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A Computable General Equilibrium-Top Down Behavioral Microsimulation on Assessing the Philippine Tax Reform

Ricardo Laurio DIZON¹

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Abstract

The purpose of the study is to investigate the simulated effects of the Philippine tax reform, which is called Tax Reform for Acceleration and Inclusion Law, on household income and occupational choice. The study utilized the Family Income Expenditure Survey and tax collection as input to Computable General Equilibrium-Top Down Behavioral Microsimulation approach to determine the effect of Philippine tax reform on household income and occupational choice. The results of the study show that the household income in the Philippines will increase due to the implementation of the Philippine tax reform. Also, the study had found that tax reform results drive the household to shift from being farming entrepreneur to salaried workers since the utility derived from being workers is much higher compared to the utility derived from being entrepreneur. The findings of this research suggest that the Philippine Tax Reform for Acceleration and Inclusion Law is beneficial to the household since their income would increase, which will further result to an increase in their capability to buy goods and services. However, the tax reform would also lead to imbalance between the distribution of numbers of workers across sectors such as entrepreneurial farming, entrepreneurial non-farming, and wage sector.

Keywords: Tax Reform, CGE Modeling, Microsimulation, Labor Tax, Occupational Choice

JEL Classification Code: H20, H21, O11, G38

1. Introduction

The effects of the implementation of the first package of Comprehensive Tax Reform Program under the Republic Act No 10963, also known as Tax Reform Acceleration and Inclusion (TRAIN), on occupational choice and labor income can be evaluated through the concept of tax incidence. The aim of the TRAIN law is to establish efficient and effective tax collection in order to finance various government expenditures and to support the domestic economy through increasing the country's economic growth and employment, and by reducing poverty incidence and inequality among households.

The Philippines, as one of the developing countries in South East Asia, needs to increase the mobilization of its domestic resources by increasing the tax collection (United Nation, 2015). The chunk of the tax revenues of developing countries like the Philippines and Vietnam is derived from indirect taxes such as tariffs, excise taxes, sales taxes, VAT, and the like (Nguyen, 2019). The theory of economic development emphasized that the taxation serves as primary tool in order to restrict the non-essential consumption of the household so that the household income could be allotted in savings and investments. Thus, increasing savings and investment results to increase in accumulation of capital and economic development (Dom & Miller, 2018). The implementation of the first package of the TRAIN Law in 2018 has brought mixed reactions to Filipinos due to its imbalance effect on the distribution of workers among sectors of the economy due to occupational choice amid the increase in the disposable income of the household. This research aims to evaluate the effects on the household labor income and occupational choice of the implementation of the Philippine First Package of the Comprehensive Tax Reform Program.

¹First Author and Corresponding Author. Associate Professor, Master of Science in Economics, Graduate School, Polytechnic University of the Philippines, Philippines [Postal Address: 262 Sizzling House, Teresa Street, Sta. Mesa, Manila, 1016, Philippines]
Email: rldizon@pup.edu.ph

2. Literature Review

2.1. Tax Reform and Labor Income

Since the tax reform plays an important role in an economy of a country, the taxation should be dependent on the amount of expenditures, efficiency in the collection of tax, and kind of tax system. The aims of the tax reform are to reduce deadweight losses, improve the policy of tax system to attain equity, increase revenue collections, and decrease transactionary burden among tax payers. Rutkowski (2007) had emphasized that a nation that imposes too much tax burden on labor income often sees an increase in unemployment rate, decrease in labor participation rate, and increase in informal sector among workers. Also, the increase in labor income tax results to an increase in cost of labor for business, and a decrease in the real disposable income of the household. Thus, this increase in labor tax often creates gap between labor cost among firms and net disposable income of households. Workers choose the occupation where they can yield higher satisfaction in terms of monetary and non-monetary benefits (Gomes, Lozachmeur, & Pavan, 2018). Mankiw and Taylor (2006) cited that the person who is burdened due to government's tax policy is not always the person who gets the tax bill from the government. Moreover, alteration in the tax system changes the movement of demand and supply, thereby, disrupting the price equilibrium. The tax burden falls more on those who make and sell the goods than those who buy the goods since the buyers have an option to substitute the goods. If the sellers belonged to an average or poor household, the burden of tax will be concentrated on poor household sellers.

