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Determinants of Migration Flows in Highly Skilled Migrants Interprovince in Indonesia

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Abstract

Migration and regional inequality are two interrelated concepts. Inequality between regions can lead to migration. High-skilled migration, or migration of high-quality human resources, has great potential to reduce interregional disparities by helping development in the destination area. However, in reality, the flow of high-skilled migration tends to lead to more advanced provinces, especially the capital and its surroundings. This condition causes disparities between regions to increase. This study analyzes the phenomenon of internal high-skilled migration between provinces in Indonesia at a macro level using a modified gravity model approach and is estimated using the zero-inflated negative binomial (ZINB) model. The results of this study show that the number of high-skilled populations in the provinces of origin and destination, geographical distance, average wages for workers, and the percentage of agricultural workers in the destination province, as well as the stock of migrants, influence the flow of high skilled migration between provinces in Indonesia. Increasing workers' wages, access to transportation and information/social networks, as well as industrialization outside Java, need to be carried out to attract high-skilled migrants or keep high-skilled workers to remain in their provinces to realize equity between regions.

Keywords: high-skilled migration; gravity model; zero-inflated negative binomial model

Introduction

One of the things which becomes an important concern in the process of national development is equity. It cannot be denied that regional inequality is still an unresolved issue in many countries, including Indonesia. The problem of development itself cannot be separated from population issues, one of which is migration. According to Bayraktar and Özyılmaz (2017) and Tjiptoherijanto (2000), migration and regional inequality are two interrelated concepts, in which development inequality between regions can give rise to the phenomenon of migration.

Internal migration flows generally head to more developed areas (Ritsila and Ovaskainen, 2001; Lottum and Marks, 2012). The data of the Intercensal Survey (*SUPAS*) 2015 shows that internal migration in Indonesia is still "Java-centric". DKI Jakarta and West Java respectively are the provinces which send and receive the most risen migrants, far exceeding other provinces outside Java. This indicates that disparities between provinces in Indonesia are still large, especially between regions in Java and outside Java. Therefore, information on population mobility is increasingly important in decentralized development planning (Chotib, 2015).

Remittances sent to areas of origin and increased development in destination areas are positive impacts of migration. However, migration also has negative impacts, such as congestion, overcrowding, crime, changes in behavior and lifestyle, security and terrorism, urban poverty, and so on (Chotib, 2015). Along with these problems, DKI Jakarta, West Java, and Banten are the three provinces with the largest population density and percentage of villages/*kelurahan* with slum settlements in Indonesia in 2015. This indicates that there are population problems in the three provinces which may be caused by the phenomenon of excessive in-migration.

The positive and negative impacts of migration depend on the quality of human resources (HR). High-quality human capital is a source of economic growth for a country (Capuano and Marfouk, 2013). In this case, migration plays an important role in the redistribution of human resources to each region (Ritsila and Ovaskainen, 2001), especially high-quality human resources. Therefore, the issue of migration of skilled and highly educated human resources is an important issue to raise. These migrants are called high-skilled migrants. The inflow of high-skilled migrants can encourage the accumulation of human capital, thus facilitating innovative activities and can increase the potential for endogenous growth in the destination area (Liu and Shen, 2012).

Evenly distributing the high-skilled population can be one of the solutions to reduce inter-regional disparities. However, the absence of restrictions on internal migration in Indonesia allows high-skilled migrants to freely migrate to places they want, the majority of which are to places more developed and metropolitan. This has led to the centralization of the high-skilled population in several core areas (Ritsila and Ovaskainen, 2001), especially the capital and its surroundings which are the economic, social, and political center (Choi, Kim, and Lee, 2015). This is proven by the high migration of high-skilled migrants to Java Island, especially Jakarta, West Java, and Banten, which are the three provinces receiving the highest number of high-skilled migrants. This indicates that migration polarization exists around DKI Jakarta and its surroundings. Krasulja, Blagojevic, and Radojevic (2016) revealed that with polarization to metropolitan areas, high-skilled migration will lead to increased inequality between regions where rich areas will get richer and poor areas will get poorer. This condition is indicated to occur in Indonesia, in which there will be an imbalance between the DKI Jakarta metropolitan area/surroundings and eastern Indonesia which is still in the process of developing. Therefore, it is necessary to learn the factors which influence the flow of high-skilled migration in Indonesia. This issue is becoming increasingly important for further study considering that research on high-skilled migration in Indonesia is still very limited.

This research uses the gravity model, which according to Oberg (1995) is one of the strongest theories in geographical application in macro migration analysis. Migration flows in Indonesia with this gravity model have been studied by Wajdi, Adioetomo, and Mulder (2017) and Sofian (2009). However, this research still discusses migration in general. Research on high-skilled migration flows is still very limited in Indonesia. Therefore, research focusing on the phenomenon of high-skilled migration is urgently needed.

High-Skilled Migration

According to BPS (2017), migration is the movement of people to settle from one place to another by crossing an administrative boundary, such as a district/city, province, or country boundary. The concept of migration used in this study is internal migration. The

administrative boundaries used in this study are provincial boundaries with a five-year term. Provinces as administrative boundaries with a period of five years. If the province of current residence is different from the province of residence five years ago, then the person is classified as a risen migrant. The province of residence five years ago is the province of origin and the province of residence is now the province of destination. This study uses the concept of risen migration because risen migration is more dynamic and more appropriate for describing the current dynamics of population movements than other types of migration (Wajdi, Adioetomo, and Mulder, 2017).

