# INCOME AND SUBTITUTION EFFECT OF INDONESIAN LABOUR SUPPLY

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## Abstract

Indonesia is the fifth largest populated country in the world with abundance of labour supply. There are two types of analysis that can explain the phenomenon of labour supply, namely the income effect and substitution effect. The purpose of this study is to estimate the income effect and substitution effect of labour supply in Indonesia during 2005-2008. Using a panel data analysis technique, the results show that the income effect dominates the substitution effect in influencing the level of labour supply in Indonesia. This means that changes in labour income is more influential on a person's decision not to engage in the labour market.

**Keywords:** Labour supply, income effect, substitution effect, panel data
**JEL classification numbers:** J01, J22, J29

## Abstrak

Indonesia adalah negara berpenduduk terbesar kelima di dunia dengan pasokan tenaga kerja berlimpah. Terdapat dua jenis analisis yang dapat menjelaskan fenomena penawaran tenaga kerja tersebut, yaitu pengaruh pendapatan dan pengaruh substitusi. Tujuan dari penelitian ini adalah untuk memperkirakan pengaruh pendapatan dan pengaruh substitusi dari suplai tenaga kerja di Indonesia selama tahun 2005-2008. Menggunakan teknik analisis data panel, hasil penelitian ini menunjukkan bahwa pengaruh pendapatan mendominasi pengaruh substitusi dalam mempengaruhi tingkat penawaran tenaga kerja di Indonesia. Ini berarti bahwa perubahan dalam pendapatan tenaga kerja lebih berpengaruh pada keputusan seseorang untuk tidak terlibat dalam pasar tenaga kerja.

**Keywords:** Penawaran tenaga kerja, pengaruh pendapatan, pengaruh substitusi, data panel
**JEL classificatiomumbers  :** J01, J22, J29

## INTRODUCTION

Indonesia is a developing country that has a large population and fast population growth. This big population and rapid population growth results in higher number of labour supply in Indonesia.

On average, the population growth in Indonesia is still relatively high at 1.93 percent over the last 30 years. Although Indonesian population growth has been declining, the total population size still has been very large. Table 1 illustrates that Indonesian population growth has been 2.31 percent, 1.98 percent and 1.49 percent for the period 1971-1980, 1980-1990, and 1990-2000, respectively. The highest population growth is in the Province of East Kalimantan, Riau, and Bengkulu which are approximately 4 percent. The lowest population growth is in the Province of North Maluku, Yogyakarta, and the Pacific Islands which are approximately 0.5 to 1 percent.

With the currently total population is 237 million people, Indonesia became the fifth country that has the world's largest population. Along with population growth, the workforce is also growing. Increasing number of population and labour force

should not be a problem in Indonesia if the government is able to meet the basic needs for Indonesian and provide sufficient new employment opportunities. It is a good economy if the entire workforce in a household can be absorbed and utilized properly. The fundamental difference of the real wage of each region results in the differences in the quantity of labour supplied by each household in each area. Over the last few years, the number of population aged over 15 years was around 170 million. As many as 115 million are included in the labor force. In other words, 68 percent of them are actively involved in the labor market. This percentage is labor force participation rate. However, it is only about 107 million who find their jobs, while the rest are unemployed. The unemployment rate in Indonesia is still very high, approximately 7-10 percent per year.