2.2. The Tax Incidence

Predicting the pre-tax income has played a significant role in the investment since investor heavily rely on the information provided in this forecast (Oh & Ki, 2019). Kotlikoff and Summers (1987) have stated that the tax incidence is required in characterizing the effects of alternative tax measures on economic equilibrium. It bridges both the positive aspects in public economics, by studying the government behavior in terms of taxing system and behavior influences the behavior of firms and households and the welfare effects. Moreover, tax incidence also bridges the normative aspects of public economics, where it studies the local objective function of the government on what should be implemented to achieve efficiency in the tax collection as well as efficiency in consumer's location choices and local services. Further, the burden of taxes is not necessarily borne by those upon whom they are levied. Moreover, the reform in tax system of a country often result in the changes in equilibrium in the economy, prices of goods, and in rewards for factors.

Nadoveza, Sekur, and Beg (2016) had examined the effect of lower labor tax in five sectors of the economy (households, firms, government, investors, and foreigners) in the case of Croatia using the Computable General Equilibrium (CGE) model. Furthermore, the paper broke down the economy into three components, namely, agriculture, industry, and services sector. The research paper used CGE modeling to capture the effects on the economy on changes on tax levied to household and business sectors. The results of the study had revealed that the decrease in taxes on employment results in higher demand for labor due to lower labor price, and it also results in a lower price of capital. Further, the lower labor tax also results in a decrease in the prices of final goods and services, and an increase in disposable income of labor. Among the three sectors of the economy, the service sector had the highest recorded increase in production, while the industry sector had the lowest growth of production. Moreover, the decrease in labor tax resulted in higher disposable income for the household sector, higher consumption, and higher government spending. Rum and Kusumawardani (2020) emphasized that the growth in tax collection has positive impact in the regional income due to the increase in potential local taxes.

3. Research Methods and Materials

3.1. The Sources of Data

This study used the Family Income Expenditure Survey (FIES) for the year 2015, which was taken from the Philippine Statistical Authority (2019) to determine the micro- or household-level effect of tax policies. Meanwhile, the old and new tax table and revenues were collected from Bureau of Internal Revenue (2019), and the results of CGE simulation was adapted from the study of Tũaño, Castillo, Clarete, Muyrong, and Banaag (2018).

3.2. The Computable General Equilibrium – Top Down Microsimulation

This study used the combination of Computable General Equilibrium (CGE) Model and Top-Down Behavioral Microsimulation to investigate the impact of TRAIN on household income and choices among occupations. The effects on macro-level of the implementation of TRAIN law was investigated using the CGE, while the effects on household level using FIES was analyzed using Top-Down Behavioral Microsimulation. Zhang, Wang and Chen (2012) emphasized that the CGE-Top Down Microsimulation approach has the capability to assess changes in tax system on occupational choice and household income. Figure 1 shows the flow of the study on implementing the CGE-Top Down Behavioral Microsimulation to investigate the

changes on income of household and occupational choices of the labor due to implementation of TRAIN Law. The CGE-Top Down Microsimulation involve three-tiered steps in studying the effects on household income and occupational choice, which involves: (1) the estimation of household income and occupational choice before the TRAIN Law, (2) the integration of CGE simulation to the estimated household income and occupational choice; and (3) the estimation of household income and occupational choice after the TRAIN Law. The estimation of household income before the TRAIN Law, which is the aggregation of income from employment, entrepreneurial farming activities, and entrepreneurial non-farming activities, is represented by the following equation:

$$Y_{h,t} = \sum_{i=1}^N w_t^{sk} I(E_{i,t}^{sk} = 1) + \sum_{i=1}^N w_t^{unsk} I(E_{i,t}^{unsk} = 1) + \sum \pi_{h,t}^j N_{h,t}^{j,sk/unsk} + y_{h,t}^{ex} \quad (1)$$

The first term is the income derived by the household from employment, meanwhile the second term refers to household income from entrepreneurial farming and non-farming activities.