The phenomenon of migration analyzed in this study is limited to the migration of high-skilled people. According to Kelo and Wachter (2004), there is no agreement between various countries and organizations to define an individual as highly skilled or not. However, two approaches can be used to define it. The first definition relates to the education it has. Highly skilled individuals are defined as individuals who have tertiary education. According to the Word Bank (2017), tertiary education in some countries refers to all post-secondary education, including public or private universities, colleges, technical training institutions, and vocational schools. The second definition relates to the profession one has. High-skilled individuals are identified by the type of work they do in the destination country. A person employed in the destination country in a position which normally requires higher education will be classified as a highly skilled individual. Taking into account the limitations of the Intercensal Survey (*SUPAS*) 2015 data for filtering which are high-skilled migrants or less-skilled migrants, this research will use the first definition. Therefore, high-skilled migration is defined as the phenomenon of migration of people with the highest certificate above senior high school/equivalent, specifically Diploma I/II/III/IV, Bachelor, Masters, or Doctoral Degree.

The inflow of highly skilled residents can encourage the accumulation of human capital, thereby facilitating innovative activities and can increase the potential for endogenous growth in the destination area (Liu and Shen, 2012). However, highly educated and skilled migrants tend to move to the capital area (Choi, Kim, and Lee, 2015) and this will lead to an accumulation of high-skilled residents in the capital area. This can be caused by the high differences in wages between regions (Liu and Shen, 2012). This polarization will cause the distribution of high-quality resources to be very unequal, which will lead to high regional disparities between the capital and non-capital regions.

Push and Pull Factors of Migration

Ravenstein (1885) suggests that many things influence decisions for someone to migrate, such as the factors of distance, gender, technology, and also the dominance of economic motives. The next theory is from Lee (1966) which reveals that migration is influenced by push factors, pull factors, inhibiting obstacles, and personal factors. This study tends to use Lee's (1966) framework to identify a variable as a pull factor, pusher, or even an inhibiting factor.

Economic factors are still a major factor in the migration phenomenon (Ravenstein, 1885; Greenwood, 1975; Liu and Shen, 2012; Wajdi, Adioetomo, and Mulder, 2017). Migrants will choose a destination area which has a greater net income compared to the area of origin (Greenwood, 1975). High wages in the area of origin will attract migrants to move to that place. Apart from the income side, the existence of opportunities or jobs also influences a migration phenomenon. This is represented by high or low levels of unemployment in an area (Stilwell, 2005). Ahmad, Akram, and Hussain (2013) revealed that rural-urban migration is strongly influenced by unemployment rates

and differences in income between origin and destination. The unemployment rate used in this study is focused on the urban unemployment rate which is the majority of high-skilled residents or destination migrants. This treatment was also carried out by Liu and Shen (2012).

The level of economic development in an area also needs to be considered. In a developing country like Indonesia, economic development in an area can be represented by the percentage of workers in the agricultural sector (Wajdi, Adioetomo, and Mulder, 2017). Rural-urban migration is usually also motivated by migration from agricultural areas to non-agricultural areas, along with the reduced share of per capita income from the agricultural sector and also the increasingly limited availability of agricultural land in villages (Ahmad, Akram, and Hussain, 2013).

In addition to economic factors, environmental factors also play an important role in selecting migration destinations (King, 2011; Stillwell, 2015). This is related to the presence of amenities (comfort) in the area they live. Safe areas will attract migrants and conversely, less safe areas will encourage migrants to leave the area. Therefore, the variable percentage of the population experiencing crime will be used as a proxy for the amenities factor. Buena (2012) also found that crime rates have a significant effect on migration from a statistical point of view.

The increasing phenomenon of migration occurs every time along with easier access to information about the destination. In this case, social networks play an important role in making decisions to migrate or not. Migrant stocks can be proxies for social networks in destination areas (Wajdi, Adioetomo, and Mulder, 2017). It is assumed that social networks in the destination area can provide the right information for prospective migrants. This will be the right tool for high-skilled migrants who can filter information and make more informed decisions. Liu and Shen (2012) define the migrant stock as the proportion of lifetime migrants, to be specific people who were born in the area of origin and at the time of enumeration were in the destination area. This migrant stock variable has a positive effect on migration flows from areas of origin to destinations (Liu, 2012; Wajdi, Adioetomo, and Mulder, 2017).

Gravity Models

This study incorporates Lee's theory (1966) into the migration gravity model approach proposed by Zipf (1946). This gravity model is a hypothesis which was applied by Zipf (1946) based on Newton's law of gravity which was then considered by Ravenstein's (1885) migration theory. Zipf (1946) modeled the movement of migratory flows based on the P1P2/D hypothesis he made, in which the magnitude of migration flows is proportional to the number of populations in both the origin (P1) and destination (P2), and inversely proportional to the distance (D), as stated by Ravenstein (1885). According to Oberg (1995), the spatial gravity model is one of the strongest theories in geographic applications in macro migration analysis. The following is a model of migration flows with the P1P2/D hypothesis made by Zipf (1946).

$$M_{ij} = k \frac{POP_i^{\beta_1} POP_j^{\beta_2}}{D_{ij}^{\gamma}} \qquad (1)$$

Taking to note, Mij is the flow of migration from the area of origin to the destination area, POPi and POPj respectively are the number of residents in the origin and destination areas, while Dij is the distance between the two areas.

