

## Welfare Effects and Importance of Skills and Human Capital Development Policies in a DCGE Model of Ghana

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**Abstract:** Based on a 2012 Ghanaian social accounting matrix, it was determined how different leisure levels and labour endowments affect household welfare and sectoral output. The findings of the leisure experiments point to a pattern in which the wellbeing of wealthiest households are negatively impacted. On the other hand, all other households see an increase in their welfare with rural farmer head savannah (hh01) always seeing the highest each time. Clearly there are redistribution impacts of leisure labour choice through income and substitution effects. When leisure is reduced in an effort to increase productivity, these rich households see a decrease in their consumption levels and the relatively poorer households see an increase in their welfare. So the question then is how can policy makers make such rich households contribute more to national development through income distributional effects by enhancement in their efficiency. Similar effects are noted when endowments change. Outputs in sectors increases. Some household save, spend more on health and education while others spend more consumption, specially on imported goods.

The income gap between affluent and poor households is reduced when leisure is reduced (productivity is increased), but the income gap is increased when endowments are increased. The question is, "How might policymakers encourage measures that will boost economic happiness and satisfaction for both wealthy and disadvantaged households?" Rawlsian versus Benthamite notions of utility should be considered while setting policy options to achieve the aim of the MDGs.

**Keywords:** Dynamic CGE model of Ghana, Skill and Human capital, growth and redistribution

**JEL classification:** E24, C68.

## **1. Introduction**

The main motivation for showing the importance of skills and human capital development policies is further efforts that can be pursued in order to achieve millennium development goals (MDGs) and Ghana Vision 2020 set out earlier. This is because MDGs and Poverty Reduction Strategy Papers (PRSPs) are what most economic, social and political policies in Ghana are now built on. The main goals analyses in this paper are geared towards achieving are MDGs 1, 2, 4, 5, 6 and 8. Most importantly, it is about look at ways of moving from a vicious cycle of poverty to a virtuous cycle of riches.

Perroni (1995) discusses how a life-cycle growth model with endogenous human capital accumulation and variable leisure. In his paper, income and consumption taxes changes and their dynamic equal-yield effects were analysed. Similar to Perroni (1995), the DCGEG model here is modified to simulate how changes in endowments and leisure affect national output and welfare in Ghana. Dynamic economic analysis was initiated by Ramsey (1928) and Hicks (1939). Piggott and Whalley (1985), Shoven and Whalley (1984) and Mercenier and Srinivasan (1994) had early versions of CGE models. Early social accounting matrix of Ghana is found in Powell and Round (2000) as well as Addy (2001). Human capital approach to growth of Lucas (1988) was explained in the African context by Easterly (1993). We follow Bhattarai (2007), Bhattarai and Okyere (2005), Whalley and Bhattarai (2003) in construction of dynamic CGE model of Ghana and use GAMS/MPSGE software with Path solver of Dirkse and Ferris (1996) to solve the Ghanaian DCGE model. Ghanaian SAM for 2012 also is complemented World Bank (1995d) for construction of the micro-consistent data sets. More recently Bhattarai and Benjasak (2021) have built similar model for Thailand.

Two policies to show the importance of skills and human capital development for economic development are looked at. One of such policies is increasing the endowments available to households and looking at the economy wide effects of such policies. An increase in incentive to work and or because of an increase in the skills level is what is been replicated. The other policy instrument is the reduction of leisure parameter in our model. This is used as a proxy for productivity and or hard work by people in Ghana. The reduction of leisure simply is to mimic an increase in productivity. An increase in employment can be inferred as well. Another implication is punctuality a problem at most institutions in Ghana and most developing countries is reduced. There are no systems to check punctuality as pertains in most developed



## 2. Model and Experiments

A dynamic general equilibrium model adjusted for changes in leisure and endowments is employed for the analyses in this paper. This is used to investigate how welfare of households and output changes across the models. This was calibrated to a Ghanaian data set over a fifteen year horizon. The essence of the welfare policy analysis is to know differences between the counterfactual and benchmark for informed policy making. The models run for these experiments are available on request. The level changes in welfare and percentage level changes in welfare relative to the benchmark are reported. The specification of the equations used to calculate the level and percentage level changes follow.

$$W_C - W_B \quad (1)$$

$$\left( \frac{W_C - W_B}{W_B} \right) * 100 \quad (2)$$

Equations 1 and 2 show how the level and percentage level changes were computed.  $W_B$  is the welfare in the benchmark model and  $W_C$  is welfare in the counterfactual model.

## 3. Results for Changes in Leisure

The first experiment was performed in four different ways. That is, we reduced the level of leisure in the model set at 3/4 of wages to 5/8, 1/2, 3/8 and 1/4. It is expected that people would work more, earn more and effectively consume more (higher welfare) when leisure is reduced and vice versa. The experiments are performed basically to try and quantify the level effects on welfare. That is, any income, substitution effects and productivity effects on households.

### 3.1. Effects of Reducing Leisure to 1/4 From 3/4

The results for a reduction in leisure parameter to 1/4 from 3/4 for all households follow. These are shown in figures 1 to figures 3. Welfare in figure 1 is simply the level of consumption after leisure is reduced to 1/4 and solving the model.

To see how the levels of welfare changed compared to the benchmark (when leisure was 3/4).

$W_C$  is reported in figure 1. Computed results after solving the DCGE model are reported in figure 2 and figure 3. Results in figures 2 and 3 represents numerical computed values for equations 1 and 2.

