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The Impact of Minimum Wages on Employment in a Low Income Country

An Evaluation Using the Difference-in-Differences Approach

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Abstract

Unlike the well-developed literature on the employment impact of the minimum wage in industrial nations, very little is known about minimum wage effects in low income countries. Minimum wages increased sharply in Indonesia between 1990 and 1996 and by more in some provinces than in others. Following Card and Krueger (1994) the authors exploit the large geographic variation in the rate of increase and compare changes in employment in the clothing, textile, footwear, and leather industries on either side of the Jakarta-West Java

border. They use household level labor market data to establish compliance with the legislation. They obtain matched difference-in-difference estimates of the employment impact using a census of all large and medium-size firms in the clothing, textile, leather, and footwear industries. Alatas and Cameron find some evidence of a negative employment impact for small, domestic firms but no employment impact for large firms, foreign or domestic.

This paper—a product of the Environment and Social Development Sector Unit, East Asia and the Pacific Region—is part of a larger effort in the region to assess the poverty situation and related issues. Copies of the paper are available free from the World Bank, 1818 H Street NW, Washington, DC 20433. Please contact Taranaki Mailei, room MC8-808, telephone 202-458-7347, fax 202-522-1560, email address tmailei@worldbank.org. Policy Research Working Papers are also posted on the Web at <http://econ.worldbank.org>. The authors may be contacted at valatas@worldbank.org or lcameron@unimelb.edu.au. March 2003. (42 pages)

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**The Impact of Minimum Wages on Employment in a Low Income Country:
An Evaluation using the Difference-In-Differences Approach.**

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The Impact of Minimum Wages on Employment in a Low Wage Country: An Evaluation Using the Difference-In-Difference Approach.

1. Introduction

The debate over the employment impact of minimum wage increases has been reincarnated with vigor over the past decade. The general wisdom that there is a negative impact on employment is being subject to serious re-examination. Almost all of this research has however occurred in wealthy industrialized nations. Minimum wages are also widely employed as a means of raising living standards in low income countries. The level at which they are set is often hotly contested and concerns for the employment impact taken into account. In addition to the domestic debates, minimum wage setting in low-wage countries has become internationalized with individuals and governments in wealthy nations demanding higher wages be paid in developing countries as a means of limiting the exploitation of labor by multinational corporations and enhancing the competitiveness of their own manufacturing sectors. Low income countries are being pressured via international trade organisations to increase their minimum wages or face trade sanctions.¹

It is thus surprising that there are only a few papers on the impact of minimum wages on employment in developing countries. Labor market conditions in these countries differ markedly from those in industrialized countries – most obviously in terms of the existence of a large informal, uncovered sector. This makes the reliance on results from industrialized nations unsatisfactory.

¹ For example, Indonesia had complaints filed against it under the Generalized Scheme of Preferences in an attempt to deprive it of low tariffs on its exports to the US, Rama (1999).

This paper uses data from a census of all medium and large Indonesian firms² to examine the impact of minimum wages on employment between 1990 and 1996. Indonesia is an ideal site for a study of this sort. It is a relatively low income country (GDP/capita of US\$980 in 1995) but has a large manufacturing sector (as a result of a manufacturing boom starting in the mid-80's). Much of this sector is low-tech and low wage – for example, clothing, textiles, footwear and leather. We will restrict our attention to this sector because these industries rely heavily on low-wage, predominantly female, labor. Indonesia has also had a long history of minimum wage legislation. Non-compliance with minimum wage laws is a much more serious issue in developing countries than developed countries, owing to the much weaker government enforcement capacity. In Indonesia, the minimum wage legislation was largely unenforced prior to 1990. However, since 1990 greater efforts have been put into establishing compliance leading to the expectation that most middle-sized and large firms, at least around the major metropolitan areas, would pay the minimum. We confirm this using labor survey data.

Further, partly as a result of international pressure, minimum wages have been increasing sharply in Indonesia during the 1990's. On average minimum wages across the nation tripled in nominal terms and doubled in real terms during the early 1990s, Rama (1999). More importantly for the purpose of this study, minimum wages are set at the provincial level in Indonesia. This gives rise to arbitrary differences in the legal minimum between firms that are geographically close but on different sides of provincial borders. A particularly striking difference in minimums occurs within the bounds of Greater Jakarta (which is the manufacturing hub of Indonesia) - part of which is in the province of

² Medium and large firms are defined as having more than twenty employees.

Jakarta and part in the neighboring province of West Java. In 1990 the minimum wage was 36% higher in Jakarta than in West Java. By 1994 there was no difference in minimums across the two regions. It is this provincial difference in minimum wages which we exploit and allows us to identify the employment effect.

Finally, prior to the crisis, Indonesia had experienced considerable international capital inflows. The manufacturing sector consists of domestic and multinational firms. (For example, both Nike and Reebok manufacture in the Jakarta area.) We examine the employment impact on domestic and foreign firms separately and so can comment on the employment impact within the foreign-owned firms that are the source of much international controversy.

This study advances the literature in a number of ways. First, it is only the second study of which we are aware³ that uses micro-level data to examine minimum wage impacts in a developing country. Second, it is the first developing country study to use the difference-in-difference approach and so avoid the potentially problematic regression-based method. (This will be discussed in more detail below.) Third, the data set is unusually detailed and covers *all* firms with more than twenty employees in Indonesia. Finally, by covering a relatively long six year period this paper avoids the criticism of previous difference-in-difference studies which have been able to examine only a short period around the minimum wage change.

The paper is structured as follows. Section 2 briefly discusses the previous empirical literature. Section 3 provides details on the Indonesian context. In section 4 labor market survey data are used to establish the extent of compliance with the minimum wage laws within Greater Jakarta and that the minimum wages are binding. Section 5

³ The only other being a study of Mexico and Columbia by Bell (1997).

then discusses the establishment level data that will be used to calculate the matched difference-in-difference estimates of the employment impact – as explained in Section 6 and presented in Section 7. Section 8 then explores potential explanations for the results. Section 9 concludes.

2. Previous Literature

Theoretical Structure

The simplest model of the effects of the minimum wage on employment is the standard neo-classical model which assumes homogenous labor, a competitive labor market and complete coverage of the minimum wage legislation. A minimum wage set above the market-clearing wage then decreases the quantity of labor demanded by firms and total employment decreases. The assumption of complete coverage is a strong one, even in a developed country setting, but will not hold in most developing country settings. A number of theoretical models have explored the impact of minimum wages in the presence of a non-negligible uncovered sector. (See Welch (1976), Gramlich (1976), Mincer (1976) and Brown, Gilroy and Kohen (1982), Harrison and Leamer (1995)). Although these models differ in a number of ways – for example, in their assumptions about mobility between the uncovered and covered sectors - they all predict the conventional negative employment impact in the covered sector.⁴

As is well-known, market structures other than perfect competition can result in different predictions as to the minimum wage impact. For example, if the labor market is assumed to be monopsonistic, increases in the minimum wage over a certain range cause employment to increase. Efficiency wage models can also explain such employment

gains. In these models the efficiency gains associated with the increased wages (due to lower worker turnover or higher worker effort, for example) outweigh the increased wage costs and the firm can afford to employ more workers at the new wage. Other possible explanations for an insignificant or positive employment impact are explored below in Section 8.

Notwithstanding the existence of the alternative models, the perfectly competitive labor market model remains the benchmark model. It forms the basis of most policy advice and generates the negative employment impact that many empirical papers seek to quantify.

Empirical Literature

The empirical literature on the employment impact in industrial countries (see Brown (1999) for a survey) can be characterized as having two distinct strands. The first being earlier studies (using data prior to the 1980s) which were largely based on time-series data. A measure of employment is regressed on a minimum wage variable and a number of other controlling variables, normally including some output measure that purports to control for changes in economic conditions. These found a consistent moderate negative employment impact – in line with the standard neo-classical model of the labor market. This methodology is however open to a number of criticisms. First, the minimum wage variable is normally calculated relative to average earnings (and possibly weighted by a measure of coverage). This captures the extent to which the minimum is binding. However, another consequence of this specification is that the impact of minimum wage variation cannot be separated from that of average wages. Second, these

⁴ They predict a reallocation of labor towards the uncovered sector and differ in the extent to which this

studies implicitly compare employment in relatively high minimum wage years with employment in relatively low minimum wage years, when it is likely that many other factors, including economic conditions that affect employment and minimum wages, have also changed over time. Studies normally try to control for these changes in economic conditions by including a measure of gross output as an explanatory variable. However, it is likely that this control is inadequate. To the extent that the GDP measures are unable to completely control for changes in economic conditions, the minimum wages are likely to be endogenous, in which case the resultant estimates are biased.

The second strand of the literature consists of more recent studies which have often utilized micro-data and largely found no negative impact on employment, with some indication that there may be employment gains associated with minimum wage increases. At the center of this second group of studies is Card and Krueger (1994) which examined the impact of a minimum wage increase in New Jersey by comparing employment changes in fast-food outlets in that state with those in neighboring Pennsylvania where there was no increase in the minimum. It is this difference-in-difference methodology, which has not before been employed in a developing country setting, that will be employed here. Even more recent time-series studies have shown a very small or insignificant impact of minimum wage increases.

Developing Country Studies

Unlike the literature on the impact of minimum wages in developed countries, there is very little developing country research. All of the studies that do exist use the regression-based methodological approach described above, with differing degrees of data aggregation. The results are mixed but the majority of the studies find a negative

decrease in covered sector employment is compensated by an increase in uncovered sector employment.

employment impact. Carneiro (2000) found a negative employment impact in the formal sector in Brazil using time-series data, as did Freeman and Freeman (1991) using national and industry level data for Puerto Rico. Bell (1997) is the only study of which we are aware that uses firm-level data. She finds a negative employment impact in Columbia where the minimum wage is found to be binding and no impact in Mexico where the minimum is set below market-clearing.