The use of the number of populations in equation (1) is a modification of Newton's law by replacing the mass of the object with the number of populations. The larger

the population in the area of origin or destination, the higher the migration flows (the more mobile). In previous research, the variable population size, both in origin and destination, affects the magnitude of migration flows that occur (Stillwell, 2005; Shen, 2011; Wajdi, Adioetomo, and Mulder, 2017). In fact, Shen (2011) and Wajdi, Adioetomo, and Mulder (2017) found that there is a positive relationship between migration flows and population numbers in the origin and destination areas. Because this study focuses on high-skilled migration flows, adjustments will also be made to the components of the gravity model used, that is by changing the variable population size to the number of high-skilled populations. This treatment was also carried out by Liu and Shen (2012).

Besides population size, another major component of the gravity model is geographic distance. Distance represents the amount of money which must be spent to migrate (Wajdi, Adioetomo, and Mulder, 2017). The greater the distance, the tendency to migrate from areas of origin to destinations will decrease (Ravenstein, 1885; Greenwood, 1975; Stillwell, 2005; Shen, 2011; Wajdi, Adioetomo, and Mulder, 2017). Liu and Shen (2012) also found that distance also has a negative effect on high-skilled migration flows. However, Wajdi, Adioetomo, and Mulder (2017) found that the effect of distance decreases over time.

Methodology

This study uses a quantitative approach covering 34 provinces in Indonesia in 2015 so that there will be 1,122 flows of high-skilled migration. as an observation. This study uses 16 variables consisting of one response variable, specifically inter-provincial inter-provincial migration of high-skilled research in Indonesia, and 15 explanatory variables in the 2015 period. The details are in Table 1.

Table 1. Variable Details and Data Sources

No	Variable	Notation	Data Source **
1	The flow of high-skilled internal migration	M	A
2	High-skilled migration *)	POP	A
3	Migrant stock	STOK	A
4	Geographical distance	D	E
5	Dummy variable of Island	Pulau	E
6	Dummy variable of Java	Jawa	E
7	Dummy variable of Capital	Ibukota	E
8	Urban unemployment rate *)	TPTU	B
9	Average wages of workers *)	UPAH	C
10	Percentage of workers in the agricultural sector *)	AGRI	C
11	Percentage of crime victims during the past year *)	CR	D

Note:
*) as two variables, namely characteristics in origin (i) and destination (j)
**) A: SUPAS 2015 estimation; B: *Publikasi Keadaan Angkatan Kerja di Indonesia Agustus 2015*; C: *Publikasi Keadaan Pekerja di Indonesia Agustus 2015*; D: *Publikasi Statistik Kriminal 2016*; E: Researcher's calculations

The distance variable is calculated from the Indonesian SHP map with ArcGIS. The island dummy variable is coded 1 if the migration flow occurs on one island, and code 0 if it is on a different island. The Java dummy variable is coded 1 if migration flows through Java Island, both as the province of origin and destination, and code 0 if it does not pass through Java Island. The capital dummy variable is coded 1 if migration flows through the capital and its surroundings (DKI Jakarta, West Java, and Banten), and code 0 if not. The three dummy variables were included to look at the phenomenon of inter-island high-skilled migration, the existence of the island of Java, and the existence of the capital city and its surroundings.

The gravity model in equation (1) can be called the basic gravity model. Meanwhile, there are many other factors besides the three components, such as economic factors, amenities, and social networks. Like the pull and push factors which have been described previously, several explanatory variables will be included in the basic gravity model to form an extended gravity model as follows.

$$M_{ij} = k\frac{POP_i^{\beta_1} POP_j^{\beta_2} \dots STOK_{ij}^{\beta_{14}}}{D_{ij}^{\gamma}} \qquad (2)$$

Details of the variables included in the extended gravity model can be seen in Table 1. With the natural logarithm transformation in the model, is being substituted to and () to . Then, error term is included as a result of parameter estimation with *count regression* so equation (2) changed to become:

$$\begin{aligned}\ln M_{ij} = {} & \beta_0 + \beta_1 \ln POP_i + \beta_2 \ln POP_j + \beta_3 \ln Pulau + \beta_4 \ln Jawa \\ & + \beta_5 \ln Ibukota + \beta_6 \ln TPTU_i + \beta_7 \ln TPTU_j + \beta_8 \ln UPAH_i \\ & + \beta_9 \ln UPAH_j + \beta_{10} \ln AGRI_i + \beta_{11} \ln AGRI_j + \beta_{12} \ln CR_i \\ & + \beta_{13} \ln CR_j + \beta_{14} \ln STOK_{ij} + \beta_{15} \ln D_{ij} + \varepsilon_{ij}\end{aligned} \qquad (3)$$

Furthermore, equation (3) will be estimated using count regression, such as Poisson regression and negative binomial regression. Count regression is a regression method with a discrete-scale dependent variable (count). Poisson regression is a benchmark of a count regression analysis (Yaacob, Lazim, and Wah, 2010). Poisson regression requires the fulfillment of the equidispersion assumption, that is, the mean equals the variance. However, these conditions are rarely found in real life. Violating the equidispersion assumption will lead to underestimation of the standard error of the estimation so that what should not have a significant effect will be found to have a significant effect.

