Impact of Agricultural Income Tax on Household Welfare and Inequality: Pakistan A Case-in-Point

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Abstract

This article intends to explore the impact of Agricultural Income Tax on Household Welfare and Inequality and the situation in Pakistan is reviewed as a Case-in-Point. A computable general equilibrium model is used to analyse the implementation of Agricultural Income Tax for Pakistan. The model analyses the economic implications of Agricultural Income Tax and reduction in sales tax for production activities to adjust the budget surplus. The experiment i.e., imposition of tax on agriculture income, was based on a combination of the said two elements. The objective of this experiment was to determine the possibility of implementation of agricultural income tax in case of Pakistan and to analyse its benefits at macro and household level. Two variables were considered in this experiment i.e., imposition of agricultural income tax, and decrease in sales tax rates. The article concludes that the imposition of agricultural income tax is beneficial in terms of household and economy-wide welfare indicators. The results suggest that implementation of agricultural income tax tends to be a real and potential tool to show improvement in country's economic indicators and household utility at micro level.

1. Back ground

Despite of structural shift towards industrialization since 1947, agriculture sector is still the largest sector of the economy and have a great impact on the socio-economic set up of the country being the largest sector of Pakistan's economy. Majority of the population, directly or indirectly, depends on this sector. It is the largest source of foreign exchange earnings through export of raw materials; semi processed and processed agricultural products. It also feeds whole rural and urban population. It contributes about 22 percent of Gross Domestic Product (GDP) & accounts for about 45% of the total employed labour force (FBS). This simple fact suggests that agriculture contributes less to the national GDP relative to its size of population and labour force compared to other sectors of the economy (SBP-2009). Major crops are wheat, cotton, rice, sugarcane, maize etc. However, in recent years, due to persistent hikes in the prices of essential commodities like pulses, onions, potatoes, chillies and tomatoes these crops have also gained economic importance.

Prices of major crops are doubled in the last 5 years time. Now government support price of the major crops shows significant increase as compare to previous years. This increased the revenue of growers enormously. Pakistan has a history of taxing agriculture through the old and outdated land revenue system. Under pressures from World Bank and International Monetary Fund (IMF), Pakistan introduced various variants of agricultural income tax in the past and in full during 1993 and 1996 respectively (World Bank-1999). However, the introduction of agricultural income tax is an extremely controversial matter in Pakistan, in government circles as well as among professional researchers and economists. Out of the nine commissions [Pakistan (1959, 1960, 1963, 1964, 1970, 1975, 1986, 1988, 1989 and 1993a)] that studied agricultural taxation only two [Pakistan (1960, 1993a)] recommended the imposition of tax on agricultural income.

While thee remaining seven commissions favoured the existing land revenue system (Chaudhry-1999) Pakistan's 180 million citizens in 2010, fewer than three millions, pay any income taxes, and Pakistan's tax-to-GDP ratio is just 9 percent. This figure puts Pakistan in the 155th position out of 179 nations on the Heritage Foundation's Index of Economic Freedom. Only oil-rich countries that impose few taxes perform worse. Without sufficient revenue, the government will continue to be burdened with an unsustainable debt. There is a need to end tax exemptions for the wealthy and develop broader, long-term economic plans for sustainable growth. It is fact that Pakistan's economic instability stems in large part from low government revenue resulting from the elite's use of tax evasion, loopholes, and exemptions. Hence reformations in tax regime are useless until the all sectors including agricultural income is brought under the tax net. The government, which is also dominated by the feudal lords, is not considering the suggestions of economists, media and public seriously, who suggested to tax agricultural income, real estate sector and the rich.

It is unfortunate that agriculture income is exempted from GST reforms on the plea that it has become a provincial subject after the passage of the 18th Amendment. On the other hand the GST is imposed on agriculture inputs like fertilizers, seeds and machinery, resulting into a more hike in prices of basic food items. Pakistan's influential agriculture lobbies, both inside and outside the government machinery, are always succeeded in pushing the government to exempt the politically-sensitive sector from taxes. The irony is that at the moment in 2010, there is about one third of the National Assembly members are big landlords holding hundreds and thousands of acres agriculture land. It is worth mentioning that in Pakistan, there are about 88 per cent farmers having less than 12.5 acres of land, while other 12 per cent are big farmers with way larger land holdings (Khan, 2009). Keeping the sector untaxed indicates that 22 per cent of the GDP would still be out of the tax net and big farmers earning billions of rupees 'green income' would contribute zero to the country's tax revenues.

During the last 62 years, nobody has dared to impose taxes on the agriculture sector because of the strong lobbies in the country. Agricultural subsides, on the other hand, are part of government expenses from long ago. Government started to subsidize the key agricultural inputs beginning from chemical fertilizer around mid 1950s. Finally, the end of 1960s, the government subsidized all the agricultural inputs such as fertilizers, insecticides, seeds, irrigation water, tube well installations, and agricultural machinery (Hanif, 2004). After 1980, the government claimed that they are withdrawing subsidies from agricultural sector, but actually it never happened. The government announced Rs 12.69 billion of subsidy for the agriculture sector in the recent budget of 2009-10, that would eventually go into the pockets of landlords. The government has been dolling out billions of rupees of subsidy on the agriculture sector with a view to support the small farmers and help boost their incomes as a result of high production. But, in reality it is the big landlords who have been the real beneficiaries in the name of small farmers and have contributed nothing to the national exchequer.

Countries with massive fiscal surpluses can afford to give subsidies. Those with large budgetary deficits must end up printing notes accompanied with high inflation - which is the worst form of taxation of the poor. Economics is all about choices to get the right priority. Accurate solution for government would be to impose tax on agricultural income with some limitation so that small farmers would not be affected. Firstly, the tax may be imposed on the output; output means the final crop, e.g. wheat, rice, etc. So the tax would be calculated on the income of the crop. Secondly, to streamline the taxation process and make it comparative with other industries tax rate may be the same for the whole industry. Thirdly, this tax may be imposed on the people having more then 50 acre of farming/cultivated land. The large and well-off farmers are typically characterised by underutilisation and inefficient use of land resources.

