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ASSETS AND THE POVERTY TRAP IN INDONESIA: USING HOUSEHOLDS PANEL DATA 1993-2007

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ABSTRAK

Assets and the Poverty Trap in Indonesia: Using Households Panel Data 1993-2007. Indonesia faces relatively high-level of persistent poverty for years which indicates the existence of poverty trap. Using four waves of longitudinal household data (1993-2007), this paper examines the existence and various patterns of household-level poverty traps in Indonesia. By following an asset-based approach introduced by Barrett and Carter (2006) and Adato et al. (2006), this paper performs parametric to construct an asset index and nonparametric techniques to estimate dynamic asset pattern and the poverty trap. Findings indicate that there is evidence for multiple equilibria poverty trap in Sumatra region. Also, this study finds that all households in Sulawesi region converge to a single stable equilibrium below the poverty line, which indicates that these households are collectively trapped. However, the findings show that households in Java and Bali, West Nusa Tenggara and Kalimantan converge to a single stable equilibrium that households in these regions do not face a poverty trap.

Kekayaan dan jebakan kemiskinan di Indonesia: analisis dengan data panel rumah tangga 1993-2007. Tingkat kemiskinan di Indonesia yang cenderung tidak berkurang secara signifikan selama beberapa periode memberikan indikasi awal kemungkinan adanya rakyat (rumah tangga) yang tidak bisa keluar dari lingkaran kemiskinan. Penelitian ini menggunakan empat periode data panel rumah tangga untuk menguji keberadaan dan pola jebakan kemiskinan di tingkat rumah tangga di Indonesia. Penelitian ini mengikuti pendekatan kekayaan yang diperkenalkan oleh Barret dan Carter (2006) serta Adato et al. (2006). Pendekatan ini memerlukan penerapan metode parametrik untuk membentuk indeks kekayaan dan metode non-parametrik untuk mengestimasi pola kekayaan dinamik dan jebakan kemiskinan. Penelitian ini menemukan adanya bukti yang menunjukkan adanya jebakan kemiskinan dengan banyak titik keseimbangan di wilayah Sumatra. Selain itu, seluruh rumah tangga di wilayah Sulawesi pada periode menengah terindikasikan terjebak dalam kemiskinan secara bersama-sama. Di sisi lain, rumah tangga di wilayah Jawa dan Bali, NTB serta Kalimantan cenderung terhindar dari jebakan kemiskinan.

1. INTRODUCTION

Poverty alleviation is an interesting issue in the development problem. Over the past decade when economic growth takes place, the world also sees great improvement in poverty over time. The growth however has not brought about equally improvement in standard of living to everyone. Inequality also rises along the steady evidence of persistent poverty among some subsets of populations. The increasingly evidence of persistent poverty worldwide has thus stimulated the need to understanding of the patterns and mechanisms why some subset of populations tend to be trapped in poverty

Understanding the patterns and the cause of the poverty trap can provide important practical policy implications. A possible cause for the subset of population, such as households, trapped in poverty is their inability to accumulate their assets in order to grow their path to move out of poverty over time (Barrett & Carter 2006). Further, there are various patterns of households asset accumulation over time. The analysis of analysis these patterns can favour policy implications by informing target of intervention, identifying of key enabling conditions to the pathway out of poverty, and designing safety net policies (ibid.). For instance, if the households asset accumulation converges into a single point below poverty line, which means that all households are collectively trapped in poverty, then there should be structural policy changes that provide new economic opportunities for households to elevate their convergent point into above poverty line (Naschold 2012). Thus, understanding the cause and patterns of poverty trap can lead to efficient policies.

This paper uses four waves of longitudinal household panel data (1993-2007) to explore existence and patterns of household-level poverty traps in Indonesia and how these patterns vary across different livelihood groups and regions in the country. This study would be relevant for Indonesia because, though,

Indonesia has enjoyed positive growth for years, but poverty seems still to be a significant development problem. Two periods of the SBY administration also make poverty as development focus, known as pro-poor policy (BAPPENAS 2008). Though the poverty headcount ratio has been decreased in the last five years from 24.23 per cent in 1998 to 15.42 per cent in 2008, the ratio still lies above 15 per cent (BPS 2008).

Furthermore, using longitudinal household data of Indonesia Family Life Surveys (IFLS) and World Bank's US$2 a day (at PPP adjusted) standard poverty line, Table 1 and Table 2 illustrate early indicators that some households cannot move out of poverty for a long period (7 years lag), neither from 1993 to 2000 nor from 2000 to 2007. There is slight different poverty rate for year 2000 because the number of paired households in 1993-2000 and 2000-2007 is different. Both tables show that there are some households that still live in persistent poverty. This is represented by the shaded cells which are summed to 40.72 per cent in the period 1993-2000 and 24.51 per cent for the later period. Despite the declining figures, this roughly indicates that a poverty trap may exist in some households in Indonesia. Thus, further analysis is needed to test whether the poverty trap exist or not.

Table 1. Decomposing poverty transition in Indonesia for the year 1993 and 2000

		2000	
		Poor 48.83%	Non Poor 51.17%
1993	Poor 64.62%	Always poor 40.72%	Moving out poor 23.90%
	Non Poor 35.38%	Moving in poor 8.11%	Never poor 27.27%

Source: Author's calculation using IFLS data.

Table 2. Decomposing poverty transition in Indonesia for the year 2000 and 2007

		2007	
		Poor 33.35%	Non Poor 66.65%
2000	Poor 48.14%	Always poor 24.51%	Moving out poor 23.62%
	Non Poor 51.86%	Moving in poor 8.84%	Never poor 43.02%

Source: Author's calculation using IFLS data.

Few studies have investigated poverty dynamics or the poverty trap in Indonesia. Using three waves of IFLS from 1993 to 2000, Sumarto et al. (2009) find that persistent poverty exists in some households in Indonesia. Further, using the same period of longitudinal household panel data, Prima (2009) applies a model of household consumption growth as introduced by Jalan and Ravallion (2002, cited in Prima 2009) to examine the existence of the poverty trap in Indonesia. He finds that the poverty trap exists in Indonesia during the period 1993 to 2000 (ibid.). He also argues that there are multiple equilibria; so that, there are two groups of households, one that has increasing consumption level and positive returns on investment and another group that cannot move out of poverty because their investments seem to be not sufficiently profitable (ibid.). Another study from Wardhana (2010) that adds one latest wave, 2007, of IFLS also finds that chronic poverty seems to exist in Indonesia in the long run. Wardhana uses multiple correspondence analyses (MCA) to construct an assets index and then observes how this multidimensional index plays a role in examining whether households are trapped in poverty over a longer time.

Despite many works on the poverty trap in some developing countries, only a few studies focus on Indonesia. Though both Prima (2009) and Wardhana (2010) have examined the existence of the poverty trap in Indonesia, their findings are still at the national level which seems to incompletely represent various characteristics of households in different regions across Indonesia. Even more, aggregating the analyses into the national level may result in cancelling out one characteristic of a region with a similar characteristic but opposite effect from other regions.

This paper attempts to fill this gap and to enrich the existing literature. This study differs from previous studies in the approach and the sub-national level analysis used. The study employs asset-based approach in identifying poverty traps. We first construct household-level asset index using regression approach to estimate their regional-specific livelihood contribution of each asset. We then use parametric and non parametric approaches in estimating the long-term patterns of asset accumulation paths for the sampled households and for separate regions and subgroups in the country.

The hypothesis is that the poverty trap may exist in some regions, as Prima (2009) and Wardhana (2010) finds in the national level, other than region of Java and Bali because these regions are known as the centre of the economy and more developed areas. Yet, our results shows that multiple equilibria poverty trap only exist in Sumatra region and a single equilibrium poverty trap only exists in Sulawesi region when a longer period of observation is used.