Conditions which often occur in the field practically are conditions in which the variance is greater than the average, especially in migration flow data. This condition is called overdispersion (Yaacob, Lazim, and Wah, 2010). Overdispersion detection can be done by looking at the Deviance/df and Pearson Chi-Square/df values. If the value of the two criteria is more than 1, then it is indicated that there is an overdispersion problem in the formed Poisson model. This problem causes Poisson Regression to be no longer good for use. Therefore, negative binomial regression can be used as an alternative to Poisson regression which suffers from overdispersion problems (Jong and Heller, 2008). This negative binomial model is more flexible for data with overdispersion problems.

In a developing country like Indonesia, the number of people with high-skilled status is still very limited, so there may be many high-skilled migration flows that are

zero. This condition is called excess zero. Therefore, the use of a zero-inflated model is highly recommended, as well as overcoming the problem of overdispersion. This study will consider the use of the Zero-Inflated Poisson (ZIP) or Zero-Inflated Negative Binomial (ZINB) model to analyze the determinants of inter-provincial high-skilled migration flows in Indonesia. Before constructing the model, multicollinearity detection is performed with VIF. If VIF value for each variable is smaller than 10, then there is no multicollinearity problem.

Results

Overview of High-Skilled Migrants in Indonesia

For an overview of high-skilled migrants between provinces in Indonesia in 2015, it can be seen in several individual characteristics as shown in Table 2.

Table 2. Percentage of High-skilled Migrants based on Each Category

Characteristics	Category		Percentage
Gender		Man	50.12
		Woman	49.88
		Total	100.00
Main Reason for Migrating		Job/Looking for Job	46.99
		Follow your husband/wife/parents/ other	38.38
		Housing area	6.13
		Change of Marital Status	4.51
		Other	3.99
		Total	100.00
Main Reason for Migrating	Man	Job/Looking for Job	62.83
		Follow your husband/wife/parents/ other	17.64
		Housing area	8.81
		Change of Marital Status	5.77
		Other	4.95
		Total	100.00
	Woman	Job/Looking for Job	31.06
		Follow your husband/wife/parents/ other	59.23
		Housing area	3.44
		Change of Marital Status	3.23
		Other	3.03
		Total	100.00

Source: Intercensal Survey (*SUPAS*) 2015

Percentage of high-skilled migrants of men are almost the same as women. This indicates that there is no dominance of one gender in the phenomenon of high skilled migration. The development of gender equality and the freedom for a woman to receive higher education provides insight and a sense of self-confidence. When viewed from the main reasons for migration, high-skilled migrants in general are more dominated by reasons of work/looking for work (46.99%) and joining husband/wife/parents/children/ siblings/other relatives (38.38%). This shows how economic factors are still involved in the phenomenon of migration in Indonesia, including high-skilled migrants.

However, an interesting phenomenon can also be seen if another breakdown is carried out according to gender, the majority of male high-skilled migrants move for the main reason of work/finding work (62.83 %), while the majority of female high-skilled migrants prefer to join their husbands/parents/ other relatives as the main reason (59.23%). This indicates that there are differences in the behavior of male and female high skilled migrants in making migration decisions. Male high skilled migrants are more able to decide for themselves why they migrate, while women seem more likely to migrate because they want to follow their husbands, parents or other relatives, which is not their own initiative to migrate.

In addition to an overview of the micro characteristics of migrants, we will also look at a macro overview of high skilled migrants, namely through the thematic map in Figure 1 and through the circos plot in Figure 2.

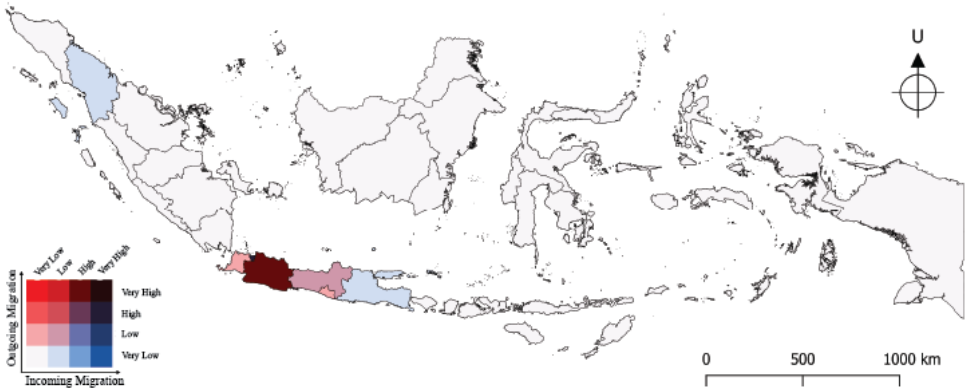

Figure 1. Thematic Map Representing the Number of Incoming and Outgoing High-Skilled Migrants by Province in Indonesia in 2015

As seen in Figure 1, the highest number of incoming and outgoing high-skilled migrants occurs in the provinces on the island of Java. This indicates that there is a polarization of migration flows of the high-skilled population on the island of Java, especially in the provinces of DKI Jakarta and West Java. The very dark colors in the two provinces indicate that the majority of this phenomenon of high-skilled migration occurs in the capital city and its surroundings. Meanwhile, the phenomenon of migration of risen high-skilled does not occur so much in provinces outside Java. This polarization has led to an imbalance of high-quality human resources between regions on the island of Java and areas outside Java. Furthermore, to see the flow of high-skilled migration in more detail, the circos plot is used as seen in Figure 2.