The cultivation concentration of land varies inversely with farm size. As cultivation intensity is equals to 150 percent on farms less than 5.0 acres but is only 70 percent for farms exceeding 150 acre, therefore, rising and higher tax rates under income tax should force many large farms to use their land more intensively and efficiently (Chaudhery, 1999).The appeal of imposition of agricultural income tax also follows from the benefit approach as large farmers used to be benefited more from government's policies of input subsidies, institutional credit its extension and research services. The introduction of agricultural income tax may exhibits some cost effectiveness as tax estimation and collection may be undertaken by income tax department and the services of provincial revenue departments may no longer be required after abolishment of land revenue system. Finally, the higher tax rates for the well-to-do may restrict mass spending by the rich and the policy may ensure steadiness of prices of most of the consumer goods.

2. Review of Literature

Taxing agricultural income is controversial issues in different economies of the world. There are many studies on agricultural taxation in developing countries, especially in the context of the ongoing policy debate about the tax structure and administration, affecting agricultural producers. Taking this problem into consideration Khan (2001) used the examples of number of countries; and analyzed the conceptual and practical problems associated with different tax regimes. He found that governments in most countries have reduced indirect taxes on agricultural producers. However, the revenue from direct taxes on farmers has not increased. On the other hand, major problem in most countries has been the measurement of actual agricultural income. Different measures for presumed income have been used. They seem to have the most potential for increased revenue in many countries. But their effective implementation is constrained by the political and administrative considerations. According to Anderson (2009) this matters for the majority of households in the world, because 45 per cent of the global workforce is employed in agriculture and 75 per cent of the world's poorest households depend directly or indirectly on farming for their livelihoods. It matters even more in Asia's developing economies where 60 per cent of the workforce and 81 per cent of the poor (625 million people earning less than $1/day) are engaged in agriculture (World Bank, 2007).

Similarly, Spencer & Stewart (1973) discussed the concerns that number of different kinds of agriculture systems are in place. Varied approaches and conceptual formulations have been used, but these often mix together the bases for categorization. Differences in the concepts are clarified, and nine primary criteria having second-order elements are set up to distinguish thirteen agricultural systems that have evolved since the beginning of primary production late in the Mesolithic Era. The effect of tax policies on aggregate agricultural investment is very vital. LeBlanc & Hrubovcak, (1986) provide evidence that tax policies are effective in promoting agricultural investment. Nearly 20 percent of net investment in agricultural equipment and structure during the particular period was attributed to tax policy. Daugbjerg (1998) demonstrated through his research that there is huge link between the political power of producers and policy design. It is argued that the more politically powerful they are, the more likely policy makers are to reimburse tax revenues, to give producers control over the spending of the revenue and to design tax schemes.

A comparison of fertilizer and pesticide tax policy making in Denmark, Norway and Sweden supports his argument. Thompson (1996) described the overriding objective of American agricultural policy. That is to ensure that there is a safe, reliable, low-cost, nutritious supply of food to the American public. And secondary objective is for the agricultural sector to contribute to the balance of payments by generating export revenue. He used four distinct categories of public policy that affect agriculture: those that affect the overall environment in which agriculture functions, those that reduce the cost of agricultural production and marketing, those that support or stabilize agricultural prices or incomes, and those that increase demand for agricultural products. Pakistan's agricultural policy is stagnant since 1947 in terms of taxation. Agriculture tax is the land revenue system. Being income and price inelastic, the replacement of the system with agricultural income tax seems to be inevitable for meeting the financial needs of a growing national economy.

In fact, under pressures from World Bank and International Monetary Fund (IMF), Pakistan introduced various variants of agricultural income tax in the past and in full during 1993 and 1996 respectively. (Chaudhry, 1999) But that system never implemented properly. The studies of individual economists are no less controversial in this respect. There seems to be a general consensus among such writers as [Hamid (1970); Yaqub (1971); Chowdhury (1971); Khan (1991) and World Bank (1999)] on the repeal of land revenue system in favour of agricultural income. On the other side, many economist have shown dissatisfaction over this system. (Chaudhry, 1999) Hertel & Tsigas, (1988) used computable general equilibrium model to analyze the effects of eliminating farm and food tax preferences in 1977. They examined the Tax differentials on capital income, labor payments, production and sales taxes. Results indicate that these combined preferences lowered food costs by about $4.5 billion while enhancing after-tax returns to farm land, labor, and capital.

The associated general equilibrium tax expenditure is estimated to have been between $5.5 and $6.6 billion. Notwithstanding, the merits and demerits of agricultural income tax perceived by various writers in theory and practice are a major source of the controversy. The present paper is devoted to provide an assessment of introducing the agricultural; income tax policy in Pakistan in the light of typical characteristics of a good tax policy. Accurate solution for raising the government revenue seems to be to impose tax on agricultural income with some limitation not worsening off the small farmers. By using the General Equilibrium model, the the article intends to explore the effects of implementing the agricultural income tax policy on the larger producers, and contribution to the Pakistan's economy leading to increase the welfare of the society in general.

3. Important Key Terms and their Concepts

a. Computable General Equilibrium Model (**CGE**) models are a class of economic models that use real economic data to show the reaction of an economy after changes in policy, technology or other external factors. Computable general equilibrium (CGE) modeling is particularly useful in analyzing the effects of a policy that profoundly modifies the relative price system of an economy. CGE models are also known as Applied General Equilibrium (AGE) models. A CGE model is combination of two parts. First is equations describing model variables and second is a database (usually very detailed) consistent with the model equations. The equations tend to be neo-classical spirit, often assuming cost-minimizing behaviour by producers, average-cost pricing, and household demands based on optimizing behaviour. However, most CGE models conform only loosely to the theoretical general equilibrium paradigm. For example, they may allow for non-market clearing, especially for labour (unemployment) or for commodities (inventories). They may also allow imperfect competition (e.g., monopoly pricing) and demands uninfluenced by price (e.g., government demands). Beside these a range of taxes and externalities, such as pollution etc. are also part of their loose net.

b. A CGE model database consists of tables and elasticities. Tables include transaction value tables showing thetotal value of particular transaction, for example, the value of cotton used by the textile industry.

Usually the database is presented as an input-output table or as a social accounting matrix. In both cases, the database covers the whole economy of a particular country. It can be extended to multiple countries or up to the whole world. It distinguishes different sectors, commodities, primary factors and perhaps types of household.