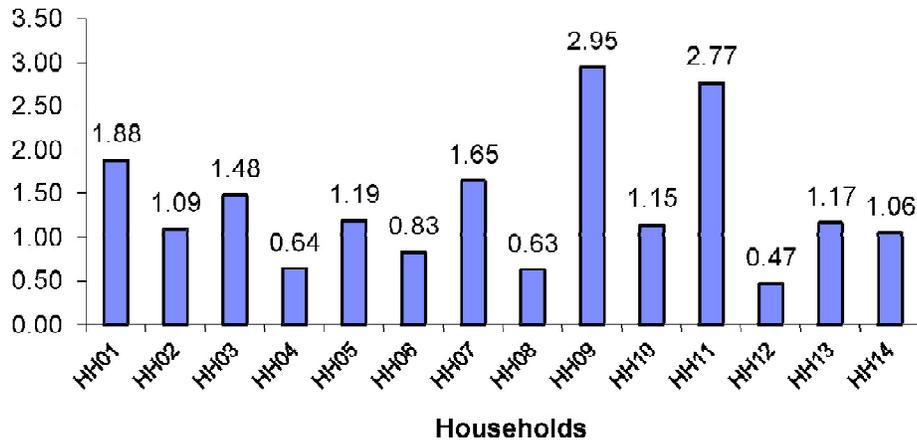


Figure 1: Leisure Reduced to 1/4 (Level of Welfare)

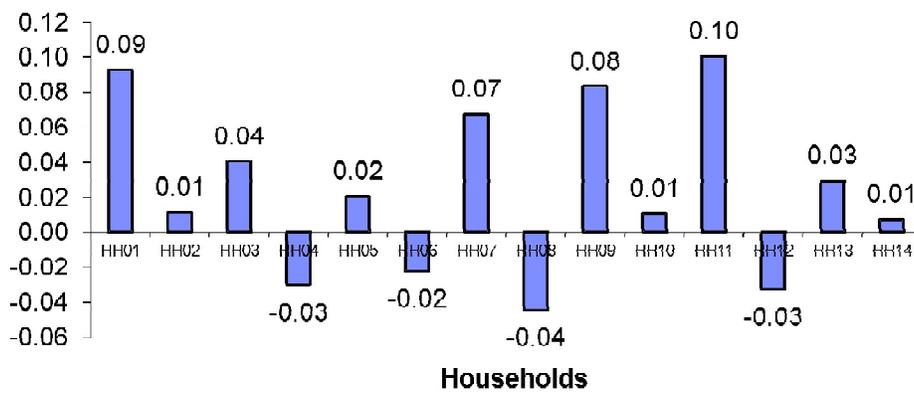


Figure 2: Leisure Reduced to 1/4 (Change in Level of Welfare)

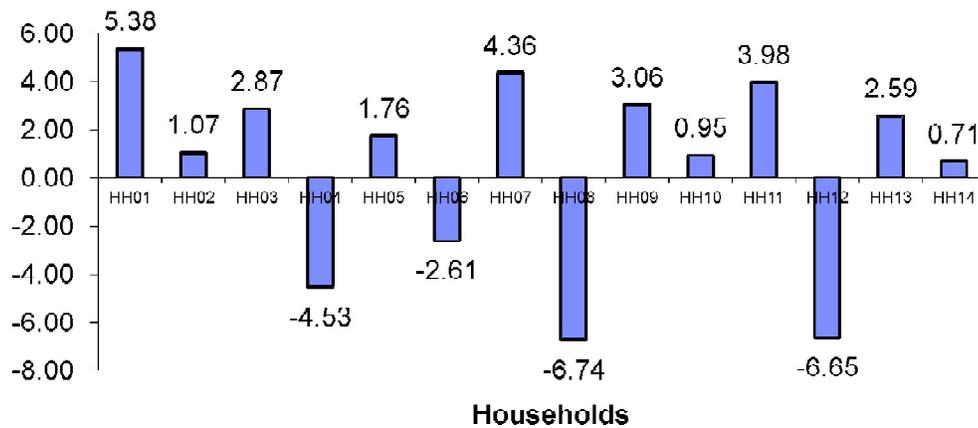


Figure 3: Leisure Reduced to 1/4 (Percentage Change in Level of Welfare)

Clearly households rural non agric head savannah (hh04), rural non agric head coast (hh06), urban unskilled head forest (hh08) and urban skilled head coast (hh12) are the worst affected in that they see a decrease in their welfare. These households are the high income households. What then has happened is reducing leisure has led to a sort of redistribution of income to lower income households. Secondly the data places a greater weight in leisure than in consumption in their utility function of the four households. These households have higher income effects and an implication of they being unproductive can be inferred. Rawal's versus Benthamite notions of utility is basically been encountered.

Similar effects are reported or seen when leisure is reduced to  $3/8$ ,  $1/2$  and  $5/8$  in the next three experiments (sections 3.2, 3.3 and 3.4). All other households see an increase in their welfare with rural farmer head savannah (HH01) seeing the highest of 5.38%.

### 3.2. Effects of Reducing Leisure to $3/8$ From $3/4$

The results got when the leisure parameter is decreased from  $3/4$  to  $3/8$  are reported below. Similarly the results for figure 4 were arrived at after reducing leisure to  $3/8$  and solving the DCGE model. This represents  $W_c$ .

Computed values of equations 1 and 2 are reported in figures 5 and 6 below. They indicate in this instance as well that households rural non agric head savannah (hh04), rural non agric head coast (hh06), urban unskilled head forest (hh08) and urban skilled head coast (hh12) are the worst affected in that they see a decrease in their welfare. All other households see an increase in their welfare with rural farmer head savannah (hh01) again seeing the highest of 3.82%.

