Centre for ASEAN Studies

Centre for International Management
and Development Antwerp

ISSN-2031-065X

Export-led growth and income differentials: evidence from the Indonesian assembly manufacturing[1]

Ana Rivas

CAS Discussion paper No 76

December 2010

[1] The author acknowledges the generous contribution of Ingrid for providing valuable data on Indonesian manufacturing sectors. Financial support from the IOB, University of Antwerp, is gratefully acknowledged.

1. Introduction

Since the last decades, changes on the production schemes and trade structures have occurred as part of the globalization era. The vast majority of production processes increasingly entail a sequential, vertical trading chain in which many countries are involved. Yet, based on the international division of labour, countries who are skill-labour intensive tend to participate into the high stages of production while unskilled-labour intensive countries perform the last stages of production.

This phenomenon has received several denominations -such as vertical integration, fragmentation, sharing production, disintegration of production and others[2]- and has been widely studied by renowned researchers (see for instance Jones et al. (2005); Grossman & Helpman (2002)). Furthermore, one of the issues that have gained substantial attention within this literature refers to the implications fragmentation[3] has had on wages and employment. For instance, Feenstra (1998) has pointed out that domestic employment is affected when firms decide to split up their production overseas. Moreover, it will impact differentially the wages of unskilled and skilled workers. As unskilled labour in a developed country is relatively more expensive than abroad, the fragmented activities will be those that use a large amount of unskilled labour and, consequently, this will shift down the demand of unskilled relative to skilled labour within an industry. Furthermore, trade (through international fragmentation) and technology are complementary rather than competing explanations for the change in employment and wages.

Although the implications of fragmentation on labour markets developments have been widely explored in the literature, the lack of adequate statistics has constrained the development of empirical studies addressing this issue. Yet, the available empirical literature addresses mostly to developed countries (see for instance Feenstra & Hanson (1996); Falk & Koebel (2002)). Furthermore, most of the available empirical studies examine the effects of fragmentation on wages at industrial level whereas just few studies have tackled its effects on wages at individual level. This chapter attempts to contribute to this literature. It combines macro and micro data to explore the levels of fragmentation reached by the diverse Indonesian manufacturing sectors and to analyze to what extent fragmentation has affected wage differentials both across and within industries with especial attention to the gender issue.

The remainder of the chapter is structured as follows. Section 2 provides an overview on the trade patterns of Indonesian and its linkages to the labour market. Section 3 turns attention to the related literature. Section 4 describes the methodological approaches used to assess fragmentation developments across Indonesian manufacturing sectors and its effect on wages disparities. Section 5 discusses the empirical evidence and section 6 concludes.

[2] See for instance Feenstra (1998); Hummels et al. (2001).
[3] Hereafter, the terms of fragmentation and vertical integration will be used indistinctly.

2. Trade patterns and trends of Indonesian manufacturing

Based on stages of production[4], statistics at a national level indicate that Indonesian trade is highly concentrated in intermediate goods. Table 1 shows that in 2005 around 22 billion dollars (70%) of total Indonesian imports comprised intermediate goods of which around 16 billion dollars (53%) were sub-classified as semi-finished products and 6 billion dollars (17%) as parts and components. Likewise, intermediate products represent by far the foremost category into the Indonesian exports. These exports climbed from 21 billion dollars (57%) in 2001 to 30 billion dollars (57%) in 2005. Yet, semi-finished products remain the most important sub-group within this category.

By broad categories, both imports and exports of parts and components refer mainly to products comprised into the machinery and transport equipment category (SITC7)[5]. The substantial significance of this category into the Indonesian trade structure is explained by the participation of the country into the global automotive production chain. Moreover, it suggests that Indonesian participation into the automotive industry is linked to activities which require certain level of skills than those needed to perform only assembly activities.

Table 1: Indonesian trade by stages of Production

			Countries		
			Guatemala */	Indonesia	Peru
Exports	Total Export *(millions $) 2005*		4344	53466	11810
	Share of Intermediates	Semi-finished	22.5	24.4	70.0
		Part & components	0.9	5.7	0.5
	Share Consumption goods.		63.7	21.5	15.5
Imports	Total Imports *(millions $) 2005*		7446	32232	7870
	Share of Intermediates	Semi-finished	53.1	49.1	44.1
		Part & components	6.1	18.4	11.9
	Share Consumption goods.		23.2	7.8	18.4
Main export industries			Apparel & clothings	Apparel & clothings	Mining (gold, oil)
			Organic chemicals	Electrical apparatus	Non- Ferrus metals
			Paper & related products	Food processing	Fishing & agro-ind. Prod.

Source: Author's calculation based on COMTRADE databases 2004-2005
*/ Figures are for 2004

Chemical and related products (SITC 5) and manufactured goods classified mainly by material (SITC 6) are the top two categories within the Indonesian imports of semi-finished goods. Table 2 shows that in 2005, these categories represented 47% and 36% respectively of total imports of semi-finished goods. Furthermore, splitting up these two categories[6], it is shown that imports in chemicals products (SITC 5) are mainly comprised by organic chemicals (SITC 51), Plastics (SITC 57) and other chemicals (SITC 59) which are used as inputs into the food, agriculture, pharmaceutical and plastic industries.

[4] To determine trade by stage of production, we first reclassify exports and imports data (up to five digits) by Broad Economic Activities, Then, a second reclassification, is undertaken to categorize them by stages of production as follows: primary, intermediates and final goods. A more detailed description of this methodology with an application to Latin American countries can be found in chapter three.

[5] Hereafter, we will use SITC to refer to the Standard International Trade Classification, rev. 3.

Imports in manufactured goods classified by material (SITC 6) are highly dominated by iron and steel (SITC 67) products which are used mainly in the automotive and construction sectors (see Table 2). Products comprised into textile yarns and fabrics (SITC 65) represent the second most important sub-group within the imports of the SITC 6 category. These imports are linked with the Indonesian apparel sector. Moreover, export's figures show that articles of apparel and clothing accessories (SITC 84) represent by far the most important sub-group within the exports of final consumption goods, representing roughly 40% (2.5 billion $) of exports in this category. This last is a clear indication that Indonesian participation into the global apparel chain of production is highly dominated by assembly activities.

Footwear represents another important sector with which Indonesia participates into the global economy. Trade figures show that, similar to the apparel industry, its participation is merely limited to assembly tasks. In fact, Table 2 depicts that inputs used in this industry such as leather and related products (SITC 61) plastics in not-primary forms (SITC 58) and rubbers manufactures (SITC 62) enter into Indonesia as imports of semi-finished products, processed and exported as footwear articles (SITC 85) which are classified as final consumption goods.

It is not surprising that Indonesian trade flows appear to be quite linked to the automotive, garment and footwear chains of production. According to Aswicahyono (1997), the beginning of the Indonesian automotive industry dated back to 1927 when General Motors established operations in Jakarta. Nevertheless, at that time only trading and simple assembled activities were performed in this sector. During the following years the government of Indonesia undertook several important decisions which aimed at building a national automotive industry. The program Banteng in 1950, the Economic development program based on an import substitution policy in 1968 and the Import Completely build up (CBU) system at the beginning of the 70th were the most notorious measures[7]. This package of measures enhanced greatly the development of the Indonesia automotive industry which experienced a significant growth in the following decades and increased its technological capacities. In fact, the sector has benefited to some extent from technology transfer[8] which is indicated by the ability of the industry to produce various kinds of components. Nowadays, Indonesia accounts for its own national car industry with its typical local market- oriented production.

The apparel and clothing industry is of recent development compared to the automotive sector. Its beginning date back to the earlier seventies when the Chinese ethnic groups in Indonesia shifted its investments choices from business to manufacturing and more in particular to the textile and garment sector. The development of this sector has been encouraged by the availability of a cheap labour force as well as the export-oriented industrialization (EOI) the country has followed. Furthermore, the rapid growth of this sector placed Indonesia among one of the largest exporters of clothing in the world. In fact, according to the WTO (2002), Indonesia accounted 2.3% of total world exports in textiles and apparel products in 2001, ranking Indonesia as the nine largest exporter of apparel in the world.

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[6] Decomposition was made only up to two digits level as our study attempts to identify fragmentation by economic sectors rather than by specific goods.

[7] Aswicahyono (1997)provide a more detailed review of the development of the Indonesian Automotive Industry

[8] This transfer of technology has been done mainly through licensing and technical agreements.

The end of the quota restriction on developing countries' textile and clothing exports at the end of 2004 caused some concern among the Indonesian's garment manufacturers as it implied stronger competition from lower-cost producers. Nonetheless, according to the Indonesian's WTO report (WTO, 2006), the introduction of safeguard quotas on China by the U.S and the EU at the end of 2005 helped Indonesia to increase its share into the U.S market from 3.7% in 2004 to 4.2% in 2005.

