WILL CHILDREN BE ASKED TO WORK MORE AND LEARN LESS?
THE IMPACT OF AGRARIAN INCOMES ON EDUCATION IN TANZANIA

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By

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WILL CHILDREN BE ASKED TO WORK MORE AND LEARN LESS?
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ABSTRACT

Environmental conditions in Africa are favorable for a multitude of agricultural crops, making economic growth through the agriculture sector an attractive choice for African leaders. Policy makers are focusing efforts on agriculture in hopes of increasing household incomes and providing the means for other development goals, including education. Still, farming requires more labor hours than other means of income generation. If these poverty alleviation policies are providing incentives for families to keep children home from school, the short term benefits of increased income will be offset by the long term consequences of an uneducated generation.

Research exists showing the positive impact of education on human development and economic prosperity. Research also illustrates the negative impact of child labor on educational attainment. However, linking the effects of agrarian income on children’s labor hours and education has yet to be established. This analysis attempts to fill this gap.

Using a robust probit regression analysis this work analyzes the effects of labor-intense agrarian livelihood on child labor hours and school attendance in Tanzania. The study finds that income has an impact on school attendance, and an increase in household responsibilities decreases the probability that a child will attend school. The results of this study imply that economic policies focused on improving the productivity of agriculture must be coupled with education policies to offset the opportunity cost families face sending children to school.
The research and writing of this thesis is dedicated to everyone who helped along the way. This study would not have been possible without the endless support of my parents, the encouragement and assistance from my friends and family, including Michael Nilo, Jennifer Bires, Elizabeth Manney, Dave McGurl and Igor Kheyfets. I am especially grateful for the superb editing skills of Benjamin Recchie and Elizabeth Brown and for the gracious guidance from Drs. Donna Morrison and Jean Mitchell.

Many thanks,
Laura
INTRODUCTION

Many African nations have a comparative advantage in farming and other agricultural production due to favorable environmental conditions for a multitude of different crops. This potential means that leaders often focus policies and development efforts on promoting agricultural sector growth in hopes of increasing household incomes and providing the means to reach other development goals. However, the labor-intensive activity of farming requires more labor hours than other means of income generation. It is therefore possible that these policies will create an opportunity cost for families who will choose to set children to work rather than send them to school. While, these policies have the ultimate goal of poverty alleviation, if they provide incentives for families to keep children home from school, the short-term benefits of increased income may be offset by the long-term consequences of an uneducated generation. Thus, the question is if policies that make farming more lucrative, will families choose to have their children work more, in order to earn more income? Will children be asked to work more, and learn less?

Education is considered by many to be an important component of sustainable growth and a major contributor to both social and economic development. An educated population has a positive impact on multiple areas of society. Studies show that one additional year of education can raise the living wage of men and women by an average of 10%.1 The benefits of education are not limited to health and economics: educated citizens are more likely to be engaged in the

political process and less likely to resort to violence as a form of conflict resolution. In fact, every additional year of formal schooling for males reduces the risk of their becoming involved in conflict by 20%. Furthermore, one additional year of school has the same stabilizing effect as a 5% annual growth rate. The International Labor Organization found that the nations of Sub-Saharan Africa, including the focus region for this research, would receive the greatest net gains by expanding education for their people.

Due to the importance of education, countries as disparate as the United States, and Kenya, Tanzania’s neighbor, spend on average over 5% of their GDP on education. Regardless of its proven significance for development and growth, however, Tanzania still only spends 2.2% of its GDP on education. As a result, less than 70% of the population is literate and only 62% of Tanzanian women are able to read and write in Kiswahili, English or Arabic.

In Africa, child labor usually consists of unpaid work in family agriculture enterprises. Political philosopher John Stuart Mills wrote:

"It is right that children should be protected from being overworked. Laboring for too many hours in a day, or on work beyond their strength, should not be permitted to them, for if permitted it may always be compelled. Freedom of contract, in the case of children, is but another word for freedom of coercion. Education also, the best which

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circumstances admit of their receiving, is not a thing which parents or relatives should have it in their power to withhold.”

Labor-intensive activities require more workers and more work hours than other activities. Even with advanced technology, farming remains labor intensive; however, without advanced technology, farming requires more people to complete the same farming tasks. In countries such as Tanzania, farming can easily employ entire households in daily activities. Furthermore, because adults often dedicate so much time to farming, the younger members of the family must take care of household chores and perform the less physically grueling tasks, such as fetching water, collecting firewood, and caring for younger children and smaller livestock.

National leaders often gear policies towards specific sectors in an attempt to promote economic growth, hoping that increased household income will provide the means for other development goals, such as encouraging education. However, if these poverty-alleviation policies are providing incentives for families to keep children home from school, the short-term benefits of increased productivity will be offset by the long-term consequences of an uneducated generation.