The recent large increases in minimum wages in Indonesia have generated a small number of papers that have all used panels of provincial level data. Rama (1999) aggregated his data up from the firm-level and found a negative employment effect for small firms (less than twenty employees) but a possible positive effect amongst large and medium-sized firms. A SMERU Research Institute report (SMERU, 2001) conducted a similar analysis using the household labor force survey data (*Sakernas*). They conclude that increases in minimum wages between 1988 and 2000 have had a negative impact on urban, formal sector employment. However, a closer look at their range of estimates suggests this relationship is not very robust. The employment impact switches between being positive and negative depending on the sample used and the way in which the minimum wage variable is constructed. Islam and Nazara (2000) also conduct a provincial level analysis for the whole of Indonesia and find that the results are sensitive to the measure of the minimum wage used and the other controlling variables included in the regression.

All of the above developing country studies used either panel or time-series regressions and so are open to the aforementioned criticisms. In addition to these concerns, much information is lost in the aggregation of data up to the national, sub-national or industry level. In contrast, this paper uses the difference-in-difference

methodology of Card and Krueger (1994). This has the advantage of exploiting the richness of firm-level data while also avoiding the pitfalls of the regression-based approach. Comparing like companies that receive different treatment on the basis of small differences in their geographic location provides a “natural experiment” that can be used to assess the employment impacts of minimum wage legislation without having to worry about the endogeneity problems associated with the regression-based approach. Although the difference-in-difference approach is like the panel regression approach in that it compares employment in regions with differing minimum wages, by examining very close geographic regions that constitute the same market⁵ the problems associated with differing economic conditions are avoided.

One of the more serious criticisms aimed at Card and Krueger (1994) was that they were able to examine only a period from shortly before the minimum wage change to shortly after the change and so captured only short term impacts of the minimum wage. In this study we use data over a much longer time period and so are able to capture longer term impacts of minimum wage increases.

3. Indonesian Context

Indonesia is the fourth most populous country in the world. Its islands cover an area greater than that of Europe. Due to its relatively low average per capita income its economy is small in international terms – only about 3% that of the United States. Nevertheless, prior to the financial crisis of 1997 Indonesia was experiencing a manufacturing boom. Protectionist trade barriers had been dramatically reduced from their high levels in the mid-1980’s and the flow of foreign capital had also been liberalized. As a result many multinational companies chose to locate in Indonesia and

⁵ As opposed to estimating regressions on data from different states within a nation, for example.

exports of manufacturing goods boomed. Non-oil manufacturing production grew by an average of 11% per annum between 1985 and 1992. Manufactured exports grew by a remarkable 20 to 30% per annum in real terms from 1980 to 1992, Hill (1996).

Indonesian manufacturing is unusually concentrated in the Greater Jakarta region. Jabotabek is the term given to this region (taking its name from the first two letters of its constituent regions - Jakarta, Bogor, Tangerang and Bekasi.) Seventy-eight per cent of national adult full-time manufacturing employment is concentrated on the island of Java, with the vast majority of this being in or close to Jakarta.

Jakarta is a province in its own right. The districts (kabupaten) of Bogor, Tangerang and Bekasi (known as Botabek) are all in the province of West Java. See Figure 1.⁶ As such, firms in Jakarta are subject to the Jakarta legislated minimum while firms just over the border are subject to the (historically lower) West Java minimum.

Table 1 presents the average monthly minimum wage in each province in Indonesian Rupiah.⁷ The government sets monthly minimums for full time workers. For workers who do not work full-time, the corresponding pro-rata daily rates apply. These minimums apply to all firms, no matter how small but not to workers in the informal sector. The Ministry of Manpower does not explicitly define the informal sector but it is understood to include such occupational categories as household servants and agricultural laborers outside the estate sector, Rosner (1995). In 1990 (with an exchange rate of Rp2500 to US\$1) the Jakarta minimum was equivalent to US\$22.32 per month and so significantly less than a dollar a day. This had risen to almost US\$2 per day in 1996.

⁶ Jabotabek is surrounded to the west, east and south by other districts in West Java and to the north by the Bay of Jakarta. Unlike in Tangerang and Bekasi, most of the manufacturing in the kabupaten of Bogor is located south of the city of Bogor which is quite a way from the Jakarta/West Java border. Excluding Bogor from the sample does not affect the results.

Although low by international standards, this is quite high relative to the average manufacturing wage. For example the Jakartan (Botabek) minimum was 42% (31.2%) of the average manufacturing wage in Jabotabek in 1991. The minimum in both regions was 50% of the average wage by 1996.

Table 1 shows that in 1990 the minimum wage was about 36% higher in Jakarta than West Java. Both provinces have experienced relatively rapid increases in their nominal (and real) minimum wages and there were larger increases in West Java so that the gap between the two provinces has closed over time and there has been no difference between the regions since 1994.⁸ The government's stated aim in establishing the level of the provincial minimum wages is that they cover the cost of a defined consumption bundle. Thus, in setting the minimum wage, regard was to be paid to these minimum physical needs and the cost of living. The initial difference between the minimum wages of Jakarta and West Java arose from differences in the average cost of living across the two provinces. Jakarta is an entirely urban province whereas West Java is largely rural. Costs of living are consequently higher in Jakarta than they are on average in West Java and the lower West Java minimum reflected this fact. However, Botabek (although within West Java), like Jakarta, is urban and shares Jakarta's high costs of living. Figure 1 shows there was comparable manufacturing density in Jakarta, Tangerang (to the west) and Bekasi (to the east) in 1991 and there is no discernible changes as one drives from Jakarta into West Java – other than the provincial markers at the side of the road. Henderson, Kuncoro and Nasution (1996) document the very high labor mobility across the

⁷ The minimum wage is defined as including the 'basic wage' plus regular allowances (that are fixed every month and do not depend on performance or absence). The provision of the basic wage must amount to at least 75% of the minimum wage.

⁸ Inflation averaged 9.6% per annum between 1990 and 1996 in Jakarta. The real value of the Jakarta minimum wage increased by 50% over the period and Botabek's more than doubled.

Jakarta/Botabek border which indicates that they are part of an integrated market.

Historically, prior to its development, costs in Botabek may have been lower but our data show that by 1990 there is no systematic difference between manufacturing land rental costs per worker in Jakarta and Botabek.⁹

This anomaly in the minimum wage setting process has since been officially recognized by the West Java government which now sets different minimum wages for each of the four distinct regions in West Java (Botabek being one). Since then Botabek's minimum has equalled Jakarta's, whereas lower minimums were set for the other areas in West Java.

The different magnitudes of the increases in the minimum wages in Jakarta and Botabek in the years 1990-1994 creates a natural experiment in which to assess the impact of minimum wages on employment. We are also able to use the period over which the minimum is the same in both provinces to test the eligibility of our control group - that is, to test whether there are systematic differences in changes in employment between the two regions when the minimums are the same.

Possible Endogeneity of the Minimum Wage Setting Process

Although the government's ultimate goal was that minimum wages should cover the cost of a minimum needs consumption basket, local labor market conditions were explicitly allowed to affect the speed at which the minimum reached the government's consumption targets.¹⁰ The potential role for labor market conditions in the setting of the minimum

⁹ The rental costs data are not ideal as only total rental expenditure is given and we do not know the size of the rental property. We compared rentals costs per worker in Jakarta (for those firms that paid rent) with those in Botabek.

¹⁰ Provincial tri-partite councils (consisting of members from the provincial branch of the Ministry of Manpower, employee and employer delegates) were instructed to take labor market conditions into account when making minimum wage recommendations to the provincial governor. The governor then forwards the

wage raises the possibility that the legislated minimums may be endogenous.¹¹ An advantage of the approach used in this study is that we do not need to rely on the exogeneity of the wage setting process. Because both of the regions we examine are part of the same market - Greater Jakarta – there are no market differences that can explain the differences in the minimum wages. Also, as explained above, the initial difference in the Jakarta and Botabek minimum wages was an anomaly arising from the overall provincial level cost-of-living differential.

4. The extent of compliance and whether the minimum wage is binding.

A number of authors have documented the increased attention paid to enforcing compliance with the minimum wage legislation in Indonesia in the early 1990s. Manning (1998, p117) writes that “From around 1990 onwards the institutional framework changed significantly for modern sector firms. Increasing attention was paid by the government to the implementation of provincial minimum wage legislation ..., especially those (firms) close to major cities.”¹² Wild (1992, p116) states that the evidence on modern firms in Java “strongly suggests that urban and peri-urban industrial firms do pay the minimum.” The main enforcement mechanism of the Indonesian government is the public “shaming” of companies that fail to comply. Non-compliers receive a tiny fine of US\$50 but are also blacklisted. In order to be dropped from the blacklist, companies have

(possibly revised) recommendation to the Ministry of Manpower which has the final say. (This was the case in the 1990s but is likely to change under the current process of decentralisation.)

¹¹ Rama (1999) argues that this is unlikely to be the case because 1) the major impetus for the minimum wage increases was pressure from foreign governments (predominantly the US) and that this was not at all related to the Indonesian labor market; 2) the Indonesian government’s targets were based solely on the consumption bundle; and 3) labor market conditions seemed to play very little role in practice (provincial minimums were not closely related to average provincial productivity and labor costs).