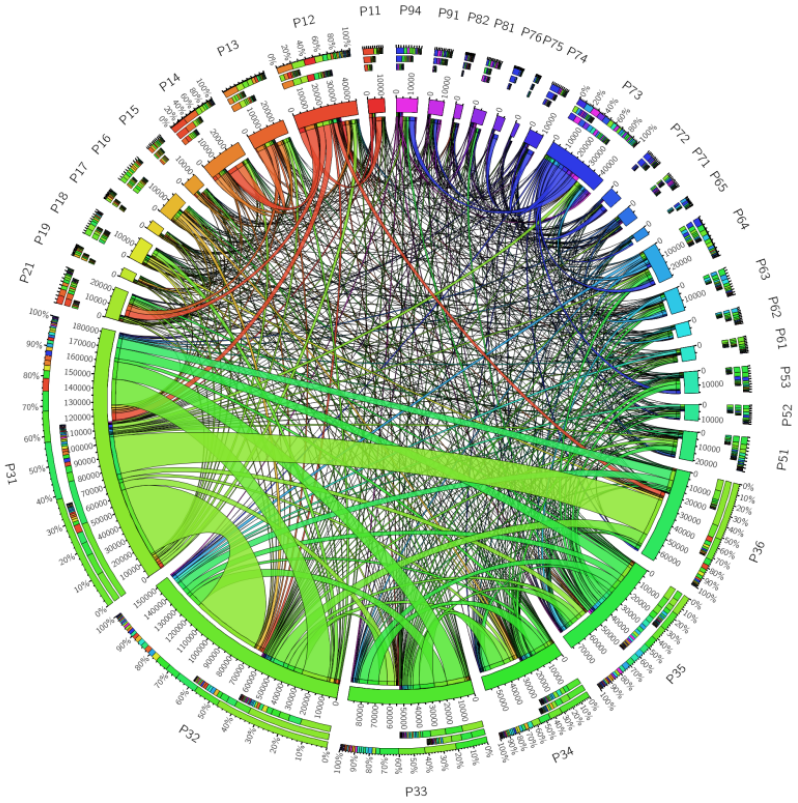

Figure 2. Circos Plot of High-Skilled Migration Flows Between Provinces in Indonesia in 2015

The high number of high-skilled migrants entering and leaving Java is apparently due to high inter-provincial migration of high-skilled migrants in Indonesia who move from provinces on Java Island to neighboring provinces, which are also on Java Island. This can be seen in Figure 2. Information on the provincial code used in Figure 2 can be seen in Table 2. The phenomenon of inter-provincial high-skilled migration in Indonesia in 2015 was no longer dominated by movements from outside Java to Java Island, but rather movements between provinces on Java Island to other provinces which were also on Java Island. In Figure 2, it can be seen that the largest migration flow of risen high-skilled occurs from DKI Jakarta (P31) to West Java (P32). This can be seen from the thickness of the migration flow line from DKI Jakarta to West Java. Then, the next largest flow of high-skilled migration is the flow of high-skilled migration from DKI Jakarta to Banten (P36). This phenomenon indicates that there is a large movement of high-skilled residents from DKI Jakarta to suburban areas of Jakarta, such as Bogor, Depok, Tanggerang, South Tangerang, and other areas which incidentally have cheaper accommodation prices and also remain close to the capital area.

Table 2. Code and Name of Province

Code	Province Name	Code	Province Name
P11	Aceh	P52	West Nusa Tenggara
P12	North Sumatera	P53	East Nusa Tenggara
P13	West Sumatera	P61	West Kalimantan
P14	Riau	P62	Central Kalimantan
P15	Jambi	P63	South Kalimantan
P16	South Sumatera	P64	East Kalimantan
P17	Bengkulu	P65	North Kalimantan
P18	Lampung	P71	North Sulawesi
P19	Bangka Belitung Islands	P72	Central Sulawesi
P21	Riau Islands	P73	South Sulawesi
P31	Jakarta Capital Special Region	P74	Southeast Sulawesi
P32	West Java	P75	Gorontalo
P33	Central Java	P76	West Sulawesi
P34	Special Region of Yogyakarta	P81	Maluku
P35	East Java	P82	North Maluku
P36	Banten	P91	West Papua
P51	Bali	P94	Papua

Mobile movement between provinces in Java is also due to access to inter-provincial transportation in Java which is very affordable, both in terms of location, quantity, and cost. This is again due to the large imbalance in development between regions on Java Island and areas outside Java Island. Apart from that, it is also coupled with the high number of high-skilled people residing on Java Island which makes a big difference in the flow of high-skilled migration between areas on Java Island and outside Java Island.

