DETERMINANTS OF LAY-OFFS DURING INDONESIAN ECONOMIC CRISIS WITH SPECIAL ATTENTION TO SPATIAL EFFECTS

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Abstract

Seeking the determinants of the lay-off process that takes place at the onset of Indonesian economic crisis in Java island, this study robustly shows that the lay-off rate, i.e., the ratio of number of lay-offs to the size of the labor force, is negatively related to the economic growth rate and share of labor in informal sector; and is positively related to the unemployment rate at the district and municipality level. Further, this study also confirms the empirical significance of spatial effects. Suggesting the existence of interregional spillover effect, the latter implies some degree of integration in the district-level lay-off process as well as, most likely, labor market.

Keywords

Labor market, economic crisis, layoff determinant, spatial effect, Asia, Indonesia.

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1 Introduction

One major economic phenomenon striking Indonesian economy during the 1997 economic crisis, other than the price hike, is widespread lay-offs. For many people, concerns about the lay-offs are so great that it haunts their life on a daily basis. News about firms in financial trouble that are planning to lay off workers is featured daily in newspapers. Statistically, the attention toward lay-offs during the crisis is fewer than toward, the much more-widely discussed, unemployment phenomenon. In retrospect, lay-offs would be better reflecting the severity of the economic crisis because they are the most visible outcome of contractions in production and in the economy as a whole. Different from unemployment, lay-off-related variable is not 'cluttered' with crisis's adjustment mechanism. Note that in the system with no unemployment benefits, it is hard to be unemployed. The latter relates to a very specific definition of working, i.e., earning income, within the last week of survey, for at least an hour. Hence, the 1998 National Labor Survey (*Sakernas*) reports a mere increase of 0.4% unemployment from the 1997 rate. With a labor force of 90 million nationwide, the percentage translates to less than 0.4 million additional unemployment. On the other hand, using the 1999 National Household Survey (*Susenas*), the number of lay-off during mid-1997 to early-1999 in Java alone was more than two million, approximately about 3.8% of the number of workers.

Despite the widespread grief, it is widely noted that Indonesian regional governments are not at the forefront when it comes to mitigating impacts of the crisis. Instead, local governments generally play a mere supporting role to the central government's program.[1] There are two reasons for this. First, the crisis affects nationwide; resulting in a typical attitude that crisis-related policy is the purview of the national government. A suggestion made by Dhanani and Islam (2002) on the two-track policy –one focusing on aggregate price stability and the other on subsidizing the price of key goods and services consumed by the poor– to help mitigating inflation shock on the poor is an example of this. Second, there is a lack of capability, primarily financial, at the

[1] In a case study of two villages in Sleman district, Yogyakarta province, Kumorotomo (2001) shows that all poverty alleviation programs as a response to the economic crisis are national government programs.

local governments' side to carry out substantial responses to the economic crisis. In fact, central government deregulations to eliminate various local distortions in January 1998 have been skeptically received by local governments for its revenue-cutting effects.[2]

What are the roles that local government can assume in helping people coping with massive lay-offs during the economic crisis? This is not an easy question, partly because the answer would require a better understanding about the mechanics of the lay-off process among local economies in the country. This study aims at improving that understanding by identifying the determinants of the lay-off process that takes place among districts and municipalities.[3] Further, when dealing with local economies, an essential feature that needs to be addressed is the existence of spatial or neighbor effects; economically opened one to another, interaction among local jurisdictions is inevitable and need to be taken into account in the analysis. Hence, this study will examine whether the lay-off process in one particular district, or municipality, is influenced by that in other neighboring regions. As a case study, districts and municipalities in Java are taken for two particular reasons. First, Java, comprising five provinces: Jakarta, West, Central, East Java, and Yogyakarta, is considered as the most severely hit region during the economic crisis that began in mid-1997 (Wetterberg *et al.* 1999). Secondly, districts and municipalities in Java island are relatively in close interaction one with another, a feature responsible for the existence of spatial effect in the first place. Compared to other regions in Indonesia, Java has better communication and transportation infrastructure that facilitates greater interaction, thus creating greater spillover effects among its districts and municipalities.

The importance of a spatial, or neighbor, effect in the lay-off process, and in labor market generally, can be traced to two causes. The existence of spatial effect first indicates the jurisdictional interdependence of variables in labor market: the lay-off in one district is dependent on variables in other districts. There is a spillover effect in the labor market that must be taken into consideration in explaining the district-level lay-off phenomenon. Some degree of spatial integration in the district-level labor market may

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[2] The inability of local governments, by law, to tax assets and income has left them with an alternative to tax trades. While the latter provides the majority of local government's own revenue (i.e., local's revenue net of upper level's subsidy), it is a source of various distortions in the local economy.

[3] Districts and municipalities are the second level governmental administrative unit in Indonesia, under the province. Among the two, municipalities are typically associated with an area comprising of a city, or primarily urban areas. In this paper, the term 'district' will also be used to denote the two types of second level government.

be implied by such interdependence. Consequently, there is a whole range of policy implications that follows the existence of interdependence, spillover and spatial integration. For instance, labor market planning should not only be based on own-region features, but should take into account relevant variables in the neighboring regions. Likewise, the inter-jurisdictional coordination, which is the purview of the upper level government, should play a pivotal role in the district-level labor market policy. Secondly, the existence of such a spatial effect may also indicate the existence of contiguous effects in the lay-off process, implying a spatial chain reaction process where a lay-off in one region sparks a follow-up lay-off in another. However, it should be pointed out here that the examination of the contiguous effect in lay-off process is beyond the scope of the current paper. Contiguous effect should be addressed more appropriately in a dynamic setting, which requires spatiotemporal modeling techniques.