¹² See also Rama (1999) and Rosner (1995).

to “confess guilt and pledge to apology (sic.)”, quote from *The Indonesia Times* in Rama (1999). Strikes by workers in non-complying firms are also part of the shaming process.¹³

In addition to there being compliance, the minimum wage must also be binding (set above the market clearing wage) if it is to have an employment effect. Table 2 provides preliminary evidence that this is the case. For instance, it shows that between 1989 and 1996 the average wage bill per worker in Botabek increased by 19.4 percentage points more than it did in Jakarta.¹⁴ We further confirm the anecdotal evidence on compliance and determine that the minimums were binding by examining the distribution of wages in West Java and Jakarta. If the minimum wage is binding and being complied with then those who were earning below the minimum will be pushed up to the minimum and a discontinuity or spike should appear close to the minimum wage. The data used for this exercise come from the Labor Force Survey (*Survei Angkatan Kerja Nasional = Sakernas*) which is conducted by the Indonesian Central Statistical Agency (Badan Pusat Statistik = BPS). Since 1994 the survey has been conducted annually.¹⁵ Prior to this it was conducted quarterly. The survey covers a random sample of the population. The Sakernas sample consists of approximately 65,000 households, or slightly more than 250,000 individuals across the nation. Of these, there are approximately 2000 adults working in manufacturing in Jabotabek in each year of the survey. We use data for the whole province of West Java when examining compliance rather than the smaller region

¹³ Certain labor intensive companies and small firms can apply for a 12 month postponement of the need to comply but this involves opening their books to the government and a written agreement either with the workers union or with a majority of workers. As a result few applications are made. Rama (1999) reports that during the early 1990s, there were never more than 135 requests per year nationwide.

¹⁴The average nominal wage bill per worker increased by 102.7% in Botabek between 1989 and 1996 relative to 83.3 percent in Jakarta.

¹⁵ It was conducted in July in 1994 and in August thereafter.

of Botabek because of the much smaller sample size for Botabek.¹⁶ The questions are the standard ones for labor force surveys around the world.¹⁷

Establishing compliance by examining labor force data is more difficult in a developing country context than in developed countries because of the large role played by the informal, uncovered sector and the difficulty of identifying informal sector workers. The Sakernas does not allow us to clearly identify formal and informal sector workers. To try and minimize the inclusion of informal sector workers we limited our sample to those employees aged 10 or more who report working at least 40 hours a week in the urban manufacturing sector. To increase the probability of being able to discern the impact of the minimum wage on the distribution of wages we further restrict our sample to female workers. Female workers are much more likely to receive the minimum wage than male workers (who are better paid); Rosner (1995).¹⁸ Ideally we would limit our sample to only the clothing/textiles/footwear/ leather sectors of the manufacturing industry here (as we do when examining the employment impacts) but the sample size precludes us from doing so.

Households in the Sakernas are asked the province in which they live. We do not know the province in which they work. To the extent that individuals travel across provincial borders to work, this will add some noise to our density plots.

¹⁶ The Survei Industri data allows us to calculate the average wage paid per production worker in each firm. The sample is large enough to allow us to plot the distribution of these averages for firms just in Botabek. Although these data are likely to be noisier because of the use of averages, they also show spikes at or close to the minimum.

¹⁷ For example, respondents are asked whether they have worked for at least one hour in the last week. If so, for how many hours? Questions are then asked about the sector of work, whether it is as an employee or self-employed, paid or unpaid. If they are an employee they are asked the amount of their earnings in the last week and the last month.

¹⁸ Rosner (1995) conducted a small survey of managers – 7 in the footwear industry, 4 in garments and an official from a footwear and textiles association. The interviewees all stated that the factories with which they were involved paid the minimum wage or more. While male workers may earn more than the minimum, it was reported that female workers more often earned the minimum only. See also Wolf (1992).

Figures 2 and 3 plot the kernel density estimates of self-reported monthly wages at different points in time between 1990 and 1996 for Jakarta residents and West Java residents respectively.¹⁹ The monthly minimum wage that is in force at the time is shown by a vertical line. In some cases the new and old minimum are shown (the old minimum being the vertical line to the left). The difficulty in discerning a spike is increased by the smoothing of the kernel density estimator. Nevertheless, spikes at or close to the minimum are evidenced in most of the figures.

Table A1 in the appendix shows the timing of minimum wage increases. The minimum wage in West Java was the equivalent of Rp1600/day from the 1st April 1990 until June 1st 1991. It then increased to Rp2100/day. Figure 2a plots the distribution of wages in West Java for the last three quarters of 1990, Figure 2b for the first two quarters of 1991 and Figure 2c the last two quarters in 1991. (Plotting the quarters separately was only possible in the earlier years in which the quarterly data was collected.) In all three figures there is a distinct peak almost exactly at the current minimum and there is no discernible peak at the old minimum just after the minimum increased (figure 2c).²⁰ There is some evidence in figure 2b that the increase on June 1st was anticipated because there is also a peak close to what was to become the new minimum. The minimum wage stayed at Rp2100/day until 1st September 1992. Figure 2d shows that the spike in the distribution remained at this level in the first three quarters of that year, it then moved to the right when the new minimum became effective in the 4th quarter. This pattern of the peak shifting with the minimum wage increases is repeated in the subsequent years. Also

¹⁹ A Epanechnikov kernel was used. The bandwidth was chosen by visual inspection of the plots, as suggested by Deaton (1997). Observations greater than Rp200000 were dropped to allow us to focus on the lower portion of the distribution.

²⁰ The daily rates in Table A1 are converted to monthly equivalents assuming a six day working week.

as expected in an economy with a positive inflation rate, the longer a minimum has been in place, the greater the percentage of the population that receives above the minimum.

The figures for Jakarta (figures 3a-g) show similar evidence that the minimum was binding. Only in 1990 (figure 3a) and 1992 (figure 3c) is there no spike at or close to the minimum.²¹

As anticipated, in both provinces a sizeable portion of the sample is receiving less than the minimum wage. These people are likely to be employed by small manufacturing businesses in the informal sector. The proportion receiving less than the minimum is higher in West Java which is less urban and the formal sector plays a smaller role.

5. Establishment Level Data

Having established that the minimum wage legislation is taken seriously, we now turn our attention to examining the employment impact of minimum wages. The data source we use is the Annual Survey of Manufacturing Firms (Survei Tahunan Perusahaan Industri, SI) from 1990 to 1996.²² These data are also collected by BPS. The data are collected at the establishment level and the survey is a census of all manufacturing establishments in the country with twenty or more employees. Owing to the size of these establishments, they are considered here as constituting the formal or covered sector of the labor market.

The survey provides detailed data on the establishments' businesses. This includes 5-digit industry codes, information on the number of employees (broken down by

²¹ The figure for the first three quarters of 1991 shows a peak just beyond the minimum. This is not surprising given that the minimum had already been in place for 12 months. Rama (1999) had similarly examined the Sakernas data by province for such spikes - although he only used the 1993 data and presents only one figure in the paper (for West Java). He also finds that "minimum wages affect the shape of the wage distribution".

production and non-production workers), the total wage bill, the percentage of foreign ownership, the proportion of the output that is exported, value-added per worker and land rental payments. Detailed geographic location information is also provided so we know whether a firm is in Jakarta or Botabek and also whether it is in one of the sub-districts immediately adjacent to the Jakarta/West Java border.²³ Establishment codes allow firms to be tracked over time.

There are 1224 firms involved in the clothing/textiles/footwear/leather sector (excluding batik) in Jabotabek in 1991 and 1519 in 1996.²⁴

6. Empirical Methodology

We obtain estimates of the employment impact by comparing the average change in the number of workers employed within firms in Jakarta with the average change within like firms over the border in Botabek.²⁵ This methodology thus differences out business cycle employment effects which are common to both Jakarta and Botabek. Any systematic difference in the Botabek and Jakarta averages is attributed to the only known difference between the regions – different minimum wages. One thus needs to ensure that there are no other differences between either firms or economic conditions in the two regions that could account for the different employment patterns. There are no other

²² We do not utilize data beyond 1996 for fear of contaminating our estimates with the impact of the Asian crisis which began in mid-1997.

²³ There are four levels of geographic division in Indonesia – provinces, districts (kabupaten/kotamadya), sub-districts (kecamatan) and villages (desa).

²⁴ This is after dropping a small number of irregular observations and batik firms. An examination of the 5 digit industry codes for those with a 2-digit code of 32 revealed that batik manufacturing is especially concentrated in Jakarta while there is very little batik manufacturing in Botabek. Because of its traditional origins, these firms are also more likely than others to be informal in nature. All other industries were pretty evenly spread across Jakarta and Botabek.

²⁵ The Survei Industri data provide information on the number of workers employed rather than the hours worked by employees. Most production workers in the clothing, textiles, leather and footwear industry

administrative reasons of which we are aware. There are however some systematic differences between firms in the two areas. Table 3 shows that on average firms are larger in Botabek than Jakarta and there are a larger percentage of foreign owned firms in Botabek. This suggests that firms in Jakarta may be more informal and may not be using the same level of technology as firms in Botabek. For this reason we calculate matched difference-in-difference estimates where we match on the basis of value-added per worker which acts as a proxy for the firm's production technology.²⁶ Our estimator is:

$$\hat{\beta} = \frac{\sum_{j=1}^J n_j (\Delta \bar{Y}_j^{JAK} - \Delta \bar{Y}_j^{BOT})}{\sum_{j=1}^J n_j} \quad (1)$$

where J denotes the number of per-worker-value-added cells, n_j is the number of firms in value-added cell j , and $\Delta \bar{Y}_j^{JAK}$ is the simple average across firms in Jakarta within value-added cell j of either 1) the change in the number of production workers employed between the initial and base year (for estimates in terms of changes in the number of workers); or 2) the proportional change in the number of production workers employed between the initial and base year (in the case of proportional estimates). $\Delta \bar{Y}_j^{BOT}$ is similarly defined for Botabek. That is, we calculate the employment change for each firm, calculate the average of this change within value-added cells for Botabek and Jakarta and then calculate a weighted average of the difference in these.

work full-time and work eight hour shifts (Wolf, 1992) so examining changes in the number of workers captures any significant employment changes.