4. Computable General Equilibrium Model for Pakistan

The Computable General Equilibrium Model of Pakistan (CGEM-Pak) follows the static model framework developed by Lofgren et al. (2001). It pursues that the Social Accounting Matrix (SAM 2001-02) integration of activities, commodities, factors and institutions. The equations of the model explain the interactions and behaviour of these sectors. In addition, the equations guarantee that a set of both micro and macroeconomic constraints are fulfilled. In other words, these equations ensure that requirements regarding factors and commodity markets, savings and investment, and the government and current account balance are satisfied.

a. Price Block

Detailed handling of the prices is one of the distinct features of the model. In this model each activity produces only one commodity. Final export price (*PE*) can be obtained by including any taxes that might be imposed on the export of commodities from the producer price (*PX*) of a commodity. The final supply price for the domestic market (*PD*) is determined by the interaction of producer and export prices. By changing focus from production to consumption, the domestic supply price is transformed into the domestic demand price (*PD*). Import prices (*PM*) are calculated by adding tariffs that might be placed on foreign commodities entering the domestic market. The price of composite commodities (*PQ*) is determined by the interaction of domestic and import prices. Sales taxes are then added to the composite price to arrive at a final market price.

b. Production and Commodity Block

The production block is defined as the component of the model that establishes the combination of the representative firm's inputs and outputs that will maximise profits within the economy sector. In the model under consideration, activities carry out production in CGEM-Pak. These activities obtain their revenue from selling the commodities that they manufacture. They disburse their revenues in purchasing production inputs, i.e. purchase of intermediate input and payments of wages/rent to primary factors. It is assumed in the model that the activities maximize profits subject to production functions and neoclassical substitutability for factors and fixed co-efficient for intermediate inputs. Moreover, a single commodity is produced by each activity. CGEM-Pak identifies nine activities (productive sectors) that combine primary factors with intermediate commodities to determine a level of output. These activities consist of Agriculture, mining, food manufacturing, cotton lint/yarn, textile, leather, other manufacturing, energy and services (from now on A-AGRI, A-MINE, A-FMAN, A-YARN, A-TEXT, A-MANF, A-ENGR, and A-SER, respectively).

There are eleven factors of production identified in the model: six types of labour - own large farm labour (LA-AGL), own medium farm labour (LA-MF), own small farm labour (LA-SF), agriculture wage labour (LA-AGW), non-agriculture unskilled labour (LA-SKU), and skilled labour (LA-SK) - , four types of land - large farm land (LN-LG), irrigated medium farm land (LN-MG), irrigated small farm (LN-SG), non-irrigated small farm land (LN-DR) - and one type of capital (K). Producers in the CGEM-Pak maximize their profits subject to constant returns to scale. They make choices between factors of production on the basis of a constant elasticity of substitution (CES) function. This specification permits producers to react to changes in relative factor returns. They can easily substitute between available factors so as to derive a final value added composite. Maximization of profit implies that the factors receive income where marginal revenue equals marginal cost.

These marginal cost and revenue are determined on the basis of endogenous relative prices. Once factors are determined, then these factors are combined with fixed-share intermediates using a Leontief specification. The use of fixed-shares in line with the idea that the required combination of intermediates per unit of output, and the ratio of intermediates to value added, is determined by technology rather than by the producers' decision-making. A Constant Elasticity of Substitution (CES) Cobb-Douglas production function is used to capture the relationship between the factor use and activity levels. It covers the following aspects of CGEM-Pak.

1. Domestic production and input use.
2. The allocation of domestic output to exports and the domestic market.
3. The aggregation of supply of domestic market.

The specification of foreign trade and its interaction with the domestic economy constitutes an important part of the model. According to classical theory of trade, a traded good is assumed to be one which, the country is price taker (small country assumption) and the domestically produced good is a perfect substitute of the corresponding import.

In the result of this assumption the domestic price become equal to world price. This in turn means that if domestic and imported goods are perfect substitutes, the trade creation effects of trade policies tend to be larger than when products are imperfect substitutes.Alternatively, in this model, Armington (1969) approach is followed by supposing an imperfect substitutability between domestic and imported goods. According to this assumption, each country produces a unique set of goods which are substitutes for goods produced in other countries. Although, these goods are not identical, but substitute to a varying degree. Advantages of this specification are:

1. It can accommodate cross hauling (import and export of same good in the same period) in trade data.
2. It avoids the over specialization problem (Mujeri, 2002). Moreover, according to Mustafa Mujeri (2002) it can be achieved by 'bounding the production response to trade policy changes from the demand side, since commodities subscripted by country are treated only as imperfect substitutes'. As imported and domestic goods are only imperfect substitutes, a certain percentage change in the domestic price of imports leads to a slight percentage change in the price of the locally traded goods. Therefore, dropping the assumption of perfect substitution between imports and domestic goods solves the specialization problem. This is especially significant for a developing country like Pakistan. Like other developing countries, there is a huge quality difference between locally produced and imported goods in Pakistan.

In addition to this, high level of aggregation is adopted in the model; each sector represents a bundle of different goods. Therefore, it is quite reasonable to suggest that these two goods are not perfect substitutes. The decision of substitution between domestic and foreign production is governed by the constant elasticity of transformation (CET) function, which differentiates between domestic and exported goods. Maximization of profits drives producers to sell in those markets where they can attain the maximum returns. These returns are based on domestic and export prices. Export prices are attained by multiplying world prices by exchange rate included any taxes and subsidies. As Pakistan is a small country and has no influence on world prices, so under the small-country assumption, Pakistan is assumed to face a perfectly elastic world demand at a fixed world price. The final ratio of exports to domestic goods is determined by the endogenous interaction of relative prices for these two commodity types.