This paper will be structured as follows. Immediately following this introduction, section 2 provides a discussion about Indonesian labor market and lay-offs during the economic crisis, focusing on the period from mid 1997 to early 1999. Section 3 presents the methodology used to establish the existence of spatial effects and the proposed modeling framework to identify the determinants of lay-off rate. Section 4 will discuss the relevant alternative variables that may constitute the explanations about the lay-off rate. Discussions on the estimation results and analysis will be presented in section 5, followed by policy implications in section 6. Some closing remarks in section 7 complete the paper.

2 The labor market and lay-off during the crisis

The flexibility of Indonesian labor markets during the economic crisis was asserted in Manning (2000).[4] He argued that the Indonesian labor market mimics the classical labor market where a demand shock in the market is absorbed in a real wage decline. The negative labor market effects generated by the crisis were shared by larger numbers than would have been expected if the labor market had followed Keynesian principles. The unemployment rate indeed did not increase dramatically; moving only from 4.7% in 1997 to 5.4% in 1998, and 6.3% in 1999.[5] Another possible explanation of such a mild response in unemployment is offered by the luxurious unemployment

[4] Look also comments by Dhanani and Islam (2001) and further reply by Manning (2001). For earlier accounts on labor market impact of the crisis, see ILO (1998) and Hugo (2000).

[5] Another indicator such as the labor force participation rate (using 10 years or older as the work force) grew from 58.0% in 1997 to 59.0% in 1998, and 59.5% in 1999.

hypothesis (Myrdal 1968).[6] In a system where no unemployment benefits are offered, unemployment can be considered as a luxurious good, as it is only affordable by those with sufficient non-labor income. Hence, laid-off workers have a higher incentive (or necessity) to seek alternative employment in either formal or informal sectors.

The severity of the crisis, however, is better depicted by the lay-off process in the labor market. Indeed, lay-offs provide the labor market response to economic contractions, especially in a sudden economic decline such as the 1997 economic crisis. Different from the number of unemployed, the number of lay-offs would not reflect various coping mechanism or adjustments made by people during the crisis.

The lay-off data for each district and municipality in Java are obtained from the 1999 National Household Survey (*Susenas*). The individual core questionnaire of the 1999 *Susenas* surveys about 333,000 respondents representing approximately 120 million inhabitants in Java provinces. The calculation of the number of lay-offs during the crisis benefits largely from two questions in the questionnaire:

Block VI q. 30. Did you ever quit job or move to other job since July 1997?
(Yes/No)

Block VI q. 31. Main reason quit/moved the last work:

1. Got fired
2. Business stuck
3. Becoming housekeeper
4. Work no longer suitable
5. Income no longer satisfying
6. Uncomfortable working environment
7. Others

Question 30 was asked to all respondents 10 years of age or older, and question 31 was asked to those answering 'yes' to the previous question. For the present analysis, a person is assumed to have experienced a crisis-related lay-off if (s)he answers 'yes' to question 30, and chooses answers '1' or '2' in question 31. The 1999 *Susenas* took place in February, implying that the above questions cover lay-offs between July 1997 and February 1999. About 4.8 million people claim that they had quit work or moved to other job since July 1997. Out of this number, about 2 million (42.3%) of them are crisis-related laid-offs, i.e., answering '1' or '2' on q.31 above.

[6] Using 1992 *Sakernas*, Manning and Junankar (1994, 1998) and Manning (1998) cast his doubt about the existence of luxurious unemployment in Indonesia. However, the severity of economic crisis indeed warrants further examinations of this hypothesis which are well beyond the scope of this current study.

Before moving on, it is worth discussing several qualifications of this lay-off variable. First, the location of the lay-off detected by the survey is based on the residence of workers, not business. Indeed, this feature applies to practically all labor market indicators –such as unemployment rate, sectoral labor share, etc.– derived from the household based survey. Secondly, the variable is not able to detect multiple lay-offs which may have taken place during the period. The plausibility of multiple lay-offs is of great concern especially for blue collar workers. In the crisis period, choices of work are characterized more by the short-run necessity to earn income rather than by long-run perspective of career development. Thirdly, question 31 records only the main reason for quitting or moving; consequently, it dismisses the possibility of multiple reasons for quitting. It is possible that a person might choose 'income not satisfying' while such a reason may have been generated by declining business.

Table 1 explores some spatial variations in the lay-off experience. West and East Java are two provinces with the highest share of workers in Java, accounting for about 62.5% of 52.8 million Java workers. Compared to the share of workers, then the share of laid-offs in Jakarta is relatively high, while home to only 7% of Java's worker, the region is responsible for 14.7% of the total two million crisis-related lay-offs. This percentage should be read cautiously since it may underestimate the actual situation. A significant proportion of those working in Jakarta reside in suburbs that are parts of West Java province. East Java, on the other, has a relatively low lay-off proportion, i.e., 17.8% in contrast to being a home to 31.6% of Java's workers.

<<< table 1 around here >>>

As mentioned earlier, the question whether one had ever been laid-off from work was asked to all population 10 years of age and older. Among the two million crisis-related lay-offs, only about 1.1 million (55.6%) were workers at time of the survey. The provincial distribution of these ever laid-off workers is relatively similar to the distribution of lay-offs. The percentage of ever laid-off workers in the total laid-offs can be interpreted as the probability of getting work when one has ever been laid-off since July 1997. For the whole of Java, the probability is 55.6%, but is higher in Central Java (63.6%), and much lower in Jakarta (38.6%). On the other hand, the percentage of ever laid-off workers in total workers can be interpreted as the probability of getting laid-out among workers. As table 1 suggests, this probability is quite low. For all Java, if one is a worker, then there is only a 2.1% chance that (s)he had been laid-off since July 1997. The regional variations of this probability suggest that workers in Jakarta have greater probability to get laid-off compared to those in other provinces in Java.