The remainder of this paper is organized as follows. Section 2 summarizes some theories and previous empirical literatures of the poverty trap. Section 3 presents the model and methodology used in this study as well as introduces the data. Then, Section 4 summarizes the main results and discussion of the results. Section 5 concludes the study.

2. POVERTY TRAP AND EXISTING LITERATURES

A common approach in poverty analysis for answering questions of persistent poverty or the poverty trap is through inter-generation (dynamic) poverty measurements. These measurements attempt

to identify and understand the structure and persistence of poverty as summarized in Figure 1.

First period measurement in Figure 1 is a traditional static standard income or expenditure-based poverty measure (Barrett & Carter 2006). Using this measure, the population can be divided into poor and non-poor categories at single point of observation, but this measure cannot distinguish which households remain poor (chronic poor) and which swap from poor to non-poor, and vice versa, in the next period (ibid.). Addressing this problem, Grootaert and Kanbur (1995, cited in ibid.) introduce a second generation of poverty measurements that uses panel data-based (dynamic) expenditure or income analysis to decompose households into three categories: the always or chronically poor, the transitorily poor, and the never poor.

Notwithstanding, this second generation poverty measurement faces a limitation. It cannot distinguish poverty transitory whether it is a stochastic poverty transition, such as because of random price or stochastic earnings from positive or negative shocks, or it is a structural transition, for instance because of the accumulation of new assets or enhanced returns to the assets (ibid.). The use of asset-based approach can be formulated as Equation (1) (Adato et al. 2006). This equation is intended to distinguish the structural source (represented as sum of assets, Aijt) of poverty (represented as household's income, yit) from the stochastic source (represented as the error term,εit).

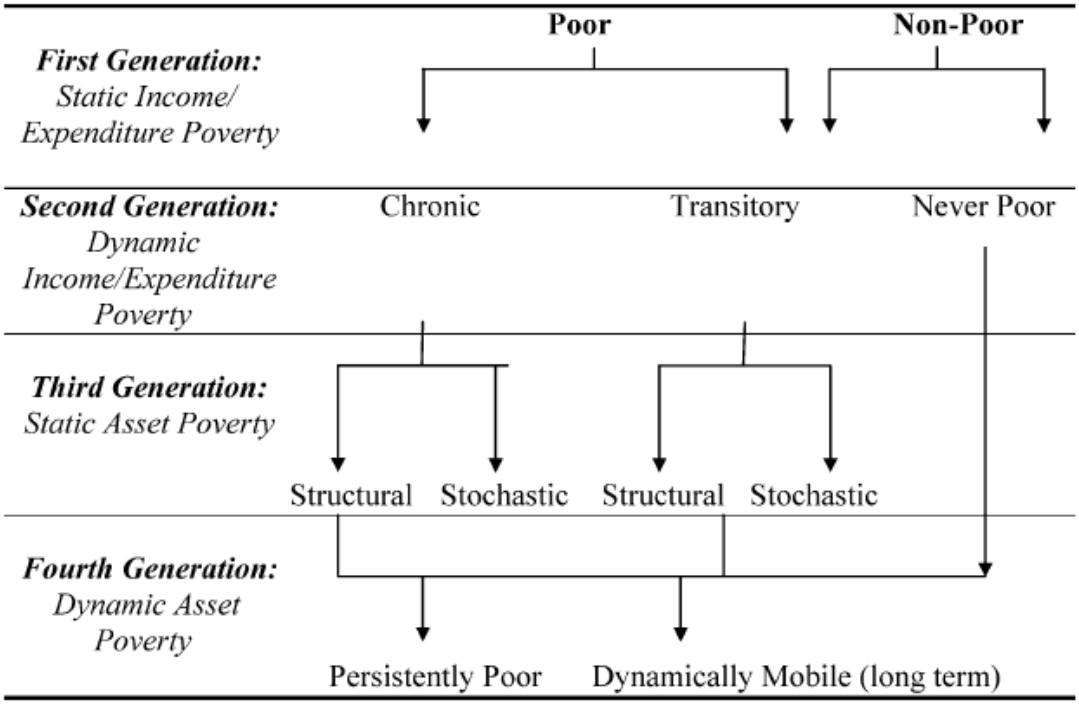
$$y_{it} = \sum_{j=1}^{J} A_{ijt} + \varepsilon_{it} \quad (1)$$

Barrett and Carter (2006) propose to reformulate the poverty measurement in an asset-based as a solution for overcoming the limitation of the dynamic expenditure poverty measurement. Further, asset measures have advantage that they are more accurately measured and less volatile than income or expenditures measurements (Giesbert & Schindler 2012).

However, a static asset poverty line as the third generation measure still has a limitation in further analysis of poverty. This measure cannot identify whether the current structurally poor are likely to remain poor over the longer time (caught in a poverty trap), or others who are currently non-poor can sustain their position (Barrett & Carter 2006). Therefore, a dynamic asset poverty measure is developed as the fourth generation to decompose these groups based on their positions over the longer term (ibid.). The existence of the poverty trap, which is defined as 'any self-reinforcing mechanism which causes poverty to persist' (Azariadis&Stachursky 2004, cited in Barrett & Carter 2013 p.977), should be visible in the pattern of this asset dynamics (Adato et al. 2006). Thus, dynamic poverty analysis requires estimating the pattern which shows the relation between multiple economic assets of a household at a current year and at its initial or base year.

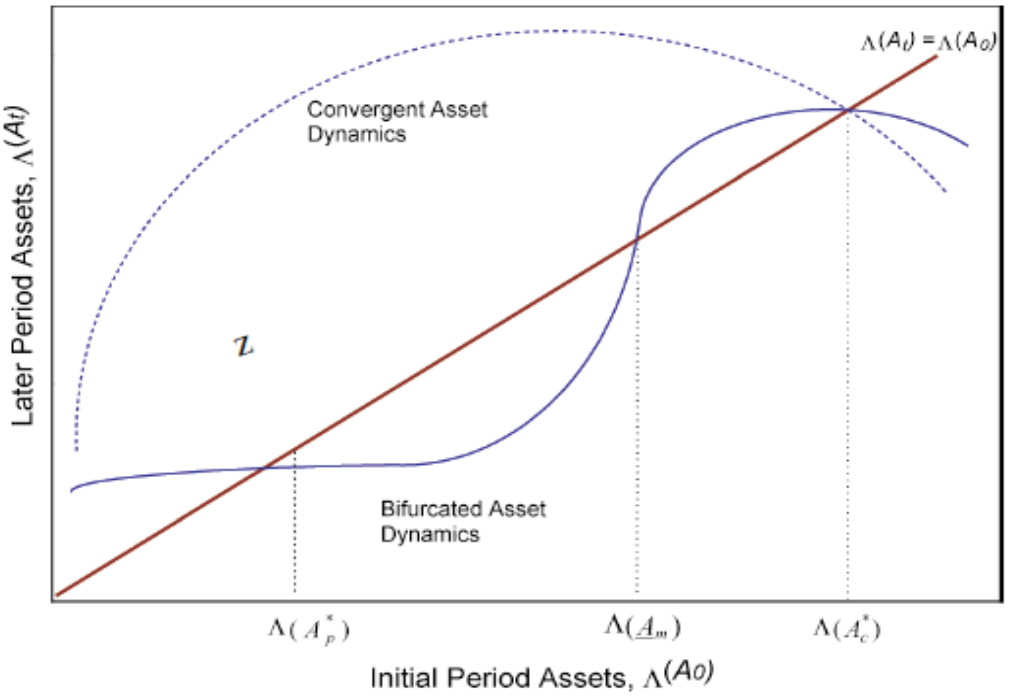
To estimate the pattern of assets dynamic, various assets with different units need to be compressed into an appropriate asset index. DeRosa et al. (2013) summarize five common methods to construct an asset index. First, an asset index can be constructed by aggregating weights of the first principal component from a principal component analysis (PCA) (Filmer & Pritchett 2001; Minujin & Delamonica 2002; McKenzie 2005; cited in DeRosa et al. 2013). Second, the asset index is derived from the aggregating weights of the first factor analysis of multiple assets (Naschold 2006; Sahn & Stifel 2003, cited in DeRosa et al. 2013). The third method uses multiple correspondence analyses (MCA) in producing the index (Booysenet al. 2008, cited in DeRosa et al. 2013).

