

Firm ownership and labour demand in Vietnamese manufacturing

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This paper examines the effect of firm ownership and export intensity on labour demand in the manufacturing sector through a case study of Vietnam, a country where outward-oriented reforms have played an important role in manufacturing employment over the period 2000-09. The core focus of the paper is on an econometric analysis of the determinants of labour demand in a manufacturing firm using firm-level panel data. The results suggest that the presence of foreign investment enterprises is associated with higher labour demand, as compared to domestic firms. The degree of employment creation is strongly reliant on the impact of export expansion on the firm's labour demand. In particular, these foreign enterprises tended to have a high degree of job creation in export-oriented manufacturing. However, our analysis reveals that the macroeconomic instability after 2006 has had a significant impact on job creation in Vietnamese manufacturing.

Keywords: labour demand, firm ownership, manufacturing, export-orientation, panel estimators

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1. Introduction

The expansion of manufacturing employment is arguably one of the main policy concerns for a labour-abundant developing economy such as Vietnam. Creating jobs in the manufacturing sector provides a broad basis for shifting unskilled labour away from agriculture and reducing poverty. This paper examines the determinants of labour demand in Vietnamese manufacturing, paying attention to the impact of ownership differences and export expansion in determining inter-firm differences in the degree of employment creation. The key hypothesis of this paper is that changes in firm ownership categories following an export-oriented industrialization (EOI) in the Vietnamese economy led to a significant variation in labour demand, with a special emphasis on an association of firm ownership and export intensity on job creation. An econometric analysis of the determinants of labour demand is undertaken to examine the differential impact of four ownership categories (state-owned enterprises, domestic private firms, FIE joint ventures and wholly owned FIEs) on labour absorption while controlling for the other firm-level characteristics. The analysis is based on a new firm-level panel dataset derived from the unpublished returns to the annual Enterprise Survey, undertaken by the General Statistical Office of Vietnam (GSO) in the period 2000-09.

There are a number of reasons for expecting the nature of firm ownership to have different impact on labour demand in the manufacturing sector in a developing economy. Private sector firms that normally exploit the comparative advantage of labour-intensive manufacturing for exports have associated with a significant likelihood of contributing a high level of employment generation. By contrast, in a typical transition economy, state-owned enterprises that were assigned a significant position for economic development are mainly involved in capital-intensive industries with a low level of job creation (Djankov & Murrell 2002; Megginson & Netter 2001). Among private sector firms, foreign-invested enterprises (FIEs) normally show more efficiency in business performance than domestic firms due to their acquisition of firm-specific assets (Bellak 2004; Lipsey 2004; Ramstetter 1999; Ramstetter & Sjöholm 2006). The impact of higher degree of efficiency could well result in labour saving, but production by export-oriented FIEs are generally expected to be characterised by greater labour intensive because relative wages are a key consideration in their location decisions.

Several studies of Vietnamese manufacturing investigate the issue of firm-ownership categories in association with labour productivity, export propensity, and wages in that sector (Athukorala & Tran 2012; Phan & Ramstetter 2004a, 2009; Ramstetter & Phan 2007).

Although previous studies focused on the overall trends and patterns of employment intensity during the EOI (Jenkins 2004, 2006; Lim 2011, 2014), only a small number of studies have examined an association between trade and investment liberalization and the degree of employment creation in manufacturing (Fukase 2013; 2014; Kien & Heo 2009; McCaig 2011). To date little research has, however, been undertaken to examine determinants of manufacturing employment in Vietnam. In particular, the important issue of how firm ownership affect labour demand for a manufacturing firm in the process of EOI in Vietnam is yet to be explored and we also need to examine how it could inform current debate about job creation following the EOI.

To preview the results, we found that foreign investment enterprises have had a higher level of job generation in Vietnamese manufacturing as compared to domestic enterprises. Export expansion are found to have a significant impact on manufacturing employment creation. More importantly, our finding provides significant support for the important role of export-oriented foreign investment in employment generation. Export expansion from FIEs is strongly associated with job growth.

The structure of this paper is as follows. Section 2 develops the model specification for the analysis of determinants of labour demand at a firm level, paying attention to the implications of firm-ownership categories and export intensity. Section 3 discusses estimation methods and the process of compiling firm-level data from the Enterprise Survey. Section 4 presents estimation results for the impact of firm ownership and export expansion in determining inter-firm differences in labour demand. Section 5 examines whether the macroeconomic disturbance after 2006 has had a significant impact on the labour absorption pattern. The final section provides some concluding remarks on labour demand in Vietnamese manufacturing during the export-oriented industrialization.

2. Labour demand model

The empirical analysis of this paper draws on the labour demand model developed by Hamermesh (1993), which is widely applied in the literature relating to this topic.¹ It starts with a Cobb-Douglas production function for the representative firm i in manufacturing in period t :

$$Y=A L_{it}K_{it} \tag{1}$$

¹ See Fabbri et.al 2003, Görg et al. 2009; Greenaway, Hine & Wright 1999; Hamermesh 1993, Navaretti, Checchi & Turrini 2003; Mouelhi 2007 and the works cited therein.

where i : firm, t : time, Y = real output; A = total factor productivity; K = capital stock; L = units of labour employed; α and β denote the factor share coefficients and γ captures the growth in efficiency in the production process. The marginal products of each factor are $\frac{\partial Y}{\partial L} = A^\gamma \alpha \frac{Y}{L}$ for labour and $\frac{\partial Y}{\partial K} = A^\gamma \beta \frac{Y}{K}$ for capital.

A profit-maximizing firm will utilize labour and capital at such levels that the marginal product of labour equals the wage (w) and the marginal product of capital equals its user cost (r):

$$A \frac{Y}{L} = w \quad (2)$$

$$A \frac{Y}{K} = r \quad (3)$$

Solving this system simultaneously gives:

$$Y_{it} = A L_{it} \left[\frac{\beta L_{it} w_{it}}{\alpha r_{it}} \right]^\beta \quad (4)$$

Transforming the equation (4) by natural logarithm, with small notations denoting logarithmic values, gives the preliminary equation of the firm's derived labour demand as:

$$l_{it} = \lambda_0 + \lambda_1 y_{it} + \lambda_2 w_{it} + \lambda_3 r_{it} \quad (5)$$

where:

$$\lambda_0 = \frac{-(\gamma \ln A + \beta \ln \beta - \beta \ln \alpha)}{(\alpha + \beta)}$$

$$\lambda_1 = \frac{1}{(\alpha + \beta)}$$

$$\lambda_2 = \frac{-\beta}{(\alpha + \beta)}$$

$$\text{and } \lambda_3 = \frac{\beta}{(\alpha + \beta)}$$

By definition, λ_1 , λ_2 are output elasticity of labour demand and wage elasticity of labour demand, respectively.

