Industrial Estate and Export Decision of Manufacturing Firms in Indonesia

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Abstract: Industrial estates may influence a firm's decision to export through better facilities and agglomeration economies. This paper investigates whether a firm's export decision in the industrial estate is better than those outside. We then assess how industrial estate characteristics determine a firm's decision to export.

Treatment effect methods are used to compare a firm's decision to export for those inside and outside of the industrial estate. A probit model is developed to assess how industrial estate characteristics (port distance, port capacity, electricity, water, number of tenants and fiscal incentive) affect a firm's decision to export. We conduct a qualitative analysis through in-depth interviews with industrial estate top level managers and related institutions.

The results show that a firm's decision to export in the industrial estate was better. At the national level, industrial estate characteristics that affect firm's export decision are water sources and fiscal incentives. At the regional level, especially in the Greater Jakarta area, almost all of the characteristics affected a firm's decision to export. Utilities such as electricity and water sources positively affect a firm's decision to export. Agglomeration economies which is represented by number of tenants and government fiscal policy is effective in increasing a firm's decision to export.

Keywords: Export, Indonesia, industrial estate, manufacturing firm
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1. Introduction

Economic zones are promoted by many governments around the world to spur economic growth and competitiveness. The economic zone may be located in a particular and fenced area such as industrial park (IP), export processing zone (EPZ), eco-industrial park (EIP), technology park (TP) or innovation district (ID). Economic zones can also cover a wide geographical area such as the special economic zone (SEZ) in Penang, Malaysia and Shenzhen, China. Another type is an area with a port that is concentrated for trade and logistics activities like Singapore and Dubai.

The Government of Indonesia (GOI) has been trying to boost exports of the manufacturing industry through the development of industrial estates by locating manufacturing firms in a proper, correct and environmentally friendly area, so that the industry can become more efficient and makes it easier for future development (Ministerial Industry Decree No. 35, 2010). Industrial estates are generally open to export-oriented firms or non export-oriented ones. Some of them have an EPZ or a bonded zone in their area.

Industrial estates were initially managed by the government through state-owned enterprises (SOEs) which developed the Jakarta Industrial Estate Pulo Gadung (JIEP) in 1973, Surabaya Industrial Estate Rungkut (SIER) and Cilacap Industrial Zone (1974). These were followed by the Medan Industrial Estate (1975), Makassar Industrial Estate (1978), Cirebon Industrial Estate (1984), and Lampung Industrial Estate (1986). The role of the private sector in the development of industrial estates started after the release of Government Regulation No. 53, 1989 whereby the industrial estate can be managed by the private sector (domestic and foreign) with or without government participation.

The development of industrial estates has a positive impact on Indonesia's manufacturing export. The Ministry of Industry of the Republic of Indonesia estimated that the value of exports from industrial estates was US$52 billion per year or 41 percent of the total value of non-oil exports in 2012. Industrial estates can still be optimised because land usability is only 58 percent and there is high demand for land which is up to 1000 ha/year especially in Jakarta and the surrounding areas[1] (Kementerian Perindustrian, 2012). Furthermore, since 2009 through Government Regulations No. 24/2009 concerning Industrial Estates, industries are required to be located in industrial estates. The growing number of firms located in the industrial area is expected to increase the number of exporters. The effort to increase manufacturing exports is not only through boosting the values of existing exports but also by increasing the number of exporters (Koenig, 2009).

Two questions arise from the focus on increasing the number of exporters. First, how effective are industrial estates in encouraging a firm's export decision. We would like to evaluate whether the industrial estate is effective in encouraging exports by comparing the export decision of firms located inside and outside of the industrial estate. The main problem that arises when comparing a firm's export decision is the firm's self-selection to be located in the industrial estate. Locating in an industrial estate

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[1]   Bogor, Tangerang, Bekasi, Karawang, Purwakarta and Bandung.

might be more beneficial for firms and make them have a higher propensity to export than being located outside of the industrial estate. This self-selection into industrial estate might result in an upwardly biased estimate of the causal effects on firm's export decision. To solve this problem, we use statistical analysis of cause and effect based on the framework of potential outcomes using the Rubin Causal Model (RCM). We need to estimate the potential outcome of treated firms (in the industrial estate) if they had located elsewhere. This counterfactual is inherently unobservable, but we can find the average treatment on the treated (ATT) value base on similar observable covariates under the unconfoundedness and overlap assumptions. Studies related to the comparison of export performance inside and outside economic zones indicate that special economic areas have a positive influence on the export of firms. Schminke and Bieselbroeck (2013) showed that firms in specialised areas such as economic and technological development zones (ETDZs) and science and technology industrial parks (STIPs) in China have a higher total value of exports than firms outside of the two regions. Yi and Wang (2012) stated that firms in an economic zone are more likely to export compared to firms outside the economic zone.

The second question is, what are the industrial estate characteristics that determined firm's decision to export? Previous studies showed that a firm's decision to export is determined by both internal and external factors. The internal factors, firm-specific determinants are associated with internal economies of scale such as age, size and productivity (Aitken, Hanson, & Harrison, 1997; Bernard & Jensen, 1999; Greenaway & Kneller, 2004; Roberts & Tybout, 1997; Zhao & Zou, 2002). The external factors involved external economies of scale regarding agglomeration (Bernard & Jensen, 2004; Greenaway & Kneller 2008; Koenig, 2009). Agglomeration is the benefit that firms would acquire by locating close to each other in a city or industrial estate as compared to being separately located (Glaeser, 2010). In these studies, a firm's location was merely indicated by a regional dummy variable. The characteristics of the regions were not fully explored as determinants of a firm's decision to export.