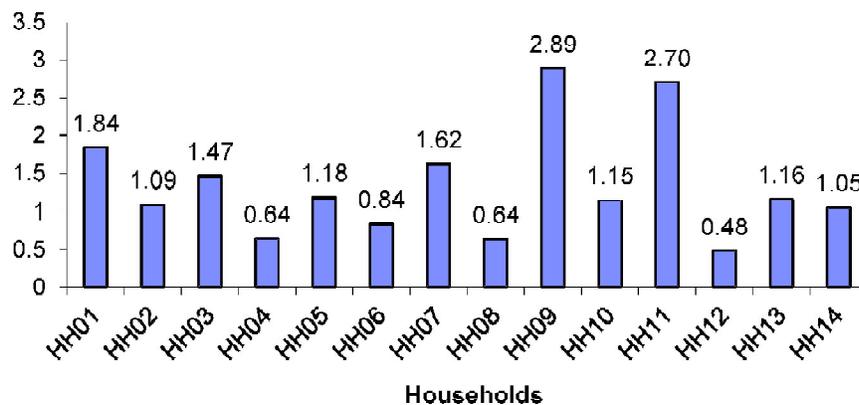


Figure 4: Leisure Reduced to  $3/8$  (Level of Welfare)

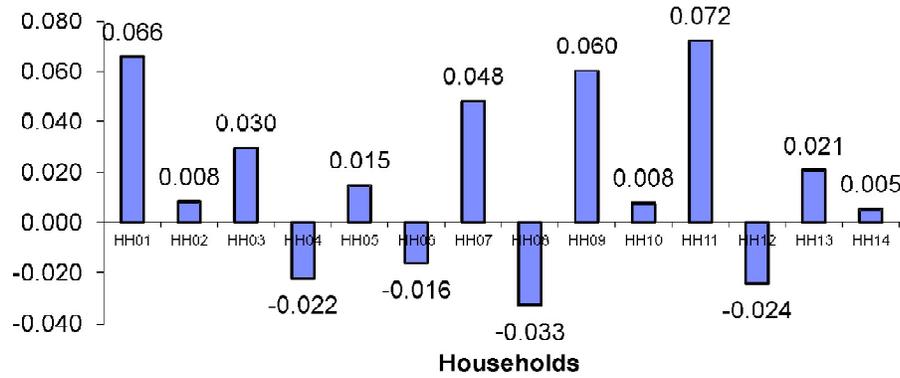


Figure 5: Leisure Reduced to 3/8 (Change to Level of Welfare)

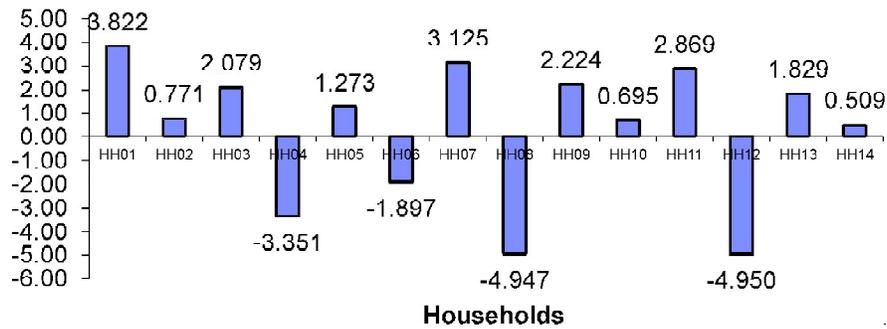


Figure 6: Leisure Reduced to 3/8 (Percentage Changes in Level of Welfare)

### 3.3. Effects of Reducing Leisure to 1/2 From 3/4

Reducing leisure to 1/2 from 3/4 produces figure 7 below. Figure 7 is arrived at after solving the model and represents  $W_c$ .

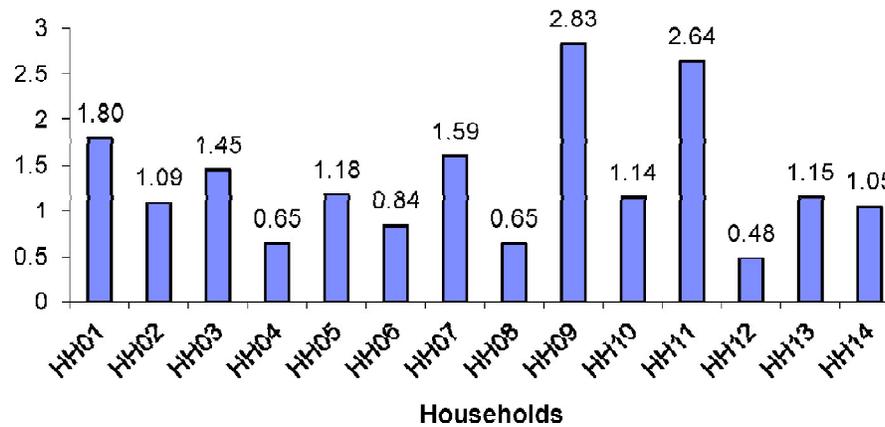


Figure 7: Leisure Reduced to 1/2 (Level Of Welfare)

Computed values of equations 1 and 2 are reported in figures 8 and 9 below.

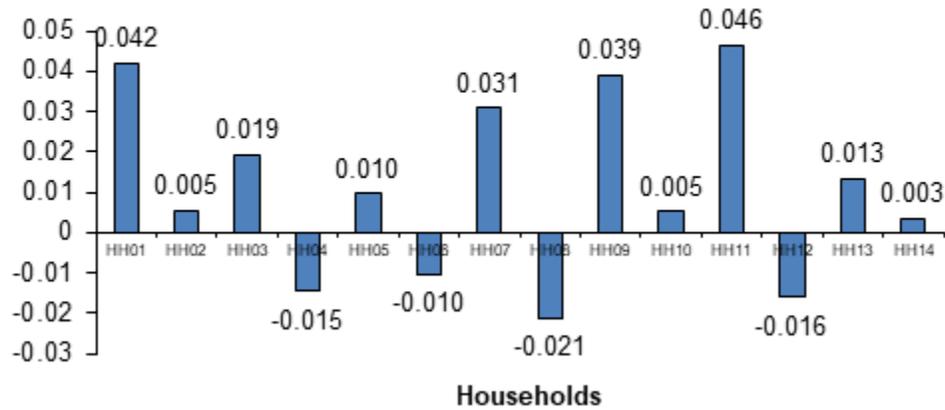


Figure 8: Leisure Reduced to 1/2 (Changes to Level of Welfare)

Similarly households rural non agric head savannah (hh04), rural non agric head coast (hh06), urban unskilled head forest (hh08) and urban skilled head coast (hh12) are the worst affected in that they see a decrease in their welfare. All other households see an increase in their welfare with rural farmer head savannah (hh01) again seeing the highest of 2.42%.