Figure 1. Alternative Approach of Poverty Measurements



Source: Barrett & Carter (2006).

Figure 2. Hypothetical Asset Dynamics



Source: Adato et al. (2006).

Fourth, this method uses the fitted value from a livelihood regression of household assets and characteristics on household income or expenditure as an asset index (Adato et al. 2006; Naschold 2009, cited in DeRosa et al. 2013). Last method constructs the asset index by weighting assets with their estimated monetary values (DeRosa et al. 2013). However, there is still disagreement regarding the robustness of those different methods and only a small consideration of them that would affect subsequent analysed and policy recommendation (ibid.). Researchers usually perform one of these methods to construct the asset index. Thus, this paper uses the fourth method, a livelihood-weighted asset index, in constructing an asset index.

Once the asset index is constructed, a hypothetical pattern of asset dynamics can be generated. To make it easier to understand the pattern, Adato et al. (2006) illustrate it in Figure 2. Barrett and Carter (2006, cited in Giesbert & Schindler 2012 p.1595) argue that a poverty trap is a critical threshold, 'Micawber threshold', which is associated with an unstable equilibrium in multiple dynamic equilibria. This threshold is represented as asset level Am in Figure 2, while the stylised bifurcated dynamic (S-shape) represents two (or more) stable equilibria that may exist at level Ap* and Ac*. This S-shape results from the existence of locally increasing marginal returns to assets (ibid.). A household that is above this threshold, Am, is predicted to accumulate assets over time and to reach the stable upper asset equilibrium, Ac*, and moves out of poverty (ibid.). On the contrary, when a household is below the threshold, the household is too poor to accumulate assets and tends to fall behind and converge to low-level poverty trap, Ap* (Adato et al. 2006).

However, there is another pattern that leads to a poverty trap instead of multiple equilibria poverty trap. The poverty trap may also exist in a circumstance where a household faces a single equilibrium that is below the poverty line (Giesbert & Schindler 2012). This circumstance is likely in a converse way of the convergent asset dynamics in Figure 2 which instead of converge to high equilibrium level, Ac*, the assets accumulation of household converges to lower level equilibrium below the poverty line. The convergent pattern exists when the marginal returns to the assets are globally diminishing (ibid.). Thus, both patterns, either convergent or bifurcated dynamics, can exist in some households, but they need to be empirically tested.

Further, there are few empirical studies on different developing countries to empirically test whether the poverty trap exists. Barett et al. (2006) finds multiple equilibria poverty trap in Kenya. On the other hand, a study by Naschold (2012) in rural semi-arid India finds that the estimated dynamic asset accumulation paths show single stable equilibrium below the poverty line. This means that a household that is currently poor cannot hope to move out of poverty or move to the higher level of equilibrium in the next period (ibid.). The same pattern is also found by Giesbert and Schindler (2012). They find that the asset dynamic path of the households in rural Mozambique tends to converge to single equilibrium level slightly below poverty line (ibid.). In other words, all rural households are collectively trapped in poor (ibid.). Another study by Baulch and Quisumbing (2013) in rural Bangladesh finds evidence for concavity single low-level equilibrium or poverty trap, but no evidence for multiple equilibria. These studies

can have different findings in the dynamic assets equilibrium patterns, but they use a similar assets-based approach that generally follows the method introduced by Adato et al. (2006).

3. METHODOLOGY AND DATA

This study examines whether a poverty trap exists, based on the asset-based approach introduced by Barrett and Carter (2006). In constructing the asset index needed in the asset-based approach, it follows a livelihood-regression asset index from Adato et al. (2006). Further, steps in examining poverty trap follow the methodology used in Mozambique from Giesbert and Schindler (2012) and use statistical package software STATA 12.1. There are two steps in examining the poverty trap: a parametric method to construct an asset index and a non-parametric method to analyse the pattern of asset dynamics and existence of the poverty trap (ibid.).

3.1. Constructing Asset Index

This first step is performed to estimate the relation between multiple economic assets of a household at certain time and the assets at early period. These assets are considered to provide contribution in generating incomes and livelihoods for the households. However, since multiple assets usually have wide variation of measurement units, an asset index should be constructed first.

Following Adato et al. (2006) this asset index is derived from a bundle of all assets which are held by household and contribute for the future well-being. This index is constructed from the regression function that relates household i's livelihoodor welfare measure at time t (λ_{it}) to the bundle of all assets j=1,2,…,J held at that time (A_{it}). This function is generally modelled as:

$$\lambda_{it} = \sum_{j=1}^{J} \beta_j (A_{it}) A_{ijt} + \varepsilon_{it} \qquad (2)$$

In this equation, household's livelihood (λ_{it}) or material well-being is measured by household consumption expenditure divided by the money value of the household's subsistence needs and provincial-specific poverty line is used as a proxy measure for household's subsistence needs.

Then, an asset index is constructed using the regression results of Equation (2). The coefficients of each asset from this regression represent the marginal contribution to household livelihood of the j different assets. Using the estimates of β_j, the livelihood-weighted asset index (Λ_{it}) is calculated as the fitted value of the regression function from the Equation (2). Thus, Λ_{it} is defined as:

$$\Lambda_{it} = \sum_{j} \hat{\beta}_j (A_{it}) A_{ijt} \qquad (3)$$

This asset index has been expressed in unit-free measurement using poverty line units (PLU), so that a value of 0.5 means that a household owns a bundle of assets that can predict the household's livelihood is at a half of poverty line.

Prior to estimating this asset index, determining the components of the assets bundle that can likely provide a contribution to the household's livelihood is required. This paper uses two groups assets which are almost similar to assets in Adato et al. (2006). These groups are human capital (education and health) and natural and productive capital.

In human capital, this study uses some proxy variables for representing education and health of the households. The mean of household's member education year (*m_edummm*) and household's head education year (*eduhhh*) are chosen as the proxy for education. Since data for education year is not available, these variables are transformed from the existing data of the level of school graduated. Further, this study does not use health status of household member as represented of the health because the value of health status information is only based on the answer of the member which seems to be very subjective. Instead, it employs variety of nutrient intakes, or food diversity, as the proxy of health (*fdiverse2*). The consideration of this proxy is that according to Dietary Guidelines for American, a health plate should vary its food (USDA 2011).

In contrast, more information concerning households assets are available as a proxy for natural and productive capital. The sources of this capitalis derived from farm business assets, non-farm business assets and non-business assets. Various assets from these three groups that are presumed to provide a contribution for livelihood are picked up and converted to their real value using Consumer Price Index 2007 as base year. These assets consist of land (*ln_land*), house (*ln_house*), other building (*ln_bldg*), four-wheel vehicles (*ln_vhcle*), other vehicles-such as boat (*ln_othvhcle*), livestock, poultry and fishpond (*ln_livestock*), hard-stem plants (*ln_plants*), tractor and irrigating equipment (*ln_tractor*), heavy equipment (*ln_heqpmnt*), small tools for business (*ln_smltol),* jewelry (*ln_jewelry*), and savings (*ln_saving*). The last two asset types are less likely used in a productive activity, but they are relatively liquid assets. All these assets are also measured in their natural logarithm in order to control for severely skewed distribution. Then, to capture potential heterogeneity in asset returns, this paper also includes the interactions of natural and productive capital with the education (*edu_***) as well as the urban or rural location of the household (*urb_***).