In a recent approach, Farole and Winkler (2011) and Rodriguez-Pose, Tselios, Winkler and Farole (2013) found that regional characteristics influenced a firm's decision to export, but the regional characteristics were unable to capture the differences among industrial estates that are located within the same regional area. In a region, there can be more than one industrial estate where each has different transportation costs, infrastructure and number of tenants that can affect the costs of exporting. The industrial estate characteristics that influence a firm's decision to export need to be explored because they are related to cost savings from exporting in each industrial estate as depicted in Figure 1.

Concentration of firms in the regional level has a significant effect on firm's export decision. Winkler (2013) found that firms in the core region are twice as likely to be exporters as those outside the core in Indonesia[2]. Based on the concentration of industrial estates, we set the Greater Jakarta area which covers Bekasi, Karawang, Bogor, Purwakarta, Tangerang, Serang and Bandung as the core with over 50 percent of

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[2] Core region is defined as a region with most firms (Jakarta and West Java).
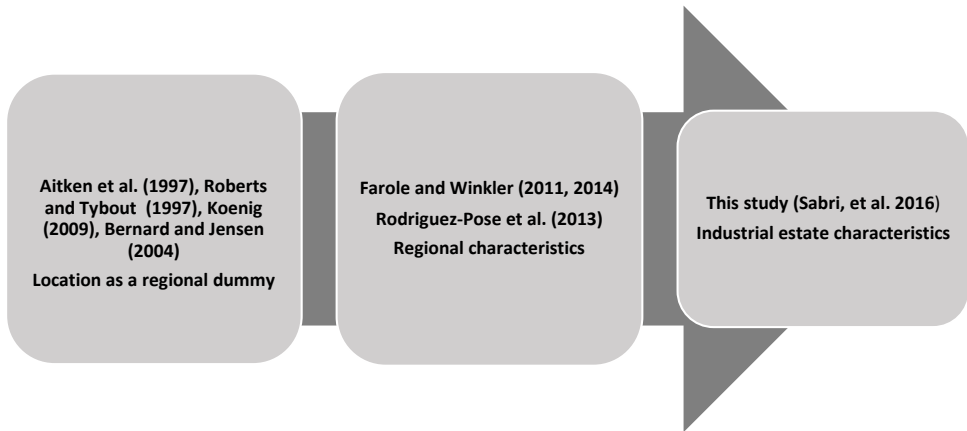
Figure 1. Research position related to a firm's decision to export

total industrial estates. Another region such as North Sumatera, West Sumatera, Riau, Riau Islands, Lampung, Central Java, East Java, South Sulawesi, and East Kalimantan is defined as outside the Greater Jakarta area.

This study is restricted to two aspects. First, the research was done on the industrial estate which has an area of at least 50 hectare, following the survey of the Ministry of Industry.[3] Second, the study is limited to the effect of characteristics of the industrial estate on a firm's decision to export. Many exporting firms in an industrial estate export via a third party. This kind of firm does not report the export transaction thus making it difficult to keep track the value of export.

We contribute to the empirical study of a firm's decision to export in Indonesia. First, we evaluate the effectiveness of industrial estate on export decisions by comparing firms located inside and outside of the industrial estate. Then we assessed characteristics of the industrial estate that can reduce the costs of exporting such as transportation costs, availability of infrastructure, local agglomeration and government policy in fiscal incentive. To the best knowledge of the authors, a study on the role of characteristics of the industrial estate in affecting firm's export decision has never been conducted (see Figure 1). We try to fill this gap by providing a complete analysis on the effect of the industrial estate characteristics in the same region.

This paper is organised as follows. After the Introduction in Section 1, Section 2 explains the type of economic zone and discusses the industrial estate characteristics that may affect a firm's decision to export. In Section 3, we outline the methodology and data. The results on the treatment effect to compare export decision of firms inside and outside of the industrial estate by controlling firms' self-selection into industrial estate, and a probit regression to assess the role of industrial estate characteristics on a firm's export decision are discussed in Section 4. We close with conclusions in Section 5.

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[3] According to the Ministry of Industry regulation, industrial estates should have a minimum area of 50 hectare.

2. Literature Review

2.1 Economic Zone

A strategic location may influence a firm's decision to export. Being located in the same location with other firms can benefit a firm through economies of scale and agglomeration economies. Marshall (1890) introduced localisation economies where firms receive benefit from others in the same industry through the availability of intermediate input providers with a lower price, access to a large pool of specific skills labour and development of new ideas or technology. Jacobs (1970) also argued that firms may benefit from externalities arising in regions with diverse industrial structures, or from urbanisation economies. Firms can observe and adapt ideas from others.

Localisation of industries in a particular area is generally due to market forces. However, many governments in the world built some planned areas known as economic zones to spur economic growth and competitiveness. Economic zones, based on objectives, activities and markets can be divided into six types as described in Table 1.