The energy is the only product which is produced and consumed domestically, i.e. the production of energy sector is neither imported nor exported. While domestic demand for other commodities is met through the use of either domestically produced or imported commodities, the supply from these two sources are combined to form a composite commodity, which is subsequently sold to meet the domestic demand. The demanders are assumed to minimize cost subject to the substitutability between imported and domestically produced commodities. This Substitution between imported and domestic goods takes place under a CES Armington specification (Armington, 1969). The final composite good (combination of imported and domestic goods) is supplied to meet the final and intermediate demand. As explained above, intermediate demand is determined by technology and by the composition of sectoral production. Final demand is dependent on incomes of institutions and the composition of aggregate demand.

c. Institution block

There are several sources of income of institutions in the model. The major sources of income of household are income from factors of production. These factors (different types of labour and land, and capital) receive income from their involvement to value added. The income of factors is in turn to be paid to institutions who supply these factors. In CGEM-Pak, incomes from different types of labour and land are dispersed across nine household groups. Conversely, capital income does not only go to households, but also as part of the incomes of capital income accrues to the government and enterprises according to their initial endowment of capital. Consequently, income of capital is distributed to the nine household groups, government and enterprises. The government receives a large amount of its income from direct and indirect taxes, and then uses it on consumption expenditures and transfers to households. Moreover, the government receives income from capital. Both of these payments are fixed in real terms. The difference between revenues and expenditures is the budget deficit. This is primarily financed through borrowing (or dis-saving) from the domestic capital market. In the CGEM-Pak, the role of government is as a consumer and quantities of government's consumption of each commodity is fixed exogenously. Moreover, transfers of government to households are CPI-indexed, that is, they can be simply fixed in nominal terms. The only source of enterprises' income is returns from capital. Enterprises then make payment to cover transfers to households and savings. It is assumed that enterprises do not consume commodities. Enterprises' saving can be explained as the difference between income and expenditure.

d. Model Closure

For current account balance, Foreign Savings (FS) is fixed, and hence a flexible exchange rate (EXR) clears the current account.

For savings/investment account, savings-driven investment is assumed, therefore savings are fixed, and Investment adjustment factor (IADJ) is flexible, permitting investment to adjust. For capital market, it is assumed that capital is activity-specific and fully employed. This means that the price of capital is fixed and factor price distortion adjusts to clear the market. Note that capital is the only factor which is used in all types of activities. There are four types of land in our model and all types are being used in agriculture sector, which has only one activity (agriculture). For land market it is assumed that all types of land are fully employed and hence price of land will clear the market. There are four types of agriculture and two types of non-agriculture labour in the labour market of the model. They are mutually exclusive and there is no mobility between them. The assumption for four types of agriculture labour is that they are fully employed and hence price of labour will clear the market. In CGEM-Pak, non- agriculture sector has eight types of activities and each type of activity uses two types of labour (non-agriculture labour; skilled and unskilled). Full employment is assumed for non-agriculture labour. Moreover, labour is fully mobile and a unique wage clears the labour market. The sets, parameters, exogenous variables, endogenous variable and equations are presented in Table 1 – 5, respectively.

5. Data and model calibration

Fiscal year 2001-02 is selected as the bench mark year as the most recent, comprehensive and consistent data set was available in the form of Social Accounting Matrix (SAM). It is a 114 x 114 matrix developed by Dorosh, Niazi, and Nazili (2006). This dataset is not only micro-consistent but satisfies all equilibrium conditions and properties of CGEM-Pak. A standard calibration procedure, developed by Mansur and Whalley (1984), is followed based on a base year dataset (SAM 2001-02). Most of the model parameters are calibrated directly from the benchmark data, such as input-output coefficients (IO), shares in the returns to factors by household types and parameters of the Cobb-Douglas functions. The CES and CET functions are taken from existing literature. Other coefficients are implicit in the benchmark data, given the functional forms used in the model equation and other parameters. Thus calibrated, the model reproduces the initial year in the absence of any shock. Generalized Algebraic Modelling System (GAMS) software (Brooke *et al*., 1997) is used for all model computations. Ideally, trade elasticities should be estimated econometrically from cross section and time series data. Given limited resources as well as data constraints, therefore, elasticity parameters employed by different studies examining similar questions for comparable developing economies have been used.

Table 6 shows the Armington elasticities adopted in selected countries, whereas trade elasticities for CGEM-Pak are given in Table 7. It must be noted that trade elasticities such as the value of Armington play a vital role in the relatively disaggregate models. This gives rise to the need for conducting a detailed sensitivity analysis to assess the robustness of the results. In essence, the equations of the model describe interrelationship of macro economy while the SAM provides actual values for the coefficients in these equations through the calibration process. The model will help to solve primarily for equilibrium to make sure that the base year dataset is reproduced. Afterwards, it would be possible to shock the model with a change in the value of one of the exogenous variables. The model will then be re-solved for equilibrium (as before) and the changes in the values of the endogenous variables. These values will then be compared to those of the base-year equilibrium to establish the impact of the exogenous shock.

6. Welfare Measures

Among all possible welfare measures, Equivalent Variations (EV) is used in the paper to address the profit-loss issue when the policy is implemented. EV is a measure of how much more money a consumer would pay before a price increase to avert the effects of the price increase. Otherwise-stated, the amount of money which would have to be given to or taken away from an individual to make them as well-off as they would have been after the prices change (Gravelle, & Rees, 1987). Mathematically it can be written as:

$$EV_h = \left(\frac{CPIH_h^0}{CPIH_h^1}\right) EH_h^1 - EH_h^0$$

See appendix for explanations of each variable.

7. Inequality measures

There are different methods to determine inequality in economy. The most popular inequality measures (Theil-L, Theil-T, Theil-S and Hoover indices) are used to see the impact of implementation of agricultural income tax on household inequality. Moreover, due to the limitation of our data, only inequality between household groups is captured. To calculate inequality, a variant of the Hoover/Theil-L/Theil-T/Theil-S indices[1] is used. The range of the Hoover index lies between 0 and 1 (0% and 100%).

[1] For brevity, the derivations of inequality measure are not listed here. The full specifications and derivations of the formula are available upon request.

This index is the simplest of all inequality measures. Here, the meaning of the index is easy to explain: The multiplication of the Hoover index with the sum of all resources (income) directly yields the share of all resources, which would have to be redistributed until a state of perfect equality is reached. The Theil-T index ranges from 0 (lowest inequality) to 'ln(N)' (highest inequality). Conversely, the Theil-L index ranges from 0 to infinity and the higher the value of Theil-L, the higher the inequality is. Simplistically, Let total income of the population is *Y,* Income of subgroup is YH_h, total population is *N*, and the population in the subgroup N_h. And let *TT* represent Theil-T, Theil-T can be written as:

$$TT = \ln\left(\frac{\sum_h N_h}{\sum_h YH_h}\right) - \frac{\sum_h YH_h \ln\left(\frac{N_h}{YH_h}\right)}{\sum_h YH_h},$$

And Theil-L can be written as:

$$TL = \ln\left(\frac{\sum_h YH_h}{\sum_h N_h}\right) - \frac{\sum_h N_h \ln\left(\frac{YH_h}{N_h}\right)}{\sum_h N_h},$$