In addition to the three standard variables (y , w , and r) specified in the basic model (Equation 5), labour absorption in a firm depends on firm-specific as well as industry-specific

characteristics. These include export orientation (*EO*) and ownership category (*ONS*). An *EO* variable is incorporated to capture an export impact on a firm's labour demand as is standard in the literature (Hine & Wright 1998; Jenkins & Sen 2006).

The firm ownership category which, as used here, is typical of a firm operating in a transition economy. A process of restructuring and downsizing a state-owned enterprise can lead to massive lay-offs, while a foreign investment enterprise exploiting a country's comparative advantage, may generate higher employment. Thus, as noted briefly, four ownership categories are included in this study. The first, *DP*, is a dummy for domestic private firms and takes a value of one if the firm is a domestic private one and zero otherwise; *JV* is a dummy for FIE joint ventures and *WFIE* is a dummy for wholly owned FIEs. All three are private sector firms. And *SOE* is treated as the base dummy.

Apart from the firm-specific nature, industry characteristics can affect labour absorption in each firm. This is because firms in different industries operate under various technologies that result in varied labour demands. We can assume that this is a source of industry-specific differences. For instance, employment generation may be higher in labour-intensive industries than in resource-intensive ones. Thus, industry dummies (*INS*) for every two-digit VSIC (Vietnamese Standard Industry Classification) industry are included as an explanatory variable. It is worth noting that both these dummies representing firm and industry characteristics can be varied over the period of study. This variation can be explained by the ongoing revisions to legislation on enterprise formation and investment throughout the reform process, which allow firms to change ownership category as well as fields of business.

Adding these variables to the basic model (Equation 5) results in an extended model for examining whether ownership has an impact on the level of labour demand for a manufacturing firm:

$$l = f(y, w, r, EO, ONS, INS) \quad (6)$$

To further investigate the effect of firm ownership differences, interaction terms between ownership dummies with output and wages, respectively, are incorporated to measure the differential effect of firm ownership on labour demand. In addition, a majority of employment opportunities in the manufacturing sector are closely associated with the participation of private sector firms in export-oriented manufacturing. Thus this model also incorporates interactive terms between export expansion with ownership categories in order to examine the possible impact of firm ownership on a manufacturing firm's labour demand through exports.

Taking into account all these interactive impacts of firm ownership on the firm's labour demand results in a full empirical model for examining impact of export expansion and firm ownership on manufacturing employment growth:

$$\begin{aligned}
l_{ijt} = & \lambda_0 + \lambda_1 y_{ijt} + \lambda_2 w_{ijt} + \lambda_3 r_t + \lambda_4 EO_{ijt} \\
& + \sum_m \lambda_{5m} ONS_{ijt} + \sum_m \lambda_{6m} (y * ONS)_{ijt} + \sum_m \lambda_{7m} (w * ONS)_{ijt} + \sum_m \lambda_{8m} (EO * ONS)_{ijt} \\
& + \sum_j \delta_j INS_{it} + \gamma T_t + \mu_{ij} + \varepsilon_{ijt} \quad (7)
\end{aligned}$$

where $i = 1, 2, \dots, n$ is the firm, $j = 1, 2, \dots, k$ is the industry, $t = 1, 2, \dots, T$ is the time unit in years and m is the number of firm ownership categories. The variables are defined as:

l_{ijt}	Employment in log form
y_{ijt}	Firm output in log form
w_{ijt}	Real wage in log form
r_t	User cost of capital
EO_{ijt}	Export orientation
ONS_{ijt}	A dummy for firm ownership category
$(y * ONS)_{ijt}$	An interactive term between firm output with firm ownership dummy
$(w * ONS)_{ijt}$	An interactive term between real wages with firm ownership dummy
$(EO * ONS)_{ijt}$	An interactive term between export orientation variable with firm ownership dummy
INS_{ijt}	A vector of 21 two-digit VSIC industry dummies
T_t	A vector of time dummy variables
μ_{ij}	"Unobserved effect" captures time-invariant firm features
ε_{ijt}	A stochastic error term

By definition, there are three firm ownership dummies in this model.

DP_{ijt}	A dummy for domestic private firms
JV_{ijt}	A dummy for joint venture firms
$WFIE_{ijt}$	A dummy for wholly owned FIEs

The postulated effects of the explanatory variables on the dependent variable are as follows. The estimated coefficient of real wage rate (w) is expected to be negative.² This is premised on a possible substitution between labour and other input factors when wages increase, given a high proportion of unskilled workers in the manufacturing sector. The

² A wage variable will carry a positive sign if the wage rate reflects higher skills.

coefficient of real output (y) is expected to be positive, since output growth of a firm exploring a comparative advantage of labour abundance would result in a higher level of labour absorption. Of particular concern is that exploring this factor abundance in domestic production for exports can increase job opportunities because export-oriented goods in a labour-abundant country such as Vietnam are labour intensive. In this case, a positive sign on an *EO* variable would be justified.

Next, a set of intercept dummies representing three kinds of private sector firms: namely *DP*, *JV*, and *WFIE* are expected to be positive. Because these private firms are assumed to have a higher level of job creation than public enterprises, as it is widely argued that the former have performed better in using capital and labour in labour-abundant economies (Kuo 1983; Song 1990). Regarding the interaction of the dummies with wages ($w*ONS$), the effect of these interactive terms on labour demand could be positive or negative. A simple reason is that it becomes easier to substitute away from labour, and toward other factors of production in response to an increase in wages due to the outward-oriented reforms. Consequently, firms are increasingly involved with global production networks following reforms (Fabbri, Haskel & Slaughter 2003; Görg & Strobl 2002; Navaretti, Checchi & Turrini 2003). In this case, a negative sign would be justified. In contrast, these firms could have a less elastic labour demand because of increasing proportions of skilled workers in the job structure or rigidity in the labour market (Feenstra & Hanson 1997). Thus, the expected sign of this coefficient is positive.

Similarly, the interactive variable with output ($y*ONS$) is postulated to be positive since the outward-oriented reforms are predicted to bring about an output expansion, mainly due to increasing access to international markets for exports. This expansion would result in a proportional increase in labour absorption in each firm. Of particular interest is the close association between firm ownership category and employment generation following an export-oriented strategy. Our proposition rests on the idea that the largest part of job creation in the manufacturing sector can be attributed to the increasing participation of private sector firms, in particular FIEs. Thus, the interaction term ($EO*ONS$) implying export-oriented private sector firms is postulated to be positive. One reason lies in the fact that these private sector firms in a labour-abundant economy tend to be more significantly involved in export-oriented production that are closely associated with a highly intensive usage of the comparative advantage offered by that abundant factor-unskilled labour.

This model specification assumes that the supply of labour to the manufacturing sector is elastic so that a shift in labour away from agriculture into manufacturing can be made at a low marginal cost.³ In this way, wages can be treated as exogenous. This allows us to explain the estimated coefficients of output and wages as labour demand elasticity with respect to output and wages, respectively. As shown by our findings in the other study,⁴ surplus-labour conditions persisted in the Vietnamese economy until 2011. Thus, an assumption of elastic labour supply is still able to capture an accurate summary of labour market conditions in Vietnam. This assumption is also robust with relation to an analysis using the firm-level dataset to relax endogeneity, an issue that we discuss later.