Firms in the economic zone may have advantages through economies of scale and agglomeration (World Bank, 2009). Previous studies showed mixed results. Warr (1989) found that the establishment of export processing zone (EPZ) in Indonesia, the Republic of Korea, Malaysia, and the Philippines failed to fulfill hopes of economic gains through employment, foreign exchange earnings and technology transfer. On the other hand, Wahyuni, Anoviar and Santoso (2012) found that the successful Penang special economic zone has recorded the highest investment in Malaysia since 2010.

Table 1. Types of economic zone

Type of zone	Objective	Activities	Market	Example in Indonesia
Free trade zone (commercial free zone)	Support trade	Entrepôt and trade-related activities	Domestic, re-export	Batam, Bintan, Karimun
Traditional EPZ	Export manufacturing	Manufacturing, other processing	Mostly export	Bonded zone
Hybrid EPZ	Export manufacturing	Manufacturing, other processing	Export and domestic	
Freeport	Integrated development	Multi-use	Domestic, internal, and export	Special economic zone
Enterprise zone, Empowerment, Urban free zone	Urban revitalisation	Multi-use	Domestic	Integrated economic development zone (KAPET)
Single factory EPZ	Export manufacturing	Manufacturing, other processing	Export	Bonded zone that is located outside the industrial estate

Source: Akinci and Crittle (2008).

Research on the comparison of export performance between firms inside and outside of the economic zone has never been conducted on Indonesia. As for studies on other countries, Yi and Wang (2012) found that firms in an economic zone are more likely to export compared to firms outside the economic zone. Schminke and Bieselbroeck (2013) showed that export performances of firms in economic and technological development zones (ETDZs), and the science and technology industrial parks (STIPs) were better than firms outside of both areas in China.

One of the economic zones in Indonesia is the industrial estate. Industrial estate is defined as a centre of industrial activity equipped with facilities and infrastructure which is developed and maintained by the industrial estate management. Industrial estate is open to export-oriented firms or domestic market only. As shown in Table 1, based on the type, industrial estates are unclassified, because it can be a hybrid EPZ and located in free trade zone or special economic zone. According to a survey of the Ministry of Industry, by 2012 there were at least 59 industrial estates with a minimum area of 50 ha. They are spread across Indonesia but more concentrated in the Greater Jakarta area (53 percent).

To evaluate the effectiveness of the industrial estate on a firm's decision to export, we compare decisions to export of firms inside and outside of the industrial estate. However, we should be aware of a firm's self-selection problem which might result in an upwardly biased estimation. Statistical analysis of cause and effect based on potential outcome framework is used to overcome this problem. We estimate the potential outcome of treatment firms (in the industrial estate) if they are located elsewhere using the treatment effect methods.

2.2 Determinant of Firm's Export Decision in the Industrial Estate

In line with the theory, firms will choose to export if the expected profit when exporting is higher than expected profit when operating only in the domestic market. Their location in the industrial estate might influence the expectations of firm profits through cost savings from trade costs and economies of scale. Trade costs are costs in addition to production costs, incurred until the goods are received by consumers (transportation, tariff and non-tariff, information cost, etc.), and the economies of scale are obtained savings through the firm's size, output or scale of operations that cause the cost per unit of output to decline.

Transportation costs are part of the trading costs that can affect a firm's decision to export (Krugman, Obstfeld, & Melitz, 2012). We use the distance from the firm location to the seaport and seaport capacity to proxy the transportation costs. A farther distance increases the costs of transportation, so we expect that the distance to the seaport of export negatively affects a firm's decision to export. Yi and Wang (2012) found that firms that were located near coastal areas were more likely to export than those located on the mainland. The seaport capacity is expected to positively affect a firm's decision to export through a reduction in transportation costs. Abe and Wilson (2011) found that a 10 percent increase in port capacity reduced transport costs by up to 3 percent in East Asia.

Porter (1998) stated that the development of a region or industrial cluster needs government involvement, particularly for providing adequate infrastructure. The state-owned electricity company (SEC) and the state-owned water supply company (WSC) are part of the infrastructure provided by the government. According to the state regulations, the availability of sources of electricity to the industrial area is guaranteed to be uninterrupted. The price is relatively lower than that of privately owned power supply, which can reduce the cost of production. The WSC plays a crucial role in the industrial estates that do not have natural water sources such as rivers. The industrial estates that are not served by SWC distribution have to build their water treatment plants which can significantly increase production costs.

Various types of industries in an industrial estate can form economic urbanisation as part of agglomeration. As the number of firms operating in the industrial estate increases, competition will also increase, which leads to the firm being more productive and increases the tendency to export (Long and Zang, 2011). Agglomeration can influence a firm's decision to export through reducing costs of exporting (Aitken et al., 1997) and raising productivity. Agglomeration can lower production costs through sharing of infrastructure and information and lower transportation and transactions costs through better relation of suppliers and customers (Malmberg, 2009). However, Krugman (1991) stated that in addition to the forces that drive agglomeration (centripetal forces), there is also the forces that are against agglomeration (centrifugal forces) and characterised by congestion costs. Congestion costs can raise production costs through higher price of inputs (land, capital and labour) and transportation and transactions costs, through longer waiting times (e.g., mobility of intermediate inputs or licences). These costs may counterbalance gains from agglomerations, and the net effect can be either positive or negative.