It is interesting to find out which sector is friendly to the laid-offs. Unfortunately, there is no question in *Susenas* to indicate the sector in which a laid-off worker was able to secure another job. However, a proxy to that statistics is possible by calculating the sectoral composition of workers who stated that they had ever been laid-off before, i.e. the ever-laid-off workers. Of course, caution may be needed again in interpreting the composition as the sector associated with a particular worker is the one observed at the time of the survey. This sectoral composition for each province is presented in table 2.

<<< table 2 around here >>>

Table 2 suggests that the sectoral composition of ever laid-off workers in Jakarta is different from that in other provinces. Those in Jakarta find jobs largely in service sectors, primarily trade. That is qualitatively different from the sectoral composition in other provinces where agriculture, manufacturing, and construction, together with trade, play an important role in absorbing back the laid-offs. The surprising role of the construction sector –this is the sector that in fact is most severely hit by the economic crisis– should be attributed to the social safety net program in public works, designed to employ people in labor-intensive public infrastructure works.

The role of agriculture and trade sectors during the crisis is greatly acknowledged. These two sectors are considered as part of the coping mechanism during the crisis for: (i) their easy entry and exit, and (ii) they home the underemployment. When the economic crisis hits the more formal sector, such as manufacturing, construction or financial services, agriculture –especially in the rural areas– is a source of short relief for its ability to absorb labor surplus. In addition to widespread underemployment, this capacity also results in a high turnover of workers that eventually leads to a higher lay-off rate. On the other hand, the pivotal role of the trade sector is of no surprise because it primarily accommodates the informal sector. Typical to a developing country, the latter often serves as the bumper during an economic decline, providing an outlet in a saturated formal job market. High turnover is also one characteristics of the informal sector.

The above brief description about the lay-off during the economic crisis was derived from *Susenas*; the present paper intends to examine possible determinants of such a process. The districts and municipalities in Java will be taken as the unit of analysis, and spatial effects among them will be considered. The next section will discuss the methodology to accomplish that goal.

3 On the interaction structure and modeling spatial dependence

Spatial dependence exists as a consequence of interregional interaction among regions under study. Economically opened one to another, interregional interaction plays a pivotal role in shaping regional development. This paper seeks to point out whether lay-offs in one district during the economic crisis are sensitive to events taking place in other relevant regions. The latter refers to those that are in interaction with the region under study. It is therefore important to define at the onset how one region is considered in interaction with others.

Interaction can be defined in many ways. Two regions may be considered in interaction, for example, if they are geographically neighbors, i.e., sharing a common border. This criterion is also known as simple contiguity. Differently, interaction may be defined by taking into account interregional distance. Generally, two regions close to one another may have more intensive interaction than two distant ones. This is the essence of the first law of geography (Tobler 1979). The notion of distance, however, is not only physical; economic distance may also be considered in defining the degree of interaction between two separated regions. In regard to these two distances, it is possible to find two regions that are physically distant but economically close.

This interaction structure can be depicted in a weight matrix W, a square matrix of n dimension where n is the number of regions in study. The typical element w_{ij} in this matrix denotes the relationship between region i and j. It is a standard practice in the literature to denote the main diagonal of this matrix with zeros. The simple contiguity criteria will result in a weight matrix containing (0,1) entries. Further, the matrix can be row-standardized to produce a spatial lag variable. For an example, let the income vector be denoted by y. Then a new variable $\tilde{y} = \tilde{W}y$, where $\tilde{W}$ denotes the row-standardized weight matrix W, produces a new variable called the spatial lag of income. The element $\tilde{y}_i$ denotes the average income of neighbors of region i.

A statistics commonly used to measure spatial association of a variable is the Moran's I statistic (Moran 1948), that takes the following form:

$$I = \frac{\sum_{i=1}^{N} \sum_{j=1}^{N} w_{ij}(x_i - \bar{x})(x_j - \bar{x})}{\sum_{j=1}^{N}(x_i - \bar{x})^2} \tag{1}$$

where x_i and x_j are the observations for spatial units *i* and *j*, respectively, $\bar{x}$ is the average of x, and w_{ij} is as previously defined. The statistical inference of this Moran's *I* statistic can be conducted using normalization approaches making use of the expected values of its first and second moments (Cliff & Ord, 1973)[7]. Respectively, they are as follows

$$E[I] = \frac{-1}{(N-1)} \quad ; \quad E[I^2] = N^2 S_1 - NS_2 + 3S_0 \tag{2}$$

where $S_0 = \Sigma_i \Sigma_j w_{ij}$; $S_1 = 0.5\Sigma_i \Sigma_j (w_{ij} + w_{ji})^2$; and $S_2 = \Sigma_i (\Sigma_j w_{ij} + \Sigma_j w_{ji})^2$. Note that the mean of this statistic depends solely on the number of spatial units in the problem, and the standard deviation is solely a function of the weight matrix structure. The inference based on the normal approximation is conducted by calculating the *z*-values.

The pursuit of the determinants, taking into account the existence of spillover effects, will employ multivariate regression analysis. As a point of departure, consider the linear regression case given by

$$y = X\beta + \varepsilon \tag{3}$$

where y is $n \times 1$ vector of dependent variable, where n is the number of spatial units, X is $n \times k$ matrix containing k independent variables, β is a $k \times 1$ vector of regression coefficients, and ε is $n \times 1$ vector of error terms. If the error follows the classical assumption, then (3) is estimable by the OLS.