3. Data and estimation method

3.1 Data

Data are compiled from unpublished returns to the Enterprise Survey conducted by the General Statistical Office (GSO), Vietnam. The survey covers all large- and medium-sized firms and a representative sample of small firms with fewer than ten employees. The survey provides firm-level information on output, employment, wages, capital stock, intermediate inputs, and firm-ownership categories. Data on each firm are coded and stored individually in a unique identification unit by tax code and the Vietnamese standard industry classification (VSIC) at the four-digit level.

At the time of data compilation, data were available for ten years from 2000 to 2009. For the purposes of this analysis, manufacturing is defined to cover all manufacturing industries under VSIC excluding petroleum and gas (VSIC 23). Petroleum and gas industry is excluded because of the susceptibility of its performance to fluctuations in world market prices. The raw data from the survey are extracted and cleaned to build firm-level panel data for estimating purposes. In the first stage, all firms with missing (or negative) values on employment, capital, and output are excluded. Any erroneous observations or outliers are also eliminated in the dataset. It should be noted that many small firms report implausible or unrealistic data due to their poor information and accounting systems. Thus, this study focuses on examining the labour demand among firms with a workforce of at least ten employees.

For the purpose of examining significant differences in labour demand, firms are grouped under four specific ownership categories: state-owned enterprise (SOE), domestic private firm

³ The Lewis development model (1954) presumes that the supply of unskilled labour in the modern sector is perfectly elastic. In fact, the labour supply is only required to be elastic so that a shift in labour away from the subsistence sector to the modern sector can be made at a low marginal wage.

⁴ This study is available on request from the author.

(DP), FIE joint venture (JV)⁵ and wholly owned FIE (WFIE). Finally, the presence of firm identification codes provides a convenient way to construct a panel and trace the firms over time. The final dataset is an unbalanced panel, covering more than ten thousand firms for each year in the period 2000-09.

Apart from labour, which is measured by the number of workers employed, all other variables are in nominal values, which are then converted into real value series using appropriate deflators. The deflators for the output series are taken from the current and constant price series of manufacturing outputs at the two-digit VSIC level from GSO. The capital deflators are computed from the current and constant values of fixed-capital formation from the national account category. The consumer price index (*CPI*) is used as the deflator to calculate real wage rates. In addition, the deflator for the intermediate input series for each manufacturing industry is computed as the weighted shares of the price indices of products used as inputs in that industry. The weights for the measurement of input shares are calculated using the 2000 Input-Output table (I-O table) of GSO. To obtain these weights, the 112 sectors in the I-O table are firstly aggregated at the two-digit VSIC level, using the concordance table of GSO. Consequently, input price indices are derived after the input shares for every two-digit industry are calculated. As a result, the difference between output and intermediate inputs at constant prices indicates real value added.

Finally, data required for constructing the user cost of capital variable (r) is not available in our dataset. However, presumably excluding this variable is unlikely to result in an omitted variable bias in our estimates because the capital market is nation-wide and the user cost of capital will only vary over time (not across industries) (Görg et al. 2009; Greenaway, Hine & Wright 1999; Milner & Wright 1998), and therefore is captured by the time dummies.

Data series⁶ for all variables other than *EO* are constructed from the database compiled from the GSO Enterprise Survey. This survey does not provide data on exports by firms. We therefore measured export orientation for four-digit VSIC industries by combining trade data deriving from the UN Comtrade database with output data from manufacturing survey data⁷ and then used to estimate an *EO* ratio at a given four-digit industry for all firms belonging to that industry. The measurement error involved in this variable (arising from the implicit

⁵ This category includes both FIE joint ventures with state enterprises or domestic private firms. It was decided to treat all FIE joint ventures as one group since these firms account for less than 5% of total manufacturing employment.

⁶ Summary indicators of the variables and their correlation matrix are given in Appendix 1.

⁷ Manufacturing survey covers only about 90% of total manufacturing output. The data were therefore adjusted to obtain the full coverage by using the methodology used in Phan and Ramstter (2004a).

assumption that all firms belonging to a given industry exhibit the same degree of export orientation) is unlikely to bias the estimation results significantly because exporting firms in Vietnam are heavily concentrated in a few industries (garments, footwear, furniture, processed sea food and electronics).

3.2 Estimation method

The labour demand model is estimated by standard panel data estimation techniques, using the firm-level dataset. Pooled OLS, fixed effects (FE), and random effects (RE) estimations are the most widely used alternative techniques (Baltagi 2006; Wooldridge 2002). The FE estimator is not suitable for our purpose because one of the key variables in the model (firm ownership) is time invariant. We use the Breusch-Pagan Lagrange multiplier test (1980) to select between pooled OLS and RE. The RE estimator is based on the assumption of unobserved, random effects which are not captured by the variables in the model (Greene 2008). If this assumption holds, then the RE estimator is preferable to pooled OLS in generating efficient and unbiased linear estimates. Since there is strong evidence of heteroskedasticity in this estimation, the statistical significance of the regression coefficients are tested in terms of consistent variance-covariance standard errors, derived from the Huber-White 'sandwich' estimator.

The panel estimators can be biased and inconsistent in the presence of possible endogeneity in the labour demand equation. The wage variable can be endogenous since both labour demand and labour supply rely on wages that interact with both at the equilibrium. Consequently, exogenous shocks to labour demand will lead to shocks to wage rates. In other words, aggregate demand or technological shocks can lead to a simultaneous change in demand for labour and wages. When these shocks cannot be captured by the model, the simultaneity occurs due to a possible correlation between the error term and wages. However, the simultaneity should not be a major concern due to the labour supply assumption. This study assumes that the labour supply conditions facing each manufacturing firm are elastic. As noted earlier, this assumption is strongly relevant to an examination of labour demand at a manufacturing firm in a labour-abundant economy. Any shifts in the labour supply curve would then result in changes in wages, which would be reflected in the labour demand schedule. Conversely, any exogenous shocks to the demand for labour do not affect wages. Another important point is that the inclusion of time dummies in the model that capture exogenous shocks to labour demand would also alleviate endogeneity. Additionally, this study uses a firm-level dataset at a highly disaggregated level, thus redressing the seriousness of the

endogeneity effect. This caveat is founded on the view that demand or technological shocks to the labour demand at a firm level do not influence wage rate simultaneously, as long as there is little possibility that one individual firm could acquire a monopolistic position in the related labour market (Hamermesh 1993). Therefore, this should not be a serious issue. Given these caveats, our panel data technique estimators in this analysis should be reliable.