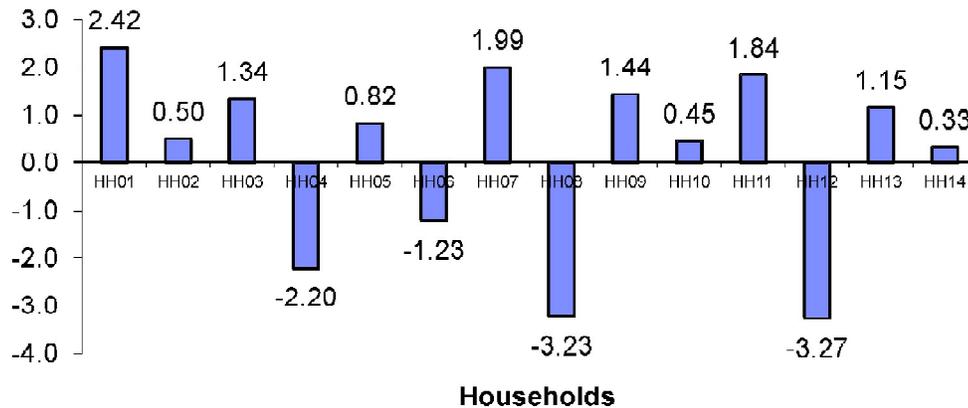


Figure 9: Leisure Reduced to 1/2 (Percentage Change in Level of Welfare)

### 3.4. Effects of Reducing Leisure to 5/8 from 3/4

$W_c$  upon performing this experiment is reported in figure 10. This shows the new welfare levels after reducing the leisure parameter in the DCGE model.

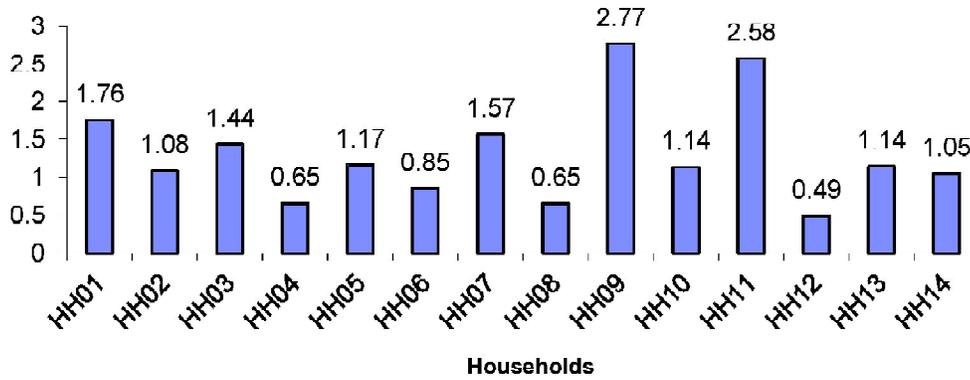


Figure 10: Leisure Reduced to 5/8 (Level of Welfare)

Reported values in figures 11 and 12 reflect the calculated values of equations 1 and 2.

The trend from the first three reductions shows here as well with households rural non agric head savannah (hh04), rural non agric head coast (hh06), urban unskilled head forest (hh08) and urban skilled head coast (hh12) are the worst affected in that they see a decrease in their welfare. All other households see an increase in their welfare with rural farmer head savannah (hh01) again seeing the highest of 1.15%.

#### 4. Results for Changes in Endowments

In this section is the performance of two experiments of increasing the endowments available to households. Wage levels for all households are increased by 25 percent

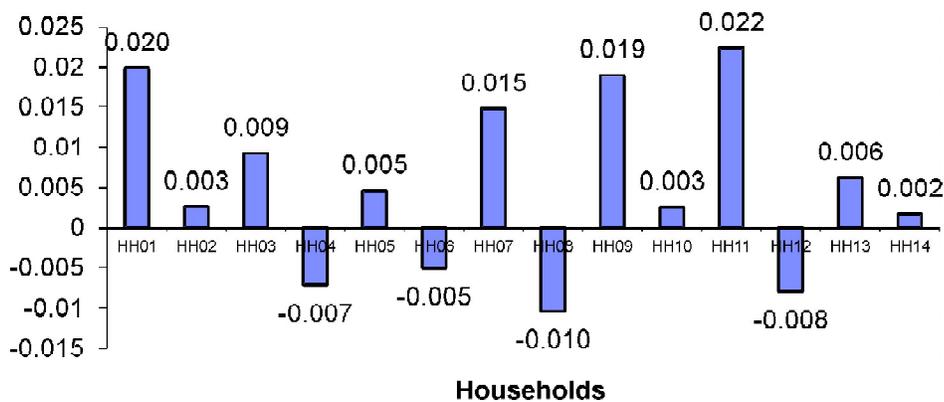


Figure 11: Leisure Reduced to 5/8 ( Change in Level of Welfare)

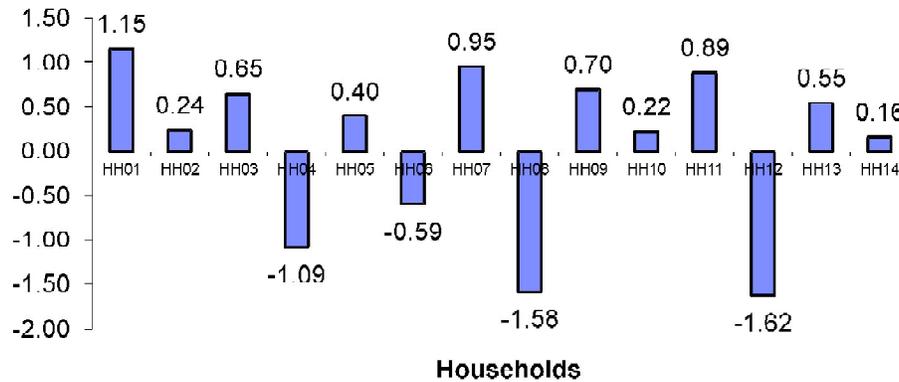


Figure 12: Leisure Reduced to 5/8 (Percentage Change in Level of Welfare)

and 50 percent. The numerical results got by performing those two experiments are reported below.