The International Labor Office found that eliminating child labor is a high-yield global investment, but many families find the additional manpower invaluable in their daily work. For short-term poverty-alleviation and long-term sustainable economic growth, policy makers need a better understanding of the relationship between the two sectors. This research will attempt to

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8 Mill, J.S., *Principles of political economy with some of their applications to social philosophy*. 1848, Boston,: C.C. Little & J.Brown. 2 v. (pg. 952)
address that gap and provide a way to determine target areas for economic policies that will address both short- and long-term development in African communities.

Through a multivariate probit regression analysis, I study the effects of income from labor-intense agricultural activities on education in the Kagera region of Tanzania. Specifically, I regress agrarian household income on child school attendance. My primary research question examines whether an increase in household income from labor-intense economic activities such as farming encourages child labor at the expense of school attendance and educational attainment. My principal hypothesis is therefore that an increase in agrarian income creates an opportunity cost for families that promotes child labor in the short term and reduces educational attainment in the long term.
BACKGROUND

Tanzania
Tanzania is a particularly interesting case study for development policy research. Situated on the east central coast of Africa, Tanzania borders several eastern, central and southern African countries including: the Democratic Republic of Congo, Rwanda, Burundi, Uganda, Malawi, Kenya, Zambia, and Mozambique. These countries share similar geographic, demographic and economic characteristics. They are also all high priorities for development in the international community.

The country’s average gross domestic product (GDP) has retained a steady average rate of growth of about 6% over the past seven years, and since 1985 the agricultural component of the country’s GDP has grown steadily at 3.3% per year.\(^\text{10}\) Still, the impact has not been enough to affect the lives of average Tanzanians. In 2006, 36% of the population lived below the poverty line, and today Tanzania remains in the bottom 10% of the world's economies in terms of per capita income. The United Nations Development Program (UNDP) gave Tanzania a score of 0.530 on the Human Development Index ranking it 151 out of 182 countries with data.\(^\text{11}\) Although the economy of Tanzania has remained fairly stable, the efforts made to improve education, develop infrastructure and expand social services have failed to provide dramatic results. An analysis of the development conditions in Tanzania could explain the lack of results. The Tanzanian government, in cooperation with international organizations like the World Bank and UNDP, is targeting efforts on the agricultural sector in an effort to promote economic growth


that benefits the Tanzanian people. This focused effort is not surprising since Tanzania relies heavily on its agricultural sector, which currently accounts for more than 40% of national GDP, provides 85% of exports, and employs 80% of the work force.\(^{12}\) Even Tanzania’s second most important sector- industry- is primarily agricultural processing.\(^{13}\) In a concerted effort to improve the agriculture market, the Tanzanian government issued the following priority actions in 2006:

1.) The pursuit of macroeconomic policies that encourage investment by small holders and large commercial farmers
2.) Proactive support to private operators, farmer’s organizations, non government organizations (NGOs) and central bank organizations (CBOs), supplying inputs and credit to farmers.
3.) Concentration of budgetary allocations in agriculture research and extension
4.) Provision of special support to investments in agricultural processing\(^{14}\)

To achieve these goals, Tanzania created an Agricultural Sector Development Program (ASDP) which published its strategy in 2006. The ASDP planned to spend a total of 2.5 trillion shillings ($1.85 billion) over the following seven years. After two years of the ASDP, Tanzania reports significant improvements in its agricultural sector. From 2006 to 2007, Tanzania provided technical support to Regional Secretariats (RS) and Local Government Authorities (LGAs) on District Agricultural Development Plans (DADPs). The ASDP strengthened sector coordination, monitoring and evaluation, as well as the Zonal Agricultural Research, Extension and Training institutes. They developed irrigation, marketing and livestock infrastructure; coordinated policy reforms and improved public-private sector partnerships. In order to create an environment that encouraged the development of sustainable member-based cooperatives, the ASDP revised


\(^{13}\) *Country Factbook: Tanzania.* CIA. Web. 15 Dec. 2009.

current agricultural legislation and created new policies.\textsuperscript{15} The ultimate goal of these reforms is to strengthen the national economy by increasing the income of the average Tanzanian agrarian household.

The coordinated efforts of the Tanzanian government and international donors to improve the productivity of the agriculture sector make the potential impacts especially interesting to policymakers and development practitioners, alike. The effect of increasing agrarian income on social development could have implications for other policy goals, including the generation of sustainable long term economic growth and the development of future human capital.

\textit{Kagera Region}

This study focuses on the Kagera region of Tanzania. Located in the northwest corner of the country, Kagera borders several foreign states, and boasts economic, geographic, and demographic similarities to many countries that are also of interest to development practitioners and regional policymakers.\textsuperscript{16}

As in the rest of the country, agriculture dominates Kagera’s economy. Almost 90\% of the regional population is involved in the production of food and cash crops and more than 50\% of the region's GDP is derived from farming\textsuperscript{17}. The graph indicates the breakdown of the agricultural households as reported in the most recent regional report by the government of the


\textsuperscript{16} \url{http://www.inadev.org/images/maplarge_tanzania.gif}


Table 1: Agriculture Households by Type - Kagera

Kagera’s dependence on agriculture makes research on family decisions in agrarian households very policy relevant. Specifically, a more thorough understanding of the effects of national and international efforts on agriculture and family decision making in the region can help development professionals working throughout the Eastern and central regions of Africa.

