



DISSERTATION BRIEF SERIES 2016:04  
**CHILD EDUCATION, CHILD LABOR AND  
THE AGRICULTURAL ECONOMY**

Elin Vimefall

*Child Education, Child Labor and the Agricultural Economy*

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*Elin Vimefall* is a researcher at the Örebro University School of Business. She defended her dissertation "Essays on child education, child labor and the agricultural economy" at Örebro University School of Business in September 2015. The dissertation can be found at <http://oru.diva-portal.org/smash/record.jsf?pid=diva2%3A821199&dswid=-5070>. Her e-mail is [elin.vimefall@oru.se](mailto:elin.vimefall@oru.se).

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## Introduction

Over the last decades, we have seen impressive progress in development around the world, and the proportion of people living in poverty (on less than \$1.25 a day) has decreased from 36 percent in 1990 to 18 percent in 2010. However, this progress has been unequal, and a large part of the change is due to the development of some Asian countries, while most countries in Africa have seen more modest development. In sub-Saharan Africa, approximately 48 percent of the population still lives on less than \$1.25 a day (UN 2014). There is also considerable inequality within countries. For example, in Kenya, the richest 10 percent of the population receives an estimated 40 percent of total income (World Bank 2014). Most poor people live in rural parts of the country, and they are more likely to be women, children, or members of a minority ethnic group.

The research presented in this brief focus on these individuals, the most vulnerable in society. The paper draws substantially from my Ph.D. dissertation “Essays on Child Education, Child Labor and the Agricultural Economy”. The dissertation consists of four separate papers, with somewhat different focus. The first two papers focus on children and human capital, while the other two focus on the agricultural economy. In the first paper we ask whether children from different ethnolinguistic backgrounds have different probabilities of being in school. In the second paper I examine the connection between income diversification and working children. In the third paper I look at income diversification among female-headed households. In the last paper we analyze how different groups of households are affected when the price of maize increases.

## Background

Child development and human capital

*Education is the most powerful weapon which you can use to change the world* (Nelson Mandela, 1993, Noble Peace Price lecture).

Education is widely regarded as the key to economic development. It can also be viewed as an investment in the individual, which is assumed to increase potential future earnings (Schultz 1960). The estimated average rate of return for one more year of schooling is approximately 10 percent, and the rates of return are higher in low- and middle-income countries (Psacharopoulos and Patrinos 2004). However, education is important not only

as an instrument for economic growth but also for a satisfying life and it can thereby be viewed as a goal in itself.

Several international agreements have pointed to the importance of education. For example, one of the Millennium Development Goals stated that by 2015, all children should be able to complete a full course of primary schooling. Thus, much attention has been paid to access to primary education, and in the developing countries, net enrollment increased from 80 percent in 1990 to 90 percent in 2012 (UNDP 2014). Despite this, in 2012, 58 million primary school aged children were still out of school (UNDP 2014).

The millennium development goals also included a goal about gender parity in education. Even though this goal has been reached in most parts of the world for primary education, in sub-Saharan Africa, there are 92 girls in primary education for every 100 boys. The dispersion increases with the level of education: at the secondary level, there are 84 girls for every 100 boys, and at the tertiary, the respective number is 64 (World Bank data). There is also evidence that certain groups are disadvantaged. Lewis and Lockheed (2007) show that approximately 70 percent of the world's out-of-school girls are members of excluded groups. Understanding which children that are kept out of school and why is an important step toward fulfilling the goal of universal primary education. Furthermore, increasing girls' education is important both for its own sake and to fulfill other development goals. Educated girls are less likely to marry early, more likely to invest in the health of their children and more likely to send their children to school, creating a positive circle of development.

An alternative and/or complement to school for many children in the poor parts of the world is work. According to the latest estimates, approximately 10 percent of the world's children are engaged in labor. The rate of child labor is largest in sub-Saharan Africa, where approximately 21 percent of children are involved in labor (ILO 2013). Most child laborers (60 percent) work in agriculture, mostly as unpaid family workers. It is common to combine school and work, and sometimes, working alongside their parents is viewed as important preparation for children's future. Although work does not have to keep the child out of school, child laborers have been shown to perform worse in school, or even drop out (see Psacharopoulos 1997 for Bolivia and Venezuela and Buonomo 2011 for Nicaragua).