The Heckman Two-Step Selection Model was used to estimate of household income due to employment, meanwhile the Instrumental Variable Model was used to derive the household income from farming and non-farming activities. The Instrumental Variable (IV) Regression Model was used to estimate the income derived from entrepreneurial farming and non-farming activities using the following equation:

$$\log y_{farm} = b_{f(m)} + \delta_{f(m)} SE_m + \phi_{f(m)} N_m + \epsilon_m \quad (2)$$

The notation in the equation $f(m)$ represents whether the income is generated in an urban or rural region, province, or district. Meanwhile, N represents the number of households involved in self-employment, and SE represents household characteristics. The δ measures the elasticity of household income with respect to household characteristics. The θ indicates the elasticity of household income with respect to number of households involved in self-employment. The refers to error components of the model. Meanwhile, the estimated household income was plugged as explanatory variable in the household occupational choice estimation using the multinomial logistic regression as shown in equation 3.

$$\ln \frac{P(E_i = m)}{P(E_i = 4)} = \alpha_m + \sum_{j=1}^J \beta_{mj} X_{ij} + u_{ij} = Z_{mi} \quad (3)$$

The household may choose among four occupational categories such as: (1) employed whom are wage works; (2) entrepreneurial non-farming; (3) entrepreneurial farming; and (4) those who are unemployed. The Z_{mi} is the utility derived due to different occupational choice. The X_{ij} individual’s characteristics such as number of children, sex, education, marital status, area classification (urban/rural), and estimated income derived from working activities in each sector. The $P(E_i = 4)$ is the occupational choice of the household that yield highest utility with reference to unemployed as the based occupation. Moreover, the individual’s residual term was calculated based on procedure discussed by Bourguignon, Ferreira and Leite (2007), and it was assumed that the residual’s distribution is random, independent, and exponential. The probability associated of choosing each occupational choice was computed after deriving the estimated utility level generated in each occupational choice. The CGE results were directly applied to the estimated income before the TRAIN Law.

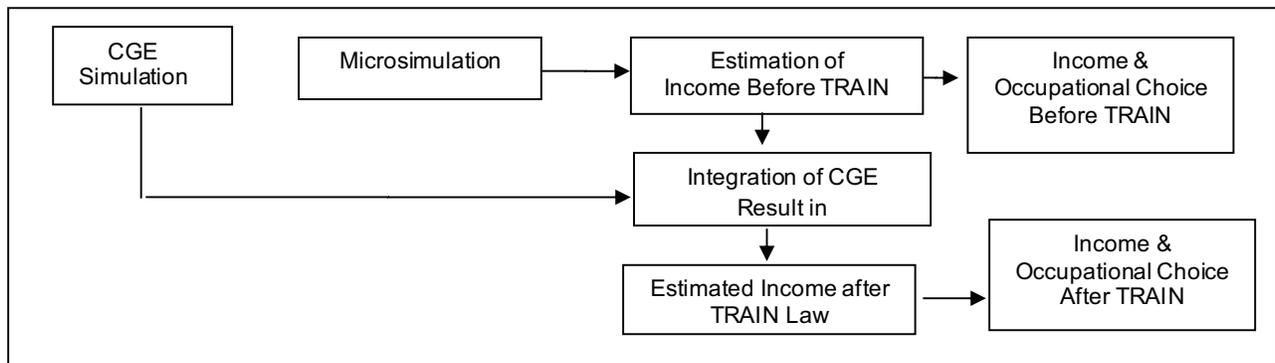


Figure 1: The CGE –Microsimulation Procedures

The estimated income for skilled and unskilled workers after multiplying the CGE derived changes in income were aggregated to derive the wage income after the TRAIN Law. The same procedure was applied to derive the household profit in farming activity and non-farming activity. The wage income after TRAIN Law, household profit from farming activity and household profit from non-farming activity were aggregated to derive the total household income after TRAIN Law. The total household income after TRAIN Law determined the new occupational choice of the household after the TRAIN Law, and the new poverty and distribution of income after the TRAIN Law. The percent changes in the prices of goods were integrated in the computation of household income by determining the real household income as inputs to the poverty and distribution of income.

4. Results and Discussion

4.1. The Philippine Labor Force, Employment, and Underemployment

The Philippines has a population of 72,524,000 aged 15 years old and above, and who are part of the total work force as of January 2019. The Philippines has posted a conservative increase in the labor participation rate from 60% in 2018 to 60.10% in the year 2019. Meanwhile, the unemployment rate had decreased by 0.2% in 2019, with 5.2% unemployment rate in 2019 from 5.4% unemployment rate in 2018. The workforce population in the Philippines is concentrated in the National Capital Region (9,354,000 persons), Regions IV-A (CALABARZON) (8,051,000 persons), Region III (Central Luzon) (8,051,000 persons), which was due to concentration of business activities in these areas. Further, the regions IV-A, VII (Central Visayas), and XII (SOCCSKSARGEN) had recorded the highest participation rate of 63.70% among regions in the Philippines.

