USING SOCIAL ACCOUNTING MATRICES TO MEASURE IMPACT OF AGRICULTURE SECTOR POLICY ON INCOME DISTRIBUTION: Lesson from Aceh, Indonesia after Megadisaster Tsunami 2004

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Abstract

Megadisaster tsunami attack violently Aceh in December 26th 2004, caused crisis, damage and loss of human and economic sector especially agriculture, sector that has the biggest role in the economy of Aceh Province. This study aim to learn how actually impact the development of agriculture sector to the economy and income distribution in the province of Aceh before and after the tsunami. This research develops the Social Accounting Matrix Aceh Province in 2010, comparing with 2002 and use structural path analysis to see the relevance of household and government income.

Based on this analysis found that Income inequality increased after the tsunami occurred in clusters and rural areas and urban labor, agricultural household groups and non-agriculture, as well as sectoral. Greatest income inequality occurred in the sectoral income, followed by household income inequality, and the smallest is labor income inequality. To reduce labor income inequality, household, and sectoral simultaneously possible investment policy. In addition, the combination of the form of policy investment in the agriculture-based economy and the redistribution of non-agricultural household income and the income of the recipient to non-agricultural households of the bottom, is also effective in reducing income inequality in Aceh Province.

Key words: Natural Disaster, Agriculture Sector Policy, Social Accounting Matrix, Structural Path Analysis, Income Distribution

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Introduction

Agriculture sector is a sector that plays an important role in the economy of the province. It can be measured by the share of agriculture in GDP formation, employment providers,

sources of income for the majority of the people of Aceh province, poverty alleviation, foreign exchange earnings through exports of non-oil and gas, the creation of food security, the creation of conditions conducive to the development of other sectors, and provider of raw materials and market potential for the industrial sector. Before the natural disasters, the agricultural sector is a major driver of the local economy that is equal to 32% of GDP and employment 47.6% of the total available. Of 98.137 households in 465 villages, about 70% or 67 614 households depend on agriculture for their livelihood. In the agricultural sector, food crop production is dominant which includes forestry, plantation, animal husbandry and related activities. Aceh also has a forest area of 2.3 million hectares are classified as forest land.

On the day Sunday, December 26, 2004 an earthquake with its epicenter about 150 miles off the coast of Aceh. Forty-five minutes after the earthquake, the tsunami waves hit the coastal areas of Nanggroe Aceh Darussalam (NAD) along 800 km. As a result of this disaster, as many as 130 013 people were killed and 37,066 remain missing. The disaster also destroyed settlements so many people are homeless and displaced. Of about 500,000 refugees, mostly children, women and elderly people. In addition to the physical impact, disasters also provide psychological impact of traumatic effects of prolonged (BRR, 2005).

A year after the tsunami, recovery efforts focused on reconstruction and progress has been made in various fields. Rehabilitation and reconstruction efforts, particularly in the agricultural sector, seems to show encouraging results. agricultural sector provides the largest contribution to GDP of Aceh province from year to year, both GDP with oil and gas (oil) and without oil.

80 percent of the number of poor people in the province of Aceh is the villagers. This indicates that rural areas are more prone to poverty than urban. The main priority for the Government of Aceh Province in reducing poverty must focus on growth and sustainable economic development in rural areas. Although the number of poor people declined, inequality of income distribution has increased from year to year after the tsunami. In 2010, the Gini ratio of 0.30 Aceh province increased from 0.01 in 2009 to reach 0.29, so the more equitable distribution of income becomes a challenge for the government to find a solution.

SAM or referred to as the Social Accounting Matrix is one of the macroeconomic data, which can measure the income distribution problem, as one indicator of social welfare. SAM is designed to provide a comprehensive overview of the important relationships between the structure of production, input factors of production are mostly owned by households, the

allocation (distribution and redistribution) factor income, the composition of demand for goods and services for final consumption, as well as savings a source of investment.

Have not been many studies on the use of SAM to measure the effect of a policy on income distribution sector. Okuyama (2004), Padli (2010) and Rose (2005) using a Computable General Equilibrium to see the impact of natural disasters on the economy. The purpose of this study is to see the portrait of two conditions before and after a natural disaster using SAM.