**Table 1:** Average Annual Population Growth Rate

| Province | 1971-1980 | 1980-1990 | 1990-2000 | Average |
|----------|-----------|-----------|-----------|---------|
| Nanggroe Aceh Darussalam | 2,93 | 2,72 | 1,46 | 2,37 |
| Sumatera Utara | 2,60 | 2,06 | 1,32 | 1,99 |
| Sumatera Barat | 2,21 | 1,62 | 0,63 | 1,49 |
| R i a u | 3,11 | 4,30 | 4,35 | 3,92 |
| J a m b i | 4,07 | 3,40 | 1,84 | 3,10 |
| Sumatera Selatan | 3,32 | 3,15 | 2,39 | 2,95 |
| B e n g k u l u | 4,39 | 4,38 | 2,97 | 3,91 |
| L a m p u n g | 5,77 | 2,67 | 1,17 | 3,20 |
| Kep. Bangka Belitung | | | 0,97 | 0,97 |
| DKI Jakarta | 3,93 | 2,42 | 0,17 | 2,17 |
| Jawa Barat | 2,66 | 2,57 | 2,03 | 2,42 |
| Jawa Tengah | 1,64 | 1,18 | 0,94 | 1,25 |
| DI Yogyakarta | 1,10 | 0,57 | 0,72 | 0,80 |
| Jawa Timur | 1,49 | 1,08 | 0,70 | 1,09 |
| Banten | | | 3,21 | 3,21 |
| B a l i | 1,69 | 1,18 | 1,31 | 1,39 |
| Nusa Tenggara Barat | 2,36 | 2,15 | 1,82 | 2,11 |
| Nusa Tenggara Timur | 1,95 | 1,79 | 1,64 | 1,79 |
| Kalimantan Barat | 2,31 | 2,65 | 2,29 | 2,42 |
| Kalimantan Tengah | 3,43 | 3,88 | 2,99 | 3,43 |
| Kalimantan Selatan | 2,16 | 2,32 | 1,45 | 1,98 |
| Kalimantan Timur | 5,73 | 4,42 | 2,81 | 4,32 |
| Sulawesi Utara | 2,31 | 1,60 | 1,33 | 1,75 |
| Sulawesi Tengah | 3,86 | 2,87 | 2,57 | 3,10 |
| Sulawesi Selatan | 1,74 | 1,42 | 1,49 | 1,55 |
| Sulawesi Tenggara | 3,09 | 3,66 | 3,15 | 3,30 |
| Gorontalo | | | 1,59 | 1,59 |
| Maluku | 2,88 | 2,79 | 0,08 | 1,92 |
| Maluku Utara | | | 0,48 | 0,48 |
| Papua | 2,67 | 3,46 | 3,22 | 3,12 |
| INDONESIA | 2,31 | 1,98 | 1,49 | 1,93 |

Source: Indonesia Central Bureau of Statistic, various years.

**Table 2:** Population and Types of Activities

| No | Type of activity | 2005 (Feb) | 2007 (Feb) | 2009 (Feb) | 2010 (Feb) |
|----|------------------|------------|------------|------------|------------|
| 1 | Population 15+ | 155.549.724 | 162.352.048 | 168.264.448 | 171.017.416 |
| 2 | Labor Force | 105.802.372 | 108.131.058 | 113.744.408 | 115.998.062 |
| | Labor Force Partici-pation Rate | 68 | 67 | 68 | 68 |
| | Working | 94.948.118 | 97.583.141 | 104.485.444 | 107.405.572 |
| | Unemployment | 10.854.254 | 10.547.917 | 9.258.964 | 8.592.490 |
| | Unemployment Rate | 10 | 10 | 8 | 7 |
| 3 | Not in Labor Force | 49.747.352 | 54.220.990 | 54.520.040 | 55.019.354 |
| | Schooling | 12.919.459 | 14.320.491 | 13.665.903 | 14.199.461 |
| | House Keeping | 29.245.027 | 31.133.071 | 32.578.420 | 32.419.795 |
| | Others | 7.582.866 | 8.767.428 | 8.275.717 | 8.400.098 |

Source: Indonesia Central Bureau of Statistic, various years.

The levels of ability and quality of labour and the labour force are determined by many aspects including the level of education, motivation, work ethic, exercise, mental and physical abilities of labour. The amount of labour that many shows that many are also supply of labour supplied by Indonesia with the real wage rate that varies from one area. The wage rate affects households in a surrender of free time (leisure) for their work.

Households are willing to sacrifice or give up their free time to work to get higher revenue. There are two analysis of household labour in offering and submitting their free time i.e. the income effect and substitution effect. Income effect says that with a higher income level (assuming a fixed wage rate) results in reducing labour supply because it was quite prosperous at their current wage level. Whereas the substitution effect states that with higher wage levels (assuming a fixed income) would lead someone will give or sacrifice their leisure time (leisure) to offer its workforce because the opportunity cost not to work (leisure) is getting higher. This analysis states that, with rising wage rates, then labour supply will increase.

