable approach is adopted. As Greenaway and *et.al* (1998), the method used is the generalized method of moments (GMM) technique of Arellano and Bond (1991), which uses lags of the endogenous variables dated t-2 and earlier as instruments since external instruments are difficult to find. The GMM estimator is adequate in this case because of the large number of observations.

3.3 Empirical Findings

The results of the GMM estimates by Arellano and Bond (1991) of the dynamic employment equations are presented in Table 1. The GMM estimator uses the lagged values of the variables in levels as instruments to remove the correlation between the regressors and the error term.

All variables in Table 1 are first differenced to eliminate individual effects. The results of the one-step model are reported though the null hypothesis of no first-order correlation in the difference residuals is rejected for all specifications, since Arellano and Bond (1991) recommend the one-step results instead of the two-step standard errors for inference on coefficients. The latter is found to be biased downwards for small samples in several studies.

Nevertheless, all the specifications in Table 1 do not display second order autocorrelation. This is important since the consistency of the GMM estimator hinges upon the assumption that $E(v_{it}, v_{it-2}) = 0$, where the v_{it} are the first differences of serially uncorrelated errors (see Arellano and Bond, 1991).

Table 1 reports four sets of estimates: the trade-augmented specification, the trade-augmented specification with interactions between trade and wage effects and the final two includes trade structure effects based on the AGL and MIIT indices to gauge the links between the speed of adjustment and intra-industry trade.

As expected, employment responds negatively to wages and positive to output in all specifications. With regards to trade, the contemporaneous effects of both imports and exports on employment are found to be positive and significant.

The short-run (coefficients of the current dated variables) effects of changes in the explanatory variables are generally much smaller than the long-run effects estimated in the dynamic model (see Table 2 for the estimated long run parameters). For example, an increase in imports by 1 per cent only implies an increase in employment by 0.08 per cent for the same year (based on specification 1 of Table 1). The corresponding long run impact on employment of a 1 per cent increase in imports is 0.2 per cent. However, short-run effects with respect to exports are much larger numerically than the long run effects, and they both exert a positive impact.

Table 1: GMM Estimates of Employment Equations (One Step Results)

Independent	(1)		(2)		(3)		(4)	
Variables	Coeff.	Std. Err.	Coeff.	Std. Err.	Coeff.	Std. Err.	Coeff.	Std. Err.
cons	0.003	0.002	0.002	0.002	0.002	0.002	0.003**	0.002
N(t-1)	0.088	0.102	0.079	0.103	0.086	0.104	0.116	0.107
N(t-2)	-0.076	0.081	-0.089	0.088	-0.069	0.073	-0.074	0.080
(W/N)t	-0.974*	0.171	-0.789*	0.180	-0.970*	0.170	-0.968*	0.169
(W/N)t-1	-0.121	0.120	-0.131	0.143	-0.165	0.113	-0.129	0.121
(W/N)t-2	-0.347	0.104	-0.441*	0.153	-0.356*	0.107	-0.332*	0.109
VAt	0.140**	0.081	0.135**	0.081	0.137**	0.080	0.129	0.083
(VA)t-1	0.032	0.045	0.027	0.047	0.022	0.040	0.027	0.045
(VA)t-2	0.041	0.041	0.039	0.041	0.034	0.041	0.040	0.041
Mt	0.095*	0.040	0.101*	0.042	0.128*	0.037	0.097*	0.038
Mt-1	0.100*	0.037	0.097*	0.035	0.108*	0.036	0.109*	0.039
Mt-2	0.027*	0.012	0.027	0.019	0.034*	0.017	0.026**	0.015
Xt	0.019*	0.008	0.021*	0.011	-0.003	0.010	0.013**	0.007
Xt-1	-0.012*	0.006	-0.014*	0.005	-0.019*	0.007	-0.017*	0.006
Xt-2	0.022*	0.006	0.021*	0.007	0.017	0.011	0.020*	0.008
AGLt					0.002*	0.001		
(AGL)t-1					0.001	0.001		
(AGL)t-2					0.0003	0.001		
MIITt							0.050*	0.017
(MIIT)t-1							0.042*	0.021
(MIIT)t-2							0.033*	0.017
(W/N)t*Mt			-0.546	0.675				
(W/N)t-1*Mt-1			0.174	0.390				
(W/N)t-2*Mt-2			0.308	0.273				
(W/N)t*Xt			-0.126	0.233				
(W/N)t-1*Xt-1			-0.046	0.116				
(W/N)t-2*Xt-2			-0.009	0.200				
2nd order serial correlation	-0.31		-0.25		-0.63		-0.60	
Wald test	4155.11 (14)		11536.02 (18)		11407.31 (17)		7892.91 (17)	
No. of obs	266		266		266		266	

Note: 1. The standard errors reported are the robust standard errors.