Determinants of Interprovincial High-Skilled Migration Flows

Before doing an inference analysis, it was used to detect multicollinearity by calculating the VIF of each independent variable included in this study. The results can be seen in Table 3, which each independent variable has a VIF value of less than 10. These results indicate that there is no multicollinearity problem between the independent variables used. After running the data with the Poisson model. There is an indication of an underestimate in the standard error of the estimate which is very unreasonable in Table 4.

Table 3. VIF Value of Each Numerical Independent Variable

Variable	VIF	Note
ln POP_i	2.0565	No multicollinearity problem
ln POP_j	2.0903	No multicollinearity problem
ln D_{ij}	1.4042	No multicollinearity problem
ln $TPTU_i$	1.2256	No multicollinearity problem
ln $TPTU_j$	1.2049	No multicollinearity problem
ln $UPAH_i$	1.8556	No multicollinearity problem
ln $UPAH_j$	1.8848	No multicollinearity problem
ln $AGRI_i$	1.5650	No multicollinearity problem
ln $AGRI_j$	1.5810	No multicollinearity problem
ln CR_i	1.0887	No multicollinearity problem
ln CR_j	1.0918	No multicollinearity problem
ln $STOK_{ij}$	2.0826	No multicollinearity problem

Table 4. Poisson Model Outputs

		Number of obs	= 1122	
		LR chi2 (15)	= 1695635.57	
		Prob > chi2	= 0.0000	
		Pseudo R2	= 0.8462	
		Log likelihood	= -154052.96	
Variable	**Coef.**	**Std. Err.**	**z**	**p > |z|**
ln POP_i	0.7432	0.0027	277.41	0.000
ln POP_j	0.4904	0.0026	187.97	0.000
ln D_{ij}	-0.6985	0.0025	-279.10	0.000
i.Ibukota	0.4554	0.0055	82.80	0.000
i.Jawa	0.0967	0.0062	15.68	0.000
i.Pulau	0.2944	0.0050	58.97	0.000
ln $TPTU_i$	0.2271	0.0066	34.45	0.000
ln $TPTU_j$	0.1012	0.0057	17.60	0.000
ln $UPAH_i$	1.0773	0.0152	70.96	0.000
ln $UPAH_j$	2.0419	0.0133	153.84	0.000
ln $AGRI_i$	-0.1213	0.0015	-80.68	0.000
ln $AGRI_j$	-0.0084	0.0016	-5.27	0.000
ln CR_i	-0.0444	0.0083	-5.32	0.000
ln CR_j	0.0874	0.0074	11.87	0.000
ln $STOK_{ij}$	0.1933	0.0011	176.36	0.000
_cons	-49.1428	0.3336	-147.33	0.000

This indication can be seen from the odd p-value for each partial test of the independent variable which is zero. This could be due to the violation of the equidispersion assumption. Therefore, the next step is to detect the equidispersion properties required in the Poisson model. The following is the detection of the equidispersion assumption.

Table 5. Identification of Equidispersion Assumption on the Poisson Model

Criteria	Value	Indication
Deviance/df	274.55	Overdispersion occurs
Pearson *Chi-Square*/df	373.89	Overdispersion occurs

Note: df = 1106

Based on Table 5, the Poisson model formed indicates overdispersion. These results can be seen from the Deviance/df and Pearson Chi-Square /df values which are much greater than 1. The high proportion of zero observations (excess zero), which is 46.61 percent, has the potential to be the main cause of the overdispersion problem. Therefore, the use of a regression model by considering the many zero-value observations (excess zero) needs to be applied in this study. Therefore, a comparison was made between the three alternative models, specifically the negative binomial model, ZIP, and ZINB. The comparison uses several criteria indicators and tests the goodness of the model. The results of the comparison are shown in Table 6.

Table 6. Criteria for Selecting Alternative Models

Criteria	Model		
	Negative Binomial	ZIP	ZINB
Ln-Likelihood	-5204.66	-108971.1	-4696.28
AIC	10443.32	218006.1	9458.57
BIC	10528.70	218166.9	9624.32
Voung Test		13.40 (0.0000)	9.40 (0.0000)
LR Test of Alpha	3.0×10^5 (0.0000)		2.1×10^5 (0.0000)

In Table 6, it can be seen that the ZINB model has the largest ln-likelihood value, as well as the smallest AIC and BIC values among the three alternative models. In addition, the results of rejecting H0 on the vuong test and LR test of alpha show that the ZINB model is better for use in this study than the negative binomial or ZIP model. Therefore, researchers chose to use the ZINB model. Following are the results of the ZINB model obtained.

Table 7. Results of the ZINB Model

Variabel	Logit Model		Negative Binomial Model	
ln POP_i	-1.0977	***	0.5631	***
ln POP_j	-0.6478	***	0.3836	***
ln D_{ij}	1.4514	***	-0.7398	***
Ibukota	-2.1614	***	0.4312	**
Jawa	-1.5029	***	0.2398	*
Pulau	-0.6832	**	0.2024	
ln $TPTU_i$	-0.6900	**	0.2447	*
ln $TPTU_j$	-0.3660		0.0828	
ln $UPAH_i$	-1.1290	*	1.3243	***
ln $UPAH_j$	-2.4248	***	1.5826	***
ln $AGRI_i$	0.5378	**	-0.0759	
ln $AGRI_j$	0.1464		-0.1626	**
ln CR_i	-0.3640		-0.0921	
ln CR_j	-0.0690		0.0519	
ln $STOK_{ij}$	-0.1245	**	0.0189	***
Konstanta	61.2799	***	-41.6863	***
Alpha	0.8194 ***			
Uji Simultan	655.19 ***			