## Agriculture

*Most of the people in the world are poor, so if we knew the economics of being poor, we would know much of the economics that really matters. Most of the world's poor people earn their living from agriculture, so if we knew the economics of agriculture, we would know much of the economics of being poor* (Theodore Schultz, Nobel Lecture, 1979).

Nearly half of the world's population, approximately 3 billion people, lives in rural areas. This is where we find approximately 82 percent of poor people, and most of them depend on agriculture, in some way, for their livelihoods (World Bank 2008). Because most poor people live in rural areas, agricultural development is important to reducing poverty.

However, it is also important to consider development in the non-agricultural sectors. Structural change is a natural part of the development process, and when countries develop, the agricultural sector typically decreases, while the service and industrial sectors increase. Structural change is not only a macro phenomenon; indeed, it begins at the micro level with households and individuals diversifying out of agricultural production. Although the production of their own farms is often the most important source of income for the majority of rural households in sub-Saharan Africa, smallholders have shifted from being full-time farmers to holding a more diversified income portfolio. However, to access higher-return activities, individuals have to overcome entry barriers, such as education, credit and labor. These constraints can be especially difficult for poor households but can also be linked to gender.

Women have been shown to have less access to land, use less credit, and use less fertilizer. In addition, they generally have lower levels of education and have less access to extension services than men. These factors will not only decrease their productivity but also determine which other options are available to them. For example, women are less likely to work for wages than men, and when doing so, they are more likely to have part-time jobs or seasonal employment and are often paid less (FAO 2011).

## Kenya

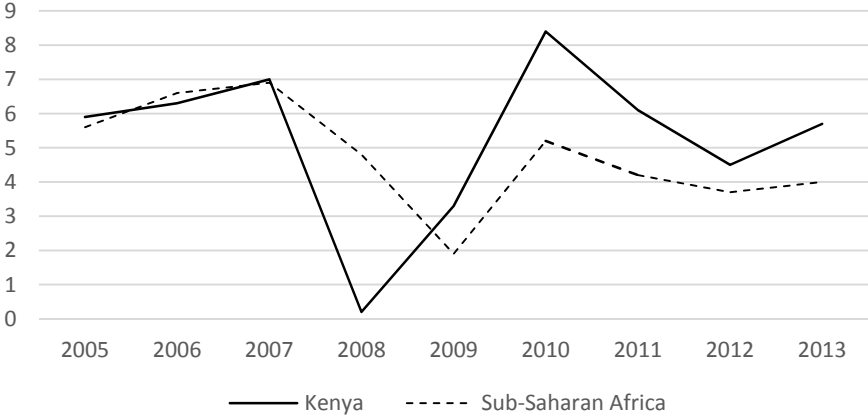
The papers in the dissertation focus on the situation in Kenya. In all papers we use data from the Kenya Integrated Household Budget Survey 2005/2006. Although most conclusions may generalize to other countries, it is important to understand the specific country context of our results.

Kenya, a former colony of the United Kingdom, became independent in 1963. With a population of approximately 44 million (2009), it is one of the largest countries in sub-Saharan Africa. The poverty level in 2012, using the national poverty line, was an estimated 39 percent (World Bank 2014), and life expectancy in the same year was 61 years (World Bank data). In September 2014, Kenya became a lower middle-income country and the fifth largest economy in sub-Saharan Africa.<sup>1</sup>

Even though only about 15 percent of Kenya’s land area is suitable for agricultural production, agriculture dominates the economy and approximately 75 percent of the labor force worked in agriculture (Library of congress 2007). Tea, horticultural products and coffee are the main cash crops, while corn is the main food staple. The semi-arid areas in the north and east are dominated by livestock production. In 2013, agriculture contributed 30 percent of GDP, while the largest share came from services, which contributed approximately 50 percent of GDP (World Bank data).

During most of the 21st century, the growth rate in Kenya has been relatively high and stable, and since 2009, it has been above the average for sub-Saharan Africa. However, the country was strongly affected by the violence that followed the 2007 presidential election, resulting in a large decrease in growth (Figure 1).