#### 4.1. Effects of A 25% Increase in Endowments

The first are the results for a 25 percent change in the wage levels for households. Figures 13 to 18 report the effects on welfare and output levels. Clearly the results are mixed for households. See figures 13 and 14. Only five households, rural farmer head forest (hh02), rural non agric head savannah (hh04), rural non agric head coast (hh06), urban unskilled head savannah (hh07), urban unskilled head forest (hh08) and urban skilled head coast (hh12) see an increase in welfare.

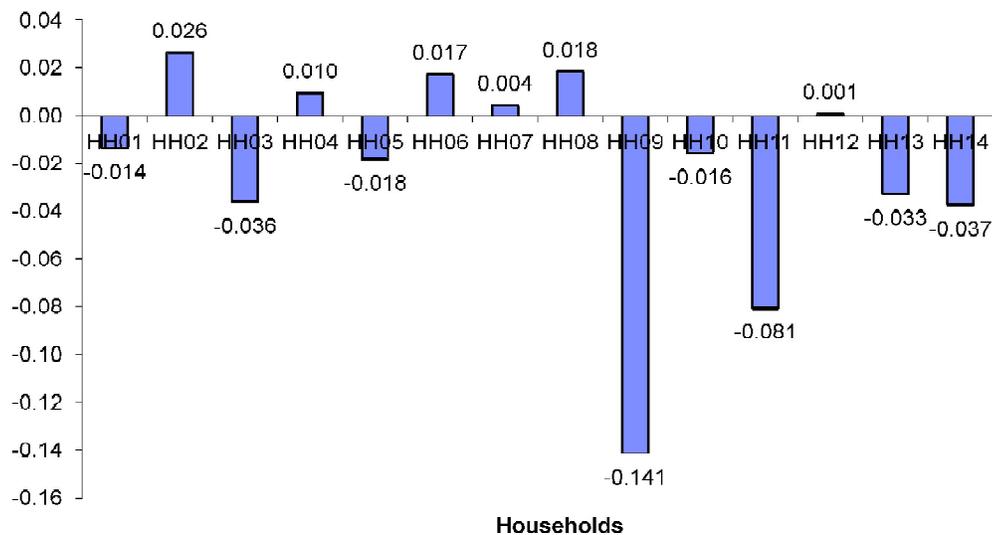
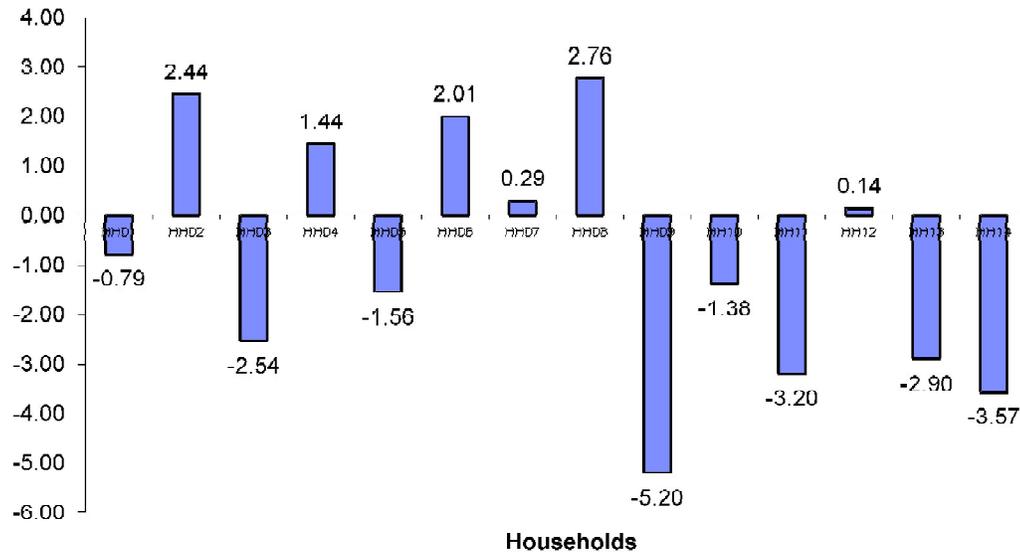


Figure 13 : Change in Level of Welfare after Increasing Endowments By 25%



**Figure 14: Percentage Change in Level of Welfare By Increasing Endowments By 25%**

All other households see their welfare falling with welfare of the household urban unskilled head coast (hh09) reducing by the highest of 5.2%.

However figures 15 to 18, proves otherwise in the sense that with a 25% increase in endowments all sectors see an increase in the output of all sectors. The highest is education and health sector. It increases by 19.25%. Considering only goods available for local consumption the sector with the highest increase is wholesale and retail sector. It increases by over 170%. In addition labour supply increases with the increase in endowments or incentive to work. However some households choose to save instead of consumption which can explain the decrease in welfare for some households. Or rather they spend now on luxurious goods from outside since imports have increased. This might explain the shooting up of the output of wholesale and retail sectors by 170% allowing for imports.