The textile and apparel sector represents not only a significant contributor to Indonesian's GDP but also an important source of employment. According to the Ministry of Trade and Industry of Indonesia, in 2003 there were around 2 654 textile companies across the country employing more than 1.18 million people. The next section will discuss more extensively the changes occurred into the labour market of the manufacturing sector and more in particular labour changes into the garment sector.

Labour market structure

As trade- in the form of fragmentation -is linked to manufacturing production processes, it is expected that its expansion causes changes on the labour structure of the concerned sectors. Moreover, as several authors have emphasized these changes happen not only in terms of factor intensities but in terms of gender (see for instance Standing (1989) and Wood (1991)). In this line, Caraway (2007) investigated empirically the importance of labour intensity in promoting female's employment. The author found that as capital intensity increases, women's share of employment decreases.

Furthermore, the dynamic of these changes can be understood through the forms of industrialization outlined in the political economy literature. Accordingly, employment in labour-and-capital sectors of manufacturing as well as men and female's shares of employment will vary depending on the type and stage of industrialization a country is pursuing. In this vein, two main industrialization models have been identified in the literature: the import substitution industrialization (ISI) and the export-oriented industrialization (EOI).

The ISI relies on production for local market and high levels of protection for producers; it also tends to promote the growth of capital-intensive sectors. Scholars have distinguished two stages within this model: primary and secondary (see Gereffi & Wyman (1990), Haggard (1990), Hamaguchi (2007)). Primary ISI is characterized by a moderated capital-intensive level. Although it entails the production of some labour-intensive goods such as textiles, it is more capital intensive than primary EOI. When primary ISI evolves to secondary ISI, the industry becomes even more capital intensive and strengths the use of male workforce. On the contrary, the EOI model relies on manufactured exports, reduction of tariff barriers and a policy of domestic market openness. In its first stage, primary EOI is highly labour-intensive and tends to increase the demand of female workforce. Similarly to ISI, the industry becomes more capital-intensive when primary EOI progresses to Secondary EOI, however, the employment in labour-intensive sectors remains large (Gereffi & Wyman (1990)).

In practice, the ISI model was adopted by many Latin American economies from the 1930s until the late 1980s, and in some Asian and African countries from the 1950s on. Nevertheless, during the last decades, most of these economies switched to the EOI as a mechanism to integrate into the global

economy. The analysis of these patterns requires looking closely to each country and industry in particular as stages of EOI or ISI may vary from one industry to another.

Caraway (2007) has analyzed the labour market developments that occurred in Indonesia into the patterns of industrialization above mentioned. The author points out that in the early seventies, men represented a majority into the manufacturing labour force and only three of twenty-four manufacturing sectors employed more female than male workers. By the middle of the nineties, however, men and women each composed about half of the production workforce in Indonesia. Furthermore, women's participation increased into nineteen of twenty-four manufacturing sectors and they become the majority in six sectors as follows: textiles, footwear, other chemicals, plastics, electronics and professional and scientific equipments. The author argued that though theoretically these changes may be linked to the rise of EOI in Indonesia during the 1980s, from a holistic and historical view it appears that female participation raised not only in EOI sectors but also in sectors that were not exposed to EOI. For instance, the Indonesian tobacco industry which characterises by being an inward-oriented and relatively capital-intensive sector became the most female-intensive sector.

Aside from the industrialization schemes, there were several other factors that altered the labour supply, making women more attractive and more accessible workers in Indonesia (Caraway (2007)). For instance, the improvement on women's basic education and the family planning policy[9] as well as the economic crisis created a large pool of young female workforce ready to work at the time Indonesia embarked into an EOI policy in the 1980s. In addition, the government removed gradually a protective legislation which limited the extent to which factories could hire women. The weakness of labour unions to stop employers from feminizing labour, the efforts made by the Indonesian government to demobilize political parties and lessening radical Islamic restriction on women were other factors enhancing women's insertion into the manufacturing workforce.

Statistics based in recent labour surveys reveal, however, that women's share on Indonesian production workforce has turned around in the last few years. As table 3 shows, overall men represent 64% of the manufacturing labour force. Between 1994 and 2005, women's share shrank drastically into textiles from (56% to 46%), footwear (from 78% to 44%) and electronics (from 60% to 24%)[10] sectors in which men became the majority. Despite women represent yet a majority into wearing apparel (58%) and tobacco (78%), their shares are much lower than those exhibited in 1994 (79% and 88% respectively).

Garment workers

The labour-intensive garment sector of Indonesia is dominated by low and medium- skill workers (see Table 4). These groups hold jointly around 97% of the total workforce in this sector, being the low-skilled group the most representative (62%). In 2002, women were the majority in both low and medium-skill groups sharing more than half of the workforce employed into these categories. However, women's share into the medium-skill group shrank by 46% in 2005 and men became a majority into these group. On the contrary, men and women each composed half of the high-skill workforce.

[9] This policy aimed at lowering fertility rates
[10] Comparative figures of 1994 were taken from Caraway (2007).

The workforce in the garment sector is relatively young. The average age a person starts working in the clothing sector is fifteen, after finishing compulsory junior high school. It is also the average age people from rural Indonesia start of founding a family Hassler (2004)). Recent statistics, show that women employed in the garment sector appear to be on average younger than men. Nevertheless, women composed the low and medium-skill groups are in average younger than age 30 (see Table 4). In terms of educational attainment, both men and women from all skill-groups hold in average similar years of schooling which indicates that women are as well-educated as men are. In terms of income, Table 4 shows that for all skill-groups the average hourly wages for women are much lower than the average hourly wages for men. For instance, while a low-skilleded man earns on average 2999 rupiah per hour, a low-skilled woman receives on average 2651 rupiah per hour. These figures indicate that women tend to earn on average less than men. Moreover the gender gap tends to increase for medium and high-skill groups.

It is worth mentioning that the scarcity of domestic skilled-workers drove employers of this sector to use foreign workforce. In fact, it is a common practice that Indonesian garment companies employ foreign technician and experts to perform skilled positions (e.g. Product development, production development). The majority of these positions are fulfilled by expatriates from South Korea and Taiwan (Dicken & Hassler (2000)). In contrast, operational and other low-skilled positions are performed mainly by domestic labour force in which females represent a majority. According to Hassler (2004) Indonesian managers prefer to employ women arguing, among others, that women are easier to manage and that they appears to have a greater dexterity in sewing than men.

Concerning the institutional framework, numerous pieces of repressive labour legislation were repealed after the end of the Suharto era in 1998[11]. The new administration led by Bacharuddin Jusuf Habibie endeavoured to reinstate the terms of labour-friendly labour laws established by Sukarno[12]. As part of this process, the government ratified all the ILO core conventions and enacted social protection programs. By the end of 2005, Indonesia had ratified seventeen (17) ILO Conventions including the eight (8) ILO Core Conventions and two (2) Priority Conventions Sivananthiran (n.d). Moreover, international pressure has contributed to the enactment of Indonesian labour laws increasing worker's statutory rights and facilitating collective bargaining (Cox (1996)). The current Indonesian labour law guaranties maternity leave and security job to women. In a sense, this might drive to anticipate a great percentage of married women into the Garment sector. Nonetheless, figures reveal that single women characterise the pool of female workforce employed into this sector (see table 4).

In addition, many garment factories carried out several of innovations in the labour process as a mechanism to raise productivity and profitability in this sector. For instance it is also a common practice in garment companies to train new workers as these will increase their productivity[13]. Besides, several garment companies also provide certain facilities such as accommodation, transport and lunch supply.

[11] During Suharto's regime (1967-1998) about 197 executive decrees, all in favour to employers and bussiness were enacted.
[12] Sukarno's regime (1945-1967) established a labour legislation based on minimun working standards including outlawing employment of children under 15, limiting night work for women, women's right for maternity leave, and job security.
[13] Training practices differ from garment companies. For further details see Hassler (2004).

In sum, this section highlights the main features of Indonesian participation into fragmentation as well as its linkages to the labour market developments. The country has reached its insertion into three global chains of production: Automotive, garment and footwear. Diverse changes on the labour market have been associated to the growth of these industries. Some key questions that arise up to this point are how fragmented these sectors are? To what extent fragmentation affects wages? We will attempt to answer these questions in the following sections.

3. Literature review

From a theoretical point of view, it has been argued that increasing fragmentation might decrease wages of low-skilled workers in developed countries. (Feenstra (1998) & Feenstra & Hanson (1999)) provided empirical evidence in line with this argument. In their study, the authors focused on the USA experience. Based in a price regression approach, they found that outsourcing explain between 15% and 40% of the increase of the relative wage of non-production workers. Egger, Pfaffermayr, & Wolfmayr-Schnitzer (2001) investigated the effects of outsourcing on wages of low-skilled and high-skilled workers in the Austrian manufacturing. Following Feenstra & Hanson (1996) and Feenstra & Hanson (1999), these authors estimated the productivity and mandated-wage equation. They found that in the presence of perfect factor markets, wages would be lower for low-skilled workers and higher for high-skilled workers in response to outsourcing.