Household and time fixed effects are also included to control for household and year specific unobserved heterogeneities. To control for specific characteristics, this study also adds household characteristics and community characteristics. Household characteristics cover the age of household's head (*agehhh)* and a dummy variable that represents whether the household's head is female (*d_sexhhh*). Further, community characteristics include road quality (*road*), existence of market (*market*), existence of industry or factory (*factory*), and access to electricity (*electricity*). These characteristics inclusion follows Giesbert and

Schindler (2012), but since almost all households already have access to electricity which make this variable less variant among households, then the variable electricity is dropped.

Considering these variables, Equation (2) is customized, so that the model of a livelihood-weighted asset index for each region is:

$$\lambda_{it} = \beta_1 + \beta_{2jit}\sum_{j=1}^{J} assets_{jit} + \beta_{3mit}\sum_{m=1}^{M} HHchars_{mit} + \beta_{4nit}\sum_{n=1}^{N} Commchars_{nit} + \beta_{5oit}\sum_{o=1}^{O} interact_{oit} + \beta_{6it} D_{Pit} + \beta_{7it} deta_{Tit} + u_i + v_t \quad (4)$$

where assets$_j$ represents human capital and natural and productive capital, *HHchars* represents household's characteristics, *Commchars* represents community's characteristics, *interact* represents the sum of interactive variables, $D_P$is province specific effect, $deta_T$is year specific effect and u_i is household specific effect. Then, this equation is analysed by using household fixed-effect panel regression.

Compared to Prima (2009) and Wardhana (2010), this study also estimate this regression separately for each hypothetical region instead of national level regression function to take into account the possibility that asset returns could vary across different livelihood and geographical settings. In this paper, provinces of the households are regrouped into five regions: Sumatra and islands, Java and Bali, West Nusa Tenggara, Kalimantan and Sulawesi. These classification are based on their similar economic activities and characteristics each province.

Further, the regression results of Equation (4) need to be examined to determine whether the obtained model for each model is valid. Using the estimates of coefficient ($\hat{\beta}_j$),predicted livelihood ($\hat{\lambda}_{it}$) for each household in different regions and in different period can be obtained. Since this study covers many values of continuous livelihood data, visible analysis is used to determine the most appropriate models using the Epanechnikov kernel density plot of predicted livelihood, $\hat{\lambda}_{it}$, and the actual value of livelihood, λ_{it} (Cameron & Trivedi 2009). The rule is that the estimates can proceed when the kernel density plot of $\hat{\lambda}_{it}$ is not shifting so that it is significantly different with the λ_{it}. The simpler rejecting criterion is that $\hat{\lambda}_{it}$ is considered not a well-proper model if the distribution of poor households using $\hat{\lambda}_{it}$ is totally disappear. Finally, the predicted livelihood, $\hat{\lambda}_{it}$, which is the fitted value of the most proper model of Equation (4), can be used as the representation of the estimated asset index.

3.2. Estimating Asset Accumulation Dynamics

This second step is crucial in this study because the objective is to examine whether a poverty trap could be found in the results and to identify the pattern of the asset dynamics. This step uses a non-parametric technique to estimate the relationship between a household's current and its baseline asset level as Equation (5) (Giesbert & Schindler 2012):

$$A_{it} = f\left(A_{it-1}\right) + \varepsilon_i \quad (5)$$

where *A* represents the asset index of household *i* (it is also the fitted value of livelihood, $\hat{\lambda}_{it}$, from parametric method), *t* stands for the current period and *t-1* for the baseline period and the error term ε_i is assumed to be normally and identically distributed with zero and constant variance (ibid.).

Equation (5) needs a pair of asset index *from* current period and baseline level. Yet, the fitted values, $\hat{\lambda}_{it}$, from parametric method are still in panel data form that could not directly be used. Further, this paper uses four rounds of panel data which covers longer period than data used by Giesbert and Schindler (2012). Thus, in this study, the fitted asset index is transformed from a set of panel data into a pair of current and baseline level of household's livelihood. To get a deeper picture, the non-parametric technique is run in two different pairs. The first pair uses three to four years lag, so that the baseline-current period is 1993-1997 and 1997-2000. On the other hand, the second pair uses longer period, 7 years lag, so that the baseline-current period is 1993-2000 and 2000-2007.

Further, this study uses a local polynomial regression with Epanechnikov kernel weight as used by Giesbert and Schindler (2012) in estimating Equation (5). This non-parametric technique treats A_t as dependent variable and A_{t-1} as independent variable. This technique can produce a report of asset recursion diagram which shows the pattern of equilibrium of the households whether the households converge into a single stable equilibrium (convergent assets dynamic) or the household have a multiple-equilibria, at least two stable equilibria and at least one unstable equilibrium (ibid.). The unstable equilibrium is called the 'Micawber threshold' (Zimmerman & Carter 2003, cited in Giesbert & Schindler 2012, p.1595) at which dynamic assets accumulation bifurcate (Barrett &Carter 2006).

Moreover, the detailed visible analysis can be processed from these patterns. Households in some regions can be said to be in a poverty trap when the patterns show that either the single equilibrium converges at a point below the poverty line or the stable equilibrium at the multiple equilibria is at a point below poverty line (Giesbert & Schindler 2012). Thus, by performing this technique, the question of this paper should be answered.

Figure 3. Provinces Covered in IFLS1

Source: RAND Corporation (2012).

3.3. Data

This study uses continuing longitudinal household unbalanced panel data from RAND Corporation known as Indonesia Family Life Survey (IFLS). By now, there are four waves of IFLS that have been done. The first wave of IFLS (IFLS1) was conducted in 1993-1994 and covered 7,224 households that represented about 83 per cent of the Indonesian population (Sikoki et al. 2009). These household samples are living in 13 provinces out of 26 provinces in that period which can be seen in Figure 3 (ibid.).

The second wavewas conducted in 1997. Based on the User Guide of IFLS4 (Sikoki et al. 2009), there were 7,698 households as respondents in IFLS2, of which 6,821 were the original respondents from IFLS1. Thus the recontact rate for IFLS2 is 94.42 per cent. Further, this book also shows that the recontact rate for IFLS3 which was conducted in 2000 is 95.30 per cent which means that there were 10,574 households as total respondents in IFLS3 and 6,800 households of which were the original respondents from IFLS1. Lastly, IFLS4 that was conducted in 2007 covered 13,995 households as total respondents and 92.4 per cent or 6,596 of original respondents from IFLS could be recontacted (ibid.). This recontact rate is at least as high as most longitudinal survey in the United States and Europe (ibid.). In addition, all waves contain massive information collected at the individual and household levels which includes multiple indicators of economic and non-economic well-being (ibid.). For examples: consumption, income, assets, education, migration, labor market outcomes, and, health status (ibid.).

The IFLS data has some strengths and limitations. The most powerful strength is that IFLS is the only large-scale longitudinal survey available for Indonesia that provides a dynamics of behaviour at the individual, households and community level (ibid.). IFLS also provides data for multipurpose analyses and the current and retrospective information (ibid.). However, IFLS faces limitations because, by design, it did not cover some provinces which might provide a more realistic view of Indonesian households; for instance, the poorest provinces (West Papua, Papua, East Nusa Tenggara) are not covered in this survey. There are also many missing values in the expenditures variable and the asset measures are not provided with theirquantity values.