Firms that are located in an EPZ or bonded zone which is part of an industrial estate receive fiscal incentive through various taxes. Exemptions of import tariff and tax for intermediate input and machinery are given to firms that produce for the export market. This fiscal incentive allows the exploitation of scale economies in production. More firms having fiscal incentives are expected to influence the decisions of other firms in the industrial estate to export. This effect is known as export spillover. Previous studies have shown positive effects such as Farole and Winkler (2011), Koenig (2009), Rodriguez et al. (2013), but Bernard and Jensen (2004) did not find a significant export spillover effect.

Other determinants of export are, but not limited to, export status in the previous year, productivity, number of labour, source of capital, firm's age, and information availability. Export status in the previous year as a proxy for sunk entry costs has a positive influence on a firm's decision to export as found by Farole and Winkler (2011), Narjoko and Atje (2007), Roberts and Tybout (1997) and Rodriguez et al. (2013). Melitz (2003) showed that only firms with a high productivity could export. Labour is an important factor of production because more labour implies more output. Sources of capital, especially from abroad brings technological transfer. The higher the share of foreign capital, the higher the export opportunities. Sjöholm and Takii (2008) found that in Indonesia, firms that used foreign capital are more likely to export than domestically funded firms. However, the influence of age on a firm's export decision

is still ambiguous. Naudé, Gries and Bilkic (2013) stated that starting time to export was an important strategy. Firms often delayed exporting until the information was available and the requirements such as learning ability, innovation, productivity growth, access to finance were met. Johanson and Vahlne (1977) argued that making the decision to export was a long process, but adequate transportation facility shortened that process.

3. Methodology

3.1. The Treatment Effect

The treatment effect is used to analyse the effect of the industrial estate on a firm's decision to export. We cannot directly compare a firm's decision to export among those located inside and outside of an industrial estate because it may be affected by the facilities and regulations that support exports. The results will be biased. Treatment effect works with a counterfactual, where each firm has an outcome with and without treatment. In this paper, the outcome is a firm's decision to export, and the treatment is an industrial estate. The average treatment effect on the treated (ATT) is used to measure the difference in mean (average) of both outcomes.

Following Schminke and Bieselbroeck (2013), let y be the outcome variable of performance and w be the binary variable of treatment. There are two potential outcomes even though only one can be observed for each firm. If firm i is in the industrial estate and its potential outcome is y_{i1}, the potential outcome for the same firm when it is located outside of industrial estates is y_{i0}. The average treatment effect (ATE) measures the effect of treatment on a random sample of a particular population, that is, the effects of an average over the entire population. However, not all firms are willing to enter into an industrial estate so the measurement of treatment effect need to be focussed on firms that are located in the industrial estates. This measurement is called the average treatment effect on the treated (ATT). ATT is defined as:

$$\tau_{att} \equiv E((y_1 - y_0)| w = 1) \tag{1}$$

Two identifying assumptions are needed to deal with the missing information on y_0 for the treated firms:

1. Unconfoundedness or ignorability of treatment

$$(y_1, y_0) \perp w|\mathbf{x} \tag{2}$$

This first assumption of unconfoundedness or ignorability of treatment is conditioned on a set of covariates because it makes the firm's presence in the industrial estate becomes random. Covariate variables in **x** must be effective in separating the correlation between the potential performance of a firm when it is not located in the industrial estate and the actual value of the firm's performance in the industrial estate.

A weaker assumption of (2) known as an independent mean is used, i.e.

$$E[\,y_0|\mathbf{x}, w] = E[\,y_0|\mathbf{x}] \tag{3}$$

2. Overlap

When conditioned on a set of control variables **x**, each firm in the population has a potential to get the treatment,

$$\forall\, \mathbf{x} \in \chi, 0 < P(w = 1|\mathbf{x}) < 1 \tag{4}$$

where χ is a collection of the covariates. These assumptions guarantee that for each firm in the sample, there is a firm outside of the industrial estate to be used as a control with the same covariates.

In estimating the average treatment effects, we defined ATT as:

$$\hat{\tau}_{att} = \frac{1}{\sum_i w_i} \sum_{i=1}^{N} w_i[\hat{m}_1(\mathbf{x}_i) - \hat{m}_0(\mathbf{x}_i)] \tag{5}$$

where the function $\hat{m}_1(.)$ and $\hat{m}_0(.)$ are the predicted values of the variable performance of firms in an industrial estate and those outside the industrial estate using the same covariates but can have different coefficients.

This study uses the firm's internal characteristics such as previous year export status productivity, number of employees, percentage of foreign capital, firm's age, sector and location as covariates. Location of the firm is represented by a dummy variable that distinguishes whether the firm is located in the same province. A firm's decision to export is defined as a dummy variable which has a value of 1 if the firm exports and 0 otherwise.

Many estimators can be used to estimate ATT through regression and matching. We use two estimators from regression to estimate ATT. The first estimator is regression adjustment (RA) estimator which uses the difference of the average predicted outcomes for estimating treatment effects. The first step is fitting a regression model of the outcome for firms inside and outside of industrial estate on a set of covariates, and then after the average predicted outcomes are computed, we restrict the computation on firms inside the industrial estate to obtain ATT.