In contrast, the Region V (Bicol Region) (55.90%), Region IX (Zamboanga Peninsula) (55.80%), and Autonomous Region in Muslim Mindanao (ARMM) (47.70%), have recorded the lowest labor participation rate. The Philippines has four major occupational classes: (1) salaried and wage workers; (2) entrepreneur in farming activities; (3) entrepreneur in non-farming activities (firms or business); and (4) unpaid labor works. The Philippine labor force is composed of almost 66% salaried and wage workers, 26% entrepreneur non-farming activities, 3% entrepreneur in farming activities, and 4.70% unpaid labor works. The Tax Acceleration and Inclusion (TRAIN), under the Republic Act (RA) 10963, is the first package of the Comprehensive Tax Reform Program (CTRP) of the Republic of the Philippines, which was signed on December 19, 2017, and took effect on January 1, 2018. The TRAIN aims to simplify and attain efficiency and effectiveness in the collection of Philippine taxes in order to support economic and social activities such as inducing

investments, poverty and unemployment reduction, and economic growth. The Bureau Internal Revenue (2019) had provided the Philippine Bureau of Internal Revenues tax matrix that stipulated that the minimum net monthly taxable income is Php10,000.00, and this revenue act provides guidelines that for each tax payer there is corresponding deductible base amount of Php50,000 and additional Php25,000.00 for each child to a maximum of four dependents.

The total number of persons employed in the Philippines are composed of 84.37% working in private firms, and 15% working in government institutions and corporations. Most of the workers in the government have been earning a yearly taxable income (net of tax) between Php250,000 and Php500,000.00 with 21% share to the total number of public workers. Meanwhile, 25% of the total workers in the private sector are earning between Php360,000 and Php840,000.00. In the first year of the implementation of the TRAIN Law, those workers who are earning gross income amounting between Php140,000 to Php250,000 and Php400,001 has the highest gained monetary benefit. In contrast, those workers who are earning between Php250,000 to Php260,000 a year did not benefit from TRAIN. Further, results revealed that those public workers who are holding from supervisory and managerial position with Salary Grade (SG) 20 up to 27 have recorded the highest increased in net disposable income due to combination of TRAIN Law and SSL IV. In contrast, those who hold Salary Grade 6 draw the least benefit in TRAIN Law.

4.2. The Statistical Results Using the CGE-Top Down Microsimulation

The estimated total household income before the TRAIN Law is the aggregation of all incomes from wage, profit from farming activities and profit from non-farming activities. The Heckman Two-Step Procedure was used to estimate the household wage for both skilled and unskilled workers (see Table 1).

The statistical results show that the household age and individual's educational attainment have positive effects on natural logarithm of wage, which is reflected in the respective probability value of 0.009 and 0.09 that are less than the 5% and 10% level of significance, respectively. The statistical result conformed with the Theory on Human Capital (Amaral, Queiroz, Goncalves, & Faustino, 2013; Becker, 1994; Mincer, 1974; Schultz, 1961) that stipulates that the years of education and experience have a positive effect on earnings of workers. Moreover, the Mincerian Wage Equation emphasized that education level would lead to an increase to the individual earnings (Mincer, 1974). Meanwhile, the result of the study revealed that sex has significant negative effect on wage of skilled workers. Polavieja (2008) emphasized that the worker's education and sex had significant effects on the household income.

Table 1: The Estimation of Individual Wage for Skilled Workers

Dependent Variable: Logarithm of wage for Skilled Workers				Dependent Variable: Logarithm of wage for Unskilled Workers		
Variables	Coefficient	Error term	P>/z/	Coefficient	Error Term	P>/z/
Constant	-0.4664	0.0166	0.0000	10.9566	0.0145	0.0000
Education	1.0928	0.0028	0.0090	-0.8685	0.0180	0.0000
Age	0.0074	0.0826	0.0900	0.0188	0.0031	0.0000
Sex	-0.1401	0.1336	0.0000	0.5220	0.0897	0.0000
Dependent Variable: Salaried						
Constant	1.8124	0.0042	0.0000	1.8125	0.0526	0.0000
Sex	-0.3030	0.0005	0.0000	-0.3029	0.1860	0.0000
No of children	0.0323	0.0186	0.0000	0.0323	0.0045	0.0000
Urban	-0.2654	0.0141	0.0000	-0.2654	0.0156	0.0000
Education	0.0205	0.0045	0.0000	0.0205	0.0042	0.0000
Region	-0.0001	0.0156	0.7510	-0.0001	0.0006	0.7510
Inverse Mill lambda	-0.9081	0.4437	0.0410	-3.8015	0.4830	0.0000