More recently, Geishecker & Görg (2005) point forward that at country level, fragmentation may have different effects on labour across industries. Accordingly, and relying on the labour literature the authors calculated an indicator of fragmentation to be included as one of the explanatory variables into an individual minceran wage equation. Their findings reveal that only low-skilled workers from low-skilled intensive industries experienced a reduction on their real wages. This adverse effect is not experienced by low-skilled workers from high-skill intensive industries. By contrast, high-skilled workers in high-skill-intensive industries may be able to receive higher wages while it does not appear to be the case for high-skilled workers in low-skilled-intensive industries.

Empirical studies addressing the impact of fragmentation on labour earnings in developing countries are very limited. De Hoyos et al. (2008) estimate the poverty reduction effect derived from the expanding maquila sector for the case of Honduras, which, according to the authors is closely linked to increased opportunities for women. Their results indicate that poverty in Honduras would have been 1.5 percentages higher had the maquila sector not existed. In chapter four, we have investigated gender wages effects derived from the growth-export apparel sector in Guatemala The findings indicate that albeit maquila-based workers are, on average, better paid than those occupied in the reserve sector, the former group seems to be exposed to a less favourable working environment when compared to those employed in other manufacturing industries. Moreover, the study reveals huge income disparities in terms of gender, exacerbated, among others, by the typical patriarchal structure prevailing in the Guatemalan economy.

The literature is much narrower when it comes to Indonesia. Using firm-level data Amiti & Cameron (2004) explored the agglomeration benefits that arise from vertical linkages between firms in Indonesia. The authors found that firms benefit greatly from proximity to a large supply of inputs and from good market access. Firms with the best supply or market access can afford to pay wages that are more than 20 percent higher than those paid by firms with the poorest access. At studying the industrial developments of Indonesia, Caraway (2007) analyzed the gender aspects of the manufacturing employment changes. Her work relies in a multisectoral approach which tackled four different industries: garments, textiles, plywood and automobiles. The author found that even though women's average wages in Indonesia are lower than men's average wages, many Indonesian employers in labour-intensive firms paid men and women the same wages.

As shown, empirical literature tackling the impact of growing export sectors on income differentials in developing countries is yet narrow. This paper intends to contribute to this literature. A novelty of this study is that we explore wage differentials not only across fragmented and non fragmented manufacturing sectors but within a particular fragmented sector. Indeed, the feasibility to track labour history of a particular sample – which up to our knowledge has not been made before- allowed us to assess the real average effect of the export-growth garment sector on hourly wages of Indonesian assembly workers.

4. Methodology

4.1 Assessing fragmentation

As Hummels et al. (1998) pointed out that; the concept of fragmentation concerns the phenomena in which countries participate on one or more stages of production of a particular good. Moreover, this sequence of production requires that involved countries must import the inputs used in their stage of production and export the resulting output. Taking into account this definition, a first step to undertake before assessing the effects that fragmentation has had on Indonesian labour markets developments is to determine to what extent Indonesia is involved in the process of fragmentation. Furthermore, considering the fact that at a country level, manufacturing production processes are usually heterogeneously distributed across regions, it seems more adequate to determine the degree of fragmentation at this level. Accordingly, we adopt Hummels et al. (1998) definition of fragmentation to construct our proxy of fragmentation $(Frag_{kr})$ at provincial level. A detail description of the index definition is provided in appendix A.

4.2 Fragmentation's effects on income differentials

4.2.1 Across manufacturing sectors

In the economic context, the phenomenon of fragmentation can be seen as an external shock redistributing resources in the manufacturing sector. Yet, this redistribution is thought to take place through price mechanisms. For instance, the insertion of Indonesia into the global apparel chain of production may increase labour demand in this sector and therefore, driving changes in its labour

composition and wages. In other words, fragmentation impacts labour market developments through changes in wages and employment that can be attributable to the growth of the fragmented industries.

With this in mind, and relying on the human capital theory, we define a Mincer earning's equation as function of personal characteristics and a random component. Inspired in De Hoyos et al. (2008), a set of control variables are included to capture wage disparities accounted by gender as well as the wage effects accounted by fragmentation. Thus, our baseline earning's equation can be expressed as follows:

$$\ln(w_i) = \sum_j \beta_j x_{i,j} + \delta_1 gender + \gamma Frag_{kr} + \varepsilon_i \qquad (1)$$

Where $\ln(w_i)$ is the log of hourly wage of individual, i; $X_{i,j}$ is a set of 'j' personal characteristics (e.g. Years of schooling, experience, marital status); $Gender$ is a dummy variable that takes the value of 1 for female workers and zero otherwise; $Frag_{kr}$ is the fragmented industry measure and ε_i is the error term.

As previously mentioned, a key feature of various manufacturing sectors (e.g. garments, textiles) is the tendency to employ female workers to perform the low stages of production. This draws attention to the likely effects that fragmentation might has had on wages in terms of gender. To investigate this issue, we proceed as De Hoyos et al. (2008). Accordingly we decompose the effects of fragmentation on wages and express it in terms of gender, then:

$$\frac{\partial \ln(w_i)}{\partial Frag_{kr}} = \gamma \ = \delta_2 + \delta_3 gender \qquad (2)$$

Substituting equation (2) into (1) yields:

$$\ln(w_i) = \sum_j \beta_j x_{i,j} + \delta_1 \ gender + \delta_{2,} Frag_{kr} + \delta_{3,} gender * Frag_{kr} + u_i \qquad (3)$$

Parameters $\delta_{1,}$ and δ_2 in equation (3) measure the gender and the fragmented wage premium, respectively; δ_3 captures the wage effects of fragmentation that operate through gender. The iterative effect, δ_3, is equal to the difference in the gender wage gap in and out of the fragmented sectors.

Male workers from non-fragmented sectors comprise the excluded category in equation(3), hence the three parameters $\delta_1, \delta_2 \, and \, \delta_3$ are interpreted as shifts in wages with respect to this control group. Accordingly wage premiums for all population subgroups- after controlling for the effects that $\sum \beta_j$ have on labour earnings – are determined as shown in Table 5.

Additionally, taking into account that trade might impact differently to low and skill workers, equation (3) is estimated for different skill groups.

Table 5 Wage premium decomposition

	Sector of Employment	
	Fragmented	Non Fragmented
Men	δ_2*$frag_{kr}$	Control
Women	$\delta_1+(\delta_2+\delta_3)$*$frag_{kr}$	δ_1
Wage gap (men/women)	-($\delta_1+\delta_3$*$frag_{kr}$)	$-\delta_1$

4.2.2 Within a specific sector

To go further in our analysis, we also investigate wage differentials within a specific fragmented sector. We selected the assembly garment industry which - as we previously mentioned -remains among one of the most fragmented sectors in Indonesia. The methodology used for this purpose comes from the literature on treatment evaluation and is known as the difference-in-difference approach (DID). The use of this technique has become increasingly popular since the work by Ashenfelter & Card (1985) to estimate causal relationship in economics and other fields. A key advantage in using this approach is that it provides results that have policy relevance but whose validity does not depend on strong assumptions.

Any treatment evaluation approach entails the identification of a specific intervention or treatment[14]. Examples of treatments in the economic context are, for instance, enrolment into a labour training program, a wage subside program, a trade openness policy and any other economic reform. At the heart of this kind of intervention, at any moment in time, an individual is either in the treatment under consideration or not but not both. Hence, a distinction between two main groups is intuitively clear. Evidently, a specific intervention may cause different outcomes for those who are part of the treatment (treated group) and those who are not (control group). In this context, the core of the DID approach lies on comparing the difference in average outcome before and after the intervention for the treated group with the before and after outcome for the control group.

The DID approach requires the availability of longitudinal or repeated cross-section data as the additional time dimension can be used to estimate the treatment effect under less restrictive assumptions. To be more precise, when data on the treated and control groups is available before and after the intervention, then for the *i*th treated case the change in the outcome is measure by $\left[y_{ia}-y_{ib} \mid D_{ia}=1\right]$ and for the control group is measured by $\left[y_{ia}-y_{ib} \mid D_{ia}=0\right]$.So, the DID measure $\left[y_{ia}-y_{ib} \mid D_{ia}=1\right]-\left[y_{ia}-y_{ib} \mid D_{ia}=0\right]$, where the subscripts a and b denote “after” and “before” the intervention occurs, forms the basis of an estimated of the treatment effect.

[14] Hereafter we will use intervention and treatment indistinctly.