4. Results

Table 1 reports the estimation results of the labour demand model in four specifications. The model consisting of three variables (y , w and EO) is in the first column whereas the extended equation (Equation 6) is the second one. The full model (Equation 7) controls for the impact of the interactive terms for the firm ownership category is shown in the third column while the extended model ignores this impact. The last result plays as check-up estimation on the possible changes in the estimated coefficients after omitting several insignificant variables in the third column. As the Breusch-Pagan LM test for selection between RE and pooled OLS estimators confirms the existence of random effect, the RE estimate will be discussed in this section. For comparison, the pooled OLS estimates are reported in the Appendix 2.

The coefficients of the two basic variables of labour demand, output and wages, have the expected signs (positive and negative, respectively) at a high level of significance. First, the estimates of wage elasticity of labour demand are highly consistent with the plausible range of those generally identified in the literature (Görg et al. 2009; Hamermesh 1993; Mouelhi 2007). Second, across all cases, the magnitudes of the output coefficients are much larger than those of wages, suggesting that a firm's demand for labour is highly responsive to growth in manufacturing output. This provides strong statistical support for our proposition that the degree of employment with respect to output is much more important than that for wages in explaining the behaviours of labour demand for a manufacturing firm in a labour-abundant economy such as Vietnam.

Table 1: Determinants of labour demand in Vietnamese manufacturing, RE estimates, 2000-09

Dependent variable: logarithm of firms' employees

Explanatory variables	(1)	(2)	(3)	(4)
<i>y</i> (real output)	0.401*** (0.003)	0.387*** (0.003)	0.427*** (0.009)	0.424*** (0.008)
<i>w</i> (wage)	-0.264*** (0.005)	-0.272*** (0.005)	-0.315*** (0.016)	-0.301*** (0.010)
<i>EO</i> (export orientation)	0.021* (0.012)	0.035*** (0.011)	-0.006 (0.030)	-0.000 (0.012)
<i>DP</i> (domestic private firms)		-0.413*** (0.012)	-0.107 (0.068)	-0.101 (0.069)
<i>JV</i> (joint ventures)		0.083*** (0.032)	0.249* (0.147)	0.307** (0.147)
<i>WFIE</i> (wholly owned FIEs)		0.211*** (0.021)	0.348*** (0.101)	0.354*** (0.103)
<i>y*DP</i>			-0.045*** (0.009)	-0.042*** (0.008)
<i>y*JV</i>			-0.035** (0.016)	-0.026* (0.014)
<i>y*WFIE</i>			-0.024** (0.012)	-0.021** (0.010)
<i>w*DP</i>			0.050*** (0.016)	0.037*** (0.011)
<i>w*JV</i>			0.050 (0.030)	
<i>w*WFIE</i>			0.015 (0.020)	
<i>EO*DP</i>			0.006 (0.031)	
<i>EO*JV</i>			0.138** (0.065)	0.119** (0.058)
<i>EO*WFIE</i>			0.198*** (0.041)	0.192*** (0.030)
Constant	0.834*** (0.025)	1.265*** (0.028)	1.000*** (0.069)	0.995*** (0.070)
Observations	108,406	108,406	108,406	108,406
R ²	0.6777	0.6924	0.6955	0.6957
Number of firms	27,982	27,982	27,982	27,982
Breusch-Pagan LM test	² (1)=130,000	² (1)=120,000	² (1)=120,000	² (1)=120,000

Notes: ***, ** and * Denote significance at the 1%, 5% and 10% levels, respectively. Standard errors adjusted for arbitrary heteroskedasticity are given in brackets.

(a) The Breusch-Pagan LM test is employed for selection between random effects and pooled OLS estimation. Null hypothesis is rejected at the 1% level. See Appendix 2 for pooled OLS estimates.

(b) All specifications include year dummies and industry dummies. For brevity, their coefficients are not reported here.

The coefficients on export intensity are positive and significant at standard levels in several cases (Columns 1 and 2). However, the estimate turns out to be insignificant in the full model.

This infers that an increase in exports is associated with job growth in the manufacturing sector, given all other factors being held constant. This provides statistical evidence that labour demand for a firm involving in an export-oriented industry is relatively higher than it is for other firms. This finding is plausible given the extensive liberalization reforms focusing on an EOI in Vietnam since the early years of the period 2000-09. Export expansion of labour-intensive manufacturing as a result of the liberalization can translate into higher demand for labour. This employment effect is likely to be associated with export-oriented, labour-intensive manufacturing industries.

The positive sign and significance of these ownership dummies for FIE joint ventures and wholly owned FIEs in the full model imply that a firm's labour demand is higher in these foreign enterprises compared to both SOEs and domestic private firms. This finding is consistent with the commonly held perception that in Vietnam most FIEs in the export-oriented industries are highly labour intensive, recruiting a large number of unskilled workers for export production. Since 2000, the practice of using labour-intensive technology in export-oriented investment projects has added impetus to generate more employment in the process of EOI.

The dummy for domestic private firm (*DP*) carries a negative and significant sign in the extended model but fails to yield a statistically significant coefficient in the full model. This suggests that private domestic firms have a lower demand for labour than SOEs, holding other factors constant. This finding runs counter to the *a priori* expectation that domestic private firms contribute to employment expansion, as has been the experience of East Asian labour-abundant economies. Despite this, the finding is not surprising for a transitional economy such as Vietnam's, where the domestic private firms still face unequal treatment in terms of market access, access to investment incentives, and capital. This discriminatory business environment to some extent hindered the business performance of these domestic private firms (Kokko 2004). For example, even though the import tariffs were lower for the final product sectors over the period 2000-05, its tariffs on these input-supplying sectors still remained high. This tariff improvement only provided favourable conditions for SOEs and FIEs to access in the upstream industries rather than domestic private firms (Athukorala 2006). Over that period, many domestic private firms also experienced difficult obstacles to obtaining bank credit because commercial bank lending practices in Vietnam relied heavily on institutional procedures, personal connections and creditability and collateral, all of which favoured the SOEs and FIEs (Hakkala & Kokko 2007; Malesky & Taussig 2009).

As for public enterprises, the reasons for the lower employment outcome in these SOEs are quite straightforward since most state enterprises in Vietnamese manufacturing normally involve in import-competing industries with highly capital-intensive technology. Many SOEs in these import-substitution industries are highly protected, receiving concessional treatment from the government and state-owned commercial banks, and most are biased towards capital intensity.

Ownership category is found to have a significant impact on labour demand of a manufacturing firm through export expansion. The estimated coefficients of these interaction terms between export expansion and two corporate forms of foreign direct investment ($EO*JV$ and $EO*WFIE$) carry positive signs and are significant. All other things being equal, the degree of employment creation in an export-oriented foreign investment firm is considerably larger compared to other firms. As noted earlier, given the insignificant coefficient of the EO variable, the presence of export-oriented foreign investment has dominated the impact of export expansion on job growth in Vietnamese manufacturing. This implies that the number of jobs generated through the export expansion is largely reliant on the operation of foreign investment projects on export-oriented manufacturing industries. Thus, there is strong empirical evidence suggesting that the involvement of FIEs in labour-intensive manufacturing since the early 2000s is very important in explaining the expansion of a firm's labour demand in Vietnamese manufacturing. In brief, these findings provide a powerful explanation as to why manufacturing exports, in particular exports from FIEs in labor-intensive manufacturing, play a driving force in order to withdraw unskilled workers from agriculture into manufacturing in a labour-abundant economy. By contrast, the coefficient of an $EO*DP$ is positive but insignificant from zero. Thus, there is no statistical evidence showing the positive effect of domestic private firms on job creation through their involvement in export-oriented manufacturing industries.