Table 2: The Estimation of Household Profit Due to Farming and Non-Farming Activities

Dependent Variable: Household Profit (Farming)			Dependent Variable: Household Profit (Non-Farming)	
Variables	Coefficient	Probability	Coefficient	Probability
No.of Family Workers in Farm	3.2150	0.0030	3,228.98	0.0800
Region	0.0068	0.0000	204.77	0.0010
Urban	4.8962	0.0000	-36,936.49	0.0000
Sex	-0.7499	0.0000	37,981.33	0.0000
Education	-0.5268	0.0000	31,134.19	0.0000
Number of Children	0.1850	0.0000	-3,031.27	0.0000
Married	0.1339	0.0000	-707.00	0.7330

Ahmed, Ahmed, and Abbas (2010), Ledic (2012), and Polavieja (2008) have emphasized that male workers had higher earnings compared to female workers. Further, the result of the study revealed that male had higher probability of joining the wage sector compared to female since the coefficient sign is -0.30295, and this finding is supported by the studies of Bourguignon, Ferreira and Leite (2007) and Ledic (2012). The same with the result of the study of Colombo (2010); this research paper had found that those people living in urban areas have a higher chance of joining the wage sector compared to those people living in rural areas, which is reflected in the coefficient of -0.2654. In addition, the increase in the number of children and educational qualification increases the probability of joining the wage sector. Meanwhile, the regional differences had shown insignificant effects on the choice of worker of either to be in employment sector or not which was supported by the study of Ledic (2012). The conclusions are based on the

p-value of 0.751 is higher than the 5% level of significance. Further, those people living in the region 1 have a higher chance of joining employment sector compared to those people who are living in the other regions.

Table 1 also displays the Heckman selection model for unskilled workers. The estimation for unskilled wage revealed that three explanatory variables such as education, sex, and age, had significant effects in the natural logarithm of wage for unskilled workers since the respective probability value (p-value) were all zero (0). Age has a positive effect in the wage of unskilled workers with a positive coefficient of 0.0188. The natural logarithm of the household profit due to farming activities was estimated using the socio-demographic profile such as number of household members directly involved in agricultural activity, region, area classification (whether rural or urban), sex, education, number of children, and marital status.

The CGE simulation results presented in the study of Tũaño, Castillo, Clarete, Muyrong, and Banaag (2018) was integrated to the Top-Down Behavioral Microsimulation. The study used the 2012 Input-Output (IO) table culled from the Philippine Statistical Authority. Based on the study, the low skilled had an increase in income by 3.20% due to TRAIN. Meanwhile, the highly skilled workers would increase the income by 2.70%.

4.3. The Household Income Before and After TRAIN Law

The Behavioral Microsimulation approach was developed to capture the possible reactions of the household to the tax policy by the government. The results are presented in Table 3. CALABARZON (Cavite, Laguna, Batangas, Rizal, and Quezon) has the highest estimated total household income due to TRAIN Law based on the demographic profile of the household, such as age, region, urban, marital status, education, and number of children, as the explanatory variables amounting to Php1,062,584,439.83 in the base period to Php1,094,004,610.05 in the simulated period. It was then followed by the National

Capital Region with a total estimated household income before TRAIN Law of Php1,049,019,428.88 and after TRAIN Law of Php1,079,974,541.00. Region IV-B MIMAROPA (Mindoro, Marinduque, Romblon, and Palawan) had the lowest estimated household income amounting to Php325,272,801.84 in the base period and Php334,888,509.37 in the simulated period. To reflect the effect of changes in prices to the occupational choice of the household, the changes in prices from the CGE were directly applied to the household income to reflect real household income. The implementation of TRAIN Law resulted in a decrease in the household income by 2.79% but compensated by the increase in disposal income due to decrease in withholding tax. This further results in minimal effect in the structure of employment in the Philippines. The household occupational choice was derived using multinomial logistic regression. The household will choose sector in which they will yield highest utility among the four occupational choice such as wage worker, entrepreneurial farming, entrepreneurial non-farming, and unemployed. Table 3 presents the occupational choice estimation results to estimate the occupational choice of the household. The study used the unemployed as based variable.