In light with the treatment evaluation literature (see Cameron & Trivedi (2005)), considering a model with a fixed effect ϕ_i and a drift term δ_t , where the pre-treatment and post-treatment outcomes are given by, respectively[15]:

$$y_{it,0} = \phi_i + \delta_t + \varepsilon_{it} \tag{4}$$

$$y_{it,1} = y_{it,0} + \alpha \tag{5}$$

So that

$$y_{it} = (1 - D_{it}) y_{it,0} + D_{it} y_{it,1} = \phi_i + \delta_t + \alpha D_{it} + \varepsilon_{it}$$

Where t=a, b. Equation (4) is for the group that did not get treated and equation (5) is for the group that was treated. Using the "after" and "before" formulation, the treatment effect is giving by,

$$\begin{aligned} &\alpha = E\left[y_{ia} - y_{ib} \mid D_{ia} = 1\right] - E\left[y_{ia} - y_{ib} \mid D_{ia} = 0\right] = \\ &\left\{E\left[y_{ia} \mid D_{ia} = 1\right] - E\left[y_{ia} \mid D_{ia} = 0\right]\right\} - \left\{E\left[y_{ib} \mid D_{ia} = 1\right] - E\left[y_{ib} \mid D_{ia} = 0\right]\right\} \end{aligned} \tag{6}$$

Thus, when the same units within a group are observed in each time period; the average gain in the second (control) group is subtracted from the average gain in the first (treatment) group. This removes biases in second period comparisons between the treatment and control group that could be the result from permanent differences between those groups, as well as biases from comparisons over time in the treatment group that could be the result of trends.

Regarding our main topic of concern here, that is the evaluation of the Indonesian export-led assembly garment sector on labour earnings, two groups can be defined. The treated group is composed by individuals working in the garment sector during period 2 but not in period 1. The control group comprises individuals who did not work into the assembly garment sector neither in period 2 nor in period 1 and whose characteristics resemble closely to those individuals from the treated group. The outcomes in both groups are determined in terms of hourly wages.

Controlling for the observable differences in the distribution of characteristics between the treatment and the control group, the DID model can be written for a generic member of any group as:

$$W = \phi + \gamma T + \delta D2 + \alpha D2 * T + X\beta + \varepsilon \tag{7}$$

Where, W , is the outcome of interest and is measured by the log of hourly wage. $D2$, is a dummy variable that takes the value of 1 for the second time period, it captures aggregate factors that would cause changes in W even in the absence of a treatment. T , is dummy variable that takes the value of 1 for those individuals included in the treated group and captures possible differences between the treated

[15] For simplicity of the analysis, observable differences in the distribution of characteristics between the treated and control group are ignored. However, Cameron & Trivedi (2005) emphazises that observable covariates must be controlled for. The standard solution is to include such controlling variables in the regression.

and control groups prior to the treatment. $X\beta$, is a matrix of variables which capture observable differences within and between treated and control groups. The coefficient of interest, α, multiplies the interaction term, $D2*T$, which is the same as a dummy variable equal to one for those observations in the treatment group in the second period. The coefficient α, captures the average treatment effect between the two groups as outlined in equation (7).

5. Empirical evidence

5.1 The data

This study uses two representative Indonesian surveys carried out from 2002 to 2005 by the Indonesian Central Bureau of statistics of Indonesia (BPS, Indonesian acronym). The first one is the Manufacturing survey which gathers information on input-output at a industrial plant level. The second one, known as the Indonesian Labour Survey (SAKERNAS)[16], contains information on earnings of individuals in working age.

It is worth mentioning several problems to which we have been confronted while working with these datasets. For instance, province codes reported by the SAKERNAS surveys were not uniform as the administrative division of Indonesia has suffered several changes through time. Currently, the country is administratively divided into 33 provinces, however, for analytical purposes this study applies the administrative division Indonesia held in 2005. Accordingly, both, SAKERNAS and Manufacturing surveys from 2002 -2004 were re-grouped into 29 provinces. A detailed description of the administrative division used in this study is provided in Table 6.

Despite both SAKERNAS and Manufacturing surveys recorded information on economic activities relying on the Indonesian industrial classification (KBLI)[17], they use different revisions. While SAKERNAS survey uses KBLI revision 2, manufacturing survey uses KBLI revision 3. In order to match both surveys a previous standardization between the two KBLI versions was needed. Accordingly, a correspondence table was used to standardize codes of economic activities into KBLI revision 3. Likewise, a standardization of codes used for education attainment, was performed for those years where a different codification was applied.

A disadvantage of the SAKERNAS surveys is that the codification used to define an ID record change for each year of our sample. This does not allow tracking individuals or households through time, which made it difficult to implement difference-in–differences approach. To deal with this issue, a new identification code (Id) was constructed using a set of variables such as province code, district code, sex, education level and age[18]. We use this ID to track individual's history of both treated and control groups

[16] Survei Angkatan Kerja Nasional SAKERNAS, Indonesian acronym.
[17] The KBLI is based on the International Standard Industrial Classification (ISIC).
[18] As surveys are carried out every 12 months we used equivalent ages to built the new ID, for instance if in 2005 an individual was 20 year old, it implies that in 2002 he was 17 year old, then the age of 17 was used to track his backward labour's history and 20 when we track it forward.

between two particular years.[19] A limitation of this procedure, however, is that it could only track labour history of those individuals who have not moved. Thus, if for instance, an individual moved in 2005 to another area, district or province, his id record in this year diverge completely from the one he got in 2005. Thus, even though his labour information is available in both surveys it was not possible to match these records. This explains why despite the number of observations among surveys samples do not vary significantly, the tracking procedure was more successful when it was applied to consecutive surveys (e.g. 2002-2003) than when it was applied to non-consecutive ones (e.g. 2002-2005). In fact, in practice, it is more likely that an individual relocates to another area or region in the long term than in the short term.

5.2 Indonesian's provinces into fragmentation

Indonesia comprises 17508 islands which are administratively grouped into 33 provinces. However, the pool of manufacturing activity is concentrated in only few of these provinces. Statistics based on the annual Indonesian survey show that around 80% of the manufacturing activity is concentrated in six of the 33 provinces: West Java, East Java, Banten, DKI Jakarta, Riau, and Central Java. Moreover, in terms of trade, West Java, Riau, East Java, Banten, DKI Jakarta, North East Sumatera, and Central Java comprise around 77% of total Indonesian manufacturing exports.

Table 7 shows the indicator of fragmentation by broad product groups for selected provinces. It is worth to mention that as Indonesian Industrial Surveys recorded information at establishment level, an aggregation of the concerned variables was carried out to obtain values at industry level[20]. As shown, the figures reveal significant variability across-sectors and regions. For instance, within the garment industry (ISIC 18) the province of DKI Jakarta exhibits the greatest indicators of fragmentation. Actually, about 18% of imported intermediates from the garment sector of this region were made to produce garment's exports goods. This figure was a bit lower for 2005 (around 15%) but still significant. Fragmentation measures for Riau and Banten also indicate that the garment's sectors of these provinces are linked to the final stage of the global garment production chain.

The figures also depict that in 2005 about 31% of imported intermediates from the textile sector (ISIC 17) of Riau were used to produce final textile's exports goods. This province also exhibits very impressive indicators of fragmentation for the electrical machinery (ISIC 31) industry. By reviewing in a more disaggregated level the items included in this category, it appears that the export production of this sector is closely linked to the global automotive industry.

Likewise, the provinces of Riau, West Java and Banten show significant fragmentation indices for the Tanning & dressing of leather sector (ISIC 19). While analyzing more in detail the items comprised into this category, it appears that the leather export-growth sectors of these provinces are linked to the global footwear industry

[19] A specific program was designed to perform this quite laborious task.
[20] For matching purposes we performed this aggregation up to the 3 digits of the Indonesia ISIC rev.3 classification.

5.3 Income differentials across industries

To assess to what extent fragmentation has affected manufacturing earnings, we estimate a wage equation as described in equation (3). The sample comprises workers aged between 14 and 65 years old. Basics statistics (means and standard deviations) for our sample are provided in Table 8. Personal characteristics include age, years of education and marital status[21]. To account for demographic characteristics, urban and regional dummies[22] were included. Likewise, year's dummies were included to account for time variation.

Information on Indonesian educational system as well as education attainment was used to disentangle the sample by skill categories. According to the Indonesian educational system, compulsory education accounts for only 9 years, six of which are devoted to primary school and 3 to basis secondary school. The last one is known as junior/vocational high school. After its completion Indonesian citizens may attend Senior high school, but it is not compulsory. Senior high school can be distinguished between vocational and general. The first one prepares individuals to work immediately after its completion without attending college or university whereas the second one prepares individuals to follow tertiary education (high education).