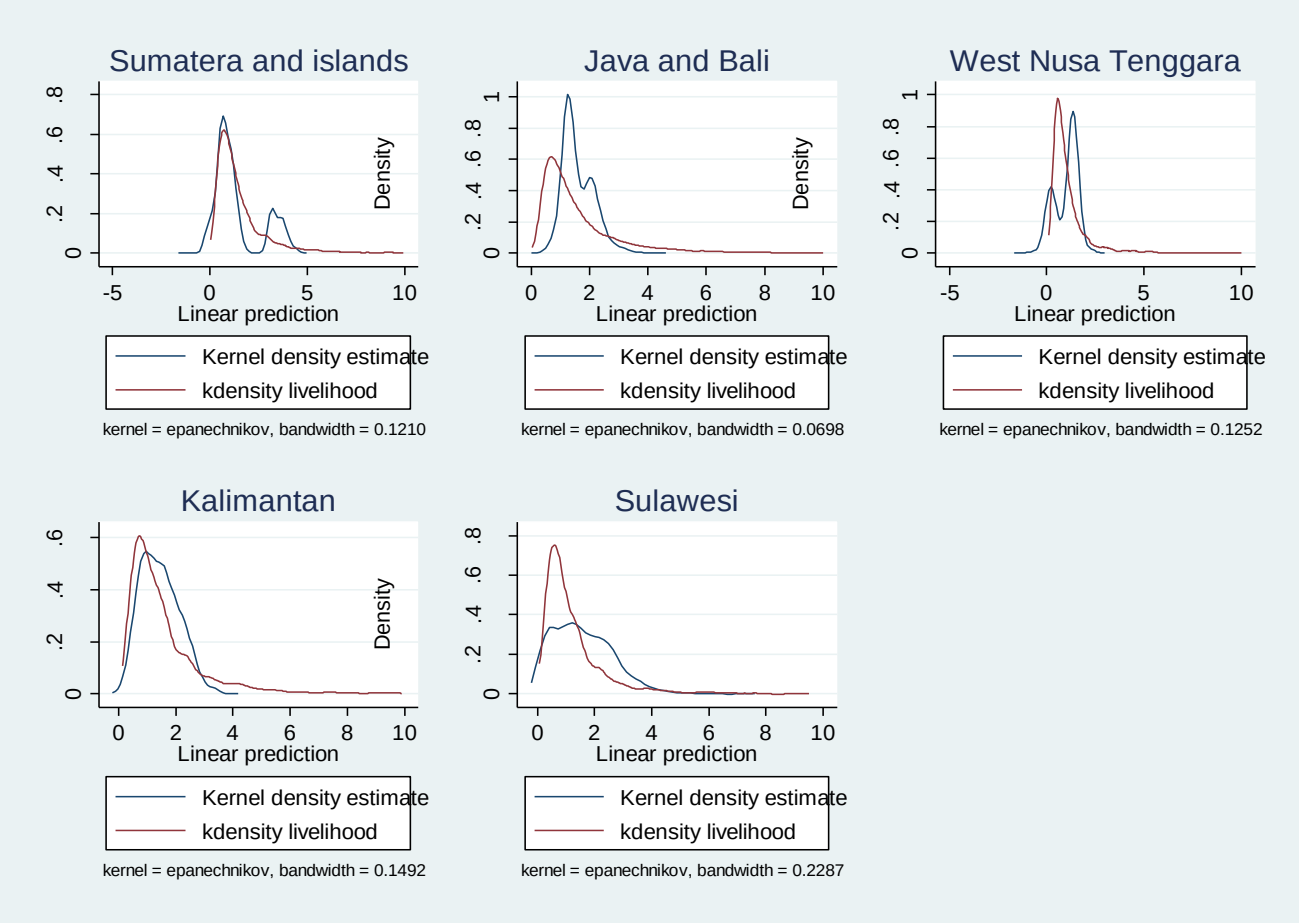
On the other hand, this study uses a World Bank US$2 a day (at PPP adjusted) poverty line instead of the national poverty line. In deflating and transforming this standard into real term Rupiah (Rp) value, Consumer Price Index (CPI) of 2007 is used as the base year. CPI data is taken from the databank of the World Bank. However, this paper cannot differentiate the real poverty line for each region because of the unavailability of regional CPI in the databank.

4. RESULTS AND DISCUSSIONS

4.1. Descriptive statistics

This section summarizes the main descriptive statistics of the dependent variable and the independent variables. Indonesia as a developing country is benefitted by its positive growth over time. This economic growth may become one cause of the increasing asset index for the period 1993 to 2007. This section presents the summary of the earliest and the latest waves which are presented in Table 3 (appendices). Detailed statistics of the variables for the period 1997 to 2000 are also listed in Table 4 (appendices).

Figure 4. Kernel Density of The Estimated Asset Index and Livelihood for Each Region



Source: Author's calculation.

Table 3 (appendices) shows that the mean of asset index for all regions, except Sumatra, raised and Sulawesi enjoyed the largest increase from 1.03 in 1993 to 1.43 in 2007, or almost 50 per cent increase. However, standard deviation of asset index for all regions, except Kalimantan, mostly unchanged in the same period. Ironically, Sulawesi that grew faster than others could not reduce its standard deviation of asset index, even more, the deviation became larger. This can be said that the gap between the non-poor and the poor households remained significant.

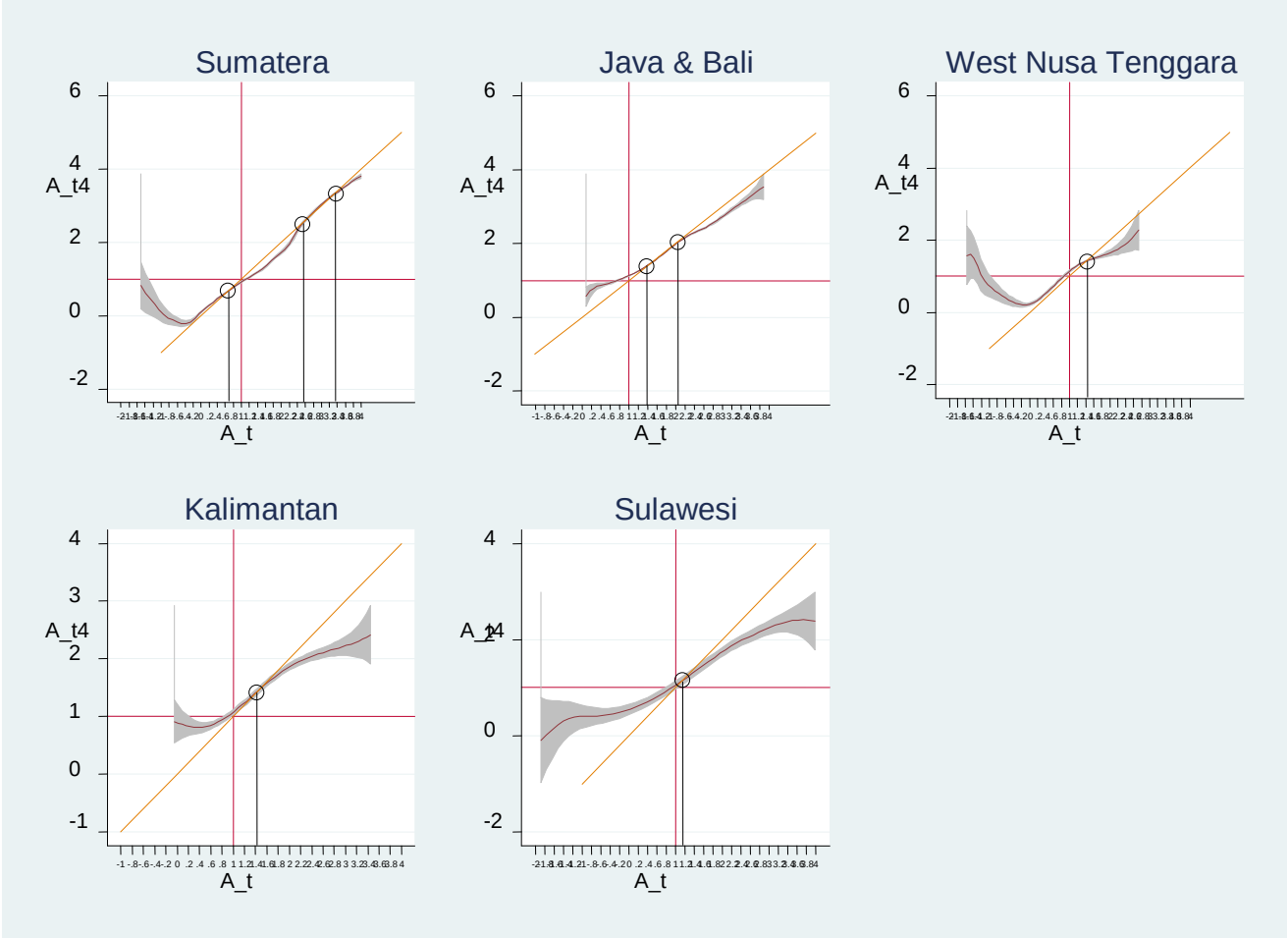
Further, the growth seemed to bring positive impacts in the components of asset index at the aggregate level as shown in Table 3 (appendices). Human capital which is represented by health (food diversity) and year of education is much better in 2007 than in the base year. Yet, the gap between the lowest and the highest level of human capital seems to be not being better. Moreover, Table 3 (appendices) shows that household's income on average was almost doubled in 2007, compared to 1993-based. This finding is represented by expenditure per capita of the households. However, the deviation of expenditures per capita in 2007 was, even, larger than its mean. Thus, it reinforces the finding in asset index pattern which indicated that the gap between the poor households and the non-poor households became worse.