Next, the coefficients of the interaction term between output and the ownership category are negative and significant at a five per cent level, or even better. This implies that within the same two-digit industries, in general the labour demand of private sector firms, both domestic and foreign, is less elastic to output growth than it is for SOEs. However, these magnitudes of the estimated coefficients are rather small. This infers that on average, these private sector firms have marginal lower output elasticity of labour demand than SOEs.

The estimated results of the interactive variable between wages and the ownership dummy are rather mixed. With the exception of $w*DP$, these coefficients on the other interaction

terms ($w*JV$ and $w*WIE$) are insignificant from zero. The positive sign and significance of $w*DP$ implies that compared to public enterprises, these domestic private firms have adjusted labour demand slowly in response to wage changes. For instance, *ceteris paribus*, a one per cent increase in labour costs reduces demand for labour by 0.31 per cent in SOEs, while a one per cent rise in the wage results in a 0.26 per cent decrease (*computed as* $-0.31 + 0.05$) in the number of workers demanded in domestic private firms. Notably, wage elasticity of labour demand for domestic private firms is only marginally different from that of SOEs. A plausible reason for this relies on differences in recruitment policy between state enterprises and domestic private firms. SOEs have various hiring policies, which mostly rely on non-market considerations whereas these private firms normally adopt a single recruitment method. Generally, given the insignificance of the interactive terms between wages and other ownership dummies, there is no strong statistical evidence for a significant difference in wage elasticity among firm ownership categories.

It is likely that the inclusion of the interactive variables between ownership dummies with wages and output, respectively do not significantly affect a firm's labour demand. Explained briefly, the last column presents the result when an estimated specification omitted all insignificant interactive variables in the full model. In the absence of these interaction terms, the signs of the estimated coefficients on all explanatory variables and their significance are quite consistent with those in the full model. Thus, the incorporation of these interaction terms does not affect the quality of the estimated results.

All estimators of the labour demand model pass the Breusch-Pagan LM test for efficiency of the RE estimation. The test decisively rejected the null hypothesis that random effects do not exist, favouring the use of the RE estimator in this analysis. In addition, given evidence of heteroskedasticity (see Appendix 2), the standard errors derived from the robust variance-covariance matrix estimator are employed to test for statistical significance of the estimated coefficients (Wooldridge 2002).

We have so far examined how the export orientation and firm ownership impacts on labour demand elasticities in Vietnamese manufacturing during the entire period 2000-09. In the next section, we try to examine whether the macroeconomic instability during the period 2006-09 has had a significant impact on the labour absorption patterns in manufacturing compared to the previous six years.

5. Macroeconomic disturbance and manufacturing labour absorption

Employment growth in Vietnamese manufacturing over the period 2000-09 has been underpinned by the increasing participation of foreign investment in the exploitation of labour-intensive manufacturing exports. The rising role of FIEs is based on the significant improvements on trade and investment regimes coupled with the enterprise reform implemented in the lead-up to the World Trade Organization (WTO) membership in 2007. However, the high inflation caused by the investment boom persisted for much of the period 2006-09, leading to macroeconomic disturbance in Vietnamese economy. Additionally, manufacturing employment is likely to have been affected by the 2009 global financial crisis. Under these macroeconomic disturbances, the impact of export expansion and firm ownership on labour demand of a manufacturing firm is equivocal. Thus, it is interesting to examine the determinants of labour demand in the sub-samples of firms over the period 2000-05 and those over the period 2006-09.

We perform the estimation of the labour demand models for these two sub-periods. The RE estimation results for the two sub-periods, amply supported by the Breusch-Pagan LM test, are shown in Tables 2 and 3 (these results are presented in the same format as in Table 1). The coefficients of explanatory variables in most cases are consistent in terms of sign and significance, as compared to the corresponding estimations for the whole period.

In addition, the Chow test (1960) is employed to examine whether the estimated coefficients derived from the first-period sample are significantly different from those from the second one. As with each individual coefficient, a t-test statistic is employed to examine whether there is a significant difference in the individual coefficient between two samples. In other words, we check to see if a coefficient's magnitude from the first period sample does not overlap with that from the second one within the standard error sub-band. The Chow test statistic provides evidence for the overall significant difference of the estimated coefficients on all explanatory variables between the two sub-period samples (Table 4). Consequently, there are several relevant differences relating to the impact of export expansion and firm ownership on labour demand before and after 2006.

Table 2: Determinants of labour demand in Vietnamese manufacturing:RE estimates, 2000-05

Dependent variable: logarithm of firm's number of employees

Explanatory variables	(1)	(2)	(3)	(4)
<i>y</i> (real output)	0.388*** (0.004)	0.377*** (0.004)	0.443*** (0.010)	0.445*** (0.010)
<i>w</i> (wage)	-0.264*** (0.006)	-0.272*** (0.006)	-0.319*** (0.017)	-0.328*** (0.013)
<i>EO</i> (export orientation)	0.001 (0.015)	0.019 (0.014)	0.009 (0.035)	-0.006 (0.015)
<i>DP</i> (domestic private firms)		-0.465*** (0.015)	0.079 (0.082)	0.072 (0.083)
<i>JV</i> (joint ventures)		0.029 (0.034)	0.535*** (0.176)	0.591*** (0.168)
<i>WFIE</i> (wholly owned FIEs)		0.127*** (0.025)	0.767*** (0.123)	0.755*** (0.125)
<i>y*DP</i>			-0.073*** (0.011)	-0.075*** (0.010)
<i>y*JV</i>			-0.073*** (0.020)	-0.076*** (0.019)
<i>y*WFIE</i>			-0.067*** (0.015)	-0.071*** (0.013)
<i>w*DP</i>			0.059*** (0.018)	0.068*** (0.014)
<i>w*JV</i>			0.060* (0.036)	0.064* (0.034)
<i>w*WFIE</i>			-0.016 (0.025)	
<i>EO*DP</i>			-0.023 (0.036)	
<i>EO*JV</i>			0.101 (0.068)	
<i>EO*WFIE</i>			0.148*** (0.050)	0.162*** (0.038)
Constant	0.934*** (0.032)	1.393*** (0.035)	0.886*** (0.082)	0.890*** (0.083)
Observations	59,247	59,247	59,247	59,247
R ²	0.6687	0.6943	0.6993	0.6990
Number of firms	17,537	17,537	17,537	17,537
Breusch-Pagan LM test	² (1)=56,207	² (1)=53,419	² (1)=52,772	² (1)=53,021

Notes: ***, ** and * Denote significance at the 1%, 5% and 10% levels, respectively. Standard errors adjusted for arbitrary heteroskedasticity are given in brackets.