Note: * *p-value* < 0.1; ** *p-value* < 0.05; *** *p-value* < 0.01

In Table 7, the high-skilled population, both origin and destination, has a significant positive effect on inter-provincial high-skilled migration flows. These results are consistent with the findings of Shen (2011), Wajdi, Adioetomo, and Mulder (2017) on migration flows as a whole, and are in accordance with Zipf's (1946) hypothesis regarding the magnitude of migration flows proportional to the total population in the origin and destination areas. This means that the majority of high-skilled migrants move from provinces with a large population of high-skilled and to provinces with a large population of high-skilled, as happened in Java. Provinces with a large number of high-skilled populations will have a high capacity of high-skilled populations to deliver (Wajdi, Adioetomo, and Mulder, 2017). This is in accordance with the analysis from Figure 2 in which the majority of high-skilled migration flows are concentrated in the provinces of Java Island. In addition, the number of high-skilled populations also has a significant effect on the presence or absence of high-skilled migration flows between provinces where any increase in the number of high-skilled populations, both in the province of origin and destination, will reduce the tendency for no high-skilled migration flows. This phenomenon can lead to an imbalance in the distribution of high-skilled human resources between provinces, the majority of which only operate in developed regions.

The geographic distance variable can represent the distance traveled, costs, and access difficulties faced by migrants (Greenwood, 1975). The geographical distance variable appears to have a significant negative effect on high-skilled

migration flows between provinces, in accordance with the findings of Greenwood (1975), Stillwell (2005), and Shen (2011). Although Wajdi, Adioetomo, and Mulder (2017) had found that the effect of the distance factor was getting smaller over time, in special research on these high-skilled migrants, distance is still a factor hindering the flow of high-skilled migration. In the logit model, distance also has a significant effect on whether or not high-skilled migration flows between provinces. Each increase in distance traveled will increase the tendency for no high-skilled migration flows to occur. Highly educated residents can make better judgments in terms of travel costs which are usually more expensive as the distance increases and also the quality of life obtained in the destination area.

The average high-skilled migration flow in one island is not significantly different from the high-skilled migration flow through different islands. These results indicate that migrating outside the island is no longer a difficult thing for high-skilled migrants. This can be caused by the easier and more affordable access to inter-island transportation. In addition, compared to inter-island travel, the mileage factor is more of a major consideration for high skilled migrants.

In logit model, if one goes through Java, the tendency for no high-skilled migration to occur will be less than if one goes through Java. Meanwhile, in the negative binomial model, it is only significant at a significance level of 10%. This indicates that there is still a "Java-centric" phenomenon as expressed by Tjiptoherijanto (2000), including the phenomenon of high-skilled migration. This result is also consistent with the results of the descriptive analysis on the circos plot in Figure 2, in which the majority of high-skilled migrants move from provinces on Java Island and also go to other provinces on Java Island as well.

The average flow of high-skilled migration through DKI Jakarta, West Java, and Banten is greater than that which does not go to DKI Jakarta, West Java, and Banten. This indicates that the flow of high-skilled migration through the capital and its surroundings is indeed very large compared to other provinces. High-skilled migrants tend to move to capital areas which have more favorable conditions for workers, to be specific higher wages and better job opportunities (Choi, Kim, and Lee, 2015). Therefore, the attractiveness of the capital is indeed very strong, even according to Lottum and Marks (2012), differences in wages are not too important, but the existence of DKI Jakarta as the capital is very influential in determining migration in Indonesia.

Urban unemployement rate is a proxy for economic factors included in the analysis. Urban unemployement rate in the destination province does not affect the presence or absence or magnitude of high-skilled migration flows between provinces. However, urban unemployement rate in the province of origin has a positive effect, even if only at a significance level of 10%. In the logit model, urban unemployement rate in the province of origin has a significant effect on the presence or absence of inter-provincial high-skilled migration flows in Indonesia which the higher the urban unemployement rate in the province, the lower the tendency for high-skilled migration flows to leave the province. Therefore, there are indications that the unemployment rate is more a push factor than a pull factor, even though its influence is still relatively weak. Results indicate that the relationship between migration and unemployment is still unclear, depending on the overall economic situation (Stillwell, 2005). This also occurs in the phenomenon of high-skilled migration in Indonesia.

The average worker wage is a proxy for other economic factors included in the analysis. The average wage of workers in origin and destination provinces has a significantly positive effect on high-skilled migration flows, however, the average wage

of workers in destination provinces has a larger coefficient. This means that the influence of workers' wages in the destination area is greater than in the origin area. These results are in line with those found by Liu and Shen (2012) in China. Mayda (2007) also added that the average income and the difference in income between the origin and destination areas will influence migration decisions. This indicates that high income or wages are one of the main factors in making migration decisions. Migrants will choose a destination area that has a greater net income compared to the area of origin (Greenwood, 1975). From these results, it appears that the wage variable has a greater influence as a pull factor than a push factor. High-skilled migrants will move to destinations with higher wages and higher economic levels.