There are several assumptions when someone offers its workforce as follows. (a) Time resources (time resources) are limited in number ie 24 hours. (b) A 8 to 10 hours of total 24 hours is for a natural hu-man process such as eating and sleeping. (c) It is assumed that human activities are divided into only two choices: work or leisure (relaxing). (d) Leisure is considered as a commodity (goods). So in accordance with the law of demand, the amount of goods (in this case is leisure) requested is negatively related to the price level, positively related to the income level and taste. (e) The opportunity cost of leisure which is the wage rate ($W$)

From those assumptions, the decision of people to work or not work can be analyzed with two effects, namely Income Effect and Substitution Effect. Income effect shows how much the change in income can affect a person's decision to work or not on the same wage rate. Assume that the income ($Y$) rises as the increase of wage rate ($W$) and a situation of fixed prices, then the demand for leisure goes up. It means that with a fixed amount of time, the increase in leisure will reduce one's desire to work ($H$), because it was quite prosperous at thatlevel of wages.

Shortly the income effect negatively affect on a person's decision to work or offer its workforce. In other words, the increase in income will cause the labour supply to decrease. In the mathematical approaches it can be written as follows

$$Income\ Effect = \frac{\Delta H}{\Delta Y \bar{W}} < 0 \tag{1}$$

Meanwhile the substitution effect shows how much the wage increase can change the opportunity cost of leisure or affect a person in making decisions to work or not work, on the same level of income. Assume that wages (*W*) rises, with a fixed income level, it causes the opportunity cost of leisure becomes more expensive. Then people will choose to leave their leisure and choose to work or the supply their workforce for the labour market. Substitution effect has a positive influence on a person's decision to work or offer its workforce. This analysis states that, with rising wage rates, then labour supply will increase. In the mathematical approaches it can be written as follows

$$Substitution\ Effect = \frac{\Delta H}{\Delta W \ddot{Y}} > 0 \qquad (2)$$

It is almost none of research which analyzes those two effects on Indonesian labour supply. Most of the researches analyze only factors influencing the supply of labor and do not specifically discuss substitution and income effect. Sulistyaningsih (1997) conducted the analysis by looking at the linkages between employment structure and economic performance in Indonesia. The results of analysis show that Indonesia's economic structure has changed from an economy that relies on the agricultural sector into an economy that relies on manufacturing and services sectors. These changes in economic structure further influence the structure of labor absorption. Prima (1992) conducted a study on the effects of education on labor force participation rates in Indonesia. The results of his studies show that education has a positive effect on the absorption rate of workers. In other words the increased educational levels will increase the absorption rate of workers.

Federman and Levine (2004) examine the impact of different levels of education on the earnings of manufacturing labor in the period of 1985-1995 using cross-national studies approach. Overall, the absorption of educated labor in the manufacturing sector increased, while that the uneducated labor participation declined. There is a positive correlation between education level and income. Botero et al. (2003) examines the impact of labor regulations on labor income, using panel data of 121 countries for the period 1970-2000. It concluded that, in general, labor regulations are less able to improve the distribution of income for workers.

Some researches investigate those of non Indonesian case study. Falch (2010) utilizes institutional features to identify the supply curve. The elasticity of labor supply is estimated using data for the Norwegian teacher labor market in a period where the only variation in the wage level was determined centrally and with information on whether there is excess demand or not at the school level. In fixed-effects models, the supply elasticity faced by individual schools is estimated to about 1.4 and is in the range 1.0-1.9 in different model specification.

Meanwhile Müller and Steiner (2010) found that 10% of all affected workers go to work after the minimum wage. In addition almost all the low income people are to work after the minimum wage. With the minimum wage regulations, it results in the increase in total wage bill. In absolute, most of the women workers experience the increasing wage. Notwithstanding this increase in the wage bill is still very small effect on the total average national wage level. According to this research, the work intensity of the minimum wages are expected to slightly limited. It is estimated that there are growth of the labour force participation of 16 000 workers and an increase in working hours for 66,000 full-time equivalents. Meanwhile the demand for labour depends on the level of wage and price elasticity of output. They assume that if the elasticity of demand for

goods is -1, then the demand for labour will go down by 220,000 people.