"Symmetrized" Theil index can be calculated as:

$$TS = \frac{1}{2}\left[TT - TL\right].$$

Substituting values of *TT* and *TL* in above equation

$$TS = \frac{1}{2}\sum_h \ln\left(\frac{YH_h}{N_h}\right)\left(\frac{YH_h}{\sum_h YH_h} - \frac{N_h}{\sum_h N_h}\right),$$

Hoover's Index can be written as

$$HI = \frac{1}{2}\sum_h \left|\frac{YH_h}{\sum_h YH_h} - \frac{N_h}{\sum_h N_h}\right|$$

8. Experiment: Implementation of Agricultural Income Tax and Reduction in Sales Tax Adjusting the Budget Surplus

Agricultural income tax is not implemented in Pakistan. However, this simulation is constructed to check the impact of agricultural income tax implementation and sales tax reduction on welfare of household. This simulation helps in understanding the overall impact of agricultural income tax imposition on Pakistan's economy. It is assumed that if agricultural income tax is imposed on farmers holding more then 50 acres of land. So, only two types of households would become under agricultural income tax large farm household (H-LF) and medium farm household (H-MF) While all other types of house holds which are small farm household (H-SF), landless farmer household (H-0F), rural agriculture landless household (H-AGW), rural non-farm non-poor household (H-NFNP), rural non-farm poor household (H-NFP), urban non-poor household (H-URNP) and urban poor household (H-URPR) would not be paying this tax. Tax rate of agricultural income tax is equal to the tax rate of urban non-poor household (H-URNP) which is 0.084% (Table 10).

It is also assumed that sales tax is reduced from its existing levels on production activities. For example, on A-AGRI it is reduced to 5.68%, on A-MINE 0.117%, on A-FMAN 0.065%, on A-YARN 0.097%, on A-MANF 0.072%, and on A-ENGR 0.040% respectively. As A-TEXT and A-LEAT are export oriented industries so they are enjoying subsidies instead of paying taxes.It is assumed in the simulation experiment that the agricultural income tax is imposed on H-LF and H-MF at the rate of 0.084% as H-URNP is already paying tax at the same rate. Besides implementation of agricultural income tax "Sale Tax" is reduced on all production activities. Simulation results of the experiment are as follows:

a. Macro Level

The results of simulation experiment at macro levels are visible from the data given in Table 8. The results indicate that there is positive impact of implementation of agricultural income tax on the economy of Pakistan. It shows that increase in GDP by 0.76% is visible after the implementation of agricultural tax indicating the contribution of agricultural sector in the economy. The examination of data also shows a considerable increase in government consumption.

It is increased by 0.35%. This is because of increase in government revenues after implementation of the tax. This government consumption is part of development expenditures for every fiscal year, now government have more money to spend for the development expenditures as compare to previous years. Investment responds positively to implementation of agricultural income tax. They show an overall 1.24% increase after implementation of agricultural tax. Exports are increased by 0.78% and imports are increased by a very minute percentage. Net tax collection has shown a huge decline and reduced by 10.63%. This is because of reduction in sales tax rates on all production activities. Private consumption is also reduced by 0.26% after imposition of new tax on agriculture income. The implementation of agriculture income tax resulted in the fall of economy-wide EV and CV by 0.26% and 0.26%, respectively. This indicates the economy-wide welfare consequences of these policy measures, declining the economy-wide EV and CV.

b. Household welfare

One definition of welfare is the Government handouts to the poor, but Economists use the term to describe the well being of an individual or society. An Economist will mostly suggest tax cuts to improve the overall well being of the country, but most governments will not talk of tax cuts and a handout will be considered a welfare tool like in USA and even in Pakistan. The concept of efficiency or welfare, serves as a starting point for any policy analysis. Unlike a pure theoretical approach, where only an ordinal measure of alternative states is examined, applied policy analysis employs measures of welfare. This allows the comparison of changes in welfare arising from certain policy changes. The changes in Utility of households are shown in Table 9.

In response to simulation, changes in utility of household types H-LF and H-MF are found to be negative. This resulted from the direct agricultural income tax on both house holds. Whereas rest of the household types – H-SF, H-0F, H-AGW, HNFNP, H-NFP, H-URNP and H-URPR – recorded increase in their utility as the tax contribution by H-LF and H-MF has increased their spending power. Utility of H-LF and H-MF is reduced by 7.95% and 7.94% respectively. Reduction in utility of these households brought increase in utility of rest of the house holds. H-SF witnessed increase of utility by 0.55%, H-0F utility by 0.50% respectively. While H-AGW recorded an increase of household utility by 0.49%, HNFNP by 0.81%, H-NFP by 0.79%, H-URNP by 0.49% and H-URPR by 0.74% accordingly as is evident from Table 9 mentioned above. An increase in utility of these households adds the value to the decision making of imposing the agricultural income tax on H-LF and H-MF.

c. Inequality

Is equality related to growth and does it create more or less equality? Do unequal societies grow slowly than equal ones? This has been a debating point for a long time in the economics field. However, the argument about the equality of outcome (that is, INCOME) or the provision of opportunity is in question that which one is more relevant and important. In this regard mostly the Theil Indices – Theil-L, Theil-T and Theil-S – and Hoover index are used as an indicator of inequality. Due to their decomposition properties, it becomes possible to consider their respective contributions within-group and between-group inequality to the total inequality. Only the inequality between groups was measured in the case of this simulation. This limitation is a direct result of the limitations of the data. The result of inequality indices in the case of simulation (implementation of agricultural income tax) is presented in Table 11. For example, the value of Theil-T after simulation decreased from.0.318 to 0.317. While the value of Theil-T reduced from 0.326 to 0.325, Theil_S from 0.322 to 0.321 and Hoover from 0.346 to 0.345 respectively. The down falling trends of above mentioned indices disclose the fact that after simulation, inequality decreases between-households.

9. Sensitivity Analyses

Sensitivity Analysis is done in Simulation Modeling in the field of Quantitative Analysis. In Simulation analysis key quantitative assumptions and computations underlying a decision, estimate, or project are changed systematically to assess their effect on the final result of the analysis. In the experiment under discussion, Sensitivity analysis was conducted to determine how the results of CGEM-Pak are affected by changes in the trade elasticities. Experiments involving +50% and -50% changes in the trade elasticities were conducted with different combinations. The results are depicted in Table 12. It is important to note that that as sigma-q (Armington elasticity) increases the sensitivity of imports to change in the relative price increases. The same effect holds for sigma-x, the export elasticity. The examination of data presented in above Tables show that the effects of changes in trade elasticities are not very significant. Similarly, the effects on macroeconomic analysis are more or less the positive as is evident from Table 13. On the other hand, income analysis shows very small effect relative to the change in the elasticities (+50% and - 50%). The results are presented in Table 14.