On the other hand, Table 3 (appendices) shows that there are more various patterns in the households' productive capital. Some assets on average had an increasing value in 2007 such as jewellery and four-wheel vehicles. In contrast, the value of other productive assets seems to decrease from 1993 to 2007.

4.2. Constructed Asset Index

This section is started by a summary of main features of the results from parametric technique for each region. The complete results which consist of the estimated coefficients and their standard error for each independent variable in five different regions are detailed in Table 5 (appendices). Yet, before interpreting the main features of the models, these models should be tested on their wellness. In this study, Kernel density function of the fitted values of asset index (livelihood) is used as the criterion. The results of this test are summarized in Figure 4. From this figure, it can be seen that all of the fitted values of asset index do not move away from the actual livelihood. Thus, it can be inferred that each model for these five regions can be accepted. Overall, consumption-based poverty rate is higher than the asset-based poverty rate. This is well expected given fact that the former should include both structural

Figure 5. Asset Recursion Diagram With 3-4 Years Lag



Source: author's calculation.

poor (asset-based poverty) as well as the stochastic poor.

Further, estimates of five models for each region as parametric results discover some interesting findings. First, when human capital (health and education of the household's head) are not interacted to productive capital or other characteristics, they are only positively significant in West Nusa Tenggara which is known as one of less developing region in Indonesia. Another interesting finding in this region is that livestock asset is positively significant in contributing to household's livelihood which is consistent to the major economy of this region which is called as the land of a million cows (Disnakeswan 2013). Yet, this asset seems to have opposite effect when it is interacted to the household who lives in urban area which might be because most urban households do not lay their economy on cattle farming or livestock.

Second, household characteristics which are represented by age of household's head and female headed household are likely not significant in all regions. Similarly, marketplace availability is the only one community characteristic that significantly contribute in household's livelihood in two out of five regions, while existence of a factory and road quality seem to be not significant. Interestingly, existence of marketplace provides a negative significant contribution in West Nusa Tenggara. In contrast, in Sumatra marketplace availability has positively significant effect on the household's livelihood. Household's livelihood in Sumatra region which is known as large farm of oil palm tree is positively contributed by the holding of tractor.

Third, the result shows that all human capital and productive capital are not significant in Java and Bali which was hypothesized as the most developing region. Yet, year of education of the household's head when interacted to urban households becomes positively significant for household's livelihood.

Fourth, the value of other assets, such as boats, is positively significant in contributing household's livelihood in Kalimantan. This is also as expected because river is one of the main infrastructures for transportation. In contrast, there is no specific asset that relates to the economy of Sulawesi region. Instead, only the value of house and value of house interacted to urban are significant in Sulawesi. But, they have opposite effect; value of house is negatively significant, while interaction urban and house has positively significant contribution. All of these findings are needed to be deepened in the future research.

4.3. Nonparametric Estimation of Dynamic Asset Pattern And Poverty Trap

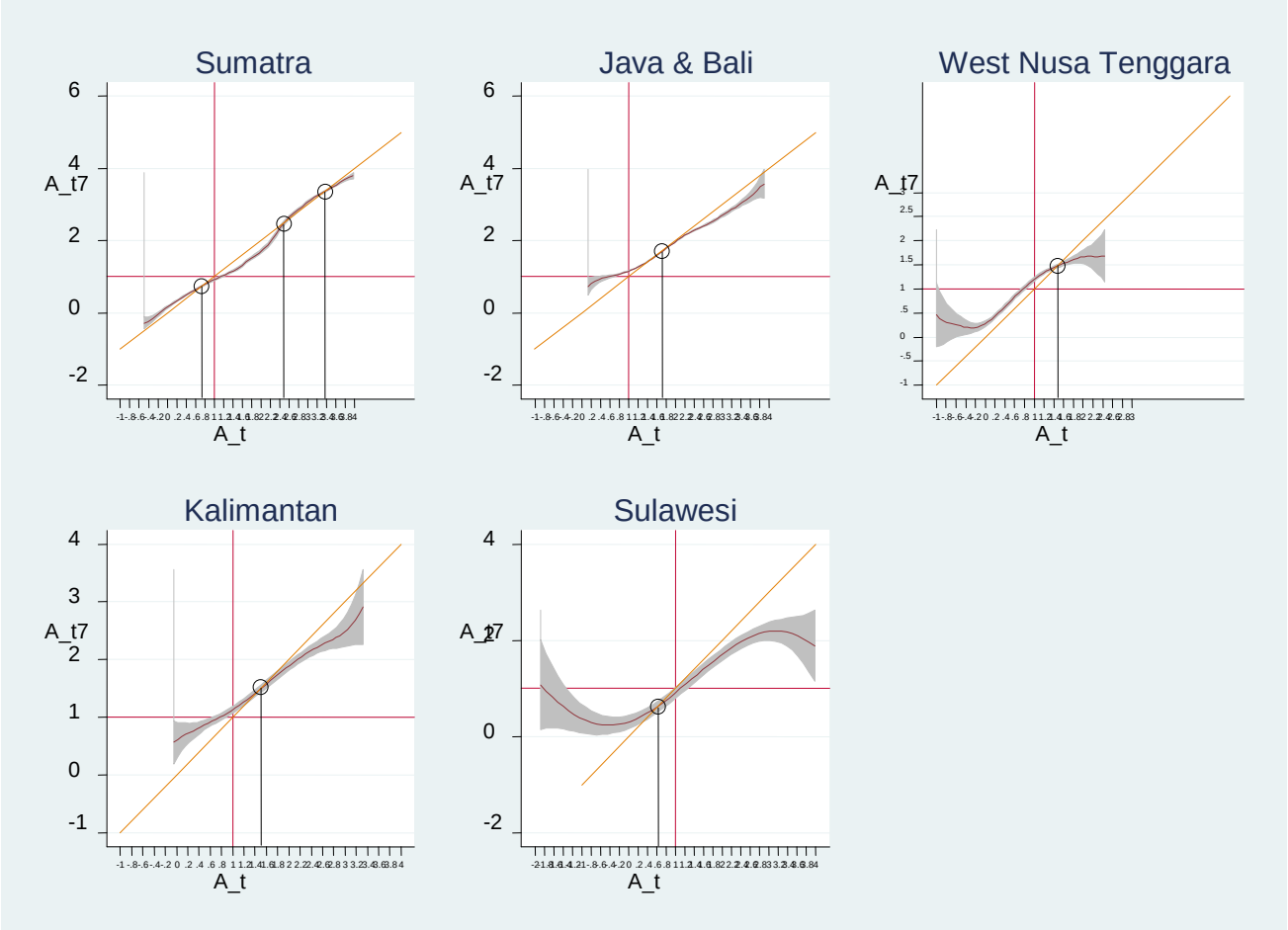
This section presents the nonparametric estimation of the relationship between the asset indexes in the later period and in the base year period. Using local polynomial regression and the second order polynomial, the asset recursion diagram is produced. Since this study using four waves of IFLS that cover long period from 1993 to 2007, this study distinguishes the shorter nonparametric analysis (3 to 4 years lag) from the longer analysis (7 year lag). Further, before this analysis can be done, the fitted values of asset index from parametric technique should be transformed into two pairs of observations. These pairs represent the dynamic of households' assets over period.