We implement a second estimator as a robustness check. Inverse-probability-weighted regression adjustment (IPWRA) estimator uses two models to predict treatment status and outcomes. First, we estimate the probability of industrial estate (treatment) on a set of covariates **x**, compute the propensity score $\hat{p}(\mathbf{x})$, and then compute the inverse-probability weights as follows:

$$\lambda^{att} = w_i + (1 - w_i)\frac{\hat{p}(\mathbf{x}_i)}{1 - \hat{p}(\mathbf{x}_i)} \tag{6}$$

The inverse-probability weights are used to fit weighted regression models of the outcome for firms inside and outside of the industrial estate, and then the predicted outcomes are calculated. We obtain ATT from the difference of the average of these predicted outcomes.

3.2 Probit Regression for Firm's Decision to Export

The model of a firm's decision to export is referred to Farole and Winkler (2011). The decision to export for firm i at time t depends on the expected revenue R and production costs c and sunk entry costs S when it began to export.

$$P(\text{Exp}_{it} = 1) = P(R_{it} > c_{it} + S(1 - \text{Exp}_{it-1})) \tag{7}$$

where *Exp* is export status, and the firm would export if expected profit $\pi_{it} > 0$. *S* is sunk entry costs, taking a value of 0 if firms export in period t–1 and *S* otherwise. Sunk entry costs can be either gathering information about the conditions of demand or building the distribution system when entering the export market.

Expected profit π^*_{it} is assumed to be influenced by the characteristics of the industrial estate *I*, firm's internal characteristics *F*, and sunk entry cost *S* that can increase or decrease the revenue *R* and cost *c*. Equation (7) is expanded into:

$$P(\text{Exp}_{it} = 1) = P(\pi^*_{it} = \beta I_{kt} + \gamma F_{it} + S(1 - \text{Exp}_{it-1}) > 0) \tag{8}$$

Expected profit π^*_{it} is approximated as a linear combination of I_{kt} (factor of the characteristic industrial estate), F_{it} (factor of internal characteristics), and sunk entry costs. Subscript *t* indicates time period, *k* for the industrial estate, and *i* for individual firm. Then, using the previous year's export status as a proxy for sunk entry cost, a probit model of a firm's decision to export can be written as:

$Exp_{irk,t} = \alpha_0 + \beta_1 lnportdistance_{kt} + \beta_2 lnportcap_{kt} + \beta_3 electricity\_pln_{kt} +$
$\qquad \beta_4 water\_pam_{kt} + \beta_5 tenant_{kt} + \beta_6 fiscalincentiveb_{kt} + \gamma_1 Exp_{ik,t-1} +$
$\qquad \gamma_2 lnprodtkikt + \gamma_3 lnemployment_{ikt} + \gamma_4 foreigncapital_{ikt} +$
$\qquad \gamma_5 age_{ikt} + \gamma_6 age2_{ikt} + \varepsilon_{ikt}$ $\qquad\qquad$ (9)

where:

Export:	Dummy variable for export status, 1 if firm exports and 0 otherwise
lnportdistance:	The distance to the seaport in logarithm
lnportcap:	Seaport capacity, approached by export volume (thousand tons) in logarithm
electricity_pln:	The percentage of the Perusahaan Listrik Negara (PLN) (state-owned power company) electricity usage by total kWh in an industrial estate
water_pam:	Dummy variable for water source, 1 if PAM (state-owned water company) and 0 otherwise
tenant:	Number of tenants in logarithm
fiscal incentives:	The number of the firms that have fiscal incentive divided by the total firms in the industrial estate
lnprodtk:	Productivity, calculated from the output value divided by the amount of labour in logarithm
lnemployment:	The number of workers in logarithm
foreign capital:	Percentage of foreign capital
age:	Firm's age (years)
age^2:	Squares of firm's age

3.3 In-Depth Interview

Interviews were conducted to obtain additional information related to the characteristics of the industrial estate that are used in this study. The primary objective of the in-depth interview is to reinforce the results of the quantitative analysis that has been done. The subjects of the interviews are senior executives from some of the industrial estates holding positions as Marketing Manager, General Manager or Chief Executive Officer (CEO). Top executives are considered to have extensive knowledge of the behaviour of tenant and market. Also, interviews are conducted with the Executive Director and Chairman of the Association of Industrial Estate (HKI) for getting information about the condition of industrial estates in Indonesia. HKI plays an important role as a liaison between the government and the industrial estate management. Relating to fiscal incentives, we interviewed the officer of Customs Office in Bekasi.

3.4 Data

The database in this study was mainly built from three datasets: (i) industrial estates directory and tenants from the Ministry of Industry, (ii) Large and Medium Industries Survey or Industri Besar dan Sedang (IBS) of Statistics Indonesia or Badan Pusat Statistik (BPS) and (iii) export statistics directory 2011 and 2012 from the BPS. Information on industrial estates characteristic variables such as distance to the seaport, source of water and number of tenants were obtained from the industrial estate directory data. The port capacity was taken from transportation statistics. The percentage of PLN electricity usage by total kWh in an industrial estate was sourced from IBS, and the number of firms that have bonded area facilities in the industrial estate was sourced from Customs. Meanwhile, all of the firm's internal characteristics were sourced from IBS.