The spillover effects can be considered in a model such as (3) in two alternative forms (Anselin 2003): through the error terms (unmodeled effects) and/or the independent variables (modeled effects). One alternative to model the spillover through the error terms is by assuming (3) to have an autoregressive error form

$$\varepsilon = \lambda W \varepsilon + \upsilon \tag{4}$$

where λ is the autoregressive parameter, υ is an $n \times 1$ vector of i.i.d residuals, and the rest is as previously defined. The variance-covariance matrix of this spatial autoregressive (SAR), or also known as the spatial-error, model is given by

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[7] Other inferential methods for the Moran-*I* is using the permutation and randomisation. For more discussion about this, see Cliff and Ord (1973, 1981).

$E[\varepsilon\varepsilon'] = E[(I-\lambda W)^{-1}\upsilon\upsilon'(I-\lambda W)^{-1'}]$. This variance-covariance matrix is global in nature, since it relates every single spatial unit to another, via the $(I-\lambda W)^{-1}$ terms.[8] OLS is no longer appropriate to estimate this spatial-error model. Instead, the model should be estimated using maximum likelihood (Ord 1975, Anselin 1988) or method of moments techniques (Kelejian and Prucha 1999).

Through the modeled effect, one basically forms and adds to the model the spatial lag of independent variables, i.e., *WX*. Thus, an alternative model is:

$$y = X\beta + WX\delta + \varepsilon \tag{5}$$

Since *X* and *WX* can be considered as exogenous to the independent *y*, given the usual assumption of error terms, equation (5) can be estimated using OLS.

A different perspective on how spatial dependence can be brought into the picture considers whether the dependence is local or global in nature (Anselin 2003). The spatial-error model, as given by equations (3) and (4), accommodates global effect of interaction. However, the interaction captured in equations (5) is local in nature, since the resulting variance-covariance matrix of error does not take into account relations beyond the first order neighbor.

Another possibility to bring global effect into the model is by including the spatial lag of independent variable on the right hand side of the equation (Anselin 2003). One alternative of the model is

$$y = X\beta + \rho Wy + \varepsilon \tag{6}$$

which can be thought of being derived from $y = (I-\rho W)^{-1}X\beta + (I-\rho W)^{-1}\varepsilon$. Equation (6) belongs to the family of the spatial-lag model (Anselin 1988). OLS will no longer be appropriate for the estimation, and maximum likelihood (Ord 1975, Anselin 1988), or instrumental variable or two-stage least square (2SLS) approach (Anselin 1988, Kelejian and Robinson 1993, Kelejian and Prucha 1998) will be needed. In (6), ρ is called the spatial lag parameter, signifying the relationship between the dependent variable and its spatial lag. Note again that, using a row-standardized weight matrix, spatial lag variable *Wy* is the average of *y* in the neighboring regions. The closer the ρ to its maximum value, which is 1, the more intensive is the relationship between a particular region with its neighbors.

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[8] The notion of 'global effect' relates to the inclusion of $(I-\rho W)^{-1}$ term. Recall that this term can be expanded as $(I-\rho W)^{-1} = I + \rho W + \rho^2 W^2 + \dots$, relating every single cell in the weight matrix to another. See Anselin (2003) for more detail.

For the specification search, we will follow the general suggestion proposed by Anselin (1988). As mentioned earlier, the point of departure is equation (3). Anselin (1988) shows that the Lagrange Multiplier (LM) test, originally proposed by Burridge (1980), can be applied to residuals obtained from (3) to determine whether they suit the spatial lag or spatial error model. The maximum likelihood expressions of the above competing models can be written down, and a score test against the null of no spatial dependence parameter can be calculated,[9] resulting in two widely used tests LM-lag and LM-error. One disadvantage of the above tests is that the LM-error test is not only powerful with respect to the error dependence but is also capable of detecting the lag dependence structure, and *vice versa*. This feature is shown in Anselin *et al* (1996) where the robust versions of those two tests are devised.[10] If LM-lag and LM-error tests do not provide convincing evidence about the type of dependence, then the robust versions of the tests can be consulted. Once the type of spatial dependence is statistically determined, then appropriate estimation will follow. As an alternative to equation (3), equation (5) may be considered where the spatial-lags of independent variables are included on the right hand side. It is again possible to apply the LM tests to the OLS residuals of this equation. If the spatial lags of explanatory variables are statistically justifiable, then the spatial specification tests should show not further evidence of spatial lag or spatial error dependence.

4 The relevant variables and hypothesis

The variable of interest is the lay-off rate, defined as the ratio between the numbers of laid-off workers to the total labor force in a particular district. There are several variables that are considered to explain the lay-off rate. These variables are as follows. The first is the economic growth of the district, in 1998 (GR98) and in 1997 (GR97).[11] Naturally, the economic growth is expected to show a negative relationship with the lay-off rate. This can be inferred from the definition of the laid-off workers in this study, defined in terms of business decline or shortage of demand. Differently, the 1998 and 1997 GDRP deflator (DEF98 and DEF97) are hypothesized to be negatively related with the lay-off rate. Reflecting the severity of the price hike, greater deflator

[9] For technical details in deriving the LM tests for spatial-lag and spatial-error, see Anselin (1988) and Anselin and Bera (1998).

[10] See also Anselin and Bera (1998).