LITERATURE REVIEW

A significant body of research literature demonstrates both the positive impact of education on human development and economic prosperity and the negative impact of child labor on educational attainment. Detailed below are several researchers that have analyzed the various aspects addressed in this research, including poverty alleviation, economic development, child labor, and education. Linking the effects of agrarian income on children’s labor hours and thus education has yet to be established. This research attempts to close this gap in order to draw conclusions about the relationship between agricultural income and educational attainment; this enables policymakers to create policies that have positive effects in short- and long-term development and growth. Following is a brief introduction to the literature regarding the multiple elements of the dynamic relationship analyzed in this study: poverty reduction, education, child labor, opportunity costs and labor markets.

Poverty Reduction
Research on poverty reduction suggests that the most effective way to alleviate poverty is to increase the access of the poor to productive assets. However, while land and capital are fundamental for economic growth, they are not sufficient for substantial and sustainable economic growth. To experience real long-term economic benefits, a country must also develop human capital.\(^{20}\) R.E. Lucas (1998) states that human capital, or education, can increase the economy’s capacity to innovate, which promotes growth through new inventions and advancements in technology.\(^{21}\) In addition, N.G. Mankiw, D. Romer, and D. Weil (1992) illustrate the manner in which education increases human capital already present in the labor force.

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force. This in turn increases labor productivity, thereby creating a higher equilibrium level of output. R.R. Nelson and E. Phelps (1966) empirically illustrate the positive impact that knowledge transfer has on economic growth, and show that education facilitates that transfer of knowledge necessary to operate technologies invented by others.

Finally, Joseph Bredie (1998) analyzes the impact of educational attainment on economic growth using a cross-section of industrialized and newly industrialized nations to find patterns in education. Bredie found a minimum level of education is necessary for a country to experience economic growth. However, he also expressed concern about the trend of stagnation and decrease of education in developing nations, which he attributes to the high costs and uncertain benefits of schooling in these countries. Bredie alludes to an idea that families involved in labor intensive activities face an opportunity cost by sending their children to school, but unfortunately does not move beyond speculation in his theory. Instead, he leaves the issue an open question, prescribing more in-depth study and stating that “to help reverse this stagnation, we need to understand better what is happening.”

Education
Studies by Bredie, Lucas, Nelson, etc that focus on the impact of education and poverty alleviation conclude that developing human capital is necessary for economic growth and human development. Research targeted to conflict areas show that additional benefits of education also

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include political and economic stability. In fact, one year of education can raise the living wage of men and women by an average of 10% in what Save the Children has labeled conflict affected fragile states (CAFS). Moreover, J. Wedge (2008) finds that every additional year of formal schooling, for males particularly, reduces the risk of their becoming involved in conflict in these CAFS.

Traditionally, studies analyzing the impact of education look at indicators such as economic status and region to show economic growth. Lant Pritchett (2004) uses asset possession as a proxy for long-term wealth to find regional patterns in educational attainment. In particular, he found generally smooth patterns of attainment across the transition from primary to secondary levels of school. Rarely in his study did countries boast high dropout rates during this transition; an exception to this, however, is Tanzania. While Tanzania is economically similar to its neighbors and many of the other countries in Pritchett’s study, something has interrupted children’s education for this particular country. Pritchett did not identify what caused this interruption, but the age at which this interruption occurs is also around the age that a child traditionally becomes able to undertake more physically intensive tasks, such as those involved in agricultural production. Understanding this irregularity could help provide a clearer understanding of family decision-making in agrarian households of developing countries with agriculture-based economies.

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**Child Labor and Opportunity Costs**

Perceived or real opportunity costs can encourage families to keep children home from school to participate in economic activities. John Cockburn (2000) found that household assets and other household production variables play an important role in how families decide to use their time.\(^{29}\) His research also discovered a clear relationship between child labor and school participation with respect to physical assets. Specifically, Cockburn found that families that own labor-increasing physical assets are more likely to keep their children home from school to work.\(^{30}\)

There is additional work illustrating the detrimental impact of child labor on educational attainment. Harry Patrinos and George Psacharopoulos (1995) used school attainment to measure the effect of child labor and found a negative correlation between the two.\(^{31}\) Other researchers used test scores to measure the effect of child labor. For example, C. Heady (2003) found a negative relationship between child labor and objective measures of reading and mathematics ability in Ghana.\(^{32}\) Likewise, C. Cavilieri (2002) used propensity score matching to conclude that child labor is associated with a 10% reduction in the probability of advancement to the next grade level.\(^{33}\)