To differentiate workers by skill groups, we proceed as Geishecker & Görg (2005). Accordingly, our classification follows the International Standard Classification of Education (ISCED) information as described in UNESCO (1997)[23]. Educational attainment recorded in the SAKERNAS surveys correspond to (1) No schooling; (2) Not yet completed primary school; (3) Primary school; (4) Junior high school; (5) Vocational high school; (6) Senior high school; (7) vocational senior high school; (8) Diploma I, II; (9) Academy/Dipl. III and (10) University diploma. IV. Using this information, three groups of skills were defined: (A) Low-skilled which comprises 1 to 5; (B) Medium-skilled includes 6 to 8 and (C) High-skilled includes (9) to (10).

Wage estimation results are provided in Table 9. Coefficients for personal characteristics and demographic covariates have the expected signs and are statistically significant. The sign of age and age squared are in accordance with the human capital theory which states that earnings follow a parabolic curve due to depreciation of worker's human capital in the form of employing more time to perform tasks as they get older. For instance, the results depicts that the parabolic curve peaks at the age of 46 years for low-skilled workers. Estimates results for the whole sample shows that in average one additional year of schooling yields 11% increase in wages. By splitting the sample, estimates for schooling show that one additional year of schooling yields a 6% increase in wages of low-skilled workers while it yields a 16% increase in wages of medium-skill workers and only 7% increase in wages of high-skill workers. In the case of low and medium-skill workers, urban wages are 4% higher than rural wages, high skill-workers, however, are paid 13% more in urban than in rural areas. With exception of Java, coefficients for regional

[21] Although we consider ethnicity as a relevant covariate to account for, we could not include it as this information is not recorder through the SAKERNAS surveys

[22] Provinces were grouped into eight regions. For further details see Table 6

[23] A comparative description between the International and Indonesian education systems can be found at: http://www.unesco.org/iau/onlinedatabases/systems_data/id.rtf ; last consulted: 23.07.09.

dummies indicate that wages are much lower in Nusa region (omitted covariate) than in other regions. Contrary to what we expected, our results show that for the whole sample single workers are paid around 11% less than married ones. Single workers from low and medium-skilled categories depict similar percentages whilst the figure is slightly smaller for the case of high-skilled group in which single workers earn about 9% less than married ones.

The estimated effects of the covariates of interest, $\delta_1, \delta_2, \delta_3$ on wages are presented in Table 10. As known, these covariates capture the gender wage gap, a fragmented-specific wage premium and the fragmented premium that operates through gender. Recall that men working in non-fragmented sectors comprise the excluded category in equation(3)nts our group of control while interpreting the estimated effects.

As shown, after controlling for personal and demographic characteristics, estimates for the whole sample depict that between 2002 and 2005 women employed in non-fragmented sectors earned average hourly wages that were 17% lower than those of men. The average hourly wage of women working in fragmented sectors was 15% lower than those of men working outside the fragmented industries. These figures indicate that gender wage gap in fragmented sectors was about 2% points lower than the one observed in non-fragmented industries which suggests a slightly but positive contribution of fragmentation in narrowing the Indonesian gender wage gap.

Estimates for the three skill categories indicate that wage differentials were higher for low-skilled women than for medium-skilled ones[24]. While in non-fragmented sectors low-skilled women earned on average 35% less than men, Low-skilled women from fragmented industries earned average hourly wages that were around 33% lower than those of men working outside the fragmented sectors (see Table 10). Within the medium-skill category, however, women from fragmented as well as from non fragmented ones earn average hourly wages that were around 4% lower than those of men working in non-fragmented industries. In percentage points, within the low-skilled sample, the gender wage gap in fragmented sectors is 3% point lower than the one observed in non-fragmented industries. However, within the medium-skilled sample, similar gender wage gap are observed between fragmented and non fragmented sectors. These figures suggest that after controlling for personal and demographic characteristics wage differentials attributable to gender narrowed by skill-groups. Moreover, to some extent, fragmentation has contributed to diminish the significant gender wage gap that subsists yet into the low-skilled group.

5.4 Income differentials within the Indonesian assembly apparel sector

Samples used to perform difference-in-differences (DID) approach are much smaller due to the limitations of the tracking procedure we have already mentioned. To check for some robustness of our findings we defined two samples which diverge in time period. The first sample (sample A) used the SAKERNAS surveys of 2002 and 2003; the second one used SAKERNAS surveys of 2002 and 2005 (sample B). Moreover, it is worth mentioning that we restricted our DID analysis to low-skilled workforce. The reason

[24] No conclusions can arise for the skill-group since the estimate for the interactive covariate is not statistically significant.

to do this relies on our previous findings, which indicate that is into this category where earnings differentials are more pronounced.

Tracking procedure to define the treated group for sample A was performed to a population composed by 926 individuals who reported to work in the assembly garment sector in 2003. However, we succeeded on tracking past labour history (2002) for only 146 of them. Within this sub-sample, 99 individuals worked into the sector in both years while the remained 47 worked outside the assembly garment sector. Thus, we set up this last group (47) as the treated group in sample A. Likewise, to define the treated group in sample B we accounted initially a population composed by 761 individuals who reported to work in the assembly garment sector in 2005. Nevertheless, tracking individuals' labour history in 2002 was much less successful as we could only track labour history for 45 of them. Within this sub-sample, 25 individuals reported to be working into the assembly garment sector in both years and 5 of them worked into the garment sector in 2002 (period 0). Thus, our treated group for sample B accounts only 15 workers.

Before defining the control groups of both samples, we determined what sectors the current assembly garment workers come from. Information on current industry affiliation and former industry[25] was used to this purpose. Workers reported textiles, non-assembly garment, footwear, and processing food manufacturing as former industries. Fishery, agriculture, retail trade, domestic household service and non-specialized services were also reported. This information jointly with the one referring to individual occupation, education attainment, household size and other personal characteristics were used to define the reserve sector which composed the population to which the tracking procedure was performed to define the control groups in both samples. Finally, we set up a total of 200 individuals into the control group in sample A. For sample B, the control group is composed by 50 individuals.

These four groups composed then, samples A and B to which the DID is applied. Basic statistics for key variables are presented in Table 11. It is worth mentioning that despite the clusters of our samples are small in size, they still can be used to perform the DID analysis. According to the related literature (see for instance Wooldridge (2002), Wooldridge (2006)) inference based on even moderate sample sizes in each of the four groups is straightforward, and is easily made robust to different group/time period variances in the regression framework.

Results for difference-in-differences (DID) estimation are reported in Table 12. Recall that samples are restricted to low-skilled workforce. Thus, looking at the estimates of observable covariates, it appears that between 2002- 2003 (Sample A) male earned average hourly wages that were 48%[26] higher than those of women, whilst between 2002 and 2005 they earned average hourly wages that were 28% higher than those of women. These figures indicate that wage disparities in terms of gender are yet quite significant for low-skilled women. Estimates for years of schooling depict that one additional year of education increases hourly wages in about 7% (sample A) and 6% (sample B). Moreover, analogous findings were

[25] Aside from worker's current industry affiliation, SAKERNAS surveys also gather information on worker's former industry. Nevertheless, this information is only available for those workers who declared quitting their jobs within the last 12 months previous to the survey.

[26] $(\approx 100 * [\exp(0.39) - 1])$

drawn in section 5.3. Additionally, estimates controlling for Jakarta evidence that in sample A; low-skilled individuals from Jakarta earned average hourly wages that were 11% lower than the ones workers earned outside the region. The figure turn over for sample B; in which workers from Jakarta earned average hourly wages that were 27% higher than the ones workers earned outside the region. This result can drawn important implications from a policy point of view since the likelihood of getting higher wages in Jakarta region might increase domestic migration and labour mobility across sectors.

After controlling for observable covariates, estimates capturing the wage premium associated to the export-oriented garment sector($\hat{\gamma}$) indicate that in sample A, individuals who worked in the assembly garment sector in 2003 earned, on average, hourly wages that were 29% higher than the ones they earned working in alternative sectors in 2002. The figure was slightly lower in sample B were individuals who worked in the assembly garment sector in 2005 earned average hourly wages that were 25% higher than the ones they have earned in their former jobs. Likewise, estimates for ($\hat{\alpha}$) indicate that in sample A, the DID between average outcomes of the treated and control groups was about 21% (see section table 12). Similarly the DID between average outcomes of the treated and control groups of sample B was about 22%. In other words, these figures show that the difference in average hourly wages of individuals who have moved to the export-oriented garment sector was 21% (22% for sample B) higher than the difference in average hourly wages experienced by those individuals who remained working in alternative sectors. From a policy point of view, these results suggest a positive and significant impact of the export-oriented garment sector. Moreover, taking into account that wage disparities are wider into the Indonesian low-skilled workforce, the contribution of this sector in narrowing wage disparities of low-skilled labour in Indonesia is relevant from a policy point of view.