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1. Agriculture Development and Income Distribution

According Soekartawi (1995) agricultural development is essentially geared to meet the needs to be achieved is the welfare of the farming community more evenly. Agricultural development is done by increasing the production, productivity of labor, land and capital. With the business then, the active participation of farmers and rural communities can be improved, thus increasing the level of agricultural production can be achieved in an efficient and dynamic economy followed the division of surplus among various economic actors in a more equitable, and efficient development of the agribusiness system.

The agricultural sector is a top priority because in many other ways it is a sector that tends to be dominant in the national economy. Agricultural development is driven from the supply side and in terms of the production function through research, development of agricultural technology constantly, social and economic infrastructure development in rural and investments by the state in large numbers. Agriculture sector is now considered a leader "leading sector" which is expected to encourage the development of other sectors (Mubyarto, 1989).

Conceptually and empirically viable agriculture sector to be the mainstay of the economy, including the leading sectors in the distribution of income levels, mostly working in the agricultural sector. In the transformation process of development also has a role that is:

1. Contribution of products, namely, agriculture acts as a provider of food for the workers in the industrial sector, but it is also a provider of industrial raw materials.
2. Contribution markets, namely households in the agricultural sector is the main target of the generated output consumption in the industrial sector.
3. Contribution of foreign exchange, which act as a foreign exchange earner of export goods produced.

2.   Framework of SAM

In the framework of the logic underlying the analysis module with a data system is not as simple as what is proposed here, but more complex. Understanding of the meaning of socio-economic development is carried out by implementing equalization lines are an attempt to reach the level of life (standard of living) is feasible for all residents, especially the lower classes.

Matrix T is a matrix of inter-block transactions in the balance of endogenous. Matrix X represents income from balance sheet endogenous exogenous. Matrix Y is the matrix of the total income of endogenous account. The matrix L is a matrix that shows the balance expenditure endogenous to exogenous balance sheet, also called leakages. While the matrix Y' is the matrix of Balance endogenous total expenditure.

Endogenous balance of income distribution can be broken down as follows:

$\square$ $(Y_1) = T_{13} + X_1$ .... (1)
$\square$ $(Y_2) = T_{21} + T_{22} + X_2$ .... (2)
$\square$ $(Y_3) = T_{32} + T_{33} + X_3$ .... (3)

While the distribution of endogenous balance of expenditure can be detailed as follows:

$\square$ $(Y_1') = T_{21} + L_1$ .... (4)
$\square$ $(Y_2') = T_{22} + T_{32} + L_2$ .... (5)
$\square$ $(Y_3') = T_{13} + T_{33} + L_3$ .... (6)

As a matrix of transactions between endogenous block in the balance sheet, then the matrix T can be expressed as follows:

$$T = \begin{bmatrix} 0 & 0 & T_{13} \\ T_{21} & T_{22} & 0 \\ 0 & T_{32} & T_{33} \end{bmatrix} \quad \text{...} \quad (7)$$

3. Research Metodology

To measure the impact of the agricultural sector before and after natural disasters, use SAM Aceh's economy in 2002 as an idea before the natural disaster, and SAM Aceh in 2010 as the economic picture after a natural disaster.

3.1   Multiplier Matrix

Transaction matrix T shows the flow of revenues and expenditures are expressed in monetary units. If each cell divided by the total column, will be obtained a new matrix that shows the magnitude of average expenditure propensity (average expenditure propensity) are expressed in proportion (ratio). The new matrix (eg matrix A), its elements are aij is the result of the

division of matrix T in column involve Gen. (T_{ij}) by the number of column j, which is defined as follows:

$$A_{ij} = T_{ij}*Y_j^{-1} \text{ or } T_{ij}=A_{ij}*Y_j \quad \text{...} \quad (8)$$

dimana:

A_{ij} = average expenditure propensity matrix row ke-i, column ke-j;
T_{ij} = Balance sheet row -i, column -j;
Y_j^{-1} = number of column -j.