[11] The economic growth data set is published by Statistics Indonesia.

corresponds to a greater price increase, thus greater economic downturn and higher lay-off.

The rest of variables comprises district-level labor market characteristics in 1997. The use of these characteristics would indicate how initial conditions in 1997 labor market affect the lay-off rate during mid-1997 to early-1999 period. These conditions are calculated from the 1997 *Susenas* which was conducted in February that year. The relevant variables in considerations are as the following.

The 1997 unemployment rate (UNR97) may contribute to an explanation of the lay-off rate. Unemployment conditions may be regarded as representing the pool of potential labor ready to work. Economic crises that result from soaring prices and cost of living have intensified the need to earn income. To certain labor segment, any job bearing any amount of labor income is better than nothing. In that setting, an available job that an unemployed person may get is typically temporary, leading to a greater amount of lay-offs. Thus, we are going to hypothesize that the higher rate of unemployment will correspond to a higher lay-off rate.

The sectoral decomposition of the labor market will be represented by three variables. First is the share of agricultural workers (AGRR97). The impact of agriculture labor share on lay-off rate is not straightforward. On one hand, a greater agriculture labor share implies a lower non-agriculture share; and since the economic decline affected the latter more than the former, then a district with a higher share of agriculture labor should experience a lower lay-off rate. On the other hand, as discussed before, labor surplus in agriculture sector, which grew during the crisis, is a source of underemployment and high turnover, implying a higher lay-off rate. The second variable is the share of manufacturing workers (MANR97) in the district. This variable is hypothesized to correspond positively with the lay-off rate. This should be obvious because manufacturing is part of formal sector, typically in urban areas, and is a sector that suffers a great deal during the crisis. The third is the share of labor in informal sector in the district (INFOR97). Again, there are two contradicting effects. On one side, higher informal labor share means smaller formal labor share. Since lay-off is a phenomenon in the formal labor market, then higher informal labor share can lead to less lay-off during the economic turmoil. On the other hand, informal labor market is known for its easy entry and exit which leads to higher labor turnover. The latter should positively correlate with lay-off rate. In conclusion, the impact of greater share of informal labor share to the lay-off rate cannot be stated for certain.

The next variable to consider here is the share of urban workers (URBR97). During the crisis, it was widely believed that Java urban areas suffered more than the rural areas. This leads to a hypothesis of a positive relationship between the share of urban workers and the lay-off rate. Finally, we are also going to consider the average schooling years of labor force in the district (SCH97); this variable is used as the proxy of labor quality in the lay-off process.

5 Analysis of results

5.1 Appropriate interaction structure

Before the discussion of determinants of lay-off is presented, it is important to explain the notion of interaction that will be used. This study examines two alternative interaction structures. The first interaction structure will be based on the physical contiguity of districts in Java. Thus, two districts are considered in interaction if they share a common border; the row-standardized weight matrix of this type will be referred to as BORDERS. Post-multiplying a particular variable with BORDERS will yield spatially lagged forms of that variable. For example, the spatial lag for the lay-off rate is obtained by calculating BORDERS*LOFR. Note that the latter denote the simple arithmetic average of LOFR in one's neighbors. Spatially lagged forms for the other variables can be constructed in a similar fashion.

The second alternative interaction structure is based on interregional migration. The level of interaction between the two districts is represented by the intensity of migration between the two. The 1995 Intercensal Population Survey (*Supas*) is used to calculate the interregional migration. In contrast to the above contiguity-based interaction structure, the migration-based interaction perceives that a region does not engage in an iso-intensive relationship with each of its neighbors. Instead, such an interaction will reflect a variety of economic and social characteristics that will shape the degree of interaction between any two districts or municipalities. The row-standardized weight matrix based of this kind will be called MIGS. More specifically, the (*i*,*j*) element of this matrix denotes the percentage of migrants in region *i* who resided in region *j* five years ago.

<<< table 3 around here >>>

Table 3 shows the Moran's I statistics for relevant variables in this study, for two alternative weight matrix structures. Given (2), the mean of the Moran's I is –0.009, while the standard deviations for BORDERS and MIGS are 0.071 and 0.034, respectively. These results suggest that spatial dependence appears to be a more important phenomenon among contiguous regions rather than among those sending and receiving migrants.[12] Positive spatial association refers to the existence of clusters of spatial observations. That is, there is a tendency in the data that high observations are spatially grouped, as so are the low observations.[13] These results provide a basis to argue that the lay-off process at the district level in Java is spatially dependent on surrounding districts. Hence, the BORDERS weight matrix will be used for the estimation process.

5.2 Pursuing the determinants

Table 4 presents estimation results. Several alternatives of specification given in (3) are tried. Model 1 clearly suffers from multicollinearity problems, shown by relatively high condition number[14] and many insignificant coefficients. Models 2-4 are presented as some other alternatives. While in terms of the condition number models 3 and 4 are relatively better than models 1 and 2, changes in the coefficient magnitudes, across all models, are relatively small. The latter attests to the stability of the relationship. The R^2 is relatively high, about 45%, considering that fact that we are dealing with a cross-section, spatial dataset. These results are the basis to use model 4 as the specification to use in further analysis. The Breusch-Pagan heteroskedastic test (Breusch and Pagan 1979) suggests that the homoskedastic assumption among observations cannot be accepted. In addition, the spatial specification tests raise several observations. There are positive, and significant, spatial effects in the error structure. Statistically, the spatial dependence follows the spatial-lag, rather than the spatial-error, model. This is shown by the fact that the values of LM-lag are far more statistically significant than those for LM-error. The robust specification of the LM-lag test also attests to this conclusion.