2. The Wald test is a test of the joint significance of the independent variables asymptotically distributed as a chi-square under the null of no relationship. The figure in parenthesis represents the number of coefficients estimated (excluding time dummies).

* significant and 5% and ** significant at 10%.

Table 2: Long-Run Parameters of the GMM Estimates for Employment Functions

	Aggregate Employment		
Explanatory Variables	(1)	(3)	(4)
(W/N)t	-1.46	-1.517	-1.492
VAt	0.216	0.196	0.205
Mt	0.225	0.275	0.242
Xt	0.029	-0.005	0.017
AGLt		0.004	
MIITt			0.130

Source: Calculated from estimates in Table 1.

The second specification in Table 1 focuses on the impact of trade changes in the slope of the derived labour demand function as increased openness may facilitate the substitution of foreign workers for domestic workers (see Greenaway *et.al*, 1999). In specification 2 of Table 1, trade volumes are interacted with the average wage rate per employee. The results do not point to an increase in the wage elasticity of the demand function, and therefore runs counter to the proposition advanced by Rodrik (1997) that the potential for substituting foreign for domestic workers resulting from greater openness increases the wage elasticity. The interaction effects are found to be statistically insignificant at conventional levels and are thus not taken into account in the subsequent functions.

As for the impact of intra-industry trade, the current and lagged MIIT variable in specification 4 in Table 1 is all positive and significant. However, the long run impact of intra-industry trade is greater than the short run impact (see Table 2). The empirical findings parallel the cue obtained from the descriptive analysis of growing employment shares for industries with high levels of intra-industry trade.

Since labour market responses are not confined to employment, the wage functions are also estimated using the GMM estimator. The results from a variety of specifications of wage functions are presented in Table 3. Similar to that of Table 1, the basic functional form augmented with trade variables is reported in equations (1) and (2), while equations (3) and (4) introduces trade structure that is measures of intra-industry trade. None of the specifications exhibit second order serial correlation.

The lagged wage is negative and significant in most cases. As expected employment growth impacts negatively on wage growth and is highly significant in all specifications. Surprisingly, though the contemporaneous effects of employment growth are consistently negative, the long run impact is positive (see Table 4).

As for the impact of trade, it appears that an increase in imports causes a contemporaneous fall in wages. However, the relationship is statistically insignificant. The long run impact of imports is positive only when trade structure effects are taken into account. Exports are also not significant at 5 per cent. The long run impact of exports is undeniably negative and the estimates are larger than that for imports. In short, the negative impact of exports both in the short run and long run presumably reflects reduction in costs and prices necessary to gain increased market share overseas.

Table 3: GMM Estimates of Wage Equations (One Step Results)

Independent	(1)		(2)		(3)		(4)	
Variables	Coeff.	Std. Err.	Coeff.	Std. Err.	Coeff.	Std. Err.	Coeff.	Std. Err.
Cons	0.003*	0.001	0.002*	0.001	0.002*	0.001	0.002*	0.001
(W/N)t-1	-0.051	0.044	-0.183*	0.061	-0.191*	0.054	-0.185*	0.062
(W/N)t-2	0.002	0.029	0.023	0.034	0.018	0.035	0.022	0.032
Nt	-0.233*	0.086	-0.110*	0.044	-0.110*	0.043	-0.108*	0.044
N(t-1)	0.135*	0.031	0.076*	0.029	0.074*	0.028	0.075*	0.030
N(t-2)	0.128*	0.036	0.122*	0.033	0.126*	0.035	0.122*	0.034
Vat	0.024	0.019	0.022**	0.013	0.022**	0.012	0.022**	0.012
(VA)t-1	-0.010	0.017	-0.001	0.013	-0.003	0.013	-0.011	0.013
(VA)t-2	-0.003	0.011	0.001	0.010	-0.001	0.011	0.001	0.010
Mt	-0.017	0.013	-0.020	0.021	-0.018	0.017	-0.021	0.021
Mt-1	-0.002	0.017	0.009	0.015	0.013	0.014	0.009	0.015
Mt-2	0.005	0.009	0.011	0.008	0.006	0.007	0.011	0.008
Xt	0.002	0.005	-0.008	0.006	-0.011**	0.006	-0.008	0.006
Xt-1	-0.001	0.002	-0.002	0.003	-0.004	0.004	-0.001	0.003
Xt-2	-0.004	0.004	-0.004	0.002	-0.001	0.005	-0.004	0.003
AGLt					0.0001	0.0004		
(AGL)t-1					0.0002	0.0002		
(AGL)t-2					-0.0002	0.0003		
MIITt							-0.001	0.006
(MIIT)t-1							-0.001	0.009
(MIIT)t-2							-0.002	0.009
(W/N)t*Mt			1.243*	0.181	1.229*	0.189	1.244*	0.183
(W/N)t-1*Mt-1			0.364*	0.142	0.363*	0.141	0.370*	0.149
(W/N)t-2*Mt-2			0.143	0.129	0.163	0.121	0.148	0.109
(W/N)t*Xt			0.352*	0.154	0.367*	0.156	0.358*	0.158
(W/N)t-1*Xt-1			0.060	0.048	0.068	0.047	0.062	0.048
(W/N)t-2*Xt-2			0.036	0.043	0.024	0.038	0.037	0.043
2nd order serial correlation	-0.29		0.58		0.49		0.60	
Wald test	1317.44 (14)		31764.94 (18)		6242.27 (14)		22681.86 (18)	
No. of obs	266		266		266		266	