By decreasing educational attainment, child labor impedes the positive impacts of education and thus could potentially hurt the long term economic growth of a nation.\textsuperscript{34} One particular study by the International Labor Organization found that eliminating child labor is a high yielding global investment and that sub-Saharan Africa would receive the greatest net gains by expanding education attainment.\textsuperscript{35}

\textit{Child Labor and Labor Markets}

There is some research analyzing the precise link between child labor and labor market outcomes; however, this body of work is much less extensive than the fields mentioned regarding education and economic growth. Kathleen Beegle, et. al (2008) researched the impact of child labor on education and labor market outcomes. They used the occurrence of crop and rainfall shocks as instrument variables for child labor and found that child labor negatively and significantly impacted the probability of completing primary levels.\textsuperscript{36} Another study by Beegle, et al. (2005) found that child labor is associated with a negative impact on school participation and educational attainment, but also substantially higher immediate earnings for those who worked as children. However, in the long-term, the forgone earnings attributed to lost schooling exceed any earnings gain associated with child labor.\textsuperscript{37} The long-term consequences of child labor therefore outweigh the short-term benefits.


There is a considerable gap, however, in the literature attempting to explain the relationship between agriculture economies and child labor, and thus educational attainment. Tyler Ahn (2004) used a multivariate regression to analyze the impact of household-owned technologies on educational attainment and child labor hours. His study found that time-saving technologies allowed more time for children to go to school. My research builds upon Ahn’s work. I will analyze the impact of agrarian income, using household income of agrarian-employed homes, on school attendance to show household decisions regarding education.

METHODOLOGY

Data Description
My research uses the Kagera Health and Development Survey dataset (KHDS) to analyze the impact of agrarian income on education. The KHDS is a longitudinal household survey provided by the World Bank in conjunction with the Living Standard Measurement Survey series. The dataset was created for use in “Measuring the Economic Impact of Fatal Adult Illness in Sub-Saharan Africa: An Annotated Household Questionnaire” a study by Mead, Over, et al. (1992).

The KHDS samples the Kagera region located in the northwest region of Tanzania. To conduct the survey, the World Bank and partners through the University of Dar es Salaam interviewed over 800 households from nearly 50 communities in all five districts of Kagera. Households, community leaders, health facilities, schools, and market vendors were interviewed in 6-7 month intervals for up to four survey periods from 1991 to 1994. The researchers returned in 2004 to re-interview subjects and were able to contact most of the previous households. In the 2004, 832 households were re-interviewed and 2,774 new households were added to the 2nd round survey. I will be using the most current round of interviews for my research.

The KHDS was able to capture a majority of child labor age groups, making it especially relevant to this study. Key variables of interest for this study include those variables describing children’s activities, agrarian household income, and household characteristics that would explain a child’s attendance or absences at school. While the dataset was originally selected to analyze household welfare in relation to HIV/AIDS mortality, I will be using the data to analyze a different factor of household welfare. This ensures that the sample is unbiased for my particular purpose.
Model
This research uses the KDHS dataset to analyze the impact of agrarian household income on school attendance of school age children. The dependent variable is a binary variable that expresses whether the school age child is currently attending school. The question of school attendance was asked of everyone aged 6 and up, however, to be accurate for my model, only responses from school aged children (ages 6-18) are used.

The primary independent variable measures the amount of income derived from agrarian activities for each household. Agrarian activities include crop sales, livestock sales, and the sale of products made from crops or livestock. This aggregate also includes any income earned through shambas or gardens. These activities are high-intensity, demanding large amounts of labor. Dummy variables denoting the proportion of income derived from agriculture activities in relation to total income received in a year are included in the model as well. This analysis is specifically looking to find a relationship between school attendance and the amount of agrarian income a home earns.

Independent variables are included in the model to capture the influence of family characteristics and economic activities on decisions regarding children’s schooling. Included in this model are the age and sex of the child. As parents with an education often value their own family’s education more than parents without any education, a variable measuring the percent of adults within a household with education is included in the model. The number of adults in a household is included in the descriptive statistics, because it is hypothesized that the more adults in a household the less necessary a child's labor will be on daily activities. It is not included it in the regression, however, due to collinearity issues. Furthermore, the model contains explanatory
variables regarding the number of children in each household because more children in a family could lead to an increase in household work for families to undertake (more firewood to be fetched, more child care needed, etc.). This variable could also have a reverse effect, however, because there could also be more people to share the burden of work. A dummy variable is used to denote whether or not the child spent time working in the family shamba field or garden. Another variable measures how much time the child helped collect firewood or water for the household in a week. These variables are included because research has shown that to free up adults to work in labor-intensive activities like farming, school-age children are most often expected to fulfill the household tasks of childcare, garden work, and firewood and water collection. In addition, a number of households in Kagera that attempt to sell agricultural goods for profit are unsuccessful. Therefore, the model contains a variable to illustrate the success rate of crop and livestock sales in relation to total attempts.