Using equation (18) above, from matrix *T* can be arranged matrix A as follow:

$$T = \begin{bmatrix} 0 & 0 & A_{13} \\ A_{21} & A_{22} & 0 \\ 0 & A_{32} & A_{33} \end{bmatrix} \quad \text{...} \quad (9)$$

$Y = T+X$ and $T = AY$

so:

$$Y \qquad = AY+X \text{ ....} (10)$$

$Y\text{-}AY \quad = X$

$Y(I\text{–}A) \quad = \text{X, sehingga } Y= (I\text{–}A)^{-1} X \text{ ....} (11)$

If $M_a \quad = (I\text{–}A)^{-1}$

called *multiplier matrix*, so:

$$Y = M_a X \quad \text{...} (12)$$

In this case the matrix A contains the coefficients that show the direct influence of the changes that occur in a sector to the other sectors. While Ma is the multiplier that show the effect of accounting changes on a whole other sectors through the SAM system, which forms the matrix as follows:

$$M_a = \begin{bmatrix} M_{a11} & M_{a12} & M_{a13} \\ M_{a21} & M_{a22} & M_{a23} \\ M_{a31} & M_{a32} & M_{a33} \end{bmatrix} \quad \text{...} (13)$$

3.2. Income Distribution Analysis

From Daryanto (2010) derived from the factors of production (capital and labor income), between institutions (transfer payment), and revenue from outside the region. Total factor income is the sum of labor income earned farm labor, operator labor, production, personnel administration, and professionals in rural and urban areas. This inequality index can be measured by the formula:

$$T = \sum_i \sum_j \left(\frac{Y_{ij}}{Y}\right) \ln\left(\frac{Y_{ij}/Y}{n_{ij}/n}\right) \text{ and } L = \sum_i \sum_j \left(\frac{n_{ij}}{n}\right) \ln\left(\frac{n_{ij}/n}{Y_{ij}/Y}\right) \ldots\ldots\ldots\ldots\ldots\ldots \quad (13)$$

where Y_{ij} indicates total labor income in the income class j to group i, Y is the total income for all workers $(\sum\sum Y_{ij})$, is the amount of labor in income class j to group i, and n is the number of the entire workforce $(\sum\sum n_{ij})$.

3.3.   Policy Simulation Analysis

Through the analysis of the influence of the multiplier can be known by one unit caused the economic stimulus of exogenous variables in the fisheries sector to boost local output, labor income and household. However, such analysis can not explain the origin of the economic stimulus and the possible use of a certain amount by the number of stimulus. Therefore, to determine the impact of economic policies (eg increase in investment, export and otherwise) to increase output and income used policy analysis. Economic policy in this study focused on the agricultural sector in general. In detail, the following policy scenarios.

1. Increased Government Spending Policies for Agriculture Sector

2. Investment Promotion Policy

3. Policy Tax Incentives

4. Income Redistribution Policy

4.1. Analisis Multiplier SNSE Provinsi Aceh 2002 dan 2010

If the note is a series of numbers Value Added Multiplier (VAM) is contained in Table 2, it is seen that the three sectors of agriculture-based ranks. VAM agriculture sector has a number of 1.280984. This figure shows that if the sector balance injected as much as 1 billion dollars, it will have an impact on revenue increase of production factors (labor and capital) of 1.280984 billion dollars. In other words, the agricultural sector is able to create a rise in GDP of Aceh province as 1.280984 billion dollars every increase in demand ultimately as much as 1 billion dollars.

Tab. 2: Analisis multipiler SNSE Provinsi Aceh 2002 dan 2010

Sector	Value Added Multipler 2002	Value Added Multipler 2010
Agriculture	1,180983	1,280984
Horticulture	1,270953	1,280959
Animal husbandry	1,270946	1,280942
Forestry	1,076132	1,176133
Fisheries	1,164284	1,264284

Minning	1,250557	1,250647
Liquid Natural Gas Industry	1,258071	1,268081
Food, beverages and tobacco Industry	1,067465	1,085465
Cement and non steel industry	1,173774	1,270774
Textile and leather industry	0,359611	0,369311
Steel industry	0,016893	0,015053
Electricity, Gas, and water	1,134227	1,028227
Construction	1,244298	1,177298
Trade, Hotel, dan Restaurant	1,106210	1,223210
Transportation And Communication	1,009650	1,120650
Monetary and building rent	0,567997	0,871997
Government Administration	0,567664	0,868664
Education, Health and Recreation Services	0,456346	0,544346

Source: own calculation using SAM Aceh 2002 and 2010

During this happens in the economy of Aceh Province, Mining sector contribution in the formation of the province GDP is always higher than the contribution of Agriculture Sector. But it turned out after investigation, Mining sector multiplier effect on GDP rise Aceh province lower than the agricultural sector, that is equal to 1.250647. Fenonema this indicates that agriculture sector has a more important role in increasing the acceptance factors of production, both labor and capital. This indicates that all efforts made so far to encourage the growth of agriculture sector, which is the main livelihood of the people of Aceh Province, has been right on target and showed good results..