(a) The Breusch-Pagan LM test is employed for selection between random effects and pooled OLS estimation. Null hypothesis is rejected at the 1% level. See Appendix 3 for pooled OLS estimates.

(b) All specifications include year dummies and industry dummies. For brevity, their coefficients are not reported here.

Table 3: Determinants of labour demand in Vietnamese manufacturing: RE estimates, 2006-09

Dependent variable: logarithm of firm's number of employees

Explanatory variables	(1)	(2)	(3)	(4)
<i>y</i> (real output)	0.420*** (0.004)	0.400*** (0.004)	0.451*** (0.016)	0.430*** (0.009)
<i>w</i> (wage)	-0.240*** (0.006)	-0.249*** (0.006)	-0.188*** (0.029)	-0.221*** (0.014)
<i>EO</i> (export orientation)	0.051*** (0.017)	0.063*** (0.016)	-0.074 (0.061)	0.008 (0.018)
<i>DP</i> (domestic private firms)		-0.521*** (0.026)	0.208 (0.152)	-0.073 (0.099)
<i>JV</i> (joint ventures)		0.011 (0.048)	0.321 (0.250)	-0.089* (0.049)
<i>WFIE</i> (wholly owned FIEs)		0.109*** (0.032)	0.411** (0.189)	0.019 (0.035)
<i>y*DP</i>			-0.055*** (0.016)	-0.035*** (0.010)
<i>y*JV</i>			-0.022 (0.025)	
<i>y*WFIE</i>			-0.028 (0.020)	
<i>w*DP</i>			-0.066** (0.030)	-0.033** (0.016)
<i>w*JV</i>			-0.068 (0.053)	
<i>w*WFIE</i>			-0.043 (0.034)	
<i>EO*DP</i>			0.089 (0.063)	
<i>EO*JV</i>			0.373*** (0.110)	0.307*** (0.094)
<i>EO*WFIE</i>			0.353*** (0.073)	0.273*** (0.044)
Constant	0.720*** (0.034)	1.347*** (0.046)	0.685*** (0.150)	0.973*** (0.095)
Observations	49,159	49,159	49,159	49,159
R ²	0.6915	0.7010	0.7037	0.7035
Number of firms	16,671	16,671	16,671	16,671
Breusch-Pagan LM test	² (1)=36,149	² (1)=35,944	² (1)=35,122	² (1)=35,140

Notes: ***, ** and * Denote significance at the 1%, 5% and 10% levels, respectively. Standard errors adjusted for arbitrary heteroskedasticity are given in brackets.

(a) The Breusch-Pagan LM test is employed for selection between random effects and pooled OLS estimation. Null hypothesis is rejected at the 1% level. See Appendix 4 for pooled OLS estimates.

(b) All specifications include year dummies and industry dummies. For brevity, their coefficients are not reported here.

Table 4: The Chow test and t-test for significant difference in the estimation results between the period 2000-05 and 2006-09.

Tests	(1)	(2)	(3)
y^*t	0.015*** (0.002)	0.022*** (0.002)	-0.003 (0.007)
w^*t	0.031*** (0.005)	0.021*** (0.005)	0.058*** (0.018)
EO^*t	0.075*** (0.010)	0.045*** (0.010)	-0.100*** (0.037)
DP^*t		0.106*** (0.012)	-0.070 (0.072)
JV^*t		0.127*** (0.019)	-0.092 (0.127)
$WFIE^*t$		0.173*** (0.014)	-0.567*** (0.093)
y^*DP^*t			0.028*** (0.007)
y^*JV^*t			0.039*** (0.012)
y^*WFIE^*t			0.055*** (0.009)
w^*DP^*t			-0.051*** (0.018)
w^*JV^*t			-0.080** (0.032)
w^*WFIE^*t			0.036 (0.022)
EO^*DP^*t			0.141*** (0.039)
EO^*JV^*t			0.209*** (0.070)
EO^*WFIE^*t			0.265*** (0.048)
Chow test	$\chi^2(11)=233.1$	$\chi^2(12)=412.5$	$\chi^2(1)=581.8$

Note: The Chow test procedure is an estimation of a pooled, interacted model to examine whether this is any structural break between two sub-periods. The estimating results for this procedure are presented in Appendix 5.

First, the coefficient on the export expansion variable for the period 2006-09 is positive and significant in the extended model despite its insignificant in all cases for the period 2000-05. This implies that over the latter period, there is statistical evidence for a positive impact of export intensity on job creation in the manufacturing sector. Overall, an expansion of labour-intensive manufacturing exports during the period 2006-09, in particular following the WTO admission in 2007, likely resulted in higher demand for labour. However, this employment effect of the export expansion was lower than expected given that the coefficient on an EO^*t is significant with a negative sign. This implies that the positive impact of export orientation on a firm's labour demand has decreased over the period 2006-09. A possible reason for this

decline is an impact of the 2009 global export collapse on Vietnamese manufacturing employment. Less profitable opportunities in export markets in 2009 were possibly associated with a slowdown in manufacturing exports from Vietnam.

As for the employment impact of foreign investment, a wholly owned FIE dummy is found to have a positive influence on manufacturing employment by shifting up the firm's labour demand in the period 2006-09. This implies that the number of workers employed in wholly owned FIEs is generally higher in this period as compared to domestic firms. However, compared to the previous period, the level of employment generation contributed by these wholly owned FIEs is lower because of the significance and negative sign of $WFIE*t$ in the full model. A possible reason lies on the investment boom in Vietnam after the WTO admission in 2007 that precipitated a loss of macroeconomic control, resulting in high inflation and therefore a macroeconomic crisis started in 2008 (Pincus 2009; Riedel 2009). The appreciation of real exchange rate caused by domestic macroeconomic mismanagement seems to have hindered employment growth in the manufacturing sector.

Finally, the coefficient of the interactive variable ($EO*WFIE$) between export expansion and a wholly owned FIE dummy is still positive and highly significant in the period 2006-09. Additionally, a contribution of FIE joint ventures on job creation through export expansion is also robust over this period, given a positive and significant sign of an $EO*JV$ variable. This situation stems from the advantages foreign entrepreneurs have in marketing and access to international markets, whereas domestic firms do not seem to have much experience in world trade. Therefore, all foreign enterprises have reaped the expansionary effect of labour demand through export growth following the further liberalization after 2006. It is important to note that the impact of the export-oriented foreign investment on manufacturing employment increases over the years 2006-09. This is explained by the fact that the coefficients on both $EO*JV*t$ and $EO*WFIE*t$ are significant with positive signs. This finding reinforces the importance of the role of FIEs in employment generation through export intensity. This is also well in line with development policy in emphasizing the role of foreign investment in the export expansion of labour-intensive manufacturing experienced by the East Asian labour-abundant economies.