The percentage of workers in the agricultural sector in the destination province has a significant negative effect on high-skilled migration flows between provinces. This can be explained by 1) migration which occurs from agricultural to non-agricultural areas is caused by an increase in the relative wages of the non-agricultural sector compared to the agricultural sector as a result of economic development (Minami, 1967); 2) there is no need for a significant difference in income between the non-agricultural sector and the agricultural sector for migration to occur because simply put, people were more attracted to industrial areas than to agriculture (Adams, 1969). In the logit model, it can be seen that the percentage of workers in the agricultural sector in the province of origin has a significant effect on the presence or absence of high-skilled migration flows between provinces. Modernization is indeed one of someone's goals for moving. By moving to non-agricultural areas, high-skilled migrants hope to find jobs which are better suited to their level of education and higher wages. In general, the agricultural sector in Indonesia has not been able to utilize high-quality human resources effectively so many high-skilled migrants prefer to move closer to industrial areas.

The percentage of the population as victims of crime in origin and destination provinces does not affect high-skilled migration flows between provinces. Likewise, in the logit model, the percentage of the population as victims of crime in the provinces of origin and destination also does not affect whether or not there is a flow of high-skilled migration between provinces in Indonesia. This result can be explained by the nature of high-skilled migrants who feel able to protect themselves. This indicates that crime is not the main factor in high-skilled migration flows. High-skilled migrants consider economic factors more than criminal factors. This can also be caused by the not too unequal data on the percentage of the population who have been victims of crime in the last year in 2015, which is still at a fairly low frequency in almost every province.

The migrant stock variable is a proxy for social network factors. The stock of migrants has a positive effect on inter-provincial high-skilled migration flows in Indonesia. Information is one of the factors which reduce the physical costs of migration. Information about potential destinations plays an important role in making decisions to migrate, especially for high-skilled migrants who can filter information properly. The majority of migrants will tend to move to areas where they have information about the area compared to those where they do not have information (Wajdi, Adioetomo, and Mulder, 2017). This result is in line with the findings of Liu and Shen (2012). Furthermore, in the logit model, migrant stocks have a significant effect on the presence or absence of high-skilled migration flows, in which an increase in migrant stocks will reduce the tendency for no high-skilled migration flows to occur. Improvements in technology, communication, information, and transportation may reduce the physical costs of migration (Buena, 2012).

Conclusion

From the results and discussion which has been done, several conclusions and suggestions can be drawn. The number of inter-provincial high-skilled migrants in Indonesia in 2015 was not dominated by either male or female parties. The majority of male high-skilled migrants migrate for economic reasons, while the female ones more for personal reasons. The phenomenon of high-skilled migration is also still "Java-centric" which focuses on provinces on the island of Java, especially in the capital city of DKI Jakarta and its surroundings.

Factors influencing the flow of high-skilled migration between provinces in Indonesia are the number of high-skilled populations in the provinces of origin and destination, geographical distance, the average wage for workers in the provinces of origin and destination, the percentage of agricultural workers in the destination province, and the stock of migrants. The majority of high-skilled migration flows originate from and also go to provinces which have high-skilled populations and large average-wage workers. In terms of economic factors, workers' wages are more influential than the unemployment rate. High-skilled migrants are more interested in moving to industrial areas than to agricultural areas. They can filter information and make good decisions, so the influence of the availability of information and social networks is one of the factors which influence the flow of high-skilled migration that occurs in Indonesia. Geographical distance is still one of the main factors influencing migration flows of high-skilled migrants in Indonesia, but with the increasing ease of access to inter-island transportation, movement between islands is no longer a barrier to migration, especially by high-skilled migrants.

The government needs to make a migration policy to better distribute the high-skilled population for the sake of endogenous growth in less developed provinces. This can be done by placing high-skilled civil servants or working with state-owned enterpises (also called BUMN) to channel high-skilled workers to branch offices in less developed areas.

Given the enormous influence of economic factors on the phenomenon of high-skilled migration, it is necessary to increase the average wage for workers, either through the minimum wage or otherwise, as well as improve public facilities and access to transportation in less developed areas, such as on the island of Kalimantan, Sulawesi, Moluccas Islands and Papua. This is done to increase attractiveness in areas outside Java in order to create equity between regions. In addition, the increase in industrial areas in the region needs to be increased without forgetting the agricultural sector. This can be done by fully supporting the development of the agro-industry in Indonesia.

The drawback of this research is that it does not include the variables of public facility development and cultural elements due to the limited available data. In addition, the incomplete information obtained from the Intercensal Survey (*SUPAS*) 2015 related to identifying the education level of respondents when migrating. Despite its drawbacks, this research was able to capture the phenomenon of high-skilled migration flows well, also related to the limited research on high-skilled migration in Indonesia.

The researcher realizes that this research is still far from perfect and various improvements can be made for further research. One of them is by adding variables which can serve as proxies for the construction of public facilities and cultural elements for further research. This aims to see the considerations of high-skilled migrants in considering public facilities in choosing their destination. In addition, the substitution of the use of geographical distance with the cost factor needs to be considered and reviewed about the situation in Indonesia. Research on population mobility, especially

the high-skilled population, in the capital and surrounding areas needs to be carried out on a micro-scale given the high polarization of high-skilled migration flows to the capital and surrounding areas so that the phenomenon of high-skilled migration can be described more clearly.

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