²⁶ We also calculated matched difference-in-difference estimates on the basis of the predicted probability of a firm being in Jakarta using the propensity score method of Rosenbaum and Rubin (1983). These propensity scores were calculated from a logit with the dependent variable equalled one if the firm was in Jakarta and 0 if in Botabek. The independent variables were dummy variables reflecting the firms' 3-digit industry codes (clothing/textiles/footwear or leather), the proportion of foreign ownership, the proportion of

In addition to matching by value-added per worker, it is also desirable to differentiate by firm size and foreign ownership. Not only does this increase the likelihood of matching like with like, it also allows different firm types to experience different minimum wage impacts. For example, the increase in the minimum wage may constitute a greater burden on smaller businesses and so may affect them disproportionately. Similarly the behavior of foreign and domestic firms may differ owing to their different cost structures and the greater ability of multinational firms to absorb cost increases. For this reason we calculate separate estimates for small domestic firms (20-150 workers), large domestic firms (more than 150 workers with no foreign ownership) and large foreign firms (more than 150 workers with non-zero foreign ownership).²⁷ Small foreign firms are excluded because they are very few in number.

We focus on the employment of production workers because they are likely to be less skilled than non-production workers, more likely to be receiving the minimum wage and so more likely to be affected by the minimum wage increase. It may be that firms react to increases in the minimum wage by reallocating their labor demand towards more skilled workers. Below we also check to see whether any decrease in the employment of production workers is offset by an increase in the employment of non-production workers.

Finally, the base year must be a year in which minimum wages are equal across the two regions so that we are comparing changes from a position where we would expect firm employment to be the same in both regions. It is also important to match on the basis of value-added per worker in the base year because it may be affected by differing

total output that is exported and value-added per worker. Nearest neighbour matching was used in this case. Both methods generated the same results so we just present the results from matching on value-added.

²⁷ Almost all of the firms with some foreign ownership are majority foreign owned.

minimum wages. The minimum wage is equal across both regions from 1994 onwards - thus 1994, 1995 and 1996 are potential base years. The reported estimates use 1996 as the base year. This year is preferred on theoretical grounds because it is the most distant from the period in which the minimum wages differed. If the changes in the difference between minimum wages in Jakarta and West Java take more than a year to affect unemployment then employment in 1995 will still be contaminated by the different minimums and so not be an appropriate base year.²⁸

Center-Periphery Differences

Calculating the matched estimates aims to ensure that we are comparing like firms across the two regions. We may still be concerned however about differing economic conditions between the periphery of the city (Botabek) and those in the center in Jakarta proper. Note though that it is not accurate to characterize Jabotabek as consisting of a dense manufacturing center with less dense extremities. Henderson, Kuncoro and Nasution (1996) characterize Jabotabek as a “multi-centered metropolitan area (with some centers in Botabek) rather than one dominated by central city employment.” They find no significant correlation between the distance from the center of Jabotabek and employment density in 1991. They also emphasize that unlike the U.S. pattern of development which might see industry moving out of the center to the periphery of cities, the center of Jabotabek (particularly north Jakarta) is still a vibrant and growing manufacturing center. Nevertheless, we are able to test whether there is a systematic difference in employment growth between firms in Jakarta and Botabek in 1994-1996

²⁸ Note that if firms are still adjusting to the minimum wage changes in 1996 (two years after the minimums became equal) then this should generate systematic differences between the regions during 1994-1996 or 1995-1996. The results show no such systematic differences between these years.

and 1995-1996 when the minimum wages were the same in both regions. We also conduct a number of sensitivity tests which reduce or remove the propensity for center-periphery differences to bias the results. First we restrict the sample to those firms that are only very close to the Jakarta-Botabek border. Second, we construct an alternative control group from Botabek firms. Finally we use an estimator that subtracts off any persistent difference in employment growth rate between Jakarta and Botabek. These will be explained in more detailed below.

Firm Openings and Closures

It is only possible to calculate the matched employment impact estimate shown in equation 1 for firms that are open in the initial and final year of the comparison. For instance, the estimate of the employment impact between 1990 and 1996 uses data on only those firms that existed in these two years.²⁹ This enables us to identify whether employment decreased in firms that still exist in 1996, as predicted by the neo-classical model. Minimum wage increases will lead to further welfare losses if they result in less firms opening and more firms closing. To examine this issue we also calculate difference-in-differences in the net rate of firm openings between Botabek and Jakarta.

7. Results

Table 4 reports the difference-in-difference (DID) estimates of the employment impact when we match on value-added per worker. Five value-added per worker cells were

²⁹ Of firms that existed in 1991 (1995), 57% (86.4%) of firms are still in operation in 1996. Using a balanced panel of this sort is not unusual. Bell (1997) for example ignores firm closures. Card and Krueger attempted to control for closures by treating employment as zero in closed firms. Including closed firms in the sample in this way is not possible when calculating matched difference-in-differences because we don't know what the value-added per worker would have been in the base year (1996) for the firms that closed prior to that date

used.³⁰ It presents the employment impact estimates in two forms: as the impact on the number of production workers and the proportion of production workers employed. A negative estimate indicates a greater decrease in employment in Botabek than in Jakarta and so is consistent with the neoclassical prediction.

The first thing to note is that there is no systematic difference between the regions in the absence of minimum wage changes. None of the estimates are statistically significant for the periods in which the minimum wages were the same in both regions (1994-1996 and 1995-1996).

Examining the estimates for the years in which the minimum wage differed across the two regions shows no significant employment impact for large firms – domestic or foreign. All of the estimates for large foreign firms are negative but insignificant. Similarly, all estimates for large domestic firms are statistically insignificant (some positive and others negative). This is true of the estimates in terms of the number of workers and those in terms of the proportion of workers. The only statistically significant impacts occur for small, domestic firms. The point estimates in terms of the number of workers for the period 1991-1996 and 1992-1996 show a negative impact and are statistically significant (at the 10% and 5%) levels respectively. The estimate for 1990 to 1996 is also negative and is very close to significant at the 10% level (p -value = 0.101). The estimates in terms of proportions are also negative and significant at the 10% level for 1991-96 and 1992-96.

Hence it appears that the larger increase in the Botabek minimum may have reduced employment in small domestic firms relative to Jakarta. The point estimates are substantial in size. For example, between 1991 and 1996 firms in Botabek are estimated

³⁰ The results are not sensitive to the cell definitions. The cut-off points are 2000, 4000, 8000 and 15000

to have lost approximately 22 workers per firm relative to Jakarta. (Note that actual employment grew but by less than it did in Jakarta.) The point estimates decrease in magnitude as the initial year moves from 1991 to 1996. A comparison of the point estimates for 1991-96 and 1992-96 suggest that almost half of the total relative loss between 1991 and 1996 occurred in the first year. The magnitude of the relative employment loss in Botabek between 1991 and 1992 probably reflects not only the increase in the Botabek minimum relative to Jakarta over that period but also the lagged effects coming from the much larger relative increase between 1990 and 1991. The magnitude of the estimate for 1990- 1996 however presents a bit of a puzzle because although the difference in minimum wages between 1990 and 1996 is larger than between 1991 and 1996, the employment impact estimate is smaller in magnitude than the 1991-96 estimate. This may reflect the relative imprecision of the estimates. (The confidence intervals for the 1990-1996 and the 1991-1996 estimates overlap considerably.) It may also reflect lower compliance with the legislation in 1990 which is commonly viewed as the first year in which enforcement was treated seriously.

In proportional terms, the point estimates are also large. Employment in small firms in Jakarta grew at an average rate of 41% more than in West Java between 1991 and 1996. The proportional estimate is significantly different from zero only at the 10% level and the 10% confidence interval is 1.4% to 81% . The point estimate for 1992 to 1996 suggests a 16% relative employment gain in Jakarta.

These results are consistent with Rama (1999) who found that employment in smaller firms may have been adversely affected by the minimum wage increases, while large firms were unaffected (or even experienced a small positive effect).

thousand rupiah per worker per annum.

Sensitivity Tests

As noted above, for neither small firms, large firms, domestic or foreign firms is there a systematic difference in the changes in employment between Jakarta and Botabek in the period 1995 to 1996 - when the minimum wages are the same in the two regions. This is consistent with our identifying assumption of no systematic difference in employment patterns in the absence of minimum wage differences. Nevertheless, we conduct the following sensitivity tests to further reduce the concerns that center-periphery differences are driving the results.

a. Firms close to the Jakarta/West Java border

The first sensitivity test conducted restricts the sample to only sub-districts (kecamatan) that are directly on the West Java/Jakarta border. Sub-districts are quite small areas. There are about 130 subdistricts in Jabotabek. Looking only at this narrow band reduces the probability of the estimates being contaminated by systematic differences in economic conditions between the center and in the periphery. Table 5 presents the results for changes in the number of workers.³¹ The results for large firms – domestic and foreign – are the same as the original results. The estimates are statistically insignificant for every pair of years. The point estimates for small firms still suggest a negative impact for 1990-96, 1991-96 and 1992-96, however unlike the previous set of results, the estimates for small firms are now also statistically insignificant.

b. High Wage/Low Wage Comparisons

³¹ The proportional results are qualitatively the same and are available from the authors on request.