6. Conclusions

This paper has explored various aspects of the determinants of a firm's labour demand in Vietnamese manufacturing under the export-oriented industrialization. The central focus involved an examination of the impact of firm ownership on employment generation by

estimating the labour demand model. The estimation of determinants of labour demand was also undertaken in the two sub-periods – 2000-05 and 2006-09 – to explore a possible impact of the macroeconomic instability after 2006 on manufacturing employment absorption. The analysis was based substantially on the unpublished data of the annual Enterprise Survey for 2000-09.

Estimating the labour demand model gives several interesting results. First, output growth is significantly more crucial than wage changes in explaining the behaviour of labour demand at the manufacturing firm level. Second, foreign investment enterprises – both joint ventures and wholly owned FIEs – have a higher level of job creation in Vietnamese manufacturing as compared to domestic enterprises whereas domestic private firms have a lower demand for labour than those of SOEs. Furthermore, export expansion has had a significant impact on employment growth for the manufacturing sector.

Our analysis provides significant support for the important role of foreign investment in employment generation in Vietnamese manufacturing. It was found that export expansion from FIEs is strongly associated with employment creation. More importantly, these FIEs were observed to have dominated the employment effect of export intensity in export-oriented manufacturing, as postulated for the case of a labour-abundant economy. This indicates the significance of export-oriented foreign investment on manufacturing employment in Vietnam. This result is very much in line with the experience of East Asian economies in which FIEs have played a key role on employment generation during the outset of the EOI.

Looking at the effects of the macroeconomic instability after 2006 on a firm's labour demand, our analysis reveals that the impact of export expansion on job creation declined over the period 2006-09. This situation stems from the appreciation of the real exchange rate accompanied by the 2009 global export collapse. Also, the number of jobs created from wholly owned FIEs was lower in this period.

Appendix 1: Summary statistics of the variables

Variables	Mean	SD	Min	Max
<i>l</i> (labour)	4.15	1.38	2.30	9.21
<i>y</i> (output)	8.55	1.99	3.01	15.95
<i>w</i> (wage)	2.32	0.73	-0.99	5.56
<i>EO</i>	0.35	0.31	0	1.41
<i>DP</i>	0.75	0.44	0.00	1.00
<i>JV</i>	0.03	0.17	0.00	1.00
<i>WFIE</i>	0.13	0.34	0.00	1.00

Notes: Mean= single average, SD= standard deviation, Min= minimum, and Max=Maximum. Labour, output, and wage are the logarithmic transformation of their value while an export orientation (EO) is in a decimal term. DP, JV, and WFIE are firm ownership dummies.

Source: Compiled from data sources described in the text.

Correlation matrix of the variables

Variables	<i>labour</i>	<i>output</i>	<i>Wage</i>	<i>EO</i>	<i>DP</i>	<i>JV</i>	<i>WFIE</i>	<i>INS</i>
<i>l</i> (labour)	1							
<i>y</i> (output)	0.74	1						
<i>w</i> (wage)	0.25	0.57	1					
<i>EO</i>	0.13	-0.04	-0.14	1				
<i>DP</i>	-0.48	-0.45	-0.37	0.04	1			
<i>JV</i>	0.11	0.18	0.19	-0.03	-0.31	1		
<i>WFIE</i>	0.27	0.27	0.28	0.05	-0.66	-0.07	1	
<i>INS</i>	-0.02	-0.01	0.13	-0.09	-0.06	0.02	0.08	1

Source: Compiled from data sources described in the text.

Appendix 2: Labour demand in Vietnamese manufacturing: pooled OLS estimates, Vietnam 2000-09

Dependent variable: logarithm of firms' employees

Explanatory variables	(1)	(2)	(3)	(4)
<i>y</i> (real output)	0.607*** (0.003)	0.556*** (0.003)	0.623*** (0.010)	0.647*** (0.009)
<i>w</i> (wage)	-0.416*** (0.007)	-0.444*** (0.007)	-0.473*** (0.022)	-0.587*** (0.015)
<i>EO</i> (export orientation)	-0.031 (0.021)	0.036* (0.019)	-0.005 (0.046)	-0.026 (0.019)
<i>DP</i> (domestic private firms)		-0.834*** (0.017)	-0.186** (0.086)	-0.233*** (0.086)
<i>JV</i> (joint ventures)		-0.592*** (0.030)	0.526*** (0.170)	0.407*** (0.157)
<i>WFIE</i> (wholly owned FIEs)		-0.388*** (0.020)	0.224* (0.119)	0.023 (0.116)
<i>y*DP</i>			-0.085*** (0.011)	-0.109*** (0.010)
<i>y*JV</i>			-0.066*** (0.017)	-0.098*** (0.015)
<i>y*WFIE</i>			-0.021* (0.013)	-0.053*** (0.011)
<i>w*DP</i>			0.082*** (0.023)	0.194*** (0.016)
<i>w*JV</i>			-0.160*** (0.047)	
<i>w*WFIE</i>			-0.189*** (0.030)	
<i>EO*DP</i>			-0.016 (0.047)	
<i>EO*JV</i>			0.228** (0.097)	0.277*** (0.083)
<i>EO*WFIE</i>			0.438*** (0.060)	0.493*** (0.044)
Constant	-0.411*** (0.025)	0.681*** (0.033)	0.118 (0.084)	0.160* (0.083)
Observations	108,406	108,406	108,406	108,406
R ²	0.688	0.717	0.721	0.720
Breusch-Pagan test	² (1)=4,656	² (1)=4,134	² (1)=3,765	² (1)=3,767

Notes: ***, ** and * Denote significance at the 1%, 5% and 10% levels, respectively. Standard errors adjusted for arbitrary heteroskedasticity are given in brackets.

(a) All equations use pooled OLS estimates controlled for heteroskedasticity

(a) The Breusch-Pagan test is used for testing heteroskedasticity. Null hypothesis is rejected at the 1% level.

(c) All specifications include annual time dummies and/or industry dummies. For brevity, their coefficients are not reported here.

Appendix 3: Labour demand in Vietnamese manufacturing: pooled OLS estimates, 2000-05