The first pairs show the relationship of asset index from the year 1997-1993 and 2000-1997, where the latter years are the baseline for respective pairs. The asset recursion diagrams for each region are summarized in Figure 5. Horizontal axis in Figure 5 represents asset index in the baseline (1993 for 1997 as current year and 1997 for 2000 as current year), and vertical axis represents the asset index at current period. There is a 45-degree line in each graph which means that asset index in the baseline is exactly the same as asset index in the current year. This line also indicates the equilibrium that may exist for each region. Further, there are two intersected lines at point 1 in horizontal and vertical axis. The function of these lines is as a representation of poverty line. So, when the asset equilibrium intersects at point below this line, it can be inferred that the households are at poor condition.

Figure 5 shows some interesting findings in the pattern of asset dynamics and the existence of poverty trap for each region. Generally, almost all regions have a single equilibrium which converges at above poverty line, but there are exceptions for Sumatra and Java and Bali regions. These regions seem to have a different pattern. Instead of single equilibrium pattern, there is evidence that multiple equilibria exist in Sumatra and Java and Bali regions.

There are an unstable equilibrium at about point 2.55 PLU and two stable equilibria at point 0.65 PLU (below poverty line) and at point 3.35 PLU (much higher than poverty line) in Sumatra. So, it can be concluded that multiple equilibria poverty trap might exist in Sumatra. Further, there is a threshold at its unstable equilibrium point (at about 2.55 PLU) that households can bifurcate. So, households which have assets below the unstable equilibrium point are likely converge to the stable equilibrium below poverty trap or trapped in poverty. In contrast, households that hold assets above the threshold are likely able to accumulate enough assets and to converge at higher

Figure 6. Asset Recursion Diagram With 7 Years Lag



Source: author's calculation.

level of assets (move out of poverty). This finding is almost similar to Prima (2009) who finds that in national level (overall country) households have multiple equilibria and can bifurcate. However, this finding is not as expected because Sumatra is usually considered as the second largest economy in Indonesia.

Though Java and Bali also have multiple equilibria, Figure 5 shows that these multiple equilibria are located above poverty line. Further, these multiple equilibria seem to tangent to the 45-degree line not only two points but along the point from 1.40 PLU to 2.10 PLU. Thus, it can be inferred that poverty trap does not exist in Java and Bali, but, instead, the households in this region converge into non-poverty status. This finding is as expected since Java and Bali is the largest economy and the most developing region in Indonesia.

On the other hand, other three regions share a common trend. West Nusa Tenggara, Kalimantan and Sulawesi have a single stable equilibrium above poverty line. This can be interpreted that all households in these regions converge into non-poverty condition or poverty trap is not exist these regions. Yet, Figure 5 shows that the stable equilibrium of Sulawesi is so close to poverty line at around 1.15 PLU which means it can be vulnerable for this region to be trapped in the poverty if there is a little shock. In contrast, West Nusa Tenggara and Kalimantan which are also known as mining region share the same stable equilibrium at higher level at around 1.45 PLU. These findings are quite surprising because Sulawesi is the largest region within eastern Indonesia, but the asset dynamic shows a worse level than West Nusa Tenggara and Kalimantan.

To gain a deeper analysis, Figure 6 is used for the longer period analysis (7 year lag). This figure represents the second pairs that show the relationship of asset index from the year 2000-1993 and 2007-2000, where the latter years are the baseline for respective pairs. As in Figure 6 horizontal axis represents asset index in the baseline (1993 for 2000 as current year and 2000 for 2007 as current year), and vertical axis represents the asset index at current period. There are also a 45-degree line in each graph and two intersected lines at point 1 in horizontal and vertical axis.

Generally, there are almost similar pattern in Figure 6 compared to the shorter pattern analysis in Figure 5. Poverty trap seems to still exist and the dynamic asset pattern follows multiple equilibria in Sumatra. Though there are some slight changes, there is still no evidence poverty trap may exist in Java and Bali, West Nusa Tenggara and Kalimantan. Java and Bali seems to have a slight change in the pattern which it initially has multiple equilibria, then in the longer period, the households converge into a single stable equilibrium above poverty line at around 1.75 PLU.

On the other hand, households in Sulawesi region seems to have a worsen asset accumulation over longer period. Figure 6 shows that these households still follow a single stable equilibrium, but the stable equilibrium moves to the lower level than one in shorter period. Even more, in this longer period, the stable equilibrium is below poverty line at around 0.65 PLU which can be inferred that in the longer period of observation poverty trap may exist in the households in Sulawesi region. This finding is as predicted in Figure 5 which shows that households in Sulawesi might be at the vulnerable position to become poor. This finding differs to Prima (2009) which argues that in national scales (overall country) multiple equilibria poverty trap exists in Indonesia. But it shares the common pattern with Giesbert and Schindler (2012), Naschold (2012), and Baulch and Quisumbing (2013) who find that households tend to converge in a single equilibrium level using Mozambique, India and Bangladesh as their observations, respectively.

5. CONCLUSION

The final part of this paper concludes some findings in this study. Using asset-based approach in analysing longitudinal households panel data in five different regions in Indonesia, this paper attempts to examine whether poverty trap exist in household level in some regions in Indonesia and to identify the pattern of asset dynamics for certain periods. Based on the result from parametric and nonparametric techniques, this study finds that poverty trap seems to exist in form of single equilibrium at Sulawesi and in multiple equilibria in Sumatra. This main finding suggests that this paper's hypothesis which argues that poverty trap may exist in some regions other than Java and Bali is partly maintained because Kalimantan and West Nusa Tenggara show that there is no evidence that poverty trap exist in these regions. This study also finds that assets accumulation of the households in Kalimantan and West Nusa Tenggara tend to converge into a stable single equilibrium at above poverty line.

Another finding shows that contributions of assets toward livelihoods vary across regions. For instance, livestock is positively significant in West Nusa Tenggara, other vehicles, such as boats, are positively significant in Kalimantan, existence of marketplace in the community is positively significant in Sumatera, and year of education of the household's head in urban area is positively significant in Java and Bali. However, household characteristics, such as age of the household's head and female headed household, seem to be not significant components in the household's livelihood for all regions.