The second sensitivity test compares high wage firms in Botabek with low wage firms, also in Botabek. Using a control group from within Botabek is another way of avoiding the problems that might arise from comparing the center with the periphery.³² High wage firms are defined to be those firms who in the initial year on average are already paying the 1996 minimum.³³ They thus do not have to increase the wages they are paying to meet the new minimum and as such should be unaffected by the minimum wage increase. Low wage firms are all other firms. The estimates in Table 5 show that there is no significant difference in the change in employment in large foreign low wage firms in Botabek relative to large foreign high wage firms in the same area. For large domestic firms some of the estimates are statistically significant at the 10% level. They however suggest a positive employment impact. The estimates for small domestic firms are statistically insignificant.

c. Difference-in-Difference-Difference Estimates

The final sensitivity test conducted involves calculating difference-in-difference-in-difference (DIDID) estimators. That is, we subtract the change in employment experienced by the firm between 1995 and 1996 (when minimum wages in Jakarta and Botabek were the same) from the change experienced when the minimum wages were changing by different amounts. Thus this estimator allows that there may be a systematic difference in employment growth rates between firms in Botabek and Jakarta (between 1995 and 1996) and differences this out when calculating the employment impact estimator. More formally, the DIDID estimator is the same as the straight difference-in-

³² It does raise the question though as to whether high wage firms are an appropriate control – if they are the same as low wage firms, why are they paying higher wages?

³³ This is on the basis of dividing the firm's wage bill by the total number of workers.

difference estimator above except that $\Delta \bar{Y}_j^{JAK}$ and $\Delta \bar{Y}_j^{BOT}$ are now calculated as the simple average across firms in Jakarta within value-added cell j of the change in employment net of that which is expected on the basis of the employment change between 1995 and 1996. For instance, when calculating the estimate of the minimum wage increase between 1991 and 1996, $\Delta \bar{Y}_j^{JAK}$ is the simple average across firms in Jakarta of the change in employment from 1991 to 1996 (within the same value-added cell) minus five times the employment change experienced by the firm between 1995 and 1996.

We have already seen that the employment impacts between 1995 and 1996 in Table 4 are all statistically insignificantly different from zero. This suggests that there is no need to do difference-in-difference-in-difference estimates. The D-I-D-I-D estimates are presented here for completeness.

Table 5 shows that this method produces insignificant employment impact estimates for large domestic firms and small domestic firms. For large foreign firms it results in some positive impacts. That the estimate of the employment change 1995 to 1996 was insignificant, paired with the observation that the DIDID point estimates for large foreign firms are large and significant only in the later years, rather than in the earlier years when the largest relative minimum wage changes occurred, suggests that less reliance should be placed on these estimates.

In summary our results provide no evidence that minimum wage increases decrease formal sector employment in large firms. Not one of the 58 estimates for large firms suggests such a relationship. The initial estimates for small firms do show a

negative impact in some years. This effect however disappears when alternative control groups are used.

Rates of Firm Openings and Closures

The estimates above were calculated for firms that operated throughout the entire period and so ignored firm openings and closures. Table 6 presents the difference-in-difference results for the rate of net firm openings. These are calculated by subtracting the change in the net opening rate between the initial year and the base period in Jakarta from the similarly calculated change in Botabek:

$$\hat{\eta}_{9296} = \left\{ \frac{(N_{BOT}^{O,96} - N_{BOT}^{C,96})}{N_{BOT}^{95}} - \frac{(N_{BOT}^{O,92} - N_{BOT}^{C,92})}{N_{BOT}^{91}} \right\} - \left\{ \frac{(N_{JAK}^{O,96} - N_{JAK}^{C,96})}{N_{JAK}^{95}} - \frac{(N_{JAK}^{O,92} - N_{JAK}^{C,92})}{N_{JAK}^{91}} \right\} \quad (2)$$

where $N_{BOT}^{O,96}$ denotes the number of firms in Botabek that opened in 1996, $N_{BOT}^{C,96}$ denotes the number of firms in Botabek that closed in 1996, N_{BOT}^{96} denotes the total number of firms in Botabek in 1996 and the variables for Jakarta are defined analogously.³⁴

Of the 12 estimates presented in Table 6, only one – for large foreign firms between 1992 and 1996 - is significant (p-value= 0.064). It however is positive and suggests that for foreign firms the larger increase in the minimum wage in Botabek was associated with an increase in the net opening rate of firms in that province. Hence, table

³⁴ These estimates are in terms of the number of firms rather than the number of production workers because they are calculated from the backcast SI data which doesn't provide information on the number of workers. The backcast data supplements the regular SI data. Firms first appear in the regular data set when they are initially detected by BPS. If this is not actually the firm's first year of operation as a medium or large firm, a shorter array of supplementary questions is asked about previous years of operation and forms the backcast data. A comparison of the regular SI data with the backcast data revealed that a not insignificant number of firms were operating prior to their first year in the regular data. Hence it is more

6 provides no evidence in favor of a negative employment impact coming through firm openings or closures.³⁵

The Informal Labor Market

The theoretical models discussed above that incorporate an uncovered sector predict a reallocation of labor from the formal (or covered) sector to the informal (or uncovered) sector as a result of minimum wage increases in the former. Workers who are displaced from the uncovered sector will move to the uncovered sector.³⁶ Given that we find little evidence of the predicted negative employment impact in the formal sector, we would not expect to find a large employment impact in the informal sector – although if people did lose their jobs in small, domestic firms then this may result in an increase in informal sector employment. We examined the Labor Force Survey for an increase in the percentage of working women who are working in the informal manufacturing sector. As mentioned above, it is difficult to clearly identify whether an individual works in the formal or informal sector. Here we define the informal sector to be those who are self-employed without regular help or engaged in unpaid work.³⁷ We calculate standard difference-in-differences for the period 1990 to 1996 and find no significant difference between Jakarta and West Java in terms of the percentage of working women who are in the informal sector.

appropriate to use the backcast data for the examination of firm openings and closures. Note also that we are treating firms with less than 20 employees as being closed, or not yet opened.

³⁵ The reported estimates are not broken down by firm size. This is because most new firms are likely to be small and firms may downsize before finally closing. The estimates however remain insignificant if broken down by the size of the firm. We also calculated difference-in-differences for opening rates and closure rates separately. These produced qualitatively similar results.

³⁶ There may also be some movement in the other direction. Some uncovered sector workers might be tempted to quit their low paying jobs and choose to queue for the now more lucrative covered sector jobs. Although individuals are likely to be able to work in the uncovered sector in Jabotabek while “queuing” for formal sector work). This effect will be larger the higher the turnover rate in the covered sector.

It would also be interesting to examine the impact of the minimum wage increase on informal sector earnings but these data are not available for Indonesia.³⁸

8. Possible Explanations

With recent minimum wage studies not finding strong negative employment impacts, and some finding a positive impact, attention has turned to possible theoretical causes of a positive or insignificant association between minimum wages and employment. The most obvious contender is the text book monopsony model which shows that if the employer is a monopsonist then, over a certain range, minimum wages need not cause employment to decrease. The traditional monopsony model is often not very palatable because most industries (as is the case here) cannot be characterized as monopsonies. However, Card and Krueger (1995) argue that in the short term search costs lock employees into working for their current employer and so the only way for other firms to increase employment is to offer a higher wage. Hence, the monopsony result may even hold in markets that appear to be perfectly competitive.

Another candidate explanation for an increase in employment is that firms react to the increase in their labor costs by increasing the efficiency of their labor force (or employees raise their effort levels as in efficiency wage models). See Brown (1999). The monopsony model is not very amenable to testing. We are however able to examine

³⁷ Comparisons will also be complicated by the high mobility of workers across the Botabek/Jakarta border.

³⁸ There is no data source in Indonesia that allows identification of informal sector employees and collects earnings data at regular enough intervals to allow comparisons with the minimum wage. An obvious alternative to factory work for formal sector female employees who find themselves unemployed is to work as a household servant. The income module of the Survei Socio-Economic Nasional (Susenas) which is conducted three-yearly identifies live-in household servants but does not allow us to identify their earnings separately from other householders. We did however calculate differences-in-difference estimates from the proportion of the adult population working as live-in household servants in the 1993 and 1996 Susenas surveys and they also showed no significant impact of the minimum wage increase.

changes in firms value-added per worker and so assess whether there is any evidence of the increases in firm productivity (via the efficiency wage, or any other, route).

Admittedly the value-added data are likely to be somewhat noisy but we calculate standard difference-in-difference estimates for value-added per worker for small domestic, large foreign and large domestic firms. We found no significant difference in changes in value-added per worker between Jakarta and Botabek.³⁹

Another testable prediction put forward in the literature is whether firms substitute towards skilled labor following a minimum wage increase. Given that we do not pick up any decrease in unskilled workers in large firms, we would not expect to see any such increase in the employment on skilled workers in these firms. However, if our estimates in table 4 are accurate for small, domestic firms then it may be that the employment of skilled workers has increased in these firms, while unskilled worker employment has declined. Difference-in-difference estimates of the number of non-production (skilled) workers however reveal no significant difference in changes in non-production employment between Jakarta and Botabek.