OLS regression assumes that both y and x_i are standard normal and related linearly. Because the dependent variable in this analysis is binary, the more appropriate assumption is that the effect of a given change in x_i on the probability that a child will attend school changes as values of x_i change. For these reasons, this model is estimated as a probit. Robust standard errors are estimated to correct for heteroskedasticity stemming from the presence of multiple children from the same households within the sample. Table 2 outlines the variables of interest and the purpose of including them in this model.
Table 2: Variables of Interest and Purpose for Inclusion

<table>
<thead>
<tr>
<th>Variable</th>
<th>Measures</th>
<th>Reason for Inclusion</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>School Attendance</td>
<td>1=school aged child is attending school currently</td>
<td>Dependent Variable</td>
<td>School aged Child= observations ages 6-18</td>
</tr>
<tr>
<td></td>
<td>0=school aged child is not attending school currently</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Agrarian Income</td>
<td>Income earned from agricultural activities, including crop sales,</td>
<td>Main Independent Variable</td>
<td>Measured in Tanzanian Shillings (TSh). Logged</td>
</tr>
<tr>
<td></td>
<td>crop product sales, livestock sale, livestock product sale, farm</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>equipment rental, products from gardens and shambas</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sex</td>
<td>1=male</td>
<td>Measures Gender Effect</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0=female</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>Age; 6-18</td>
<td>Allows me to analyze specific subset of ages</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(6-18)</td>
<td>(6-18)</td>
<td></td>
</tr>
<tr>
<td>Percentage of Educated</td>
<td>Percentage of adults in household that have any education</td>
<td>Explanatory Variable for Value Household</td>
<td>Adult= observations older than 18 regardless of relation to children</td>
</tr>
<tr>
<td>adults</td>
<td></td>
<td>places on Education</td>
<td></td>
</tr>
<tr>
<td>Childinhh</td>
<td>Number of children within household</td>
<td>Explanatory Variable for Household Decisions</td>
<td>Child= observations younger than 19 years old</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Regarding Labor</td>
<td></td>
</tr>
<tr>
<td>Firewoodwaterhours</td>
<td>Number of hours observation spends collecting firewood and/or water for</td>
<td>Explanatory Variable for Measuring Alternative</td>
<td>In past week</td>
</tr>
<tr>
<td></td>
<td>household</td>
<td>Activities</td>
<td></td>
</tr>
<tr>
<td>Gardenfield</td>
<td>1=1 observation worked in a field or garden for household</td>
<td>Explanatory Variable for Measuring Alternative</td>
<td>In past week</td>
</tr>
<tr>
<td></td>
<td>0=observation did not work in a field or garden for the household</td>
<td>Activities</td>
<td></td>
</tr>
<tr>
<td>Variable</td>
<td>Measures</td>
<td>Reason for Inclusion</td>
<td>Notes</td>
</tr>
<tr>
<td>------------</td>
<td>-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>------------------------------------------------</td>
<td>-------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Successrate</td>
<td>The rate of successful transactions a household had in selling crops at the market</td>
<td>Explanatory Variable for Measuring Profit Earning Success for Activities</td>
<td>Rate= amount of successful sales/total amount of sales attempts in 12 months</td>
</tr>
<tr>
<td>Cataginc</td>
<td>Proportion of income derived from Agriculture 1= if 25% or less of income is from agriculture 2= if 25%-50% of income is from agriculture 3= if 50%-75% of income is from agriculture 4= if 75%-99% of income is from agriculture 5= if 100% of income is from agriculture</td>
<td>Explanatory variable for measuring difference among farming incomes</td>
<td></td>
</tr>
</tbody>
</table>

A reduced form model is used to create a baseline for the research. The reduced-form simply includes household characteristics and is specified below.

\[
P(schoolattendance=1/x) = \beta_0 + sex_2 + age_3 + percentofadultseduc_4 + childreninhh_5 + \mu
\]

The full model includes household characteristics, education characteristics and economic activities. It is specified as follows,

\[
P(schoolattendance=1/x) = \beta_0 + lnagrarianincome_1 + sex_2 + age_3 + percentofadultseduc_4 + childreninhh_5 + firewoodwaterhours_6 + gardenfield_7 + successrate_8 + incomeproportion_9 + \mu
\]
RESULTS

Raw Data

The summary statistics of the data used in this research are displayed in Table 3. The table depicts means, and standard deviations of the variables included in the model.