<<< table 4 around here >>>

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[12] A similar result is obtained using different methods of inferences, i.e., the permutation and randomisation, for Moran's I.

[13] Differently, negative spatial dependence refers to the existence of checkerboard pattern where high observations are located side by side with low observations.

[14] The widely used maximum condition number to argue no multicollinearity problem is 30.

As discussed earlier, it is possible to construct the spatial lag version of various explanatory variables, and see whether these are significant in the determination of the lay-off rate. Previously this was shown as equation (5). Since the spatial lag variables can be considered exogenous to the lay-off rate, then OLS can be employed. The above model 4 is considered as the starting point of this formulation, and the estimation results are presented in table 5.

Models 5-7 present the estimation results in specifications using spatially lag exogenous variables. As indicated by high condition number, model 5, where the full set of exogenous variables from model 4 and their spatially lagged exogenous variables are presented, suffers from a multicollinearity problem. Model 7 is the alternative specification that is relatively free from that particular problem. The spatial specification tests do not yield conclusive evidence on the existence of spatial dependence in these regressions. In retrospect, this should be as expected because models 5-7 handle the spatial dependence through the spatial lag of the explanatory variables.

<<< table 5 around here >>>

The coefficients on the growth variables are negative as hypothesized. The 1997 growth turns out to have a more profound effect on the lay-off rate, compared to the 1998 growth rate. For every percentage increase in the 1997 growth the lay-off rate will decrease by approximately 0.11-0.13 points. Note that the coefficient on 1998 growth rate is not statistically significant in any models here, but its magnitude is relatively close to the OLS estimates with no spatially lagged exogenous variables in model 4.

The unemployment rate generates positive impacts on the lay-off rate: every percentage increase in the unemployment rate corresponds to approximately 0.17 point increase in the lay-off rate. This result confirms the previously stated hypothesis. On the other hand, a greater informal labor share seems to bring in positive effect to the lay-off rate. Every percentage increase in informal labor share will lower the lay-off rate by approximately 0.3 percentage points. The latter result makes clear the dominant effect of informal sector in the crisis. As discussed earlier, higher informal share of labor may bestow two contradictory effects on lay-offs. First, it may keep down lay-off rate because higher informal labor share implies a lower formal labor share, and the economic decline affected the latter more than the former. On the other hand, it may also spark further lay-offs informal sectors' high labor turnover. The estimation result shows that the first phenomenon is more dominant during the crisis, hence higher informal labor share is associated with lower lay-off rate.

Estimated coefficients on the spatial lag of independent variables yield some interesting insights. First, the neighbor's 1997 economic growth turns out statistically insignificant. However, that is not the case for the 1998 growth. The positive effect of neighbor's 1998 economic growth on the lay-off rate indicates the role of neighboring economies in coping mechanism during the economic crisis: neighboring regions with better economic status would be attractive to those seeking jobs. In turn, the movement to the neighbors implies a greater lay-off within the original region. This notion may also imply that during the crisis individuals expanded their horizon in finding jobs. Not only they were seeking jobs at their home region, but also looked for ones in the adjacent regions.

A greater share in neighbor's informal labor turns out to bring negative impact to the lay-off rate. The nature of this result is not immediately clear, but it can be understood in the following sense. As is implied by the earlier analysis of neighbor's growth rate, neighboring regions can induce greater lay-off rate in the region under study by encouraging labor to quit their job in the latter and seek another in the former regions. However, greater informal labor share in the neighboring regions indicate higher saturation in the labor market of these regions, hindering any desires to quit current job and seek another in the neighboring regions. In that sense, saturated labor market in the neighboring regions may correspond to lower lay-off rate.

As has been elaborated earlier, the specification as given models 5-7 implies a local spillover effect in the system. If a global spillover process is believed to take place in the system, then the alternative spatial-lag model should be estimated. As suggested by the model and spatial specification search in table 1, again we are going to use model 4 as the starting point to estimate the spatial-lag specification. The estimation results are given in table 6: model 8 is a straightforward spatial-lag estimation of model 3, while models 9 corrects for the heteroskedasticity problem. The LM test on spatial error dependence indicates whether, after correcting for spatial-lag, the error term still conceives some spatial-error specification. As indicated by the test statistics in model 8, that is not the case. On the other hand, correcting for heteroskedasticity, which by the likelihood ratio test is statistically justifiable, maintains the magnitude of spatial lag parameter within the previous range.

<<< table 6 around here >>>

The spatial-lag coefficient, i.e., ρ in equation (6), turns out to be statistically significant in models 8-9. The magnitude of the spatial-lag coefficient can be interpreted to mean that about a quarter of the average lay-off rate of the surrounding regions will appear in a particular region's rate. The magnitude of this effect is somewhat moderate, since statistically the spatial-lag variable has the asymptotic maximum value of a unity.

The spatial lag models 8-9 also highlight the importance of 1997 growth, but not the 1998 growth rate. In this respect, the result is similar to those appear in model 5-7 where spatial effects are handled through the spatially lagged exogenous variables. Moreover, the groupwise heteroskedastic model 9 confirms the positive effect of unemployment rate, with a magnitude relatively close to one appears in model 7, i.e., approximately 0.15-0.17 points increase in the lay-off rate for every percentage increase in the unemployment rate. Likewise, the negative effect of informal labor share is again confirmed by models 8-9.