4.2. Impact of Agriculture Sector Policy on Income Distribution

Policy simulations that have been conducted indicate that the labor group income inequality can be derived by performing investment policy, investment in the Agriculture Sector, redistribution of household income and household income beneficiaries upper class households to the poor, or a combination there of ranges between 0, 13076907 to 0.13077496. If the expected decline in income inequality is greatest, then the thing to do is a combination of the investment policy of 1 billion rupiah in the Forestry, an investment of 1 billion dollars at the proporsioanal Agroindusti sector, as well as the redistribution of income and the income of recipient households upper class households to the lowest class of 1 billion rupiah proportionally.

If the investment will be made only by 1 billion, then the investment should be made in the Agriculture Sector in proportion. With the implementation of this policy will reduce income inequality by 0.00000425, where labor income inequality was at .13077527 to .13077102. If desired reduction greater income inequality, it can be an even greater investment. Not much different from labor income in general, if the assessed income

inequality in the classroom are those of labor, it can be concluded that the combination of the investment policy of $1 billion dollars in Agriculture proportionally, an investment of 1 billion dollars at the proporsioanal Agroindusti sector, as well as the redistribution of household income and upper class income earners to the lowest class households amounting to 1 billion dollars in proportion to reduce income inequality in the classroom are those of labor by 0.00000595. investment of 1 billion dollars in the Agriculture Sector in proportion to reduce income inequality by a decrease of 0.12997261 0.00000410 to 0.12996852.

Things are a little different when it came to choosing a policy that is done with an investment of 1 billion, the investment in the forestry sector can meunurunkan Tabama and income inequality that slightly more than the other alternatives, that is equal to 0.00000017. The simulation results, it gives a different impact on household income inequality. Household income inequality in the province of Aceh was greater than inequality of labor income, ie the interval 0.28469797 to 0.28472068, where the policy of investment of 1 billion dollars in proportion to the Forestry Sector Tabama and well done alone or together with investment of 1 billion in Industrial Goods Sector of wood and other forest products actually increase income inequality. While an investment of 1 billion Agroindutri proportionately and redistribution of income from non-agricultural households and income earners above $ 1 billion class in proportion to the lower class households, whether performed singly or together can reduce household income inequality in the province Aceh. Decrease in income distribution occurs as a result of the investments of 1 billion rupiah in Industrial Goods Sector of wood and other forest products as well as the redistribution of income from non-farm household income recipient and the upper class to the lower class households, either singly or jointly . Where the redistribution of income are providing the highest income inequality decreased, amounting to 0.00002184.

Tab. 2: Simulation Result Summary

Sector	SAM 2002			SAM Aceh 2010		
	Labor	Household	Sector	Labor	Household	Sector
Simulation 1	√	X	√	√	√	√
Simulation 2	√	X	√	√	√	√
Simulation 3	√	X	√	√	√	√
Simulation 4	√	X	√	√	√	√

X = increase income inequity
√ = decrease income inequity
Source: own calculation using SAM Aceh 2002 and 2010

Conclusion

Studies on the use of SAM to see the role of a sector is still not much. This analysis can also be associated with changes in the sector, especially the agricultural sector to the economy of a region. This kind of study is very useful to see whether the role of a sector that has been set by the government as what has wanted.

Based on this analysis found that Income inequality increased after the tsunami occurred in clusters and rural areas and urban labor, agricultural household groups and non-agriculture, as well as sectoral. Greatest income inequality occurred in the sectoral income, followed by household income inequality, and the smallest is labor income inequality. To reduce labor income inequality, household, and sectoral simultaneously possible investment policy. In addition, the combination of the form of policy investment in the agriculture-based economy and the redistribution of non-agricultural household income and the income of the recipient to non-agricultural households of the bottom, is also effective in reducing income inequality in Aceh Province.

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