Dependent variable: logarithm of firms' employees

Explanatory variables	(1)	(2)	(3)	(4)
<i>y</i> (real output)	0.607*** (0.004)	0.545*** (0.004)	0.623*** (0.012)	0.647*** (0.011)
<i>w</i> (wage)	-0.436*** (0.009)	-0.446*** (0.009)	-0.459*** (0.026)	-0.572*** (0.019)
<i>EO</i> (export orientation)	-0.069*** (0.026)	0.027 (0.023)	-0.016 (0.048)	-0.017 (0.024)
<i>DP</i> (domestic private firms)		-0.872*** (0.019)	-0.058 (0.097)	-0.097 (0.097)
<i>JV</i> (joint ventures)		-0.612*** (0.034)	0.572*** (0.199)	0.673*** (0.184)
<i>WFIE</i> (wholly owned FIEs)		-0.426*** (0.024)	0.559*** (0.140)	0.312** (0.140)
<i>y*DP</i>			-0.100*** (0.013)	-0.123*** (0.012)
<i>y*JV</i>			-0.072*** (0.020)	-0.096*** (0.020)
<i>y*WFIE</i>			-0.045*** (0.016)	-0.084*** (0.014)
<i>w*DP</i>			0.068** (0.028)	0.179*** (0.021)
<i>w*JV</i>			-0.165*** (0.053)	-0.080* (0.046)
<i>w*WFIE</i>			-0.230*** (0.037)	
<i>EO*DP</i>			-0.000 (0.049)	
<i>EO*JV</i>			0.179 (0.113)	
<i>EO*WFIE</i>			0.327*** (0.068)	0.385*** (0.054)
Constant	-0.376*** (0.030)	0.793*** (0.040)	0.077 (0.093)	0.110 (0.094)
Observations	59,247	59,247	59,247	59,247
R ²	0.680	0.717	0.721	0.720
Breusch-Pagan test	² (1)=2,436	² (1)=1,983	² (1)=1,813	² (1)=1,822

Notes: ***, ** and * Denote significance at the 1%, 5% and 10% levels, respectively. Standard errors adjusted for arbitrary heteroskedasticity are given in brackets.

(a) All equations use pooled OLS estimates controlled for heteroskedasticity

(a) The Breusch-Pagan test is used for testing heteroskedasticity. Null hypothesis is rejected at the 1% level.

(c) All specifications include annual time dummies and/or industry dummies. For brevity, their coefficients are not reported here.

Appendix 4: Labour demand in Vietnamese manufacturing: Pooled OLS estimates, 2006-09

Dependent variable: logarithm of firms' employees

Explanatory variables	(1)	(2)	(3)	(4)
<i>y</i> (real output)	0.420*** (0.004)	0.400*** (0.004)	0.451*** (0.016)	0.430*** (0.009)
<i>w</i> (wage)	-0.240*** (0.006)	-0.249*** (0.006)	-0.188*** (0.029)	-0.221*** (0.014)
<i>EO</i> (export orientation)	0.051*** (0.017)	0.063*** (0.016)	-0.074 (0.061)	0.008 (0.018)
<i>DP</i> (domestic private firms)		-0.521*** (0.026)	0.208 (0.152)	-0.073 (0.099)
<i>JV</i> (joint ventures)		0.011 (0.048)	0.321 (0.250)	-0.089* (0.049)
<i>WFIE</i> (wholly owned FIEs)		0.109*** (0.032)	0.411** (0.189)	0.019 (0.035)
<i>y*DP</i>			-0.055*** (0.016)	-0.035*** (0.010)
<i>y*JV</i>			-0.022 (0.025)	
<i>y*WFIE</i>			-0.028 (0.020)	
<i>w*DP</i>			-0.066** (0.030)	-0.033** (0.016)
<i>w*JV</i>			-0.068 (0.053)	
<i>w*WFIE</i>			-0.043 (0.034)	
<i>EO*DP</i>			0.089 (0.063)	
<i>EO*JV</i>			0.373*** (0.110)	0.307*** (0.094)
<i>EO*WFIE</i>			0.353*** (0.073)	0.273*** (0.044)
Constant	0.720*** (0.034)	1.347*** (0.046)	0.685*** (0.150)	0.973*** (0.095)
Observations	49,159	49,159	49,159	49,159
R ²	0.6915	0.7010	0.7037	0.7035
Number of firms	16,671	16,671	16,671	16,671
Breusch-Pagan LM test	² (1)=36,149	² (1)=35,944	² (1)=35,122	² (1)=35,140

Notes: ***, ** and * Denote significance at the 1%, 5% and 10% levels, respectively. Standard errors adjusted for arbitrary heteroskedasticity are given in brackets.

(a) All equations use pooled OLS estimates controlled for heteroskedasticity

(a) The Breusch-Pagan test is used for testing heteroskedasticity. Null hypothesis is rejected at the 1% level.

(c) All specifications include annual time dummies and/or industry dummies. For brevity, their coefficients are not reported here.

Appendix 5: Estimation results of the Chow test procedure

Variables	(1)	(2)	(3)
<i>y</i> (real output)	0.395*** (0.002)	0.378*** (0.002)	0.431*** (0.005)
<i>y</i> * <i>t</i>	0.015*** (0.002)	0.022*** (0.002)	-0.003 (0.007)
<i>w</i> (wage)	-0.276*** (0.003)	-0.277*** (0.003)	-0.319*** (0.011)
<i>w</i> * <i>t</i>	0.031*** (0.005)	0.021*** (0.005)	0.058*** (0.018)
<i>EO</i> (export orientation)	-0.008 (0.010)	0.018* (0.010)	0.021 (0.024)
<i>EO</i> * <i>t</i>	0.075*** (0.010)	0.045*** (0.010)	-0.100*** (0.037)
<i>DP</i> (domestic private firms)		-0.439*** (0.009)	0.012 (0.045)
<i>DP</i> * <i>t</i>		0.106*** (0.012)	-0.070 (0.072)
<i>JV</i> (joint ventures)		0.055** (0.022)	0.414*** (0.104)
<i>JV</i> * <i>t</i>		0.127*** (0.019)	-0.092 (0.127)
<i>WFIE</i> (wholly owned FIEs)		0.139*** (0.016)	0.691*** (0.065)
<i>WFIE</i> * <i>t</i>		0.173*** (0.014)	-0.567*** (0.093)
<i>y</i> * <i>DP</i>			-0.060*** (0.005)
<i>y</i> * <i>DP</i> * <i>t</i>			0.028*** (0.007)
<i>y</i> * <i>JV</i>			-0.056*** (0.010)
<i>y</i> * <i>JV</i> * <i>t</i>			0.039*** (0.012)
<i>y</i> * <i>WFIE</i>			-0.055*** (0.007)
<i>y</i> * <i>WFIE</i> * <i>t</i>			0.055*** (0.009)
<i>w</i> * <i>DP</i>			0.054*** (0.011)
<i>w</i> * <i>DP</i> * <i>t</i>			-0.051*** (0.018)
<i>w</i> * <i>JV</i>			0.063*** (0.022)
<i>w</i> * <i>JV</i> * <i>t</i>			-0.080** (0.032)
<i>w</i> * <i>WFIE</i>			-0.018 (0.015)
<i>w</i> * <i>WFIE</i> * <i>t</i>			0.036 (0.022)
<i>EO</i> * <i>DP</i>			-0.038 (0.024)
<i>EO</i> * <i>DP</i> * <i>t</i>			0.141*** (0.039)
<i>EO</i> * <i>JV</i>			0.058 (0.053)
<i>EO</i> * <i>JV</i> * <i>t</i>			0.209*** (0.070)
<i>EO</i> * <i>WFIE</i>			0.106*** (0.033)
<i>EO</i> * <i>WFIE</i> * <i>t</i>			0.265*** (0.048)
Chow test	2(11)=233.1	2(12)=412.5	2(1)=581.8

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