There are some data adjustments for data processing. We aggregate the capacity of the seaport in Batam as a single value since Batam is a small island located in the province of Riau Islands which has several ports for exporting. In contrast, the other provinces in this study have only one main port. The capacity of seaport that we used was export volume (thousand tons) from the seaport. We cannot find the exact capacity of seaport because of differences in measurement. The export status of the firm was matched by export statistics when a missing value was found.

The survey of industrial estate directory conducted by the Ministry of Industry in 2012 covers 59 industrial estates. After checking the existence of large and medium industries, only 48 industrial estates have data of large and medium industrial firms. The reduction occurred because of: (i) the unavailability of tenant data in an industrial estate because the database is still under construction, and (ii) no matching firms with IBS data.

4. Results

4.1 Descriptive Statistics

When comparing decisions to export for firms located inside and outside of the industrial estate, there are 21,559 firms that consist of 1,583 firms inside the industrial estate and 19,976 firms located elsewhere. For independent variables, we use

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Table 2. Descriptive statistics of variables of firms located inside and outside the industrial estate

Variables	Inside industrial estate 1583 firms				Outside industrial estate 19976 firms			
	Mean	Std. dev.	Min	Max	Mean	Std. dev.	Min	Max
Export (dummy)*	0.506001				0.171506			
Export last year (dummy)*	0.49463				0.192231			
Productivity	1155028	3632149	116.068	7.40x10⁷	401750.4	1683131	58.70834	7.65x10⁷
Employment	358.259	929.2562	20	26000	202.6572	782.9504	20	41000
Foreign capital (%)	41.64801	47.08029	0	100	5.605163	21.93982	0	100
Age	15.82502	9.172546	1	100	19.96551	12.87614	1	111

Note: *Only mean is reported for the dummy variables to indicate the proportion of export as defined in the table.

variables such as the previous year's export status productivity, number of employees, percentage of foreign capital, and firm's age, sector and location. The descriptive statistics of the variables can be seen in Table 2.

Table 2 shows that more than 50 percent of firms in the industrial estate export their products, but the corresponding percentage is only 17.2 percent for firms outside of the industrial estate. The average productivity of firms inside the industrial estate is 1155028, almost three times of firms' average productivity outside the industrial estate which is 401750. The number employed inside the industrial estate on the average is 358, higher than those outside which has an average of 202 employees. Foreign capital shows that an industrial estate is more successful for bringing in investments. The average of foreign investment inside an industrial estate is 41.6 percent, higher than outside the industrial estate which has only 5.6 percent. The average age indicates that firms in the industrial estate are newer than those outside the industrial estate. The average age inside an industrial estate is 15.8 which is smaller than outside the industrial estate with an average age of 19.9.

The descriptive statistics of industrial estate characteristics are divided into the national and regional level. Based on the concentration of industrial estates, we categorised national level into two regions: the Greater Jakarta area which has 24 industrial estate firms located in Jakarta, West Java and Banten, and the outside Greater Jakarta area which has 24 industrial estates and 466 firms located in 9 provinces (North Sumatera, West Sumatera, Riau, Riau Islands, Lampung, Central Java, East Java, South Sulawesi, and East Kalimantan). Table 3 provides an overview of the variables at national and regional level.

The discussion of descriptive statistics focussed on the difference between the variables at the regional level. The percentage of exporting firms in the Greater Jakarta and outside the Greater Jakarta are about 51 percent and 49 percent respectively. These indicate that the firms in the industrial estates in Greater Jakarta are more likely to export than those outside the Greater Jakarta area.

Table 3. Descriptive statistics of variables at national and regional level

Variables	National 1583 firms				Greater Jakarta 1117 firms				Outside Greater Jakarta 466 firms			
	Mean	Std. dev.	Min	Max	Mean	Std. dev.	Min	Max	Mean	Std. dev.	Min	Max
Export (dummy)	0.506				0.511				0.494			
Port distance (km)	37	24	0	181	43	23	5	181	21	17	0	60
Port capacity (kilotons)	9802	4052	239	33578	11573	2109	1163	12000	5558	4426	239	33578
Electricity PLN (share)	0.67	0.34	0	1	0.63	0.36	0.17	1	0.78	0.29	0	1
Water PAM (dummy)*	0.34				0.19				0.70			
Tenant	106	97	1	294	128	105	1	294	52	43	1	121
Fiscal incentive (share)	0.17	0.18	0	1	0.17	0.17	0	0.68	0.15	0.20	0	1
Export in previous year (dummy)*	0.495				0.494				0.496			
Productivity	1155028	3632149	116.1	7E+07	1285610	4E+06	1096	7E+07	842025	2398624	116.1	2.3E+07
Employment	358	929	20	26000	359	700	20	8886	356	1327	20	26000
Foreign capital (%)	41.65	47.08	0	100	45.74	47.14	0	100	31.85	45.51	0	100
Age	15.83	9.17	1	100	14.99	7.46	1	67	17.83	12.12	1	100
Age squared	334.51	536.84	1	10000	280.23	331.66	1	4489	464.64	832.14	1	10000

Note: * Only mean is reported for the dummy variables to indicate the proportion as defined in the table.

The port distance to the industrial estate in the Greater Jakarta area on average is farther away from the seaport than outside the Greater Jakarta area. It is caused by many industrial estates located in Bekasi, Karawang and Purwakarta. The distance of these locations to the port of Tanjung Priok are further than industrial estates located outside the Greater Jakarta area. The average seaport capacity is higher in the Greater Jakarta area than outside the area. The Greater Jakarta region has fewer ports but has a relatively larger capacity than outside the Greater Jakarta area.