Figure 1. GDP Growth rate (%)



Source: World Bank data

<sup>1</sup> Crossing the line into lower middle-income range was mainly due to a statistical improvement wherein the country's national income increased by 25% overnight due to a change in the base year used to calculate national accounts.

Kenya has made good progress toward the goal of universal primary education. One important step toward reaching this goal was the introduction of free primary education in 2003, which led to a large increase in the number of students. In 2012, the net enrollment rate in primary education was 84 percent, and there were as many girls as boys in primary education. However, the net enrollment rate in secondary education that same year was only 56 percent, and there were 93 girls for every 100 boys enrolled (World Bank data).

Although progress has been made, Kenya will not be able to fulfill the Millennium Development Goal of gender equality. In 2013, women constituted approximately 36 percent of employees in the non-agricultural sector (Oderoe al 2015), and held approximately 19 percent of the seats in parliament (World Bank data). As a way of increasing gender equality, the new constitution (2010) states that no gender can hold more than 2/3 of positions in an appointed or elected body.

Kenya is, in many aspects, a diverse country, and there is considerable variation in poverty levels, human capital, and access to services in different parts of the country. For example, in 2005, the poverty level in the rural parts of the North Eastern Province was approximately 74 percent, while the respective number in the Central Province was 30 percent (national poverty line, KNBS 2007). In an attempt to address these issues, the 2010 constitution changed the administrative division of Kenya, creating 47 county governments (Odero et al 2015).

Kenya is also one of the world's most ethnically diverse countries, where approximately 69 different languages exist (Lewis et al 2013). The role of ethnicity is strong and plays a central role in political mobilization and resource allocation (Kimenyi, 1997). When the first multi-party elections were held in Kenya in 1992, politics and ethnicity were strongly connected, with different parties representing different ethnic groups (Omolo 2002). According to Ajulu (2002), ethnic identity was constructed as an instrument to access power. Political parties were created along ethnic lines, and ethnicity became the most important factor in political competition. This was also the case in the 2007 election, where ethnic origins drove voting patterns (Bratton and Kimenyi, 2008). Ethnicity also played an important part in the postelection violence that followed the 2007 election.



## The Essays

### Ethnolinguistic background and enrollment in primary education

In the first paper, we ask whether the probability of being in school differs among children of different ethnolinguistic backgrounds. We expect this variable to capture several important aspects that have an impact on the expected costs and benefits of education, including culture, norms and language.

For example, households from the same ethnolinguistic group sometimes share the same way of living: some groups might be characterized by nomadic traditions, others by being traders, which would influence the expected return to education. Furthermore, the probability of being in school might be affected by gender norms, and that these norms might vary among ethnolinguistic groups. Another hypothesis about the differences in school attendance across ethnic groups comes from political economy's approach, which argues that political leaders in Sub-Saharan Africa are known to favor their own ethnic group (Franck and Rainer 2012).

In Kenya there are 16 local languages approved for instruction in school, and until the fourth year the language of instruction should be the predominant language of the school's catchment area. Thereafter, English should be used as the language of instruction (Cleghorn et al. 1989). The goal of the language policy is to make primary education locally accessible to linguistic/ethnic minorities, but it is difficult to implement mother-tongue teaching in regions in which several ethnolinguistic groups co-exist (Ogle et al. 2010). Therefore, English or Swahili may be used as the initial medium of instruction in linguistically mixed schools

We identify our language groups in our questionnaire, which was designed to allow the respondent to answer in one of eleven local languages, Swahili or English, where the two later are the official languages of Kenya. The Kenyan census (2009) indicates that approximately 89 percent of the population belongs to one of these eleven language groups (Kenya National Bureau of Statistics 2010). Answering in a local language implies that the household uses this language at home, making it a good proxy for ethnolinguistic background.

Because our dataset has a multilevel structure, where each child belongs to a household and each household belongs to a small community (cluster of ten households), we expect

children to share observed and unobserved characteristics at several levels. To consider this, we use a three-level random intercept probit model, with random intercepts at the community and household levels.