#### ***4.2. Effects of a 50% Increase in Endowments***

Next are the results for a 50 percent change in the wage levels for households. Figures 19 to 24 report the effects on welfare and output levels. Looking at figures 19 and 20, clearly the results are mixed for households. Only five households, rural farmer head forest (hh02), rural non agric head savannah (hh04), rural non agric

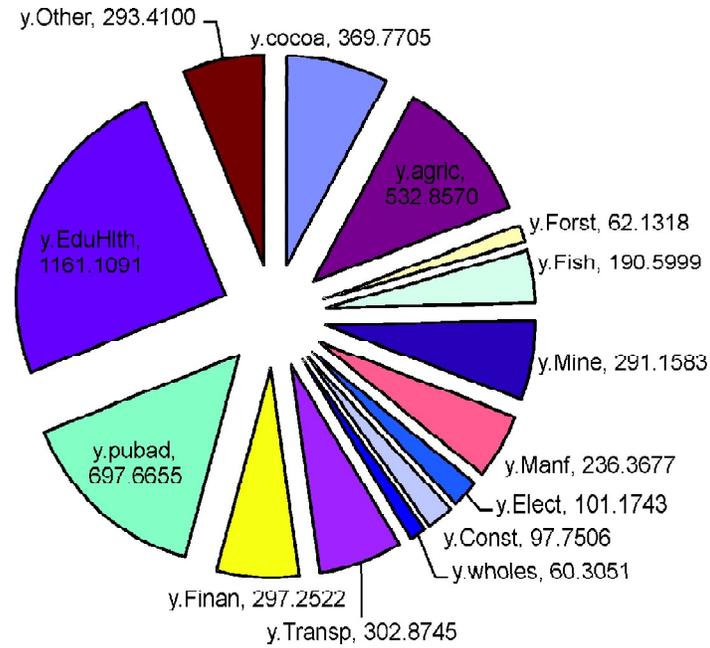


Figure 15: Changes in Output Over Time (Domestic Supply)

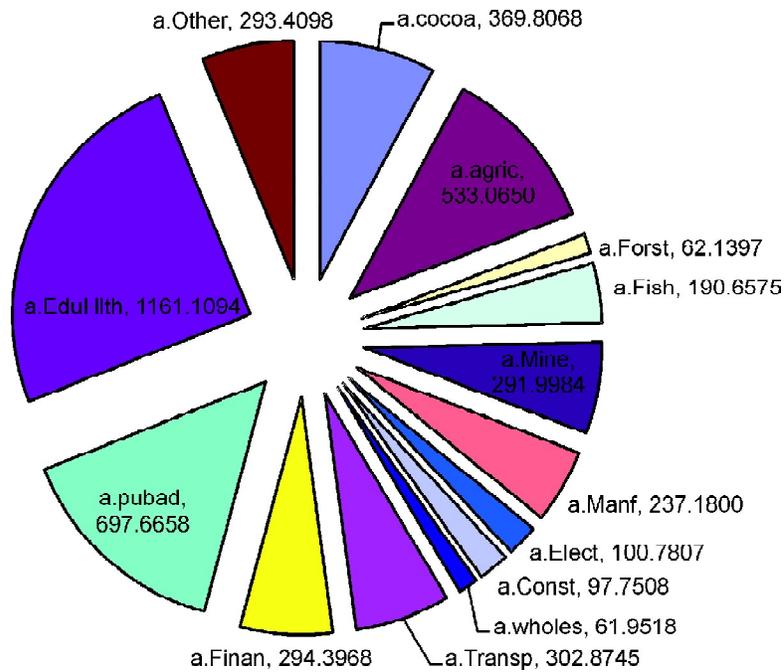


Figure 16: Change in Output Over Time (Armington Supply)

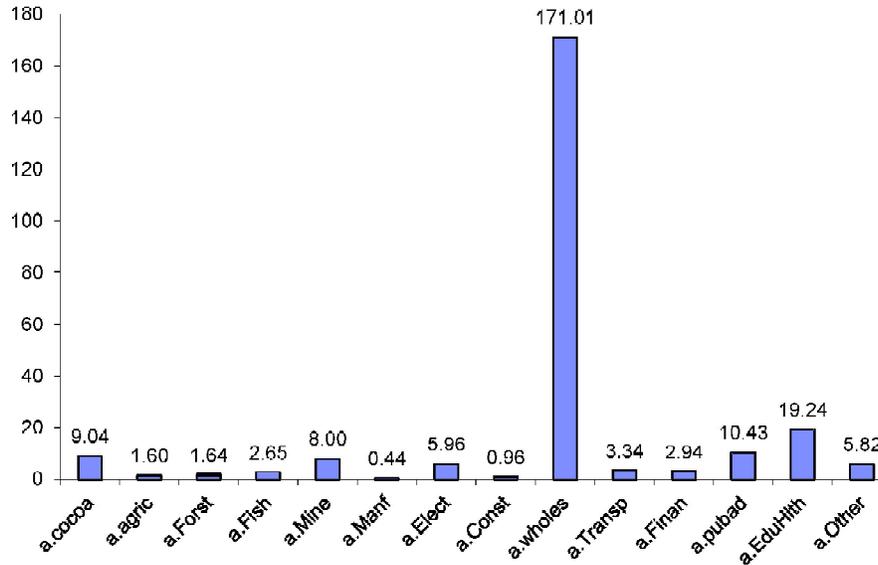


Figure 17: Percentage in Output Overtime (Domestic Supply)

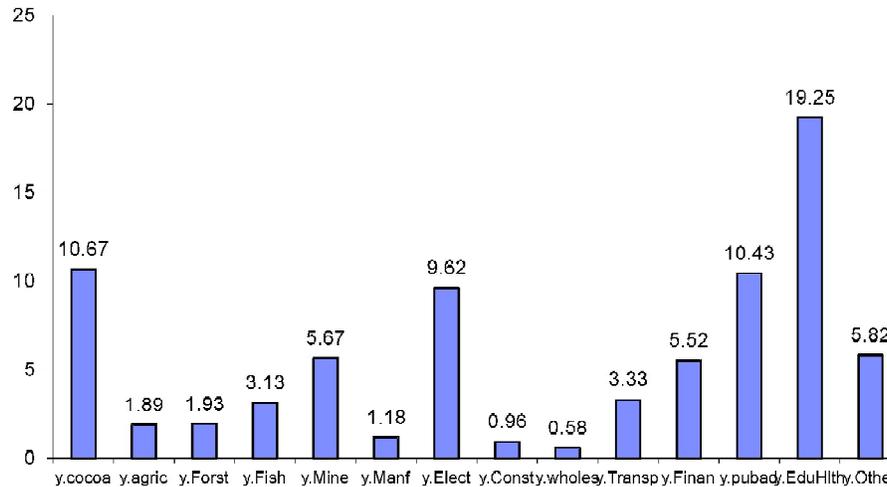


Figure 18: Percentage Change in Output Overtime (Armington Supply)

head coast (hh06), urban unskilled head savannah (hh07), urban unskilled head forest (hh08) and urban skilled head coast (hh12) see an increase in welfare.