Table 3: Summary Statistics

<table>
<thead>
<tr>
<th>Variable</th>
<th>Number</th>
<th>Mean (Standard Deviation)</th>
</tr>
</thead>
<tbody>
<tr>
<td>School2</td>
<td>2261</td>
<td>.82 (.398)</td>
</tr>
<tr>
<td>Agrarian Income</td>
<td>2211</td>
<td>10.51 (3.6)</td>
</tr>
<tr>
<td>Gender</td>
<td>2261</td>
<td>.499 (.5)</td>
</tr>
<tr>
<td>Adult In Household</td>
<td>2261</td>
<td>2.77 (1.4)</td>
</tr>
<tr>
<td>Children in Household</td>
<td>2261</td>
<td>1.06 (1.05)</td>
</tr>
<tr>
<td>Percentage of Educated Adults in Household</td>
<td>2256</td>
<td>.82 (.31)</td>
</tr>
<tr>
<td>Firewood Hours</td>
<td>2195</td>
<td>5 (7.6)</td>
</tr>
<tr>
<td>Garden or Field Work</td>
<td>2207</td>
<td>.507 (.64)</td>
</tr>
<tr>
<td>Success Rate of Agriculture Sales</td>
<td>2207</td>
<td>.207 (.14)</td>
</tr>
</tbody>
</table>

Table 3 shows sample statistics for children who are and are not currently attending school. Research has claimed that the gender and age of the child have a substantial impact on family decisions regarding schooling, with girls receiving less school, and children dropping out as they grow older. This summary data implies that the former is not the case in Kagera. The ratio of
boys to girls in both sub groups appears to be fairly equal. Still, the average age of children not in school is slightly higher than the average age of children in school. This supports the common belief that children do not continue with education as they grow older.

Table 4: School Attendance

<table>
<thead>
<tr>
<th>Variable</th>
<th>Not in school</th>
<th>In school</th>
</tr>
</thead>
<tbody>
<tr>
<td>Child Characteristics</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>15</td>
<td>11</td>
</tr>
<tr>
<td>Sex</td>
<td>.45</td>
<td>.51</td>
</tr>
<tr>
<td>Household Characteristics</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of Kids</td>
<td>.85</td>
<td>1.11</td>
</tr>
<tr>
<td>Number of Adults</td>
<td>3</td>
<td>2.71</td>
</tr>
<tr>
<td>Percentage of Educated</td>
<td>.85</td>
<td>.82</td>
</tr>
<tr>
<td>Economic Characteristics</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Garden</td>
<td>.71</td>
<td>.46</td>
</tr>
<tr>
<td>Firewood Hours</td>
<td>6</td>
<td>4.74</td>
</tr>
<tr>
<td>Success rate</td>
<td>.211</td>
<td>.20</td>
</tr>
</tbody>
</table>

The subgroups show little variation among household characteristics that often influence families’ decisions regarding family activities. The number of kids and number of adults in households are similar in both groups. The percentage of adults in a household with education is fairly equal, as well. The apparent equality in these characteristics could imply that other factors are influencing family decisions outside of the structure of the household.
The sample statistics for the economic characteristics of the household livelihood however provide support for the assumptions used in creating the model for this hypothesis. While the averages describe small variations among the families of children attending and not attending school, the direction of the variation is interesting. Children who do not attend school, on average, work more hours in gardens, shamba fields, and collecting firewood and fetching water than children that do attend school. Tables 5 and 6 illustrate the ages at which children take on these household responsibilities.
As children grow older they take on more responsibilities around the home. Previous research has claimed children are often expected to help out with daily household chores such as collecting firewood for fuel and fetching water. Most children from the ages of seven and up spend time collecting firewood and/or fetching water. And as children grow older they tend to spend more time in family gardens and shambas with the largest proportion of work being done by children in the 11-15 age range. This is particularly interesting, because this is also the age children are able to participate in more physically demanding tasks. These statistics support the hypothesis that they are dropping out of school to work for the household. Furthermore, the age at which these children are assuming the household duties corresponds with the conclusions of previous researchers regarding uneven transition patterns from primary to secondary school levels. However, the analysis will test whether or not the extra responsibilities are having an impact on their education.
Findings

Multiple stages of regression show little variation in significance or coefficients of explanatory variables as additional independent variables are added to the model. All results are illustrated in Table 4. Every stage of the regression included household and child characteristics. Results for the baseline model are presented in the first column. As children in this study grow older they are less likely to attend school. More specifically, every additional year of age is associated with a 5.9% decrease in the probability that the student will attend school. In addition, a boy is 3.2% points more likely to attend school than a girl. The number of children in the family reduces labor force participation, as expected, with each additional child decreasing the probability by 3.8%.