What explanations remain then for our insignificant results? There are three main possibilities. First, maybe labor costs in Indonesia (and other developing countries) are such a low share of total costs that even large percentage increases yield negligible increases in total costs. ILO (2000) reports that in the European Union clothing sector labor costs average 60% of total costs excluding raw material costs. The comparable figure for clothing firms in our sample is 60.4%. Hence, the insignificant results cannot be explained by unusually low labor cost shares. Labor's cost share is however significantly lower for large firms than small firms which may explain some of the

³⁹ Results available from authors on request.

difference between firms of different sizes. Labor costs are 31.2% of total costs for small firms and 20.1% for large firms.

A second possible explanation is that Indonesian manufacturers may have been able to increase their prices in response to the increasing costs. ILO (2000) shows that Indonesia has the lowest labor costs in the world in the textiles, clothing and footwear sectors, significantly lower than China and India. If demand is relatively inelastic in this range, firms may have been able to increase their prices and maintain their output. Increased prices would theoretically increase value-added per worker and so should have been picked up in difference-in-difference estimates of value-added per worker (if the value-added data are sufficiently accurate). Alternatively, maybe profit margins are so large in the export market (as a result of the low labor costs) that the firms merely were able to accept slight profit declines.

A further possible explanation is that even with a 35% relative increase in minimum wages in Botabek relative to Jakarta and information on *all* firms (of over 20 employees) in the Jabotabek region, the employment impact may be still too small, or the employment data too inaccurate, to allow the identification of the negative effect. It is not clear how the data could be improved – the sample size cannot be increased and there is no reason to suspect that the data is unusually noisy. On balance this suggests that the employment impact is not very large.

8. Conclusion

The results presented above provide no evidence that increases in minimum wages reduce employment in large firms – foreign or domestic. Not one of the many estimates presented here are negative for these firms. In contrast, the base difference-in-difference

estimates for small, domestic firms do show a negative employment impact. There was no evidence of more firm closures or less openings resulting from the minimum wage increase for any type of firms. More research is needed – in the face of the ambiguity of the results presented here for small firms and the lack of such research in other countries – to establish the robustness of these findings.

With regard to foreign firms, although they have the reputation of being very sensitive to wage relativities, the evidence presented here shows that they do not seem to reduce employment in the face of minimum wage increases. In the six year period studied, there was also no evidence of relocation in response to the minimum wage increases. It may be that the wage increases, although quite substantial, were small relative to relocation costs. Alternatively, six years may be too short a period in which to capture relocation decisions. It may also be that with Indonesia offering such low labor costs (even after the increases) firms have nowhere cheaper to go.

In addition to our finding of no significant effect on firm openings and closures, it is noteworthy that there was a 44% increase in the number of large foreign firms operating in Jabotabek between 1991 and 1996, during which period the real minimum wages increased by slightly more than 50% in real terms. The impact of minimum wage increases on foreign firm exit and entry decisions is an area worthy of further research.

As a final proviso, these estimates are calculated from data covering a period of sustained economic growth. It is not clear to what extent they carry over to the present, more fragile, post-Asian crisis situation.

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**Table 1: Monthly Minimum Wages in Jakarta and Botabek
(Average over Calendar Year in Rupiah)**

| Year | Botabek | Jakarta | % Difference Between Botabek and Jakarta |
|------|---------|---------|--|
| 90 | 41186 | 55800 | 35.5 |
| 91 | 50264 | 57571 | 14.5 |
| 92 | 60229 | 67536 | 12.1 |
| 93 | 69086 | 79714 | 15.4 |
| 94 | 100971 | 100971 | 0 |
| 95 | 122229 | 122229 | 0 |
| 96 | 147557 | 147557 | 0 |

Table 2: Monthly Cash Wage Paid to Production Workers (SI)

| | Mean Cash Wages | | | Median Cash Wages | | |
|-----------|-----------------|---------|--------|-------------------|---------|--------|
| | Jakarta | Botabek | % diff | Jakarta | Botabek | % diff |
| 1986 | 841 | 795.5 | -5.4 | 630.1 | 592.5 | -6.0 |
| 1989 | 1076 | 1056 | -1.9 | 817.6 | 717 | -12.3 |
| 1991 | 1091 | 963 | -11.7 | 936 | 791 | -15.5 |
| 1992 | 1334 | 1137 | -14.8 | 1050 | 930 | -11.4 |
| 1993 | 1507 | 1392 | -7.6 | 1218 | 1175 | -3.5 |
| 1994 | 1485 | 1695 | 14.1 | 1350 | 1380 | 2.2 |
| 1995 | 1727 | 1769 | 2.4 | 1500 | 1545 | 3.0 |
| 1996 | 1972 | 2140 | 8.5 | 1740 | 1846 | 6.1 |
| 1989-1996 | 83.3 | 102.7 | 19.4 | 112.8 | 157.5 | 44.6 |

*The 1990 figures are omitted because the SI data for this year does not allow identification of the firms' location beyond province. (We were able to calculate the DID estimates for established firms in 1990 by keeping only those firms in 1990 that were operating in Botabek or Jakarta in 1996.)

Table 3: Comparisons of Botabek and Jakarta Firms, 1996

| | Jakarta | Botabek |
|---------------------------------------|---------|---------|
| Number of workers per firm | 159.7 | 424.1 |
| Firms with some foreign ownership (%) | 4.4 | 17.2 |
| Value-added per worker ('000 Rp p.a.) | 7112 | 11294 |
| Proportion of Product Exported | 12.0 | 31.0 |
| N | 985 | 534 |

Table 4: Jabotabek Matched Difference-in-Difference Estimates
(Matching on basis of Value-Added)

BASE YEAR = 1996

CHANGE IN THE NUMBER OF PRODUCTION WORKERS EMPLOYED (Target Year to 1996)

| Target Year | Base Year | Small/Domestic | | | | | | Large/Domestic | | | | | | Large/Foreign | | | | | |
|-------------|-----------|------------------|------------------|-------|-----------|---------|------------------|------------------|-------|-----------|-------|------------------|------------------|---------------|-----------|-------|--|--|--|
| | | N ^{BOT} | N ^{JAK} | Coeff | Std Error | t | N ^{BOT} | N ^{JAK} | Coeff | Std Error | t | N ^{BOT} | N ^{JAK} | Coeff | Std Error | t | | | |
| 1990 | 1996 | 52 | 269 | -12.4 | 7.57 | -1.64 | 113 | 82 | 40.7 | 46.16 | 0.88 | 27 | 17 | -94.2 | 146.4 | -0.64 | | | |
| 1991 | 1996 | 67 | 322 | -22.1 | 12.23 | -1.81* | 144 | 94 | 35.4 | 51.4 | 0.69 | 46 | 21 | -99.7 | 124.8 | -0.80 | | | |
| 1992 | 1996 | 79 | 399 | -12.3 | 5.6 | -2.20** | 155 | 108 | 32.69 | 44.62 | 0.73 | 58 | 29 | -45.2 | 96.5 | -0.47 | | | |
| 1993 | 1996 | 98 | 458 | -5.05 | 4.67 | -1.08 | 172 | 119 | 9.81 | 34.4 | 0.29 | 65 | 29 | -36.4 | 82.6 | -0.44 | | | |
| 1994 | 1996 | 126 | 528 | -3.13 | 3.21 | -0.98 | 191 | 127 | 3.81 | 30.2 | 0.13 | 72 | 31 | -98.8 | 106.4 | -0.93 | | | |
| 1995 | 1996 | 176 | 634 | -2.15 | 1.83 | -1.17 | 209 | 147 | -18.7 | 19 | -0.98 | 75 | 32 | -159.8 | 99.6 | -1.60 | | | |

PROPORTIONAL CHANGE IN THE NUMBER OF PRODUCTION WORKERS EMPLOYED (Target Year to 1996)

| Target Year | Base Year | Small/Domestic | | | Large/Domestic | | | Large/Foreign | | |
|-------------|-----------|----------------|-----------|--------|----------------|-----------|-------|---------------|-----------|-------|
| | | Coeff | Std Error | t | Coeff | Std Error | t | Coeff | Std Error | t |
| 1990 | 1996 | -0.20 | 0.154 | -1.30 | 0.054 | 0.078 | 0.70 | -0.077 | 0.235 | -0.33 |
| 1991 | 1996 | -0.41 | 0.240 | -1.71* | 0.037 | 0.081 | 0.46 | -0.028 | 0.159 | -0.18 |
| 1992 | 1996 | -0.16 | 0.094 | -1.70* | 0.032 | 0.072 | 0.44 | 0.007 | 0.141 | 0.05 |
| 1993 | 1996 | -0.016 | 0.061 | -0.26 | -0.031 | 0.054 | -0.57 | -0.036 | 0.122 | -0.30 |
| 1994 | 1996 | 0.01 | 0.051 | 0.20 | -0.039 | 0.05 | -0.78 | -0.076 | 0.121 | -0.63 |
| 1995 | 1996 | -0.006 | 0.033 | -0.18 | -0.047 | 0.035 | -1.34 | -0.158 | 0.105 | -1.50 |

Table 5: Sensitivity Tests
(Matched Difference-in-Difference Estimates - Matching on basis of Value-Added)

CHANGE IN THE NUMBER OF PRODUCTION WORKERS EMPLOYED (Target Year to 1996)