Note: 1. The standard errors reported are the robust standard errors.

2. The Wald test is a test of the joint significance of the independent variables asymptotically distributed as a chi-square under the null of no relationship. The figure in parenthesis represents the number of coefficients estimated (excluding time dummies).

* significant and 5% and ** significant at 10%.

Table 4: Long-Run Parameters of the GMM Estimates for Wage Functions

	Aggregate Wages per Employee			
Explanatory Variables	(1)	(2)	(3)	(4)
Nt	0.029	0.076	0.077	0.077
VAt	0.01	0.019	0.015	0.019
Mt	-0.013	0	0.001	0.01
Xt	-0.003	-0.012	-0.014	-0.011
AGLt			neg.	
MIITt				-0.003
(W/N)tMt		1.509	1.496	1.515
(W/N)tXt		0.386	0.391	0.393

Note: neg. – negligible

Source: Calculated from estimates in Table 3.

The contemporaneous impact of intra-industry trade on wages in Table 3 is positive in the case of the AGL index but negative for MIIT. Nevertheless both indices are not statistically significant. Based on the small long run magnitudes, it can be inferred that relationship between intra-industry and wages is generally weak.

4. CONCLUDING REMARKS

The evolution of employment and wages does not appear to be unrelated to that of trade. This conclusion is confirmed by the evolution of labour indicators within each trade category. Bringing together descriptively the data on employment and wages reveals the following interesting links. Industries with high intra-industry trade have increased their employment and wage shares over the period of review.

The empirical analysis exploits the panel structure of the data set by GMM estimation of a dynamic model. Trade (import and export volume) is found to have a positive short run and long run impact on employment. However the import parameters are by far larger than that for exports. Ghose (2000) points out that imports may stimulate employment growth in manufacturing. He concludes that this trend serves as an important asymmetry between developing and industrialized economies since imports generally have an adverse impact on employment in the latter countries.

The contemporaneous effects of intra-industry trade on aggregate employment are also positive and significant. However the long run impact of trade structure is greater than the corresponding short run effect. Conversely, the relationship between the structure of trade and wages is essentially weak.

Summarizing the results of the quantitative examination of the trade-labour and trade structure -labour relationship yield the following broad results:

(a) Trade and the structure of trade matters for manufacturing labour market in general; and
(b) On average, there is more impact on the quantity side of the labour market (that is employment) than on the wage side.

Appendix 1: Classification of Major Industrial Groups by Trade Structure

Trade Structure	Industry	
	(By AGL*)	(By MIIT A**)
A. Shift in Trade Specialization	Chemical & Chemical Products	Chemical & Chemical Products
	Rubber Products	Paper, Printing & Publishing
	Plastic Products	Plastic Products
	Non-Metallic Mineral Products	Petroleum Products
	Fabricated Metal Products	
	Machinery Manufacturing	
	Scientific & Measuring Equipment	
B. Predominantly IIT/High MIIT	Electrical & Electronic Products	Electrical & Electronic Products
	Miscellaneous	Miscellaneous
		Non-Metallic Mineral Products
		Fabricated Metal Products
		Scientific & Measuring Equipment
C. Predominantly IT/ Low MIIT	Food	Food
	Beverages & Tobacco	Beverages & Tobacco
	Textile & Textile Products	Textile & Textile Products
	Petroleum Products	Leather & Leather Products
	Paper, Printing & Publishing	Furniture & Fixtures
	Basic Metal Products	Basic Metal Products
	Wood & Wood Products	Wood & Wood Products
		Rubber Products
		Machinery Manufacturing
		Transport Equipment
D. No Discernible Trade Specialization	Leather & Leather Products	
	Transport Equipment	
	Furniture & Fixtures	

Note: * Industries that have AGL levels of above 50% for the period 1983-2000 are considered to be predominantly high IIT and *vice versa* for those with AGL levels of below 50%.

** Industries that have MIIT levels of above 0.5 for periods 1983-1990 and 1990-2000 consecutively are categorized as high IIT and *vice versa* for those with MIIT levels of below 0.5 for both periods.

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