These findings may provide implications for government's poverty alleviation policies. Poverty analysis needs to be deepened in Sumatra and Sulawesi regions because it is unexpected that poverty trap seems to exist in these regions. These are unexpected findings because Sumatra is known as the second largest economy and Sulawesi is also the most developing region in eastern Indonesia. While this is true on average, it could be true that the level of development within these two regions vary across households. Especially in the case of Sumatra, our evidence seems to suggest that there could exist a

critical asset threshold that determines household's asset accumulation dynamics and so their long-term poverty. If this is the case, policy intervention might be targeted to helping those below the threshold, who tend to have problem accumulating asset by their own mean. Another policy implication may be related to the specific significant components in each region that should be the focus of assistance. For instance, government should focus in supporting livestock farming in West Nusa Tenggara, boat facilities in Kalimantan and marketplace proximity in Sumatra.

This study is still a preliminary stage. Future research is needed to go further into more interesting study. These may include measuring asset growth for each region, more detailed research on each region to gain more realistic picture, updating the period of observation to cover the full periods of SBY administration, and performing separate analysis for poor provinces, such as Papua, West Papua, or East Nusa Tenggara. More importantly, indirect behaviour approach, such as observing the long-term consequence of some small disturbance in asset dynamic equilibrium (for instance, from shocks and asset transfers) on asset accumulation among people locating in different sides of critical asset threshold, can be used to test the patterns of asset-based poverty trap found in this paper.

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APPENDICES

Table 3. Summary Statistics of Variables for 1993 and 2007

Variable	No. of obs.		Mean		Std. Dev.		Min		Max	
	1993	2007	1993	2007	1993	2007	1993	2007	1993	2007
Asset index										
Asset index_Sumatra	1104	1513	1.40	1.37	1.22	1.27	-0.39	-0.57	4.82	4.69
Asset index_Java&Bali	3794	4975	1.62	1.63	0.59	0.54	0.14	0.27	4.56	4.06
Asset index_West Nusa Tenggara	367	598	0.96	1.03	0.60	0.65	-1.00	-1.20	2.40	2.83
Asset index_Kalimantan	226	351	1.42	1.46	0.72	0.61	-0.05	0.21	3.27	4.04
Asset index_Sulawesi	305	340	1.03	1.43	1.29	1.39	-3.82	-3.32	4.20	7.37
Expenditure per capita in real term (Rp/month)	7136	12658	364144	623842	520414	630132	13441	27740	22500000	13600000
Human capital										
Food diversity	7111	13436	0.26	5.68	0.56	1.91	0.00	0.00	5.00	8.00
Education year of HHs' members	7111	13436	4.00	6.71	3.03	3.27	0.00	0.00	16.00	16.00
Education year of HHs' head	7111	13430	5.46	7.81	4.47	4.68	0.00	0.00	16.00	16.00
Productive capital										
Log value of land	6895	13118	3.08	-0.18	12.81	12.40	-9.21	-9.21	22.63	21.42
Log value of house	6777	12814	10.62	8.53	10.68	12.47	-9.21	-9.21	22.35	20.72
Log value of building	7097	13342	-5.98	-4.79	8.46	9.66	-9.21	-9.21	22.35	21.42
Log value of hard-stem plants	7062	13308	-5.77	-6.69	8.17	7.38	-9.21	-9.21	22.35	20.72
Log value of livestock	7157	13368	-0.50	-1.88	10.92	10.47	-9.21	-9.21	22.35	20.94
Log value of vehicles	7150	13361	-0.09	5.22	11.42	11.99	-9.21	-9.21	22.35	20.72

Variable	No. of obs.		Mean		Std. Dev.		Min		Max	
	1993	2007	1993	2007	1993	2007	1993	2007	1993	2007
Log value of other vehcles	7177	13436	-7.61	-7.08	5.88	6.84	-9.21	-9.21	21.83	18.42
Log value of tractor	7185	13431	-9.12	-8.72	1.50	3.35	-9.21	-9.21	17.92	17.84
Log value of heavy equipment	7182	13433	-8.93	-8.91	2.52	2.61	-9.21	-9.21	18.84	18.13
Log value of small tools	7151	13408	-1.95	-2.83	9.83	9.58	-9.21	-9.21	22.35	18.32
Log value of jewellery	7165	12990	-6.74	2.48	7.18	11.47	-9.21	-9.21	22.35	19.67
Log value of savings	7041	12798	-4.25	-4.18	9.52	9.67	-9.21	-9.21	22.35	20.21
Household characteristics										
Age of head of household	7111	13430	45.54	46.88	14.38	35.55	14.00	11.00	99.00	998.00
Household is female-headed	7111	13430	0.16	0.22	0.37	0.41	0.00	0.00	1.00	1.00
There is at least one factory (industry)	6664	8819	0.50	0.49	0.50	0.50	0.00	0.00	1.00	1.00
Market is close to the community	6663	8819	0.42	0.41	0.49	0.49	0.00	0.00	1.00	1.00
Main roads are paved or asphalt-used	6664	8819	0.95	0.95	0.22	0.22	0.00	0.00	1.00	1.00
Electricity avalaibility	6664	8819	1.00	1.00	0.05	0.04	0.00	0.00	1.00	1.00

Source: Author's calculation.

Table 4. Summary statistics of variables for 1997 and 2000

Variable	No. of obs.		Mean		Std. Dev.		Min		Max	
	1997	2000	1997	2000	1997	2000	1997	2000	1997	2000
Asset index										
Asset index_Sumatra	1027	1332	1.34	1.39	1.21	1.21	-1.50	-1.01	4.58	4.83
Asset index_Java&Bali	3566	4424	1.58	1.59	0.53	0.52	0.18	0.09	3.91	3.68
Asset index_West Nusa Tenggara	381	450	0.98	0.98	0.61	0.62	-0.61	-1.56	2.46	2.73
Asset index_Kalimantan	259	293	1.39	1.49	0.70	0.70	0.09	0.12	3.39	3.45
Asset index_Sulawesi	341	384	1.52	1.12	1.11	1.17	-2.01	-1.98	4.38	5.74
Expenditure per capita in real term (Rp/month)	7536	10229	561,559	514,408	1,658,412	709,644	24,587	14,700	63,700,000	32,500,000
Human capital										
Food diversity	7502	10248	5.73	5.89	1.42	1.53	0.00	0.00	8.00	8.00
Education year of HHs' members	7502	10248	5.10	5.86	3.13	3.28	0.00	0.00	16.00	16.00
Education year of HHs' head	7502	10246	5.90	6.74	4.51	4.68	0.00	0.00	16.00	16.00
Productive capital										
Log value of land	7236	10054	2.92	2.32	12.92	12.85	-9.21	-9.21	22.30	22.27
Log value of house	7058	10009	12.17	10.23	9.95	11.34	-9.21	-9.21	22.87	21.25
Log value of building	7399	10196	-5.05	-4.45	9.50	9.94	-9.21	-9.21	27.74	21.33
Log value of hard-stem plants	7442	10143	-6.41	-5.62	7.57	8.43	-9.21	-9.21	20.65	21.00
Log value of livestock	7498	10240	0.04	-4.92	11.00	8.99	-9.21	-9.21	19.78	20.15
Log value of vehicles	7476	10223	2.91	2.53	11.88	11.90	-9.21	-9.21	20.27	21.45
Log value of other vehcles	7534	10262	-7.72	-6.97	5.72	6.96	-9.21	-9.21	20.14	19.84
Log value of tractor	7539	10260	-9.09	-9.09	1.72	1.74	-9.21	-9.21	17.84	17.85