6. Conclusions and remarks

In the context of globalization, Indonesia's trade patterns have been linked to its participation into diverse global chains of production such as automotive, garments and footwear sectors. Notwithstanding the growth of these export sectors has been regarded as an engine of job creation, its effects on wage dispersion have not been extensively investigated. Accordingly, this paper attempted to assess the effects that fragmentation has had on wage differentials across and within manufacturing sectors with special attention to the gender aspects.

The main findings of this paper can be summarized as follows:

- At exploring Indonesian's trade flows by stage of production, it comes out that about 56% of exports and around 70% of imports are goods classified as intermediates. By splitting up this category into part and components and semi-finished, it appears that trade on intermediates is highly dominated by semi-finished goods. Furthermore, looking at these sub-categories it appears that while trade in parts and components is related to the Indonesian automotive industry, trade in semi-finished products are more linked to the garments, textiles and footwear sectors.

- The indicator of fragmentation shows that the export-oriented apparel sector is by far the most fragmented sector into the Indonesian economy. Furthermore, the representative indicators for Jakarta illustrate that most of the export-oriented garment production is developed in this region.

- Individual wage estimations by skills groups show that personal characteristics (e.g. age, marital status and educational attainment) as well as demographic characteristics (e.g. urban, regional covariates) are statistically significant in explaining wage differentials. After accounting for observable characteristics, the evidence suggests that wage differentials attributable to gender narrowed by skill-groups. Moreover, to some extent, fragmentation has contributed to diminish the significant gender wage gap that still subsists into the low-skilled group.

- Congruently with our finding from the wage regressions, results from the DID approach show that low-skilled women experience significant hourly wage disparities into the export-oriented garment sector of Indonesia.

- Based on the DID results, the evidence suggests that the growth of the export-oriented apparel sector have had a positive impact on wages. In fact, the difference in hourly wages that individuals who shifted to the garment sector experienced was about 21% higher than the difference in average hourly wages experienced by those individuals who remained working in alternative sectors.

Summing up, our main findings indicate that for the case of Indonesian the growth of fragmented sectors has a positive impact on wage differentials. Moreover, in terms of gender it appears to contribute to lessening the gender wage gap of low-skilled workers.

APPENDICES

Appendix A: Fragmented Production index (Frag)

Assume for simplicity that there are just 2 industries: A and B, in the region r.

We define:

M_k=Imports in intermediates in industry k (k=A, B)

X_k= Exports of industry k

Y_k=Gross production of industry k

$Frag_k$= Fragmented index for industry k

Following Hummels et al (1998), the fragmented production based trade can be measured as the value of imported intermediates embodied in industry's K exports, multiplied by two. This trade can be calculated as:

$$\underbrace{\left(\frac{M_k}{Y_k}\right) * X_k * 2}_{(a)} \approx \underbrace{M_k * \left(\frac{X_k}{Y_k}\right) * 2}_{(b)}$$

In other words:

(fraction of gross production that is imported intermediates) (exports)*(2)* ≈ *imported intermediates)*(fraction of gross production that is exported)*(2)*

The fragmented index (frg) is measured as the fragmented export share of gross output $=\left((a)/2\right)/Y$, replacing (a) we get:

$$Frag_{kr} = \frac{m^*_{kr}}{Y_{kr}}; \qquad where\ m^*_{kr} = \left(\frac{M_{kr}}{Y_{kr}}\right) X_{kr}$$

Table 2: Decomposition of Indonesian trade by selected stage of production

SITC	Description	Imports of P&C			
		Billion $		%	
		2001	2005	2001	2005
7	Machinery & transport equipment	3,47	5,46	92,8	92,2
6	Manuf. goods classifiedby material	0,20	0,28	5,5	4,8
8	Miscellaneous manufactured articles	0,06	0,18	1,7	3,0
All Above		3,74	5,92		
Detailed categories					
78	Road vehicles	1,35	1,59	41,8	41,5
71	Power-generating machinery & equipment	0,53	1,16	16,2	17,2
77	Electrical machinery, apparatus & appliances	0,55	0,97	13,0	12,5
72	Machinery specialized for particular industries	0,47	0,85	8,1	7,4
74	General industrial machinery & equipment	0,27	0,51	8,2	6,6
76	Telecommunications	0,15	0,18	3,9	6,1
73	Metalworking machinery	0,05	0,08	4,3	3,9
79	Other transport equipment	0,08	0,05	2,6	2,3
75	Office machines & equipment	0,03	0,05	1,9	2,5
7 Total		3,47	5,46		
62	Rubber manufactures, n.e.s.	0,09	0,13	25,7	45,3
69	Manufactures of metals, n.e.s.	0,07	0,11	28,9	11,6
65	Textiles	0,04	0,04	15,9	15,3
6 Total		0,20	0,28		

SITC	Description	Imports of Semi-finished			
		Billion $		%	
		2001	2005	2001	2005
5	Chemicals & related products	5,00	7,42	44,5	46,9
6	Manuf.goods classified by material	3,42	5,74	30,4	36,3
0	Food and live animals	0,96	1,31	8,6	8,3
2	Crude materials	0,63	0,73	5,6	4,6
3	Mineral fuels, lubricants & related	0,93	0,09	8,2	0,6
7	Machinery and transport equipment	0,15	0,25	1,3	1,6
8	Miscellaneous manufactured articles	0,13	0,22	1,2	1,4
4	Animal & vegetable oils	0,03	0,05	0,2	0,3
9	Commodities & transactions n.e.s	0,00	0,00	0,0	0,0
1	Beverages and tobacco	0,00	0,00	0,0	0,0
All Above		11,24	15,81		
Detailed categories					
51	Organic chemicals	2,09	3,08	41,8	41,5
57	Plastics in primary forms	0,81	1,27	16,2	17,2
59	Chemical materials & products	0,65	0,93	13,0	12,5
52	Inorganic chemicals	0,41	0,55	8,1	7,4
53	Dyeing & colouring materials	0,41	0,49	8,2	6,6
56	Fertilizers	0,20	0,45	3,9	6,1
55	Essential oils & perfume materials	0,22	0,29	4,3	3,9
54	Medical & pharmaceutical products	0,13	0,17	2,6	2,3
58	Plastics in non-primary forms	0,09	0,19	1,9	2,5
5 Total		5,00	7,42		
67	Iron and steel	0,88	2,60	25,7	45,3
65	Textiles	0,99	0,66	28,9	11,6
68	Non-ferrous metals	0,54	0,88	15,9	15,3
69	Manufactures of metals, n.e.s.	0,35	0,72	10,2	12,5
64	Paper & articles of paper pulp	0,28	0,40	8,1	7,0
66	Non-metallic mineral manufactures	0,15	0,29	4,3	5,1
61	Leather & leather manufactures	0,15	0,02	4,4	0,3
62	Rubber manufactures, n.e.s.	0,05	0,10	1,4	1,8
63	Cork and wood manufactures	0,03	0,07	1,0	1,2
6 Total		3,42	5,74		

SITC	Description	Exports of Final Goods			
		Billion $		%	
		2005	2005	2001	2005
8	Miscellaneous manufactured articles	6,13	6,82	61,6	59,4
0	Food and live animals	2,24	2,81	22,5	24,4
6	Manuf.goods classified by material	0,86	0,91	8,6	8,0
7	Machinery & transport equipment	0,49	0,53	5,0	4,6
5	Chemicals and related products	0,21	0,38	2,1	3,3
1	Beverages and tobacco	0,02	0,03	0,2	0,2
2	Crude materials	0,00	0,00	0,0	0,0
4	Animal & vegetable oils	0,00	0,00	0,0	0,0
All Above		9,95	11,47		
Detailed categories					
84	Articles of apparel & clothing	2,42	2,69	39,5	39,5
85	Footwear	1,47	1,34	24,0	19,7
82	Furniture & parts thereof;	1,00	1,54	16,3	22,5
89	Miscellaneous manufactured articles	0,95	1,06	15,4	15,6
83	Travel goods, handbags & similar	0,19	0,07	3,0	1,1
88	Photographic apparatus & equipment	0,10	0,09	1,7	1,4
81	Prefabricated buildings	0,00	0,02	0,0	0,2
87	Professional instruments	0,00	0,00	0,0	0,0
8 Total		6,13	6,82		
63	Cork & wood manufactures	0,17	0,21	19,7	22,6
66	Non-metallic mineral manufactures	0,17	0,19	19,5	21,2
65	Textiles	0,20	0,15	23,8	16,9
69	Manufactures of metals, n.e.s.	0,18	0,15	21,5	15,9
64	Paper & articles of paper pulp	0,10	0,12	11,6	13,1
62	Rubber manufactures, n.e.s.	0,03	0,10	3,9	10,5
6 Total		0,86	0,91		