All other households see their welfare falling with welfare of the household urban unskilled head coast (hh09) reducing by the highest of 9.6%.

However figures 21 to 24, gives a different result with a 50% increase in endowments all sectors see an increase in the output of all sectors. The highest is

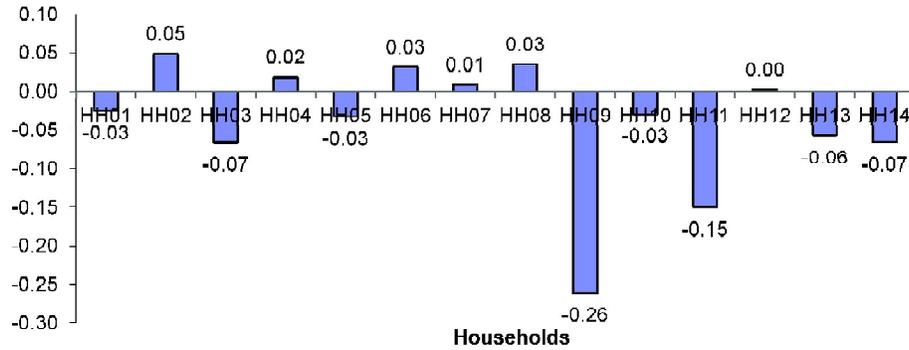


Figure 19: Change in Level of Welfare after Increasing Endowments By 50%

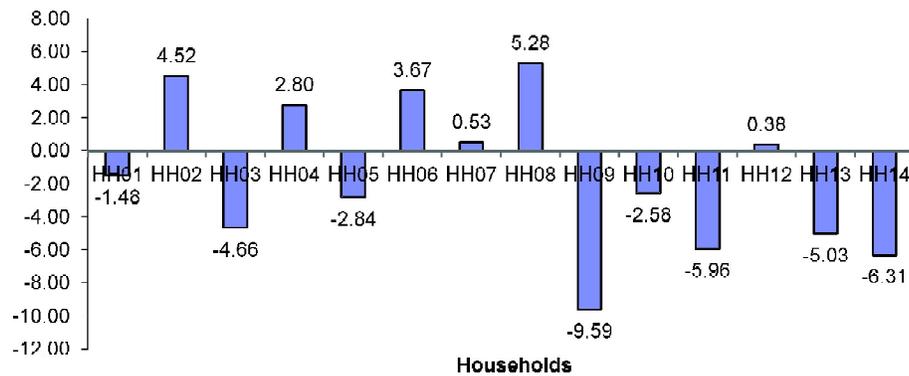


Figure 20: Percentage Change in Level of Welfare by Increasing Endowments By 50%

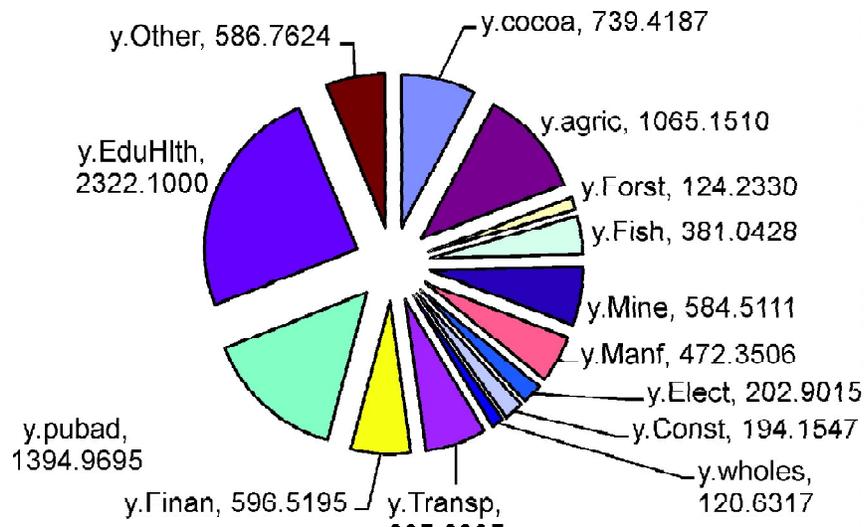


Figure 21: Changes in Output Over Time (Domestic Supply)

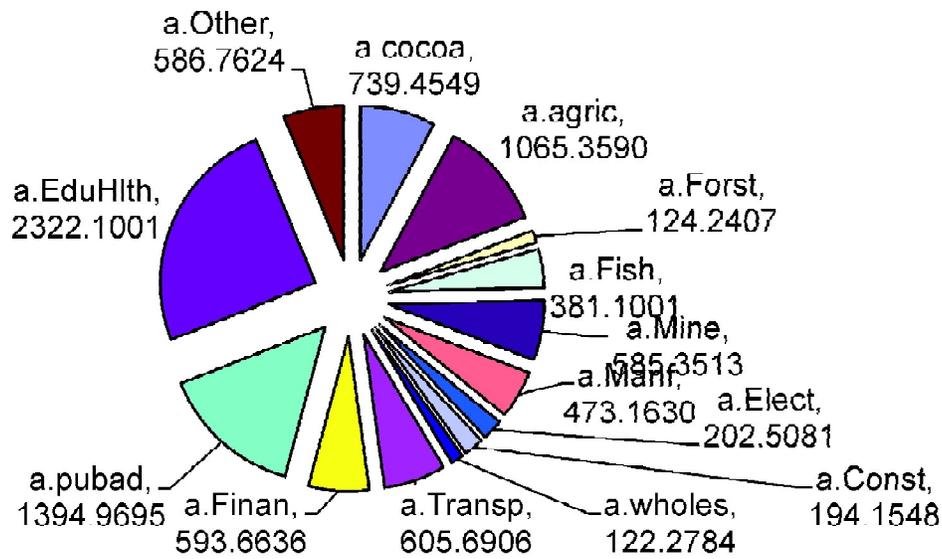


Figure 22: Changes in Output Over Time (Armington Supply)