In summary, the above analysis suggests two broad conclusions. First, the lay-off rate is negatively related to the economic growth, especially the 1997 rate; negatively impacted by greater share of informal labor; and positively related to the unemployment rate at the district and municipality level. Second, the results also confirm the existence of spatial effects, in a fashion where one region is interdependent with contiguous regions. Three important notions are apparent in the spatial effects. First, better economic status of neighboring regions serves as a relief to those seeking jobs. Higher lay-off rate in a region due to neighbors' higher economic growth indicate a coping mechanism where people expand their job-seeking areas. Secondly, saturated labor market in the neighboring regions, as measured by the share of labor in informal sector, may hinder quitting jobs for another opportunity in those regions. In essence, the saturated labor market in the neighboring regions serves as lowering the lay-off rate. Finally, the lay-off rate in a district is directly related to that average of the neighbors. As suggested by the spatial lag coefficient, a region's lay-off rate reflects about a quarter of the neighbor's average lay-off rate.

6 Policy implications

Policy implications of the existence of spatial effects in the lay-off process are guided by the following two questions. First is which government level should pay attention to the existence of spatial effects on the lay-off process or on the labor market in general. In close relation to that, the second question would be how the existence of spatial effects should characterize policy formulations especially in labor market.

We would argue here that spatial effects need to be considered by both district and municipality governments, as well as the upper level government such as the provincial or even the national government. The district and municipality governments' interest on the spatial effects is clear since these effects characterize lay-offs that took place during the economic crisis. The existence of spatial effects suggests interdependence among variables that relevant to the labor market policy. For example, the above estimation advocates that about 30% of neighbor's average lay-off rate will be reflected in a particular region's rate. From the upper level governments' perspective, interdependence at the district level warrants coordination in labor market policies. These governments should see that adjacent districts and municipalities in Java provinces are not in isolation when it comes to the policies.

The Law 25/1997 on Labor mandates the government to local labor market policy (ch. IV art. 7-9). The plan should be made upon various labor market information such as population and workforce, jobs availability, worker's training, productivity, industrial relationship, workplace condition, and wage and welfare system. This is indeed is a very broad guidelines which needs to be made operational. In relation to this study, spatial effects should be an integrated part of such plan: administrative units, which may constitute the objects of such a plan, should not be seen in isolation one to another.

This study has also found an indication that during the economic crisis, job seekers consider different jurisdictions as an alternative workplace. Indeed, neighboring regions with better economic status will attract job seekers for possibly higher employability. This strategy may be part of coping mechanisms at the worker's side to mitigate economic impacts of the crisis. In that setting, the government is expected to play an active role by allowing smoother interregional labor, and people's, movement. Various policies and programs pertaining to flexible work permits, disseminations of job market information, favorable transportation subsidy, etc., can be put in place to assist adjustments in the labor market.

Earlier estimation results also suggest that higher local economic growth and higher share of agricultural labor will lower the lay-off rate. On the other hand, greater resilience against the economic impacts of lay-offs is possible by lowering the unemployment rate. These should also be at the policy maker's agenda in managing the local labor market. Together with the recognition of spatial effects, those factors will make a better representation of the underlying local labor market.

7 Closing remarks

As the closing remarks we would like to point out several paths where this study may be further directed. First path covers the micro-analysis of lay-off process. It would be fruitful to build a micro model with an aim to explain how certain individual characteristics may contribute to the probability of getting laid-off. This type of study will be able to point out particular characteristics in the labor market that are vulnerable to sudden economic decline such as the economic crisis, where a fruitful set of policy recommendations can be built upon.

Another path of extension could cover the notion of contiguous effect in the lay-off process. While it is widely believed that the East Asian economic crisis did occur in a contiguous fashion at the country level, it would be constructive to see whether such a contiguous effect did also take place for the lay-off process in the region that was severely hit by the crisis. Such a study would have to consider the use of spatiotemporal modeling techniques, examining whether correlations may take place not only across space but also possibly over time. Further studies may cover this area.

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Table 1 Provincial distributions of lay-off related statistics

	Jakarta	W. Java	C. Java	Yogyakarta	E. Java	Total
Share of workers	7.0	31.0	27.5	2.9	31.5	100.0
Share of lay-off	14.7	40.1	25.6	1.8	17.8	100.0
Share of ever laid-off workers	10.2	39.8	29.3	1.6	19.2	100.0
Share of ever laid-off workers:						
• in total laid-offs	38.6	55.3	63.6	48.0	60.0	55.6
• in total workers	3.1	2.7	2.3	1.1	1.3	2.1

Source: 1999 Susenas

Table 2 Sectoral composition of ever laid-off workers, by province

Sector	Jakarta	W. Java	C. Java	Yogyakarta	E. Java	Total
Agriculture	1.2	30.1	37.1	29.3	29.2	29.0
Mining & quarrying	0.0	1.0	0.5	0.0	0.9	0.7
Manufacturing	6.5	16.1	17.4	22.7	14.9	15.3
Electricity, gas & water	0.7	0.2	0.2	0.0	0.2	0.2
Construction	6.4	12.9	14.8	15.3	13.8	13.0
Trade	41.7	22.1	15.5	24.8	20.4	21.9
Transport. & comm.	14.6	9.7	4.9	2.1	6.6	8.0
Financial services	4.2	0.5	0.5	0.0	0.9	0.9
Public & other services	24.8	7.5	9.2	5.9	13.2	10.8
All sectors	100.0	100.0	100.0	100.0	100.0	100.0