Source : Authors' calculations based in COMTRADE databases (several years)

Table 3: Indonesia: Manufacturing labour structure by Gender

ISIC	Industry	1994*/ Female Share	2002 Labour Male	2002 Labour Female	2002 Share Male	2002 Share Female	2005 Labour Male	2005 Labour Female	2005 Share Male	2005 Share Female
15	Food products and beverages	46	721	399	64.4	35.6	614	358	63.2	36.8
16	Tobacco products	88	106	274	27.9	72.1	87	316	21.6	78.4
17	Textiles	56	469	363	56.4	43.6	326	282	53.6	46.4
18	Wearing apparel	79	460	683	40.2	59.8	394	534	42.5	57.5
19	Tanning & dressing of leather &footwear	78	191	197	49.2	50.8	135	101	57.2	42.8
20	Wood products	39	864	233	78.8	21.2	661	213	75.6	24.4
21	Paper and paper products	23	106	32	76.8	23.2	107	26	80.5	19.5
22	Publishing and printing		210	88	70.5	29.5	177	60	74.7	25.3
23	Coke, refined petroleum products		41	4	91.1	8.9	46	10	82.1	17.9
24	Chemicals		261	98	72.7	27.3	180	84	68.2	31.8
25	Rubber and plastics products		224	157	58.8	41.2	224	108	67.5	32.5
26	Other no-metallic mineral products	7	362	112	76.4	23.6	323	90	78.2	21.8
27	Basic metals	2	172	23	88.2	11.8	135	9	93.8	6.3
28	Metal product		122	20	85.9	14.1	95	7	93.1	6.9
29	Machinery and equipment nec.		37	5	88.1	11.9	87	15	85.3	14.7
30	Office and computing machinery		10	1	90.9	9.1	11	4	73.3	26.7
31	Electrical machinery and apparat. n.e.c.	60	56	23	70.9	29.1	53	24	68.8	31.2
32	Radio, television and communic. equip.		142	73	66.0	34.0	126	120	51.2	48.8
33	Medical precision and optical instrum.		8	2	80.0	20.0	5	3	62.5	37.5
34	Motor vehicles, trailers and semi-trailers	11	130	12	91.5	8.5	111	12	90.2	9.8
35	Other transport equipment		67	2	97.1	2.9	54	5	91.5	8.5
36	Furniture		488	126	79.5	20.5	341	83	80.4	19.6
37	Recycling		4	1	80.0	20.0	4	2	66.7	33.3
			5,251	2,928	64.2	35.8	4,296	2,466	63.5	36.5

Source: SAKERNAS Surveys (2002-2005)

*/ Figures for 1994 were taken from Caraway, Teri L (2007)

Table 4: Labour Garment Sector: selected variables

Skill Group	2002						2005					
	Male			Female			Male			Female		
	N	Mean	Std	N	Mean	Std	N	Mean	Std	N	Mean	Std
Total	460			683			394			534		
Low-skill	**271**			**476**			**205**			**369**		
	(36)			(64)			(36)			(64)		
Hourly wage*(Rupees)*		2636.8	1087.6		2551.2	1174.1		2999.2	1331.0		2651.2	1256.9
Age		31	8.0		26	6.0		33	9.1		27	7.3
Year of schooling		7.7	1.5		7.5	1.7		7.3	1.5		7.6	1.6
Marital status (=single)	94			243			77			158		
	(35)			(51)			(38)			(43)		
Medium-skill	**175**			**193**			**175**			**151**		
	(48)			(52)			(54)			(46)		
Hourly wage*(Rupees)*		3711.3	1640.4		3087.1	1429.4		4431.8	2047.3		3430.0	1364.3
Age		31	8.0		26	6.0		33	9.1		27	7.3
Year of schooling		12.0	0.2		12.0	0.3		12.0	0.3		12.0	0.4
Marital status (=single)	61			125			54			87		
	(35)			(65)			(31)			(58)		
High-skill	**14**			**14**			**14**			**14**		
	(50)			(50)			(50)			(50)		
Hourly wage*(Rupees)*		7537.6	6036.2		5608.4	2960.5		9110.5	7300.6		7109.2	4295.5
Age		34	8.0		32	6.3		36	9.4		30	7.8
Year of schooling		16.4	0.9		16.1	1.0		16.6	0.9		15.9	1.1
Marital status (=single)	3			8			3			8		
	(21)			(57)			(21)			(57)		

Source : SAKERNAS surveys 2002-2005

Note: percentages are shown in parentheses

Table 6: Indonesia: Administrative division

ID	Region	Provinces
Suma	Sumatera	N.A. Darussalam; North East Sumatera; West Sumatera; Riau; Jambi; South Sumatera; Benkulu; Lampung; Bangka Belitung
Nusa	Nusa	Bali; West Nusa Tenggara; East Nusa Tenggara
Kali	Kalimatan	West Kalimantan; East Kalimantan; Central Kalimantan; South Kalimantan
Sula	Sulawesi	North Sulawesi; Central Sulawesi; South Sulawesi; South-East Sulawesi
Malu	Maluku	Maluku; North Maluku
Papu	Papua	Papua (Included west, east and south Irian Jaya)
Java	Jawa	West Java; Central Java; DIY Jakarta; East Java; Banten
Dkja	Jakarta	DKI Jakarta

Source : SAKERNAS suryeys 2002-2005

Table 7: Indicator of fragmentation across manufacturing industries by selected provinces

ISIC	Description	Provinces													
		NE Sumatera		Riau		DKI Jakarta		West Java		Central Java		East Java		Banten	
		2002	2005	2002	2005	2002	2005	2002	2005	2002	2005	2002	2005	2002	2005
15	Manufacture of food products and beverages	0.0056	0.006	0	0.0001	0.0109	0.0159	0.0087	0.0049	0.003	0.0111	0.0487	0.0236	0.0122	0.0091
16	Manufacture of tobacco products	0.1366	0.281									0.0028	0.0012		
17	Manufacture of textiles			0.1185	0.3147	0.0377	0.0357	0.0336	0.033	0.0603	0.0935	0.0477	0.0871	0.0602	0.0384
18	Manufacture of wearing apparel; dressing and dyeing of fur	0.0012	0	0.2223	0.139	0.1798	0.1523	0.0902	0.094	0.1752	0.0823	0.0783	0.0565	0.19	0.1168
19	Tanning &nd dressing of leather; manufacture of luggage, handbags,	0.0095	0	0	0.5663	0.0261	0.0248	0.2006	0.2232	0.0408	0.0579	0.1101	0.0509	0.1867	0.0846
20	Manufacture of wood and of products of wood	0.0043	0.058	0.0213	0.021	0.001	0.0136	0.042	0.0359	0.0355	0.0694	0.0114	0.017	0.0285	0.0479
21	Manufacture of paper and paper products	0	0.017	0.0478	0.0208	0.0922	0.0013	0.0138	0.028	0.0008	0.0014	0.0123	0.0128	0.0027	0.0246
22	Publishing, printing and reproduction of recorded media	0.0002				0.0001	0.0073			0.002	0.002	0.0043	0	0.0084	0
23	Manufacture of coke, refined petroleum products and nuclear fuel	0	0.112			0.2465	0.0041						0.0015	0.3895	0.0869
24	Manufacture of chemicals and chemical products	0.0087	0.043	0.0559	0.0383	0.0085	0.0181	0.0252	0.0208	0.0063	0.0053	0.0795	0.0142	0.0341	0.0383
25	Manufacture of rubber and plastics products	0.0258	0.027	0.1361	0.0747	0.0054	0.0044	0.1219	0.0764	0.0108	0.0436	0.0606	0.0233	0.0454	0.0062
26	Manufacture of other non-metallic mineral products		0.026	0.0284	0.0967	0.0304	0.0383	0.0189	0.0026	0.0133	0.0222	0.0088	0.002	0.1064	0.0172
27	Manufacture of basic metals	0.2101	0.052	0.4331	0.0007	0.0015	0.0013	0.0141	0.0224	0.0028	0.0058	0.0309	0.0396	0.0209	0.0035
28	Manufacture of fabricated metal prod. except machinery and equipm	0.0006	0.086	0.0107	0.1564	0.0023	0.0084	0.0307	0.0669	0.0001	0	0.0008	0.0127	0.1386	0.0168
29	Manufacture of machinery and equipment n.e.c.	0.0084	0	0.305	0.04	0.076	0.0363	0.0654	0.1006	0.0734	0.059	0.0432	0.0006	0.0212	0.1378
30	Manufacture of office, accounting and computing machinery								0.0125						
31	Manufacture of electrical machinery and apparat. n.e.c.	0.0157	0.017	0.3931	0.3533	0.0382	0.0275	0.086	0.0845	0.0542	0	0.0028	0.0028	0.0612	0.0187
32	Manufacture of radio, television and communic. equipment and appa			0.25	0.4327	0.0565	0.0336	0.0933	0.0276			0.149	0	0.2644	0.0025
33	Manufacture of medical, precision and optical instr. watches and clo	0	0.007	0.1374	0.6948	0.225	0.0032	0.0992	0.0026	0.3239	0	0.0155	0.0211	0.0877	0
34	Manufacture of motor vehicles, trailers and semi-trailers			0.3014	0	0.0095	0.0117	0.024	0.027	0.0003	0	0.0785	0.2238	0.0286	0.0189
35	Manufacture of other transport equipment			0.0024	0.0346	0.0215	0.0011	0.0013	0.0016	0.0022	0.0003	0.0002	0.0354	0.0749	0.01
36	Manufacture of furniture; manufacturing n.e.c.	0.0564	0.186	0.0555	0.03	0.074	0.0429	0.0224	0.063	0.0145	0.06	0.0674	0.0652	0.049	0.0384
37	Recycling											0.0237	0		
Grand Total		0.4831	0.918	2.5189	3.0141	1.1431	0.4818	0.9913	0.9275	0.8194	0.5138	0.8765	0.6913	1.8106	0.7166