Table 7: Estimated Marginal Effects (Standard Errors) for Probit Models Predicting the Probability of School Attendance

<table>
<thead>
<tr>
<th>Variable</th>
<th>Reduced form (Economic Activity)</th>
<th>2nd stage (Economic Activity)</th>
<th>3rd Stage (Income)</th>
<th>Final Stage (Income Proportion)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Children in household</td>
<td>.014* (.007)</td>
<td>.014* (.007)</td>
<td>.013** (.007)</td>
<td>.011 (.007)</td>
</tr>
<tr>
<td>Percent Educated Adults</td>
<td>-.03 (.02)</td>
<td>-.03 (.019)</td>
<td>-.04** (.02)</td>
<td>-.024 (.02)</td>
</tr>
<tr>
<td>Age</td>
<td>-.05* (.002)</td>
<td>-.05* (.014)</td>
<td>-.05* (.002)</td>
<td>-.043* (.0022)</td>
</tr>
<tr>
<td>Sex</td>
<td>.04* (.014)</td>
<td>.038* (.014)</td>
<td>.037* (.013)</td>
<td>.03*** (.013)</td>
</tr>
<tr>
<td>Garden and Shamba Activity</td>
<td>-.03* (.011)</td>
<td>-.03* (.011)</td>
<td>-.03* (.011)</td>
<td>-.03* (.011)</td>
</tr>
<tr>
<td>Firewood Hours</td>
<td>-.001 (.007)</td>
<td>-.0009 (.0007)</td>
<td>-.001** (.0007)</td>
<td></td>
</tr>
<tr>
<td>Rate of Success</td>
<td></td>
<td>-.08 (.05)</td>
<td>-.096** (.05)</td>
<td></td>
</tr>
<tr>
<td>Variable</td>
<td>Reduced form</td>
<td>2nd stage (Economic Activity)</td>
<td>3rd Stage (Income)</td>
<td>Final Stage (Income Proportion)</td>
</tr>
<tr>
<td>----------------------------------------------------</td>
<td>--------------</td>
<td>-------------------------------</td>
<td>--------------------</td>
<td>-------------------------------</td>
</tr>
<tr>
<td>Agrarian Income (log)</td>
<td></td>
<td>.00657* (.002)</td>
<td>.01* (.005)</td>
<td></td>
</tr>
<tr>
<td>&gt;25% of income is derived from agriculture</td>
<td></td>
<td></td>
<td>-.066* (.019)</td>
<td></td>
</tr>
<tr>
<td>25%&lt; income derived from agriculture &lt;50%</td>
<td></td>
<td></td>
<td>-.07* (.027)</td>
<td></td>
</tr>
<tr>
<td>50% &lt; income derived from agriculture &lt;75%</td>
<td></td>
<td></td>
<td>-.04 (.031)</td>
<td></td>
</tr>
<tr>
<td>75%&lt; income derived from agriculture &lt; 99%</td>
<td></td>
<td></td>
<td>-.04 (.032)</td>
<td></td>
</tr>
</tbody>
</table>

* = p<.05  ** = p<.10  *** = p<.01

Beginning with the second stage of regression, economic activities of the children are included to account for opportunity costs a family bears by sending children to school. The probability that a child who works in his family’s garden or shamba field will attend school is 3% points lower than a child who is not responsible for such work. This suggests that a more labor-intensive responsibility, such as gardening or field work has a negative impact on school attendance. The activities of collecting firewood and fetching water are found to be marginally significant in this model. Every additional hour a child spends retrieving water or gathering firewood is associated with a 0.6% decrease in the probability that the student will attend school.

Stage 3 included the categorical variable of the logged agrarian household income. Its statistical significance implies that agrarian based income does have an effect on a child’s attendance. Contrary to the hypothesis of this research, a 1% increase in log agrarian income would be associated with a 6.5 percent increase in the probability of school attendance. To test the impact of the agrarian income on student attendance thoroughly, the final stage included dummy
variables measuring the proportion of household income derived from agriculture. The contrast category is families with 100% agrarian income. If a family derives less than half but more than a quarter of their income from agriculture, the probability that their children will attend school is 7% points less than a student from a household with purely agrarian income. Furthermore, if a family derives less than 25% of their income from agricultural activities their child is 6.6% points less likely to attend school than a child from a purely agrarian household.

The ratio of successful sales attempts to total sales attempts implies that most farmers in the Kagera region do not, in fact, make a profit from their agricultural activities. Because of that the final explanatory variable of my regression might illustrate the most accurate picture of family decisions in regards to farming and school. According to the analysis, a 10% increase in the success rate of agricultural sales by farmers is associated with a 9.6% decrease in the probability that the student will attend school. Thus, as farming families find more success in their agriculture sales, students attend school less.