10. Conclusion

This article was devoted to investigate the impact of agriculture income tax if imposed in Pakistan as a case study. The objective of this experiment was to analyse its viability and soundness for Pakistan's economy.

In the experiment, it is assumed that if agricultural income tax is imposed at the same rate (0.084%) as is already imposed on urban population. It is also assumed that the government revenue from the collection of agriculture income tax will increase about Rs. 9557 billion making the government budget surplus. In contrast Government will be in a position to provide various incentives to the producers i.e., by reducing the sales tax by 4.7%. The research strongly supports that the imposition of agricultural income tax is vital and beneficial for the Government, household and at the macro economic improving the economy-wide welfare indicators. The results suggest that implementation of agricultural income tax tends to be a real and potential tool to play an important role in the future strategy of development. While, the alleviation of inequality and increment of household welfare indeed require effective synchronization of other instruments such as monetary policy with fiscal policy opening a good avenue of further research. However, it should be observed that the results derived are conditional according to the structure of the model.

Annexure: Tables

Table 1: Sets of the Variables Used

Sets	Definition
$a \in A$	**Activities:** Agriculture, Mining, Food manufacturing, Cotton lint/yarn, Textiles, Leather, Other manufacturing, Energy, Services
$a \in AA \subset A$	**Agriculture Activities:** Agriculture
$a \in ANA \subset A$	**Non-Agriculture Activities:** Mining, Food manufacturing, Cotton lint/yarn, Textiles, Leather, Other manufacturing, Energy, Services
$c \in C$	**Commodities:** Agriculture, Mining, Food manufacturing, Cotton lint/yarn, Textiles, Leather, Other manufacturing, Energy, Services
$c \in CA \subset C$	**Agriculture Commodities:** Agriculture
$c \in CNA \subset C$	**Non-Agriculture Commodities:** Mining, Food manufacturing, Cotton lint/yarn, Textiles, Leather, Other manufacturing, Energy, Services
$c \in CM \subset C$	**Imported commodities:** Agriculture, Mining, Food manufacturing, Cotton lint/yarn, Textiles, Leather, Other manufacturing, Services
$c \in CNM \subset C$	**Non-imported commodities:** Energy
$c \in CE \subset C$	**Exported commodities:** Agriculture, Mining, Food manufacturing, Cotton lint/yarn, Textiles, Leather, Other manufacturing, Services
$c \in CNE \subset C$	**Non-exported commodities:** Energy
$f \in F$	**Factors:** Labor, Land , Capital
$la \in LA \subset F$	**Labor:** Own large farm, Own medium farm, Own small farm, Agriculture wage, Non-agriculture unskilled, Skilled
$laa \in LA \subset F$	**Agriculture labor:** Own large farm, Own medium farm, Own small farm, Agriculture wage
$lan \in LA \subset F$	**Non-Agriculture labor:** Non-agriculture unskilled, Skilled
$\ln \in LN \subset F$	**Land:** Large farm, Irrigated medium farm, Irrigated small farm, Non-irrigated small farm
$k \in K \subset F$	**Capital**
$FA \subset F$	**Factors used by agriculture activities:** Own large farm, Own medium farm, Own small farm, Agriculture wage, Large farm, Irrigated medium farm, Irrigated small farm, Non-irrigated small farm, capital
$FNA \subset F$	**Factors used by non agriculture activities:** Non-agriculture unskilled, Skilled, Capital
$i \in I$	**Institutions: households;** Large farm, Medium farm, Small farm, Landless farmers, Rural agriculture landless, Rural non-farm non-poor, Rural non-farm poor, Urban non-poor, Urban poor, **Government, enterprise, Rest of the world**
$h \in H \subset I$	Large farm, Medium farm, Small farm, Landless farmers, Rural agriculture landless, Rural non-farm non-poor, Rural non-farm poor, Urban non-poor, Urban poor
$g \in G \subset I$	**Government**
$s \in S \subset I$	**Enterprise**
$r \in R \subset I$	**Rest of the World**

Table2: Parameters of the Variables

Parameter	Definition
ad_a	Activity parameter of production function
aq_c	Shift parameter of Armington function
ax_c	Shift parameter for output transformation (CET) function
$cwts_c$	Weight of commodity *c* in the *CPI*
$ir_{c,a}$	Quantity of *c* as intermediate input per unit of activity *a*
$shry_{i,f}$	Share for institutions *i* in income of factor *f*
$\alpha_{f,a}$	Value added share for factor *f* in activity *a*
$\beta_{c,h}$	Share of consumption spending of household *h* on commodity *c*
δq_c	Share parameter for the composite good
δx_c	Share parameter for output transformation
$\theta_{a,c}$	Yield of output *c* per unit of activity *a*
ρq_c	Exponent of Armington function
ρx_c	Exponent used in the CES aggregation function
σq_c	Elasticity of transformation for composite goods
σx_c	Elasticity of transformation for output transformation.

Table3: Exogenous variables

Variable	Definition
CPI	Consumer price index
INV_c	Base year investment demand
$MPSIN_h$	Initial marginal propensity to consume
$MPSDUM_h$	0-1 dummy: 1= for those H that saving changes, 0 otherwise
MPS_h	Marginal propensity to save for household *h*
PWE_c	World price of exports (Foreign currency units)
PWM_c	World price of imports (Foreign currency units)
QFS_f	Supply of factor *f*
QG_c	Quantity of consumption of commodity *c* by government *g*.
te_c	Sales tax on imports
tm_c	Import tariff rate
tq_c	Rate of sales tax
$TR_{i,j}$	Transfers from institution *j* to institution *i*
$TSTAX_c$	Total sales tax on commodity *c*
$TTAR_c$	Total tariff on commodity *c*
ty_h	Household income tax rate