Another study also conducted by Neumark and Powers (2005) about Supplemental Security Income program (SSI) in the United States. This program is made so that young people do not work once (reduce their labour supply) before being eligible to work. However, with the SSI program is still unable to stop the migration, so that the existence of migration resulted in biased estimation effect on the use of SSI on labour supply. This migration occurs because of the "welfare Magnets".

This study aims to estimate the income effect and substitution effect in influencing the supply of labour in Indonesia. Such information is useful to know the responsiveness of wages policies as well as non-wage income policy to the level of labour supply.

**METHODS**

This paper uses analysis of panel data to acommodate the data structure in hand. One of the advantages of this technique is that it gives high degree of freedom because the data is the combination between time series and cross section data. It also can solve omitted-variable problems (further discussion on panel data can be find in Eilat and Einav, 2004; and Yap, 2010; among others). The regression model is as follows

$$\log Y_{it} = \beta_0 + \beta_1 \log X_{1it} + \beta_2 \log X_{2it} + \beta_3 \log X_{3it} + e_{it} \qquad (3)$$

where
$Y_{it}$ is the labour supply in the province $i$ at year $t$ (person),
$\beta_0$ is a constant,
$\beta_1, \beta_2, \beta_3$ are the coefficients of independent variables,
$X_{1it}$ is the income of people working in the province $i$ at year $t$ (rupiah)
$X_{2it}$ is the average wage of workers in the province $i$ at year $t$ (rupiah)

$X_{3it}$ is the total population in province $i$ at year $t$ (person)

The values of $\beta_1$, $\beta_2$, $\beta_3$ show the level of labour supply elasticity with respect to income, wages and population, respectively.

In general, to estimate the regression model with panel data can use three approaches i.e. the Common Effect, Fixed Effect and Random Effect. The first is common effect. This model is the simplest model, because of without seeing differences over time and among individuals. Behaviour between time and between individuals is assumed to be constant. Thus estimation techniques can be performed with conventional OLS regression. The regression equation is

$$\log Y_{it} = \beta_0 + \beta_1 \log X_{1it} + \beta_2 \log X_{2it} + \beta_3 \log X_{3it} + e_{it} \qquad (2)$$

Second is fixed effect model. To accommodate the differences between the behaviour of individual characters can use the fixed effect model. The difference can be reflected from the difference intercept values, whereas the slopes are fixed. Technically, the differences between individuals can be calculated by including dummy variables. Fixed effect model with dummy variables can be written as follows

$$\log Y_{it} = \beta_0 + \beta_1 \log X_{1it} + \beta_2 \log X_{2it} + \beta_3 \log X_{3it} + \beta_4 D_{1it} + \beta_5 D_{2it} + \beta_6 D_{3it} + \dots + e_{it} \qquad (4)$$

The third model is random effect. With the increasing number of dummy variables incorporated into the model, it would decrease the degrees of freedom so that it will reduce the efficiency parameters. To overcome these problems, it can use random effects estimation approach. This approach estimate this effect using a random disturbances (error terms) which may be connected across time and between regions.

Writing the constants in this model is no longer fixed but it is random, namely

$$\log Y_{it} = \beta_{0i} + \beta_1 \log X_{1it} + \beta_2 \log X_{2it} + \beta_3 \log X_{3it} + e_{it} \qquad (5)$$

To determine the best method to use is by reviewing the $F$ statistical test to choose a model without a dummy variable or a fixed effect model. Second, by looking at Lagrange Multipler (LM) test is to choose model without a dummy variable or a random effect model. Third, using the Hausman test is to compare between random effects and fixed effects.

In this study, the data used are panel data that is a combination of time series data with cross section data. The kinds of data used are total workforce by province, the working income by province, average monthly wage by province, and the total population by province.

The data of work force by province is from 2005 to 2008. This data is to represent the level of labour supply where the workforce is working age resident, namely aged between 15-65 years, both of which are working people who had a job temporarily were not working and people who are not working or do not have jobs but still looking for jobs.

Meanwhile the working income by province is from 2005-2008. This data was obtained from the ratio between the Gross Regional Domestic Product at constant prices by the number of working people. Log variable of the income of working people is the elasticity of labour supply with respect to changes in income level or the so-called as the income effect.