*Potential Errors*

The negative impact of an increased percentage of educated adults on student attendance, and the positive impact of the agrarian income on student attendance are both counterintuitive. The former is contrary to previous research finding that the more educated a parent is the more value they place on their own children’s education. The other explanatory variables in the model in this study suggest the latter is incorrect. These results could imply that there is a specification error in the model. If these variables are absorbing the effects of omitted variables, for instance the model would display endogeneity issues through omitted variable bias.
However, given the information contained in the data I believe the surprising results are not a sign of specification errors, but instead a signal that a different measurement of agrarian impact is necessary. The true constraint to this model is the main independent variable of agrarian income. As portrayed in the following illustration, a considerable amount of attempts are made by farmers to sell a variety of crops. However, only a small portion of those attempts are successful, meaning that income is only representing a small number of families that are actively participating in agrarian activities. The unsuccessful farmers, subsistence farmers, are not earning income and thus could face even fewer options in regards to children’s education than their profitable neighbors.

Table 8: Percentage of Sales by Crop
CONCLUSION

While the final results of this analysis found that agrarian income actually a positive effect on children’s school attendance some of the other statistics imply that to disregard agrarian activity as a potential negative influence on educational attainment would still be a mistake. The encouraging conclusion from these results is that when families have the resources, such as increased income, they do choose to send their children to school. Unfortunately, the small, but significant impact that successful agricultural sales has on children’s school attendance suggest that agrarian activity does, indeed, have an effect on education. Moreover, the effect of household activities suggests that school-aged children are spending increasing amounts of time on household chores such as collecting firewood and fetching water. As children grow older, they take on responsibilities that are more physically demanding, such as garden work and shamba field work. The growing physical intensity of the work could still serve as a major factor in the decision to keep children home from school.

Policy Implications
The effect of labor on the probability of student attendance implies that economic policies should target crops and products that are high in profitability but low in labor demand. This would allow families to maximize their profits, while minimizing the need for child labor. As shown in table 8 on page 27 farmers produce a wide variety of crops. A better awareness of the varying effects among crops, livestock and products would also allow economic policy makers to make more focused, and thus more effective, agricultural policy.
While a better understanding of the effects of agriculture on children’s lives can help create improved policy, social development must be considered a goal of the economic policy to ensure sustainability. To guarantee both short term economic growth as well as long term economic sustainable development, human capital must be protected and encouraged. Therefore, a two tiered policy coupling economic growth with human capital development is the optimal way to address the present economic needs as well as the long term development of the Tanzanian people. Tanzania should consider programs that provide families with financial incentives for school attendance and parental involvement such as Mexico’s Oportunidades. Oportunidades is empirically proven to keep children in school by offsetting the cost of lost labor at home. Another program that could be considered as a complement to agricultural policies is a food for education program (FFE). Similar to Oportunidades, an FFE program provides children food in return for school attendance. These programs have been proven to increase school attendance. Furthermore, a program like FFE could provide local farmers a consumer for their product.

An efficient policy will match the incentive for attendance to the opportunity cost perceived by the families. A publicly funded FFE program that purchases foods from local farmers to feed local students creates a virtuous economic cycle. In the short-term, farmers profit from the sale of products, but are also provided with the opportunity and incentive to send their children to school. The children, in turn, immediately contribute to the household with the food they earn for


attending school which makes up for the labor lost by that attendance. In the long run, students attain an education that then allows them to transfer farming knowledge, advance technologies, increase productivity or even shift from agriculture to other enterprises – all of which ultimately can increase profits. The higher levels of education produced by an FFE-like policy also allow economies to evolve: expanding markets and job opportunities for future generations.

Suggestions for Further Research
Further research is necessary to conclusively determine the impact agrarian activity has on education in developing countries. The main independent variable in this study, income, served as a constraint for this model. As the success rate measurement illustrated, a majority of farmers in Kagera do not make substantial profit from their farming activities. Because of this, much of a household’s farming activities were not captured in household income. Two families could spend similar time on growing bananas, but if one is able to sell the bananas and another is not- the income earned will not provide an accurate measurement of family member’s activities or labor. Because of this finding, it is suggested that future studies that build upon this research should use a different measurement to serve as a proxy for agricultural activity. Given the significance of the variables measuring household activities; labor hours versus school and studying hours might serve as a rewarding direction for further research.

Alternatively, because the KHDS includes over thirty different types of crops and crop products and dozens of livestock options and products made from livestock byproduct, the results of this analysis imply that further studies should target the effect of specific crops, livelihood or products on income and child labor hours. It is possible that such research would find that some
crops or products are more profitable than others, and some might also be more labor intensive than others.

Summary
This study serves as an illustration of the relationship between agrarian income, economic activities and school attendance by children in farming households. It helps bridge a gap in development literature analyzing the impact of economics on education and provides further support for research analyzing the impact of labor on education. This study found that families in Tanzania will send their children to school when they possess the capability to do so. Moreover, the largest impediment to school education is the opportunity cost of lost labor within the household.

Based on this research, both economic policies and development policies need to provide the poorest Tanzanian agrarian households with immediate benefits for sending children to school as they will undoubtedly see the immediate cost of losing extra labor around the house. If economic policies work in cooperation with development policies, however, economic growth and human capital development can be generated simultaneously- increasing the sustainability of both.
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