Table 4: Endogenous Variables

Variable	Definition	No.
$CPIH_h$	Consumer price index of household *h*	9
EH_h	Consumption expenditure of household *h*	9
EXR	Foreign exchange rate as domestic currency per unit of foreign currency	1
$FPD_{f,a}$	Factor price distortion for factor *f* in activity *a*	99
FS	Balance of payment (foreign currency units)	1
GBS	Government budget surplus	1
$IADJ$	Investment adjustment factor	1
PA_a	Gross revenue per activity (activity price)	9
PD_c	Domestic price of domestic output	9
PE_c	Domestic price of exported good	8
PF_f	Rate of return to factor *f*	11
PM_c	Domestic price of imported goods (local-currency unit),	8
PQ_c	Composite price of commodity *c*	9
PVA_a	Price of value added (factor income per unit of activity)	9
PX_c	Commodity price of producer *c* for activity *a*	9
QA_a	Quantity (level) of activity *a*	9
QD_c	Domestic sales quantity	9
QE_c	Supply of exports	8
$QF_{f,a}$	Quantity demanded of factor *f* from activity *a*	99
QFU_f	Unused supply of factors *f*	11
$QH_{c,h}$	Quantity consumed of commodity *c* by household *h*	81
$QINT_{c,a}$	Quantity of commodity *c* as intermediate input coefficient	81
$QINV_c$	Quantity of investment demand for commodity *c*	9
QM_c	Quantity of imported commodities	8
QQ_c	Quantity of goods supplied to domestic market (composite supply)	9
QX_c	Aggregate quantity of domestic output of commodity	9
UH_h	Utility of household *h*	9
$WALR$	Dummy variable	1
$YFRM$	Income of enterprise	1
$YFRMTS$	Total saving of enterprise	1
$YF_{h,f}$	Transfers of factor income to household	99
$YF_{s,f}$	Transfer of factor income to firms	11
YH_h	Income of household *h*	9
μ_h	Weight of utility of household *h*	9

Table 5: Equations - Price Block

	Equation	Domain	
1	$PM_c = (1+tm_c)PWM_c\,EXR$	$c \in CM$	**8**
2	$PE_c = PWE_c(1-te_c)EXR$	$c \in CE$	**8**
3	$PQ_c\,QQ_c = (PD_c\,QD_c + PM_c\,QM_c)(1+tq_c)$	$c \in CM$	**8**
4	$PQ_c\,QQ_c = PD_c\,QD_c(1+tq_c)$	$c \in CNM$	**1 R**
5	$PX_c\,QX_c = PD_c\,QD_c + PE_c\,QE_c$	$c \in CE$	**8**
6	$PX_c\,QX_c = PD_c\,QD_c$	$c \in CNE$	**1 R**
7	$PA_a = \sum_{c \in C} \theta_{a,c}\,PX_c$	$a \in A$	**9**
8	$PVA_a = PA_a - \sum_{c \in C} ir_{c,a}\,PQ_c$	$a \in A$	**9**

Equations - Production Block

9	$QA_a = ad_a \prod_f QF_{f,a}^{\alpha_{f,a}}$	$a \in A$	**9**
10	$FPD_{f,a}\,PF_f = (\alpha_{f,a}\,PVA_a\,QA_a)/QF_{f,a}$	$f \in F$, $a \in A$	**99**
11	$QINT_{c,a} = ir_{c,a}\,QA_a$	$a \in A$, $c \in C$	**81**
12	$QX_c = \sum_{a \in A} \theta_{a,c}\,QA_a$	$c \in C$	**9**
13	$QX_c = ax_c[(1-\delta x_c)QD_c^{\rho x_c} + \delta x_c\,QE_c^{\rho x_c}]^{1/\rho x_c}$	$c \in CE$	**8**
14	$QX_c = QD_c$	$c \in CNE$	**1**
15	$QQ_c = aq_c[(1-\delta q_c)QD_c^{-\rho q_c} + \delta q_c\,QM_c^{-\rho q_c}]^{-1/\rho q_c}$	$c \in CM$	**8**
16	$QQ_c = QD_c$	$c \in CNM$	**1**
17	$QM_c / QD_c = [(\delta q_c / 1-\delta q_c)(PD_c / PM_c)]^{\sigma q_c}$, $\sigma q_c = 1/(1+\rho q_c) > 0$	$c \in CM$	**8**
18	$QD_c / QE_c = [(\delta x_c / 1-\delta x_c)(PD_c / PE_c)]^{\sigma x_c}$, $\sigma x_c = 1/(\rho x_c - 1) > 0$	$c \in CE$	**8**

Equations - Institution Block

19	$YF_{i,f} = shry_{i,f} \sum_{a \in A} FPD_{f,a} PF_f QF_{f,a};$	$i \in I$, $f \in F$	**99**
20	$YH_h = \sum_{f \in F} YF_{h,f} + TR_{h,g}\ CPI + EXR \cdot TR_{h,r} + TR_{h,s}$	$h \in H$	**9**
21	$HTS = \sum_h MPS_h (1 - ty_h) YH_h$		**1**
22	$HDS = HTS - \sum_h TR_{h,r} \cdot EXR$		**1**
23	$MPS_h = MPSIN_h (1 + MPSADJ \cdot MPSDUM_h)$		**9**
24	$UH_h = \prod_c \left(\frac{QH_{c,h}}{\beta_{c,h}} \right)^{\beta_{c,h}}$	$h \in H$	**9**
25	$QH_{c,h} = \frac{\beta_{c,h} EH_h}{PQ_c}$	$h \in H$, $c \in C$	**81**
26	$EH_h = (1 - MPS_h)(1 - ty_h) YH_h$	$h \in H$	**9**
27	$CPIH_h = \prod_c PQ_c^{\beta_{c,h}}$	$h \in H$	**9**
28	$CPI = \sum_h \mu_h \cdot CPIH_h$		**1**
29	$\mu_h = \frac{UH_h}{\sum_h UH_h}$	$h \in H$	**9**
30	$QINV_c = INV_c\ IADJ$	$c \in C$	**9**
31	$GBS = \sum_{h \in H} ty_h YH_h + EXR \cdot TR_{g,r} + \sum_{c \in C} tq_c PD_c QD_c + \sum_{c \in CM} tq_c PM_c QM_c + YF_{g,f} + \sum_{c \in CM} tm_c EXR \cdot PWM_c QM_c + \sum_{c \in CM} te_c EXR \cdot PWE_c QE_c - \left[\left(TR_{s,g} + \sum_{h \in H} TR_{h,g} \right) CPI + \sum_{c \in C} PQ_c QG_c \right]$		**1**
32	$YFRM = YF_{s,k}$	$s \in I$	**1**
33	$YFRMTS = YF_{s,k} - TR_{h,s}$		**1**