Table 3: The Change in Household's Occupational Choice due to TRAIN Law

Region	Before the TRAIN Law				After TRAIN Law			
	Wage	Non Farming	Farming	Unemployed	Wage	Non Farming	Farming	Unemployed
1	989	797	163	399	990	796	163	399
2	983	714	155	367	983	715	155	366
3	1,318	1,101	228	590	1,318	1,101	228	590
4-A	1,701	1,450	321	690	1,701	1,450	321	690
4-B	460	489	84	216	460	489	84	216
5	971	809	208	484	970	809	208	485
6	1,184	971	205	491	1,185	970	205	491
7	1,048	864	190	439	1,048	864	190	439
8	973	728	189	447	972	729	189	447
9	726	623	130	309	726	623	130	309
10	750	670	134	333	751	669	134	333
11	993	812	240	401	993	812	240	401
12	835	782	129	376	835	782	129	376
NCR	1,618	1,581	224	707	1,618	1,581	224	707
CAR	670	593	131	331	670	593	131	331
ARMM	1,001	734	150	363	1,001	734	150	363
CARAGA	737	598	107	340	738	597	107	340
Total	16,957	14,316	2,988	7,283	16,959	14,314	2,988	7,283

The results of the study revealed that explanatory variable such as education, income, age, urban classification, and marital status have significant effects on choosing the wage sector, and this is reflected in the p-values, which are less than the chosen 5% level of significance. The negative coefficient yielded in the variable age, education, sex, and region indicates that the probability of choosing the wage sector is less likely with reference to being unemployed. The results of the study are being supported by Colombo (2010). This explains that education is no longer a guarantee that workers will be getting better quality job, and workers sometimes experiencing difficulty in getting better jobs because of their lack of skills and ability. Further, the variables such as marital status, income, number of children and urban classification have a positive coefficient signs, which further indicates a higher the probability of joining the wage sector because of these factors. As income and the number of children increase, for married individual, and those living in rural areas, the probability of joining the entrepreneurial farming and non-farming activities is more likely to occur because of these factors.

The simulated changes in the occupational choice due to the implementation of TRAIN has been presented in Table 7. The household will opt to choose those occupations, which yield highest utility. The result revealed the implementation of TRAIN Law results in minimal changes in occupational choice of the household. The Regions 1, 2, 5, 6, 8, 10, and CARAGA show changes in occupational choice due to TRAIN, but among regions, the CARAGA region experienced the highest changes in the occupational choice of workers.

5. Conclusions

The study found that TRAIN had significant effects on household income, and insignificant effect in the movement in the occupation of the workers. This indicates that the utility yielded in imposing tax reform in the Philippine does not significantly differ across occupations. Due to associated lower entrepreneurial farming activity, the government may develop programs to increase the income of entrepreneurs in agricultural sector by expanding the land acquisition and acreage. In order to further strengthen the agricultural sector in the Philippines, the government may craft programs and policies to encourage the business sector to be involved in farming sector. This may be done through incorporating in the Philippine Development Plan and on further encouraging farming entrepreneurial activities in the Philippine. The government is also encouraged to increase its allocation of funds to offer subsidy and agricultural loans to the entrepreneurs in farming sector so as to increase the profit of the farmers. In order to encourage household to indulge

in farming activities, it is recommended to decrease the storage, shipping fee, tariff, and encouraging cooperatives so as to increase profit of farming activities.

In order to increase the number of households that will venture into business, it is recommended that the government opt to include in the future tax policy on further reducing the tax burden levied to business by providing investment tax credit, exemption in the tax for land leased by farmers, crafting policies on the retirement plan for those individual who may choose farming activities, establishment of farmer's social security pension for their retirement, for their children and other members of the family.

To encourage farmers to stay in the agricultural sector, the government is encouraging to craft incentives for those farmers who may opt to stay in farming. The government may also do geographical targeting where it could identify regions with higher prevalence of inequality. To address the country's inequality, the government should roll out programs that aim to improve access to roads, communications, and markets, which will boost the entrepreneurial activities of both the poor and non-poor.

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