Infant mortality rate

Chapter 4

Methodology

4. 1 Infant Mortality Rate: Definition and Estimation Approaches

Infant mortality rate (IMR) is the number of deaths occurring in the first year of life per 1, 000 live births. It measures the probability of a child born in a specific year will die before reaching the age of one (World Bank, 2008). The IMR are estimated using two approaches including a direct and indirect method. Choice of methods used to estimate the IMR depends on availability and reliability of data source on infant deaths.

Reliable data to estimate infant mortality rates mainly come from two data sources. The first is a vital registration system. It is a preferred source of data on infant mortality because it records all information about live births and deaths on prospective basis where a live birth or death is directly reported after it occurs. This makes vital registration system always inform statistical records of live births and deaths based on the actual condition of the population. As a result, it will provide more reliable and accurate data on infant mortality. However, an accurate vital registration system have not yet established for large part of the world, especially in developing countries. Then, it calls for an alternative source in order to estimate the IMR.

The alternative source of data on infant mortality is household surveys. In the surveys, the women of fertility age are asked to answer some questions about births and deaths of children born to them. From this information, the fertility histories then can be constructed. There are two types of the fertility histories. They are a complete or truncated fertility history and incomplete or summary fertility history (World Bank, 2008). A complete fertility history

uncovers the dates of births, survival status and date or age at death of all children born to the interviewed woman. On the other hand, an incomplete fertility history reveals only the number of children ever born and the number still alive or the number who have died.

In order to estimate infant mortality rate, a direct method requires data for each child's date of birth, survival status, and date or age at death. This information can be found both in vital registration systems and in household surveys with complete fertility histories. In contrast, an indirect method requires less data that can be found in household surveys that do not collect detailed fertility histories. The only information required are: the number of children ever born, the number of children surviving (or dead), and the total number of women classified by five year age groups.

The indirect approach uses the Brass method, after William Brass who developed a procedure to convert the proportion of death among children ever born reported by women in the age groups into estimates of the probability of dying before a certain age. Brass's method assumes that the age of the mother can function as a proxy for the age of her children and therefore for how long they have been exposed to the risk of dying (Inter-agency Group for Child Mortality Estimation, 2007). The procedures to calculate infant mortality rate using the indirect method can be explained as follows.

Step 1. Calculation of average parity per woman

Step 2. Calculation of the proportion dead among children ever born

Step 3. Calculation of the multipliers, k(i)

Step 4. Calculation of the probability of dying by age x, q(x)

Step 5. Calculation of the reference dates for q(x), t (x)

However, the indirect method has several limitations. First, it requires model life tables to adjust the data for the age pattern of mortality in the general population. Choosing an appropriate life table to a specific population is important to generating accurate estimates (Ahmad et al., 2000). The Coale-Demeny model life tables utilized to adjust the data are derived largely from European experience that may not fit population in sub-Sahara Africa for instance. Second, the Brass method assumes that fertility and child mortality have remained constant in the recent past. If, for example, fertility has been changing, the ratios of average parities and age pattern of childbearing will be affected. As a result, it will lead to over or under estimate of child mortality (United Nations, 1983).

In this paper, data to estimate province's infant mortality rates come from Indonesia's socio-economic household survey (*Susenas*) data from 2001 to 2006. *Susenas* data provides information about: (i) the number of children ever born, (ii) the number of children surviving, and (iii) the total number of women classified by five-year age groups. Based on this data, infant mortality rates are calculated using the United Nation's software, QFIVE. One should be noted that since the study period of this paper only six years, the fertility patterns across provinces are likely remain constant. This study period is too short for any meaningful changes in fertility to materialize. As a result, infant mortality rates are reliable to be used for the further analysis.

4. 2 Data

The empirical analysis in this paper uses a balanced panel of 25 Indonesian Provinces during the period 2001-2006, for which complete data can be found from three sources. The first is Indonesia's socio-economic household survey (*Susenas*), which provides information on household characteristics and the presence of skilled birth attendant at delivery. The *Susenas* data also contains information that can be used to calculate infant mortality rates with the indirect method. The *Susenas* data for this paper are available from 2001 to 2006.

The second source is the Ministry of Finance (MoF) data. It records district expenditure that can be broken down by sector, including health. It is then divided into two types of health expenditure, routine and development expenditure. Since the Indonesian government changed the financial report format for provincial and district level spending according to Government Regulation Number 24 year 2005 about Governmental Accounting Standard, time consistent data for public expenditure on health are available only for 2001 to 2004.

The last source is Ministry of Health (MoH) data on the ratio of *puskesmas* per 100, 000 inhabitants as proxy for health care supply provided by government. This data are available for every province from 2001 to 1006. This information is taken from various years of Indonesia Health Profile published by the MoH.

This study combines these three data sources to construct a panel data set. In order to simplify the analysis, these data aggregated into province level. It

also aims to make infant mortality rates feasible to be calculated. Four provinces are excluded from analysis since they do not have complete data namely Nanggroe Aceh Darussalam, North Maluku, Maluku, Papua, and DKI Jakarta. A balance panel then consist of 25 Indonesia provinces during the period 2001-2006. Table 4. 1 lists the variables with their definitions and sources.

4. 3 Econometric Model

This paper first estimates a regression model examining the effect of public health spending on infant mortality, and then it explores the relationship between the public health spending on skilled birth attendance. Finally, this study will investigate whether infant mortality is affected by skilled birth attendance. This paper introduces a fixed effect parameter in order to capture unobserved heterogeneity associated with the provinces and a time specific effects.

Representing the provinces by the subscript i and the year of observations available by the subscript t, the relationship between IMR and public health spending is specified as

$$H_{it} = \beta_0 + \beta_1 S_{it} + \beta_2 X_{it} + \alpha_i + \delta_t + \varepsilon_{it}$$

where H is log infant mortality and S is per capita total public health expenditure. X is a set of control variables, which include average house ownership in the province as proxy of average province welfare, the fraction of population living in rural area, the proportion of households with a closed sewage disposal system, and mother's level of education. This model also

controls for the ratio of *puskesmas* per 100, 000 inhabitants as proxy of health care supply provided by government.

Time specific effects, represented in dt, are captured by a dummy variables for each year. This term incorporates average trends associated with economic development, for instance technological progress. The province fixed effect ai, captures all unobserved, time invariant factors that might affect infant mortality rates, for examples geographical features and wide variations on cultural perspectives on how to care for newborn children.

The second model investigates the role of public health spending on skilled birth attendance. This model also examines role of the intermediate effect on utilization of skilled birth attendance as transmission channel through which public health spending may affect infant mortality rate. The model is

$$U_{it} = \beta_0 + \beta_1 S_{it} + \beta_2 X_{it} + \alpha_i + \delta_t + \varepsilon_{it}$$

where U is utilization of skilled birth attendance, and X are control variables including average house ownership in the province, the fraction of population living in rural area, household size, mother's education and puskesmas coverage.

Finally, in order to identify the effect of skilled birth attendance on infant mortality, this paper is examining the following model:

$$H_{it} = \beta_0 + \beta_1 U_{it} + \beta_2 X_{it} + \alpha_i + \delta_t + \varepsilon_{it}$$

where the control variables X are the same as in first equation.