For infrastructure, the average use of PLN power in industrial estates in the Greater Jakarta area is 63 percent, lower than those outside of the Greater Jakarta area that reached 78 percent. This shows the dependence of the industrial estates for PLN power outside the Greater Jakarta area is higher. The PAM water is only used by 19 percent of firms in the industrial estates in the Greater Jakarta area, much lower than outside the Greater Jakarta area which is used by 75 percent of firms. The average number of tenants in the Greater Jakarta area is higher than outside the Greater Jakarta area. Fiscal incentives are on average similar in both regions.

The export status in the previous year shows that the percentage of exporting firms increases about 2 percent at the national level. Most of them are located in the Greater Jakarta area whereas the number of exporting firms outside the Greater Jakarta area is relatively constant. The average productivity in the Greater Jakarta area is closed to the middle value, which shows that firms in the Greater Jakarta area have the same relative productivity as those outside the Greater Jakarta area. The number for labour is relatively similar between the two regions. The average of foreign capital in the Greater Jakarta area is higher than those outside the Greater Jakarta area, showing more firms with foreign capital are located in the Greater Jakarta area. Firms' age in the Greater Jakarta tend to be lower than those outside the Greater Jakarta area.

4.2 Comparison of Firm's Export Decision Inside and Outside the Industrial Estate

Comparison of firms' decision to export for those inside and outside the industrial estate is measured using regression adjustment (RA) and inverse-probability-weighted regression adjustment (IPWRA). We report the value of average treatment effects on the treated (ATT) in Table 4.

Both RA and IPWRA have a significant positive value of 0.1327 and 0.1256 respectively. It means that firms in the industrial estate have 13 percent higher probability to export, after controlling for productivity, number of employees, percentage of foreign capital, firm's age, sector and location as the covariates. This result shows that the development of industrial estates is successful in promoting exports.

Table 4. Comparison of decision to export for firms inside and outside the industrial estate

ATT	Regression Adjustment	Inverse-probability-weighted regression adjustment
Export Decision	0.1327***	0.1256***

4.3 Role of Industrial Estate Characteristics on Firm's Export Decision

At the national level, there are 1583 firms. The Greater Jakarta area has 1117 firms or 71 percent of total observations while outside the Greater Jakarta region has 466 firms or 29 percent of total observations. By using probit models, the estimation of various sets of data is robust to heteroscedasticity. The standard error is clustered by the seaport so that errors can be correlated between firms that access the same seaport. The Hosmer-Lemeshow test shows that the models used are good. Table 5 shows the regression results.

The distance to the seaport has a significant positive effect in the Greater Jakarta area. This means that a greater distance of an industrial estate from the seaport will increase a firm's decision to export, but it is insignificant for outside the Greater Jakarta area. These results contradict the hypothesis that a further distance will increase transportation costs and lower a firm's tendency to export. The possible reason is the economic benefit from production costs outweighed the effect of increasing transportation costs. From the interviews, all industrial estates have highway access to the seaports. The toll road is relatively smooth so that a longer distance does not necessarily increase transportation costs in the Greater Jakarta area.

Seaport capacity has no significant effect on a firm's export decision in the industrial estate in the Greater Jakarta area. There are only two seaports in Greater Jakarta, and most of the firms access the same port (Tanjung Priok). For those outside Greater Jakarta, seaport capacity has a significant negative effect on a firm's export decision. This is caused by non-optimal exporting by manufacturing firms in the outside Greater Jakarta area. A port with larger capacity is accessed by fewer exporting firms. A large share of the port capacity is used by other economic sectors based on natural

Table 5. Results of regression at national and regional Level

Variable	National	Greater Jakarta area	Outside Greater Jakarta area
Port distance	0.104	0.174***	0.144
Port capacity	0.0301	0.0493	-0.198**
PLN Electricity	-0.113	0.0348***	-0.879***
PAM Water	0.183*	0.265***	-0.365***
Tenants	-0.0224	0.0508***	0.204
Fiscal incentive	1.045**	1.644***	-0.217
Export in previous year (dummy)	3.194***	3.223***	3.551***
Productivity	0.0727**	0.048	0.222*
Employment	0.0531	-0.00793	0.282***
Foreign capital	0.00329***	0.00201***	0.0121**
Age	0.0374***	0.0346***	0.00962
Age squared	-0.000721***	-0.000240***	-0.000669*
Constant	-3.843***	-4.228***	-4.693**

Note: *p<0.1, **p<0.05, ***p <0.01.

resources such as agriculture and mining. We do not find the effect of costs saving as in Abe and Wilson (2011) who reported that increasing a port's capacity by 10 percent will reduce transport costs of up to 3 percent in East Asia.

PLN power source has a positive effect for the Greater Jakarta area. A higher percentage usage of PLN electricity in the industrial estate will improve a firm's decision to export. The existence of alternative power sources that has excellent reliability made PLN improve their quality of services by providing premium power. The quality is guaranteed from shutting down or flicker. Based on the experiences of respondents who use premium PLN power, a flicker might turn off the large and sensitive production machine. Production costs will increase because the large machines need time to be able to work normally after a flash happens.