REGENCIES ON THE JAKARTA/WEST JAVA BORDER

| Tgt Year | Base Year | N ^{BOT} | Small/Domestic | | | | N ^{BOT} | Large/Domestic | | | | N ^{BOT} | Large/Foreign | | | |
|----------|-----------|------------------|------------------|-------|-----------|-------|------------------|------------------|-------|-----------|-------|------------------|------------------|--------|-----------|---------|
| | | | N ^{JAK} | Coeff | std error | t | | N ^{JAK} | Coeff | std error | t | | N ^{JAK} | Coeff | std error | t |
| 1990 | 1996 | 18 | 174 | -9.83 | 11.76 | -0.84 | 28 | 77 | 7.26 | 59.3 | 0.12 | 6 | 16 | -206.7 | 99.7 | -2.07** |
| 1991 | 1996 | 23 | 219 | -10.2 | 6.95 | -1.47 | 43 | 87 | 19.4 | 65.2 | 0.3 | 17 | 20 | -94.7 | 137.5 | -0.69 |
| 1992 | 1996 | 30 | 275 | -5.41 | 6.77 | -0.8 | 45 | 101 | 19.6 | 63.4 | 0.31 | 17 | 28 | -27 | 106.5 | -0.25 |
| 1993 | 1996 | 36 | 320 | 2.13 | 5.57 | 0.38 | 47 | 111 | -15.9 | 49.7 | -0.32 | 18 | 28 | -48 | 96.9 | -0.5 |
| 1994 | 1996 | 47 | 375 | 3.53 | 2.88 | 1.23 | 52 | 117 | 10.7 | 37.9 | 0.28 | 20 | 30 | -146.4 | 139.1 | -1.05 |
| 1995 | 1996 | 61 | 461 | 2.07 | 1.43 | 1.45 | 57 | 134 | -29.7 | 21.7 | -1.37 | 20 | 31 | -176 | 133.2 | -1.32 |

HIGH WAGE/LOW WAGE

| Tgt Year | Base Year | N _{low} | Small/Domestic | | | | N _{low} | Large/Domestic | | | | N _{low} | Large/Foreign | | | |
|----------|-----------|------------------|-------------------|-------|-----------|--------|------------------|-------------------|-------|-----------|-------|------------------|-------------------|-------|-----------|------|
| | | | N _{high} | Coeff | std error | t | | N _{high} | Coeff | std error | t | | N _{high} | Coeff | std error | t |
| 1990 | 1996 | 48 | 4 | -18.1 | 6.0 | 3.03** | 101 | 12 | -18.4 | 91.7 | 0.20 | 23 | 4 | 15.3 | 53.0 | 0.29 |
| 1991 | 1996 | 58 | 9 | -12.8 | 15.5 | -0.83 | 123 | 21 | 97.6 | 54.4 | 1.79* | 36 | 10 | 86.9 | 123.6 | 0.70 |
| 1992 | 1996 | 64 | 15 | -4.82 | 14.3 | -0.34 | 109 | 46 | 120.2 | 69.1 | 1.74* | 35 | 23 | 79.8 | 86.7 | 0.92 |
| 1993 | 1996 | 75 | 23 | 10.8 | 13.7 | 0.79 | 103 | 69 | -19.4 | 55.2 | -0.35 | 25 | 40 | 95.8 | 81.4 | 1.18 |
| 1994 | 1996 | 80 | 46 | 6.1 | 9.4 | 0.65 | 88 | 103 | 28 | 37.8 | 0.74 | 28 | 44 | 84.4 | 56 | 1.51 |
| 1995 | 1996 | 99 | 177 | 3.6 | 3.2 | 1.13 | 76 | 133 | 42.4 | 25.6 | 1.66* | 13 | 62 | 14.4 | 47.7 | 0.30 |

DIFFERENCE-IN-DIFFERENCE-IN-DIFFERENCES

| Tgt Year | Base Year | N ^{BOT} | Small/Domestic | | | | N ^{BOT} | Large/Domestic | | | | N ^{BOT} | Large/Foreign | | | |
|----------|-----------|------------------|------------------|-------|-----------|-------|------------------|------------------|-------|-----------|------|------------------|------------------|--------|-----------|--------|
| | | | N ^{JAK} | Coeff | Std Error | t | | N ^{JAK} | Coeff | Std Error | t | | N ^{JAK} | Coeff | Std Error | t |
| 1990 | 1996 | 52 | 267 | 12.2 | 21.79 | 0.56 | 112 | 80 | 85.0 | 159.5 | 0.53 | 27 | 17 | 1261.3 | 618.1 | 2.04** |
| 1991 | 1996 | 67 | 321 | -8.85 | 13.67 | -0.65 | 143 | 92 | 91.0 | 114.8 | 0.79 | 46 | 21 | 510.2 | 383.6 | 1.33 |
| 1992 | 1996 | 79 | 396 | -3.05 | 9.99 | -0.31 | 154 | 106 | 87.3 | 83.6 | 1.04 | 58 | 29 | 263.6 | 191.9 | 1.37 |
| 1993 | 1996 | 98 | 457 | 6.13 | 6.58 | 0.93 | 171 | 117 | 48.8 | 56.3 | 0.87 | 65 | 29 | 226.4 | 133.2 | 1.70* |
| 1994 | 1996 | 126 | 526 | 4.21 | 2.82 | 1.49 | 191 | 125 | 31.8 | 29.6 | 1.07 | 72 | 31 | 226.2 | 105.2 | 2.15** |

Table 6: Difference-in-Difference Estimates of Net Openings
(1996 - Target Year)

| ALL FIRMS | | | | | | | |
|------------------|---------------------------------|----------|---------------------------------|----------|------------------|---------|--|
| Target Year | Net Opening Rate in Botabek (%) | | Net Opening Rate in Jakarta (%) | | DID Estimate (%) | t-value | |
| | 1996 | Tgt Year | 1996 | Tgt Year | | | |
| 1992 | -2.19 | 5.39 | -7.78 | 3.33 | 3.53 | 1.11 | |
| 1993 | -2.19 | 3.74 | -7.78 | -0.24 | -0.55 | -0.18 | |
| 1994 | -2.19 | 4.93 | -7.78 | 1.51 | 2.17 | 0.77 | |
| 1995 | -2.19 | 7.6 | -7.78 | 1.68 | -0.33 | -0.12 | |

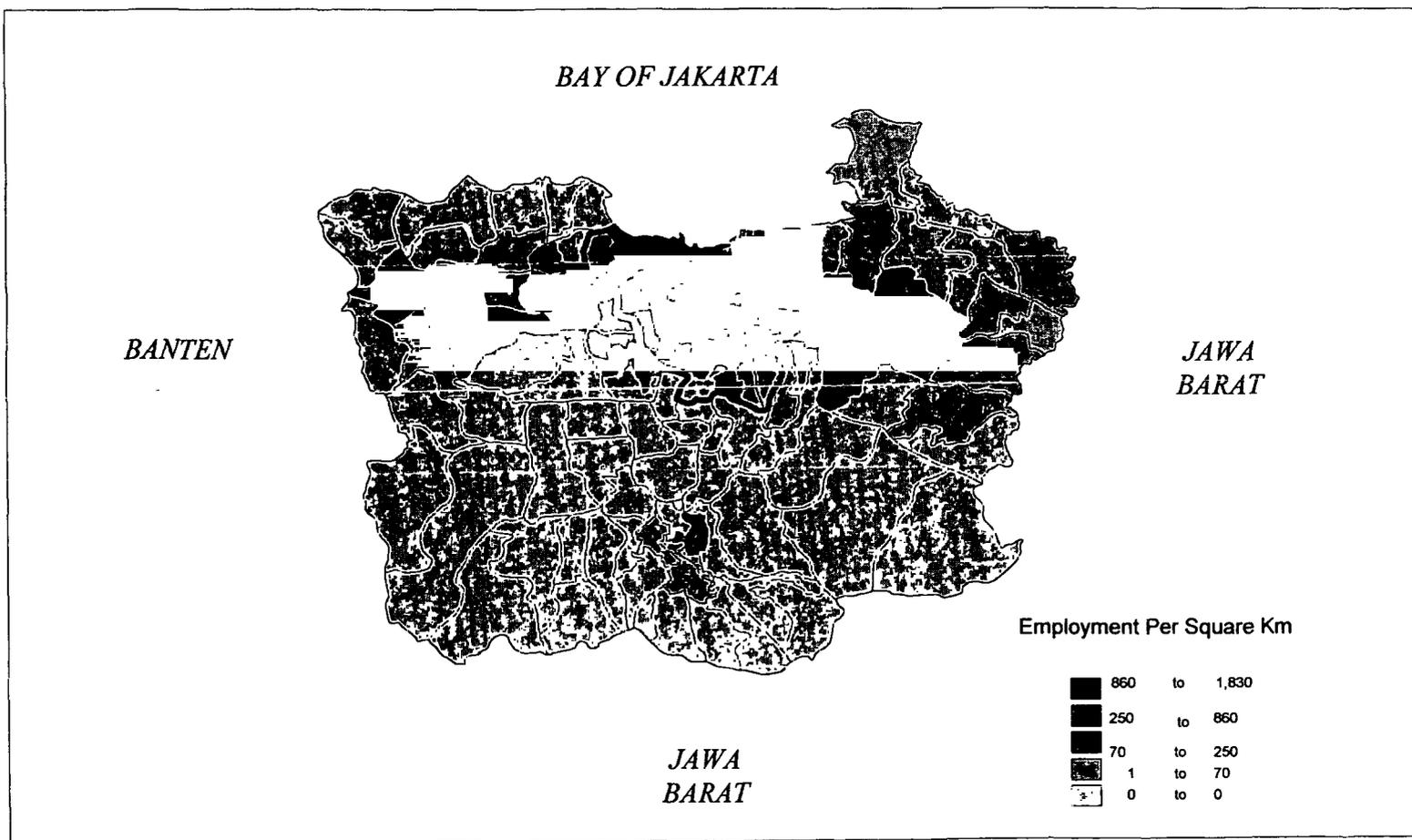
| DOMESTIC FIRMS | | | | | | | |
|-----------------------|---------------------------------|----------|---------------------------------|----------|------------------|---------|--|
| Target Year | Net Opening Rate in Botabek (%) | | Net Opening Rate in Jakarta (%) | | DID Estimate (%) | t-value | |
| | 1996 | Tgt Year | 1996 | Tgt Year | | | |
| 1992 | -2.67 | 4.31 | -7.76 | 2.59 | 3.37 | 0.96 | |
| 1993 | -2.67 | 3.65 | -7.76 | -2.43 | -0.99 | -0.3 | |
| 1994 | -2.67 | 4.70 | -7.76 | 1.89 | 2.28 | 0.72 | |
| 1995 | -2.67 | 9.19 | -7.76 | 1.89 | -2.21 | -0.72 | |