The amount of average wages is to represent the wage level. The log of this variable explains the labour supply elasticity with respect to changes in wage rates or so-called as the substitution effect. The total population by province in Indonesia from 2005 to 2008 is the sum of all people who live in Indonesia for 6 months or more and people who live in Indonesia for less than 6 months but have the desire to settle. All of the data are obtained from the Indonesia Central Bureau of Statistics (BPS).

## RESULTS DISCUSSION

Estimation of common effect is done simply by combining the data time series and cross section data without looking at the difference between time and the individual, so it can use the OLS method in estimating a panel data model. The estimation result is

$$\begin{aligned} Y = \ & {-}1.05 - 0.03 \log X_1 + 0.03 \log X_2 \\ & (-1.60)\ (-1.84) \qquad\quad (0.64) \\ & + 1.02 \log X_3 + e \\ & \ (103.55)^{***} \qquad\qquad\qquad (6) \end{aligned}$$

$R^2$ is 0.99,
$F$-statistic is 4370.89.

Notes: *** indicates a significant at almost 0% level, * is significant at 10% level.

The common effect estimation results show that income level and total population are statistically significant in influencing the Indonesian labour supply. The all variables have coefficient signs which are in accordance to the theory and hypothesis. The coefficient of income is -0.03 which means every 1 percent increase in their income will reduce the labour supply by 0.03 percent. Meanwhile the coefficient of total population is 1.02. It indicates that 1 percent increase in total population will raise the total labour supply by 1.02 percent.

While the fixed effects estimation assumes different intercepts between regions while the slope between the regions remain the same. This is done because the common effect approach is far different from reality and it is known that the characteristics among individuals or provinces are very different. The estimation results of fixed effect is

$Y = 11.83 - 0.73 \log X_1 + 0.15 \log X_2$
$\quad (2.94)^{***} \quad (8.24)^{***} \quad (2.90)^{***}$
$\quad + 0.82 \log X_3$
$\quad (2.70)^{***}$                                      (7)

$R^2$ is 99.9,
$F$-statistic is 2806.
Notes: *** indicates a significant at almost 0% level.

From this result, it can be seen that all variable are statistically significant affecting the labour supply in Indonesia at 0% level. The coefficient of income is -0.73 which indicates that every 1 percent increase in income will pull the Indonesia labour supply by 0.73 percent. The coefficients of average wage and total population are 0.15 and 0.2, respectively. The coefficient of average wage explains that for every 1 percent increase of wage on average, it will increase the total labour supply in Indonesia as much as 0.15 percent. While the total labour supply will increase up to 0.82 percent due to 1 percent increase in total population.

The significance of fixed effect test is then used to select the better model whether common effect or fixed effect. The null hypothesis ($H_0$) is the estimate model of the Common Effects and alternate hypothesis ($H_1$) is using a fixed effect estimation model. This test uses the distribution of chi square statistic which is greater than the critical value. Chi Square statistic is equal to 264.48 with a probability of 0.0000 (less than 5%), so that is statistically rejected Ho of common effect model (Table 3). Then the exact model used is the fixed effects estimation model.

The estimation on random effect model results only two variables statistically significant at 0 percent level in influencing the labour supply i.e. income and total population. While the average wage is not significant, any 1 percent increase in income will reduce the labour supply by 0.1 percent, while the 1 percent population increase will raise the labour supply by 1.03 percent.

**Table 3:** Significance of Fixed Effect Test

| Effects Test | Statistic | *df* | Prob. |
|---|---|---|---|
| Cross-section *F* | 24.184285 | (29,87) | 0.0 |
| Cross-section Chi-square | 264.48321 | 29 | 0.0 |

Notes: *df* is degree of freedom.
Source: Data estimation.

Meanwhile, random effects estimation results is

$Y = -1.0 - 0.10 \log X_1 + 0.03 \log X_2$
$\quad (-0.20) \; (-3.41)^{***} \quad (0.99)$
$\quad + 1.03 \log X_3 + e$
$\quad (59.6)^{***}$                                      (8)

$R^2$ is 0.85
$F$-statistic is 817
Note: *** indicates a significant at almost 0% level.