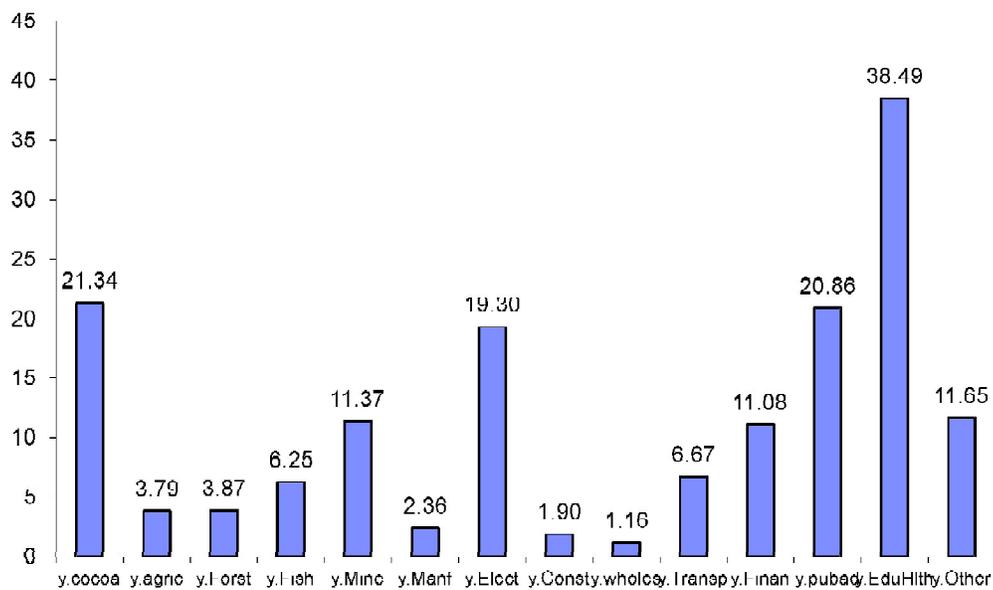


Figure 23: Changes in Output Over Time (Domestic Supply)

education and health sector. It increases by 38.5%. Allowing for exports and imports the sector with the highest increase is wholesale and retail sector. It increases by over 337%.

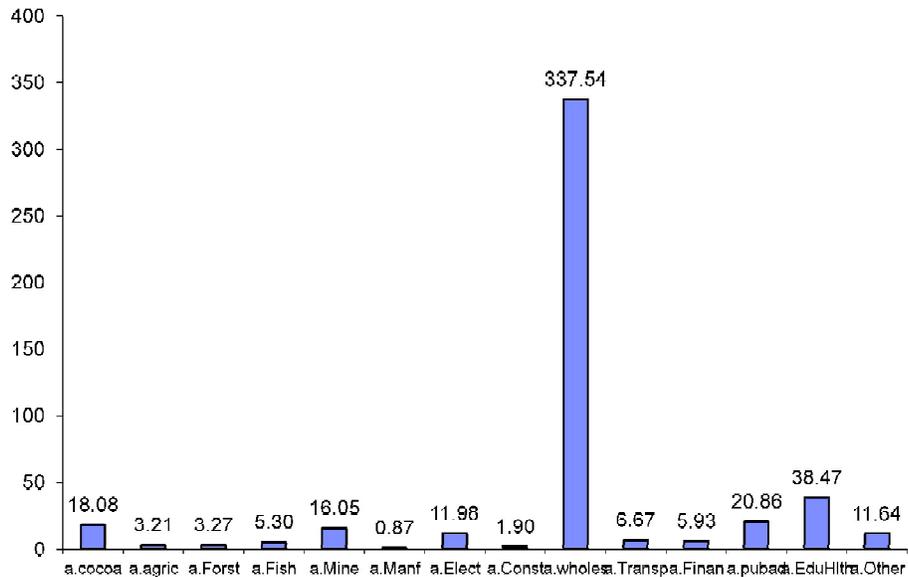


Figure 24: Percentage Changes in Output Overtime (Armington Supply)

## 5. CONCLUSIONS

How varying leisure and labour endowment affect welfare of the households and output of the sectors of the economy was analysed based on a 2012 Ghanaian social accounting matrix. The results from the experiments on leisure shows a trend where households Rural non agric head savannah (hh04), Rural non agric head coast (hh06), urban unskilled head forest (hh08) and urban skilled head coast (hh12) are the worst affected in that they see a decrease in their welfare. These are the richest households. On the other hand, all other households see an increase in their welfare with rural farmer head savannah (hh01) always seeing the highest each time. Clearly there are income and substitution effects. When leisure is reduced in an effort to increase productivity, these rich households see a decrease in their consumption levels and the relatively poorer households see an increase in their welfare. So the question then is how can policy makers make such rich households contribute more to national development given the results the model has returned? Policy makers have to decide whether to make such income distributional effects happen in real life as obviously there are increases in efficiency. However care should be taken so that people do not see it as politics or witch hunting.

Furthermore, when endowments changes. Only five households, rural farmer head forest (hh02), rural non agric head savannah (hh04), rural non agric head coast

(hh06), urban unskilled head savannah (hh07), urban unskilled head forest (hh08) and urban skilled head coast (hh12) see an increase in welfare. These are the 5 richest households. All sectoral output increases. Also some household save, spend more on health and education while others spend more money on imported goods.

The question then is given that decreasing leisure (increasing productivity) leads to a reduction in the income gap between the rich and poor households but increasing endowments leads to an increase in the income gap. How can policy makers promote policies that can make both the rich and poorer households happy and satisfied in the economy? Once again Rawls's versus Benthamite notions of utility can be a guidance.

Policies to promote scenarios discussed here can therefore help achieve the aim of the MDGs.

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