Equations - System Constraint Block

34	$\sum_{a \in A} QF_{f,a} + QFU_f = QFS_f$	$f \in F$	**11**
35	$QQ_c = \sum_{a \in A} QINT_{c,a} + \sum_{h \in H} QH_{c,h} + QG_c + QINV_c$	$c \in C$	**9**
36	$FS + \sum_{c \in CE} PWE_c QE_c + \sum_{i \in I} TR_{i,r} = \sum_{c \in CM} PWM_c QM + \sum_{i \in I} TR_{r,i}$		**1**
37	$WALR = \left[\sum_{h \in H} MPS_h (1 - ty_h) YH_h + YFRMTS + GBS + EXR \cdot \right.$ $- \sum_{c \in C} PQ_c\ QINV_c$		**1**

Table 6: Armington Elasticities in Selected Countries

Source	**Armington Elasticity**	**Country**
Alaouze et al. (1977)	2	Australia
Vincent (1986)	2	Chile
Vincent (1986)	0.5 to 5.0	Colombia
Vincent (1986)	2	Ivory Coast
Vincent (1986)	0.5 to 5.0	Kenya
Vincent (1986)	0.5 to 5.0	India
Vincent (1986)	0.20 to 2.0	Turkey
Vincent (1986)	Less than 2	South Korea
Kapuscinski and Warr (1992)	2.0	Philippines
Comber (1995)	1.64 to 3.5	New Zealand
Kapuscinski and Warr (1996)	0.04 to 3.8	Philippines

Source: Somaratne, W.G. (1998).

Table 7: Trade Elasticities

Commodities	Armington Elasticity	CET Elasticity
C-AGRI	4.0	4.0
C-MINE	3.0	3.0
C-FMAN	3.5	3.0
C-YARN	3.2	3.0
C-TEXT	3.5	3.0
C-LEAT	3.5	3.0
C-MANF	3.2	3.0
C-ENRG	3.0	3.0
C-SER	2.7	2.0

Source: Ahmad et al (2008)

Table 8: Macro effects of implementation of agricultural income tax

	Value at Base	Value after Simulation	% Change
GDP	3377101	3402861	0.763
Government Consumption	408940	410379	0.352
Investment	534109	540753	1.244
Exports	677841	683154	0.784
Imports	-1.03015	-1.03653	-6382.293
Net Indirect Tax	251634	224867	-10.637
Private Consumption	3037997	3029976	-0.264
Economy-wide EV	na	na	-0.265
Economy-wide CV	na	na	-0.265

Table 9: Impact of agricultural income tax on Household utility

	Value at Base	Value after Simulation	% Change
H-LF	82670	76094	-7.955
H-MF	210039	193342	-7.949
H-SF	467056	469641	0.553
H-0F	97329	97817	0.501
H-AGW	91732	92190	0.499
H-NFNP	352910	355768	0.810
H-NFP	124810	125805	0.797
H-URNP	1379794	1386569	0.491
H-URPR	168712	169971	0.746

Table 10: Tax rate for Agricultural Income Tax

	Value at Base	Value after Simulation
H-LF	0	0.084
H-MF	0	0.084
H-URNP	0.084	0.084

Table 11: Impact of Agricultural Income Tax on household inequality

	Value at Base	Value after Simulation
Theil-T	0.318	0.317
Theil-L	0.326	0.325
Theil-S	0.322	0.321
Hoover	0.346	0.345

Table 12: Sensitivity Experiments

Experiment	Change in trade elasticities
E0	Original values of sigma-q & sigma-x
E1	+50% in sigma-q
E2	+50% in sigma-x
E3	- 50% in sigma-q
E4	- 50% in sigma-x
E5	+50% in sigma-q & sigma-x
E6	- 50% in sigma-q & sigma-x
E7	+50% in sigma-q & -50% in sigma-x
E8	- 50% in sigma-q & +50% in sigma-x

Table 13: Effect of sensitivity experiments on National income Accounts (% change from base)

	E0	E1	E2	E3	E4	E5	E6	E7	E8
GDPFC	1.43	1.50	1.49	1.36	1.3	1.6	1.29	1.4	1.4
GDPGAP	0.00	0.00	0.00	0.00	0.00	0.0	0.00	0.05	0.0
GDPMP1	0.03	0.13	0.07	-0.1	0.0	0.2	-0.1	0.05	-0.04
GDPMP2	0.03	1.33	0.07	-0.1	0.0	0.2	-0.1	0.05	-0.05
GOVCON	1.08	1.51	1.08	0.58	1.07	1.5	0.5	1.5	0.6
INVEST	-5.3	-4.9	-5.6	-5.8	-4.9	-5.1	-5.7	-4.5	-6.0
EXP	11.5	15.1	12.3	6.84	10.4	16.6	6.6	12.9	7.0
IMP	8.9	11.6	9.2	5.32	8.47	12.4	5.4	10.5	5.3
NITAX	-18	-18	-19	-19	-18	-19	-19	-17	-19
PRVCON	1.26	1.38	1.28	1.13	1.2	1.4	1.1	1.3	1.1

Table 14: Effect of sensitivity experiments on Household Income (% change from base)

	E0	E1	E2	E3	E4	E5	E6	E7	E8
H-LF	1.267	1.085	1.283	1.51	1.25	1.109	1.508	1.067	1.506
H-MF	1.265	1.094	1.282	1.494	1.244	1.12	1.49	1.072	1.492
H-SF	1.365	1.294	1.383	1.468	1.339	1.321	1.456	1.263	1.473
H-0F	1.321	1.22	1.341	1.465	1.295	1.249	1.454	1.189	1.468
H-AGW	1.338	1.267	1.36	1.445	1.307	1.298	1.43	1.229	1.451
H-NFNP	1.544	1.754	1.579	1.303	1.485	1.8	1.257	1.677	1.332
H-NFP	1.57	1.741	1.598	1.372	1.525	1.778	1.336	1.68	1.396
H-URNP	1.095	1.312	1.099	0.837	1.085	1.319	0.826	1.291	0.845
U-URPR	1.511	1.82	1.565	1.163	1.416	1.889	1.091	1.701	1.206

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