Source: 1999 Susenas

Table 3 Moran-I statistics for various variables using BORDERS and MIGS

Variable	Weight	Moran-I	z-stat
LOFR	BORDERS	0.4152	5.9599 ***
GR97	BORDERS	0.1441	2.1546 **
GR98	BORDERS	0.3306	4.7723 ***
UNR97	BORDERS	0.3294	4.7555 ***
AGRR97	BORDERS	0.4049	5.8164 ***
DEF97	BORDERS	0.0507	0.8434
DEF98	BORDERS	0.1969	2.8964 ***
URBR97	BORDERS	0.3095	4.4762 ***
SCH97	BORDERS	0.4870	6.9688 ***
MANR97	BORDERS	0.3260	4.7086 ***
INFOR97	BORDERS	0.5075	7.2556 ***
LOFR	MIGS	-0.0286	-0.5598
GR97	MIGS	0.0354	1.3122
GR98	MIGS	-0.0511	-1.2193
UNR97	MIGS	0.0474	1.6614
AGRR97	MIGS	0.0241	0.9808
DEF97	MIGS	-0.0069	0.0748
DEF98	MIGS	-0.0200	-0.3089
URBR97	MIGS	-0.0241	-0.4301
SCH97	MIGS	0.0309	1.1805
MANR97	MIGS	-0.0117	-0.0653

Note: *, ** and *** denote significant at type-I error (α) 10%, 5%, and 1% respectively.

Table 4 OLS results of models with no spatial explanatory variables (n=107)

	Model 1	Model 2	Model 3	Model 4
Constant	8.210 **	6.8247**	7.896***	6.3725 ***
GR97	-0.1431 **	-0.1508**	-0.1495**	-0.1503 **
GR98	-0.0613 *	-0.0652**	-0.0539*	-0.0464 *
UNR97	0.0896	0.1107	0.1200*	0.1103 *
INFOR97	-0.0420	-0.0676***	-0.0623***	-0.0623 ***
DEF98	-0.0130	-0.0154	-0.0076	
DEF97	0.0157	0.0229		
URBR97	-0.0164	-0.0028		
SCH97	0.0024			
AGRR97	-0.0438			
MANR97	-0.0108			
Regression diagnostics				
Adjusted R-squared	0.447	0.452	0.459	0.457
Ln likelihood	-194.41	-195.51	-195.96	-196.66
Akaike information criteria	410.83	407.03	403.92	403.33
Schwarz coefficient	440.23	428.41	419.95	416.69
Jarque-Bera test (df. = 2)	7.50 **	7.59**	8.68**	8.95**
Breusch-Pagan test (df. =1)	20.57 **	20.20***	19.68***	18.47***
Multicollinearity condition number	97.42	78.62	32.32	18.52
Spatial specification tests				
Moran's I	0.111	0.112	0.128	0.110
Moran's I (normal approx.)	2.131**	1.985**	2.127**	1.848*
LM test for lag (df.=1)	7.163***	7.262***	8.094***	6.040**
LM test for error (df.=1)	2.343	2.387	3.124*	2.277
Robust LM lag (df.=1)	6.662***	6.895***	6.465**	4.834**
Robust LM error (df.=1)	1.843	2.021	1.495	1.071

Note: *, ** and *** denote significant at type-I error (α) 10%, 5%, and 1% respectively.

Table 5 OLS results of model with spatial lag explanatory variables (n=107)

	Model 5	Model 6	Model 7
Constant	8.5905 ***	7.8427 ***	9.262 ***
GR97	-0.1058 *	-0.1185 **	-0.1308 **
GR98	-0.0363	-0.0319	-0.0435
UNR97	0.1324 **	0.1373 **	0.1701 ***
INFOR97	-0.0378 **	-0.0371 **	-0.0275 *
W * GR97	-0.1276	--	--
W * GR98	0.1201 ***	0.1267 ***	0.1044 **
W * UNR97	0.1719	0.1936	--
W * INFOR97	-0.0494 *	-0.0450 *	-0.0710 ***
Regression diagnostics			
Adjusted R-squared	0.514	0.514	0.507
Ln likelihood	-188.58	-189.11	-190.469
Akaike information criteria	395.15	394.22	394.94
Schwarz coefficient	419.21	415.60	413.65
Jarque-Bera test (df. = 2)	7.57 **	10.52 ***	9.39 ***
Breusch-Pagan test (df. =1)	14.02 *	--	--
Koenker-Bassett test (df=5)	--	8.615	8.686
Multicollinearity condition number	45.01	40.17	28.71
Spatial specification tests			
Moran's I	0.0867	0.093	0.118
Moran's I (normal approx.)	1.642	1.677 *	1.999
LM test for lag (df.=1)	0.919	1.339	2.783
LM test for error (df.=1)	1.2423	1.633	2.632
Robust LM lag (df.=1)	0.771	0.114	0.162
Robust LM error (df.=1)	1.275	0.409	0.011

Note: *, ** and *** denote significant at type-I error (α) 10%, 5%, and 1% respectively.

Table 6 Maximum likelihood estimation of spatial-lag models (n=107)

	Model 8	Model 9
	ML	ML-GH
W * LOFR	0.2364 **	0.2571 **
Constant	5.2210 ***	3.8701 ***
GR97	-0.1397 **	-0.0821 *
GR98	-0.0381	-0.0188
UNR97	0.0940	0.1535 ***
INFOR97	-0.0530 ***	-0.0397 ***
Regression diagnostics		
R-squared	0.497	0.455
Ln likelihood	-193.89	-186.58
Akaike information criteria	399.78	385.15
Schwarz coefficient	415.82	401.19
Breusch-Pagan test [a] (df. =4)	6.277**	--
LM test on spatial error dependence	0.344	--
LR test on groupwise hetero. (df. =4)	--	14.63 ***

Note: [a] Using constant and province id
*, ** and *** denote significant at type-I error (α) 10%, 5%, and 1% respectively.