To determine whether the fixed effect or random effect is the most appropriate test is by Hausman test. The null hypothesis ($H_0$) is estimation using the random effects model and the alternative hypothesis ($H_1$) is estimation using the fixed effect model. The Hausman test uses the statistical distribution of chi square. When the statistical value is greater than the critical value, then the model used should be the fixed effects estimation model, and reversely if the statistical value is smaller than the critical value, then the model used is the random effect model estimation.

The Hausman test results shows that the value of the statistical distribution of Chi Square is equal to 61.67 with probability of zero (Table 4). So it rejects $H_0$ rejected then the exact model used is the fixed effects estimation model. Based on the estimation, it can be seen that the most suitable estimation model for this study is the fixed effect estimation model. In the fixed effect model, the coefficient of the income of people working in Indonesia is highly negative impact on labour supply in Indonesia. The economic reason to explain

this finding is the increased revenue also results in the improving welfare of society, so the people tend to reduce their labour supply because it is enough to maintain the prosperity standard with those revenues.

**Table 4:** Hausman Test

| Test Summary | Chi-square | *df* | Prob. |
|---|---|---|---|
| Cross section Random | 61.67155 | 3 | 0.0 |

Notes: *df* is degree of freedom.
Source: Data estimation.

On the other hand, both coefficients of average wages and population in Indonesia are positive effect to labour supply in Indonesia. The coefficient of average wage in Indonesia has positive effect on labour supply in Indonesia because an increase in average wages result in people tempting to work, so people tend to increase their working hours or labour supply. Meanwhile the population of Indonesia has a positive effect on labour supply in Indonesia due to the increase in population automatically also increases the number of people looking for jobs and eventually it will increase the labour supply.

In respect to the magnitude of the coefficient of income and the average wage in Indonesia, it can be seen that the income coefficient is much larger than the coefficient of the average wage. This suggests that income effect is greater than the substitution effect in explaining the behaviour of Indonesian labour supply. In other words, the income effect is more dominant than the substitution effect. It also suggests that the labour supply in Indonesia is more explainable by the income effect rather than that of substitution effect. This means that changes in income have more influence to reduce the labour supply in Indonesia. According Setiadi (2009) the effect of wage levels and social security on labour productivity is very small. In addition, in judicial formal the wages and social security is only

considered as a safety for the labour income.

Judging from the composition of people working in Indonesia, it appears that as many as 28, 27% of people who work in Indonesia is primary school graduates, while graduates of the university is only of 4.45%. This suggests that people who have low incomes much prefer to work or getting a job rather than having to continue their schooling, although wages are higher will be accepted if the school is continued to the higher degrees. It also shows that changes in the wage level are only a small effect on the level of labour supply. This is because the main reason of the Indonesian people offering their labour is mainly to get a job, without taking into account the wages to be received. The people is more concerned with getting a job in advance, and about the wages to be received is just the second factor.

**CONCLUSION**

The main purpose of this paper is to estimate the substitution effect and income effect labour supply in Indonesia for the period 2005-2008. From Hausman Test conducted, fixed effect model is the most appropriate model for estimating both the influence.

Individually, the income of people working negatively and significantly affects labour supply in Indonesia. This shows that, the higher the income of people working in Indonesia, then Indonesia's labour supply will decline. While the average wage and the population has positive and significant. This suggests that the higher the average - the average wage or salary and the number of people in Indonesia, the supply of labour in Indonesia will go up.

Evaluated from the value of the coefficient of income working people are greater than the coefficient of average wages, it can be concluded that the income effect is more dominant than the substitution effect. Thus, labour supply in Indone-

sia 2005-2008 more can be explained by the income effect. That is an increase in income workers would tend to reduce labour supply in Indonesia. Changes in the wage levels are only a small effect on the level of labour supply. This is because the main reason residents Indonesia offers them labour is to get a job, without taking into account the wages to be received (the public is more concerned with getting a job in advance, about the wages to be received into the second factor).

Taken together - the same level of income of people working, wages or salary of the average, and the number of people significantly affected the supply of labour in Indonesia. This model could explain 99.9% variation dependent variable labour supply in Indonesia 2005-2008.

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