Source: Authors' calculations based on plant-level surveys, BPS-Indonesia (2002-2005)

Table 8: Sample means by Skills categories

	Male			Female		
	N	Mean	Std	N	Mean	Std
Total	91779			42460		
Low-skill	38642			17323		
Hourly wage*/		3229.92	2641.49		2075.82	1493.85
Log hourly wage		7.92	0.56		7.45	0.62
Years schooling		7.21	1.83		6.88	2.01
Age		34.74	11.40		30.15	11.21
Marital status(=single)		0.26	0.44		0.42	0.49
Urban		0.59	0.49		0.70	0.46
Medium-skill	40924			18101		
Hourly wage		5184.47	4472.13		4656.0	5557.2
Log hourly wage		8.37	0.60		8.2	0.7
Years schooling		12.09	0.46		12.2	0.7
Age		34.29	9.59		30.5	9.5
Marital status(=single)		0.27	0.44		0.5	0.5
Urban		0.81	0.39		0.8	0.4
High-skill	12213			7036		
Hourly wage		10100.76	11384.45		7935.37	6856.71
Log hourly wage		8.98	0.66		8.76	0.68
Years schooling		16.42	0.91		16.27	0.97
Age		38.34	9.02		34.25	8.55
Marital status(=single)		0.19	0.39		0.36	0.48
Urban		0.86	0.35		0.87	0.33

Source : SAKERNAS surveys 2002-2005

*/ Hourly wage in rupees

Table 9: Pooled OLS Estimation of Indonesian wage premiums

	Whole Sample		Low-skill		Medium-skill		High-skill	
	(0)		(1)		(2)		(3)	
Age	0.038 ***	(0.001)	0.033 ***	(0.001)	0.037 ***	(0.002)	0.063 ***	(0.004)
Age2	-0.0003 ***	(0.000)	-0.0004 ***	(0.000)	-0.0002 ***	(0.000)	-0.0005 ***	(0.000)
Schooling	0.105 ***	(0.000)	0.057 ***	(0.001)	0.153 ***	(0.004)	0.070 ***	(0.005)
Urban	0.010 **	(0.004)	0.039 ***	(0.005)	0.041 ***	(0.007)	0.131 ***	(0.014)
Marital status	-0.114 ***	(0.005)	-0.119 ***	(0.007)	-0.112 ***	(0.006)	-0.096 ***	(0.013)
Gender	-0.191 ***	(0.004)	-0.434 ***	(0.006)	-0.039 ***	(0.005)	-0.094 ***	(0.009)
Frag	0.527 ***	(0.062)	0.753 ***	(0.084)	0.427 ***	(0.091)	0.829 ***	(0.316)
Gender*frag	1.205 ***	(0.091)	2.899 ***	(0.132)	0.215 *	(0.128)	-0.417	(0.504)
Sumatera	0.151 ***	(0.008)	0.197 ***	(0.012)	0.122 ***	(0.011)	0.114 ***	(0.020)
Kalimatan	0.274 ***	(0.009)	0.339 ***	(0.014)	0.244 ***	(0.013)	0.139 ***	(0.023)
Sulawesi	0.083 ***	(0.010)	0.031 *	(0.016)	0.105 ***	(0.014)	0.044 *	(0.024)
Maluku	0.214 ***	(0.017)	0.286 ***	(0.033)	0.199 ***	(0.022)	0.067 *	(0.037)
Papua	0.501 ***	(0.017)	0.598 ***	(0.033)	0.523 ***	(0.021)	0.354 ***	(0.040)
Java	-0.017 **	(0.007)	-0.026 **	(0.011)	-0.009	(0.010)	0.047 **	(0.018)
Jakarta	0.220 ***	(0.007)	0.128 ***	(0.012)	0.227 ***	(0.010)	0.446 ***	(0.019)
2003	0.105 ***	(0.004)	0.120 ***	(0.006)	0.104 ***	(0.006)	0.114 ***	(0.012)
2004	0.151 ***	(0.004)	0.158 ***	(0.006)	0.152 ***	(0.006)	0.164 ***	(0.013)
2005	0.162 ***	(0.005)	0.178 ***	(0.007)	0.160 ***	(0.007)	0.178 ***	(0.013)
Constant	5.999 ***	(0.022)	6.633 ***	(0.031)	5.230 ***	(0.063)	5.773 ***	(0.108)
N	134223		55964		59011		19248	
R2	0.43		0.27		0.27		0.25	

Robust standard errors in parentheses. * significant at 10%, ** significant at 5%, *** significant at 1%

Note: The dependent variable is the log of hourly wages. Schooling is measured as the years of formal education.

Table 10: Wage premium effects by Skill groups

		Men	Women	Wage gap
Whole Sample	Fragmented	δ_2*frag= 1.05	$\delta_1+(\delta_2+\delta_3)$*frag= -14.53	-($\delta_1+\delta_3$*frag)= 15.42
	Non-fragmented	Control	δ_1= -17.41	-δ_1= 17.41
Low-skill	Fragmented	δ_2*frag= 0.91	$\delta_1+(\delta_2+\delta_3)$*frag= -32.30	-($\delta_1+\delta_3$*frag)= 32.91
	Non-fragmented	Control	δ_1= -35.20	-δ_1= 35.20
Medium-skill	Fragmented	δ_2*frag= 0.38	$\delta_1+(\delta_2+\delta_3)$*frag= -3.28	-($\delta_1+\delta_3$*frag)= 3.65
	Non-fragmented	Control	δ_1= -3.84	-δ_1= 3.84
High-skill	Fragmented	δ_2*frag= 0.27	NS	NS
	Non-fragmented	Control		

Source: Authors' estimation

Ns: Estimates for the iterative covariate were statistically not significant for this category

Table 11 : Sample Means in Treated and Control groups

	Sample A			Sample B		
		Outcome			Outcome	
	N	2002	2003	N	2002	2005
Treated	47 Rupias	2513.06	3268.11	15 Rupias	2386.44	3823.36
		(1305.62)	(1325.16)		(795.12)	(1201.46)
	Log	7.70	8.01	Log	7.73	8.21
		(0.52)	(0.43)		(0.30)	(0.28)
Control	200 Rupias	1450.91	1584.36	50 Rupias	1557.97	2088.65
		(869.35)	(993.87)		(1030.13)	(1254.50)
	Log	7.14	7.23	Log	7.19	7.49
		(0.51)	(0.50)		(0.56)	(0.57)

Standard deviation in parentheses

Table 12 : Difference-in-Differences Estimation

	2002-2003		2002-2005	
	(1)		(2)	
Time	0.08 *	(0.04)	0.09	(0.09)
Treated	0.29 ***	(0.07)	0.25 **	(0.10)
Time*treated	0.21 **	(0.09)	0.22 *	(0.13)
Gender	0.39 ***	(0.05)	0.25 ***	(0.08)
Age	0.01	(0.01)	0.11 ***	(0.03)
Age^2	-0.0001	(0.00)	-0.001 ***	(0.00)
Schooling	0.07 ***	(0.01)	0.06 ***	(0.02)
Marital status	-0.11 *	(0.06)	0.05	(0.14)
Urban	0.31 ***	(0.08)	-0.18	(0.15)
Jakarta	-0.11 **	(0.05)	0.24 **	(0.10)
Constant	6.13 ***	0.23	5.00 ***	0.53
Sample Size	494		130	
R^2	0.49		0.54	

Robust standard errors in parentheses. * significant at 10%, ** significant at 5%, *** significant at 1%

Note: Dependent variable: log of hourly wages. Schooling is measured as the years of formal education.