Outside of the Greater Jakarta area, PLN electricity has a negative effect which means that the greater portion of PLN power in an industrial estate will reduce tendency to export. This result is influenced by the industrial estate that has a high percentage PLN power usage being mostly occupied by firms that do not export. Conversely, the industrial estate that has its power source is mostly occupied by firms that export. This result indicates that PLN has not been able to meet the capacity or quality of the power required by exporting firms in the industrial estate. Industrial estates have to build its power source according to the needs of its tenants.

PAM water has a positive significant effect on a firm's decision to export in the industrial estate in the Greater Jakarta area, which means that firms in the industrial estate that use PAM water are more likely to export than firms in the industrial estate that does not use PAM water. PAM limitations regarding water supply for the industrial estate caused many industrial estates to meet their water needs by utilising river water or groundwater, especially in the area of Bekasi, Karawang and Purwakarta. Independent water treatment by operators of industrial estates may increase production costs due to the higher price of water. On the other hand, PAM water has a significant negative effect on outside the Greater Jakarta area where more exporting firms are located in the industrial estate that has an independent water source. Conversely, in the industrial estate that uses PAM water, fewer firms are exporting. Like PLN power, there is a tendency that in an industrial estate whose many tenants are exporting have built water installations independently.

The number of tenants has a positive significant effect on export decision of firms in the industrial estate in the Greater Jakarta area. More tenants can improve interaction between firms so that the positive effects of agglomeration becomes more prominent as described by Marshall (1890) and Jacob (1969). From the interviews, we obtained information that the industrial estate with many tenants usually have a major firm or industry (anchor). For example, automotive firms get components from supplier firms that are located in the same industrial estate. Likewise, fiscal incentives have a positive influence on a firm's export decision. More firms receiving fiscal facilities (bonded zone) in the industrial estate increases a firm's tendency to export. This shows the positive effect of the export spillover through the existence of the bonded zone in the industrial estate. Both variables, number of tenants in an industrial estate and number of firms in the bonded zone show that economic agglomeration in the industrial estate significantly influences a firm's decision to export.

Exports in the previous year, the proxy of sunk entry cost, has a significant positive effect on a firm's decisions to export in Greater Jakarta and outside Greater Jakarta areas. Firms that export in the previous year tend to re-export. The tendency to continue exporting is greater in firms that are located outside the Greater Jakarta area. First-time export of firms located outside the Greater Jakarta area needs a greater sunk entry cost than those in the Greater Jakarta area. The results on the role of previous export status support the empirical study of a firm's decision to export such as Farole and Winkler (2011) and Rodriguez et al. (2013).

Productivity has no significant impact on export decision for firms in the Greater Jakarta area. This result shows that firms with low productivity also export. From the interviews, we obtain information that in the Greater Jakarta area, many firms are not only supplying components to a larger company, but they also export. For firms outside the Greater Jakarta area, productivity has a significant positive effect. This is in agreement with Melitz (2003) who stated that only high-productivity firms could export. The number of workers is insignificant to a firm's decision to export in the Greater Jakarta area. It shows that not only the big firms export but also medium-sized firms. Different results were obtained for firms outside the Greater Jakarta area where big firms have more tendency to export than medium-sized firms.

Foreign capital has a significant positive influence in both the Greater Jakarta and outside Greater Jakarta areas. A high portion of foreign capital encourages a firm to export in the industrial estate. These results support Sjöholm and Takii (2008) who found that foreign capital firms are more likely to export than domestically funded firms in Indonesia. The main reason why foreign capital might encourage export is the involvement of global production chain. Multinational companies established factories in several countries that have different comparative advantages to lower production costs. The interviews suggest that the ownership of almost all industrial estates in the greater Jakarta area are joint venture companies, in which most of the foreign ownership came from Japan and South Korea. The presence of this foreign ownership can foster the confidence of investors to invest in Indonesia and locate their firms in the industrial estate which they managed.

A firm's age has a significant positive effect in the Greater Jakarta and outside Greater Jakarta areas. Older firms have a greater probability to export. This result is consistent with Johanson and Vahlne (1977) who showed that export is a gradual development process. However, when we used squared of age, the coefficient is negative. It means that a firm's age is positively increasing the probability to export, but the marginal increase is decreasing.

5. Conclusion

Comparison of decision to export for firms inside and outside of the industrial estate using treatment effect method shows that firms in the industrial estate are more likely to export than those located elsewhere. The industrial estate development policy is effective in encouraging the export performance of manufacturing firms in Indonesia.

A firm's decision to export in the industrial estate is influenced by characteristics of the industrial estate. At the national level, PAM water and fiscal incentives increase

a firm's tendency to export. As for the regional level, industrial estate characteristics give different results across regions. In the Greater Jakarta area, infrastructure such as PLN power and PAM water, local agglomeration and fiscal incentives improve a firm's tendency to export. The government should build better and reliable infrastructure outside the Greater Jakarta area.

In this study, we have learned the effect of industrial estate characteristics on a firm's decision to export, but their impact on the economy remains to be investigated. Further study is needed considering that the industrial estates in Indonesia are mostly dominated by foreign-owned firms. The increase in exports may not provide optimum benefit to the economy of Indonesia if there is no increase in employment, foreign exchange earnings and technology transfer as suggested by Warr (1989).

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