| FOREIGN FIRMS | | | | | | | |
|----------------------|---------------------------------|----------|---------------------------------|----------|------------------|---------|--|
| Target Year | Net Opening Rate in Botabek (%) | | Net Opening Rate in Jakarta (%) | | DID Estimate (%) | t-value | |
| | 1996 | Tgt Year | 1996 | Tgt Year | | | |
| 1992 | 0 | 10.2 | -8.33 | 20.5 | 18.6 | 1.85* | |
| 1993 | 0 | 4.12 | -8.33 | -1.89 | 2.32 | 0.34 | |
| 1994 | 0 | 5.94 | -8.33 | -5.77 | -3.38 | -0.43 | |
| 1995 | 0 | 0.93 | -8.33 | -2.04 | 5.36 | 0.64 | |

* Estimates cannot be calculated for 1991 because the SI data do not provide kabupaten codes for 1990 so don't know the total number of firms operating in that year, as required by Equation 2.

Figure 1:

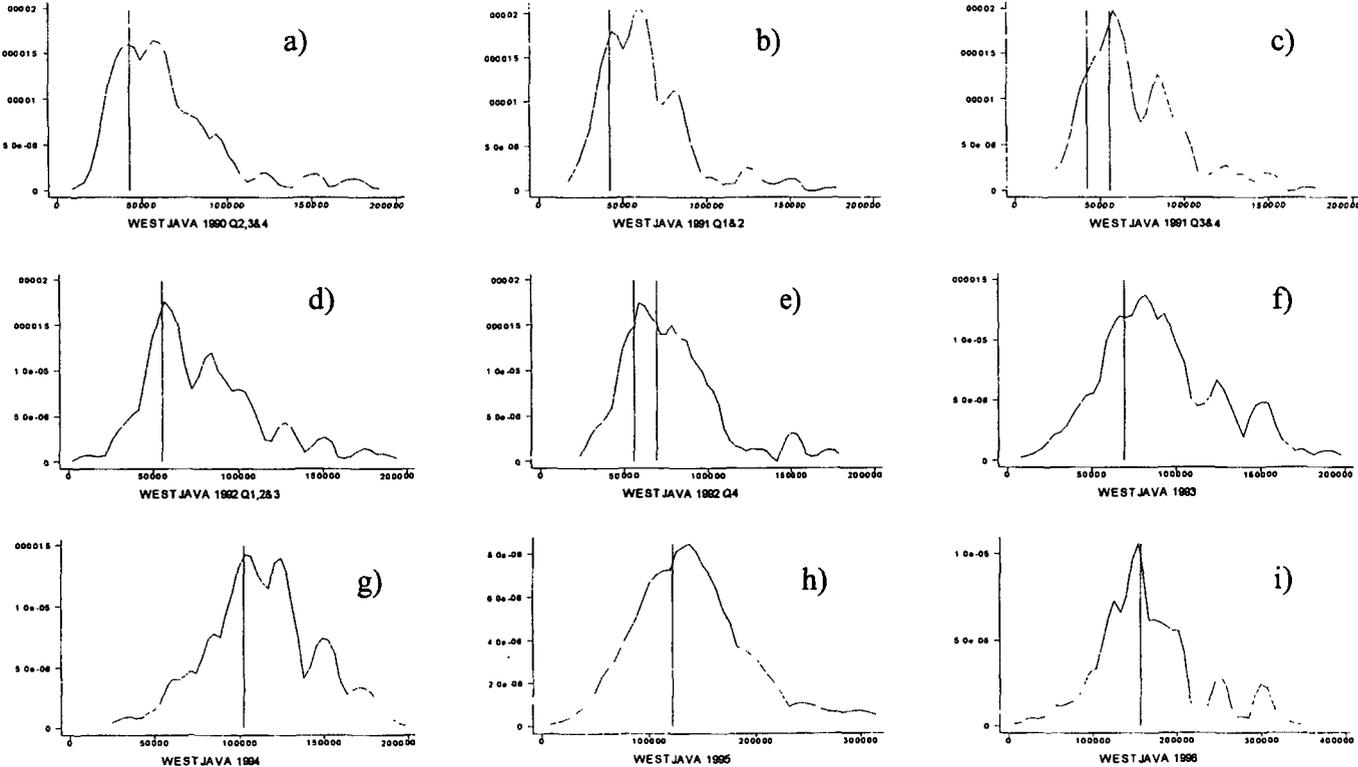
Manufacturing Employment Density in Jabotabek, 1991.



The province of D.K.I. Jakarta is in the center. The D.K.I. Jakarta province boundary is depicted as a dark line.

Figure 2.

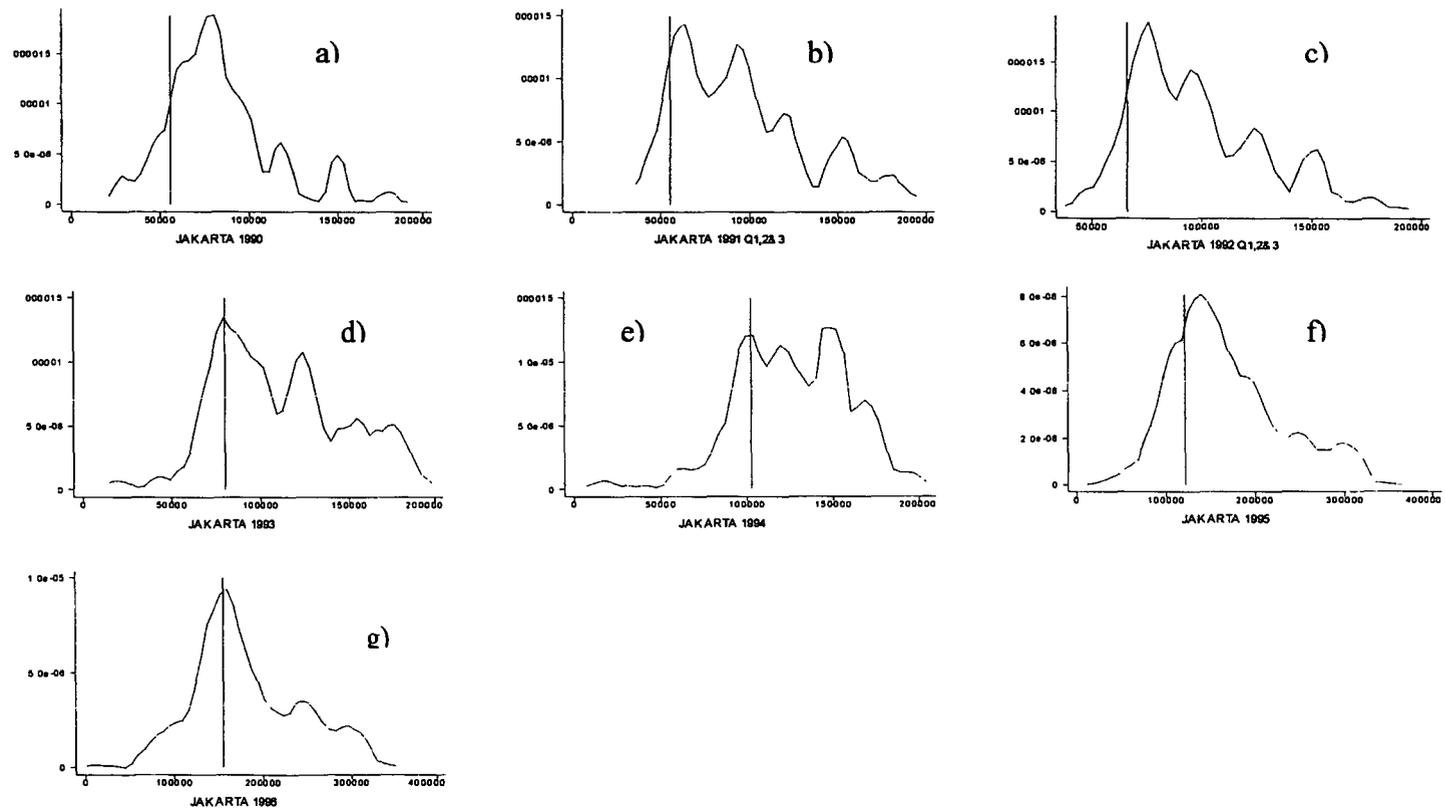
Kernel Density Estimates of Monthly Wage Distribution: WEST JAVA



Based on Sakernas Data

Figure 3

Kernel Density Estimates of Monthly Wage Distribution: JAKARTA



Based on Sakernas Data

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