Our results show that ethnolinguistic background is important for explaining the child's probability of being in school. Even after controlling for child, household, community and district characteristics, we find that ethnolinguistic background has a statistically significant impact, which supports our hypothesis that differences in culture and norms among language groups influence the expected costs and benefits of education. Regardless of the specification, Maasai and Somali children have lower probabilities of enrolling in school than children from all other groups. Both the Somali and Maasai groups have nomadic traditions, which might be a factor that influences the perceived costs and benefits of education. The effect is statistically significant for both genders but is strongest for girls, suggesting that girls in these groups are particularly disadvantaged.

#### Income diversification and working children

In the second paper, I analyze the connections among income diversification, child work and education. In recent years (2004-2008), the rate of child employment in sub-Saharan Africa increased (Diallo et al 2010). At the same time, there has been a shift in livelihoods toward house-holds relying more on sources of income beyond their own farm. In this paper, I investigate how households' income diversification strategies influence a child's probability of working and/or going to school.

When the adult in the household diversifies away from production on their own farm, this is expected to influence the children's time allocation in several ways. Households will choose to diversify if the marginal value gained by doing so is larger than the value of the marginal production of their farm. Thus, when a household chooses to diversify, this will have a positive effect on its total income. Assuming that a child not having to work is viewed as a luxury good by the household, an increase in income will decrease the rate of working children. At the same time, decreasing the amount of adult labor on the household farm will increase the return to the child's farm work and, thereby, the opportunity cost of schooling. This effect is expected to increase the rate of working children. Because these two effects lead to different predictions, empirical re-search must

determine the relationship between income diversification and the rate of working children.

I focus on children whose main activity is working because these are the ones for whom working might have the most negative consequences. Since I am interested in what happens to the rate of working children when farming households diversify, I only include households living in the rural parts of Kenya that participate in farming.

Because work and school are expected to compete for the child's limited time, I use a bivariate probit regression, which allows these decisions to be correlated. However, because income becomes endogenous when analyzing child labor, we use an instrumental approach and extend our bivariate model to a three-equation mixed-process model (Roodman 2011). Since working more hours might be more harmful for the child, I also analyze how many hours they work.

I find that children living in households that rely solely on production of their own farm are approximately 3 percentage points more likely to work as their main activity and approximately 2 percentage points less likely to be in school than children from more diversified households. They also work more hours than children in diversified households. I do not find any differences in the rates of working children across a number of various income diversification strategies

Taken together with previous literature, my results support the conclusion that diversification is good for the household, and for the children. Therefore a policy recommendation would be to increase the farming households' access to the labor market.

Income diversification by female-headed households

Continuing with the subject of income diversification, in paper three, I analyze the income diversification of female headed households. In most rural parts of sub-Saharan Africa, production on one's own farm is still the main source of income. Even so, the importance of non-agricultural sources has increased, and these have been shown to provide an important way out of poverty. However, not everyone have access to the higher-return activities.

Female-headed households have been shown to have less education, labor, and productive as-sets as well as less access to credit than male-headed households. This will limit the diversification options available to them. In this paper, I analyze the income diversification of female-headed farming households. More specifically I analyze 1) whether female-headed household are less diversified than male-headed households; 2) whether female-headed households diversify their income in a different way than male-headed households; and 3) what determine the income diversification of female-headed households.

Although I am not aware of any previous study whose main interest is the income diversification of female-headed households, many studies include the gender of the head of household as a control variable. However, we argue that this could lead to misleading conclusions because the group of female-headed households is heterogeneous and thereby faces different constraint. To capture the different constraints faced by different groups of female-headed households, we control for both the gender of the head and for all types of marital status (monogamously married, polygamously married, divorced, widowed, never married).

Looking at the number of income sources, we do not find that female-headed households are less diversified than male-headed households. Instead, we find that households where the head is married have a larger number of income sources per adult than male-headed households.

However, female-headed households diversify their income in a different way. For example, they are more dependent on transfers (transfers make up 28 percent of the income of female-headed households compared with 14 percent in male-headed households).

In regard to earned income, female-headed households have a larger probability of relying only on earnings from the own farm. We also find that female-headed households are generally less likely to diversify into non-agricultural wage work. These activities have been shown to be important ways out of poverty. We show that for female-headed households to obtain access to this type of employment, they have to overcome entry barriers such as education and norms.

## Welfare impact of higher maize prices when allowing for price heterogeneity

The world economy experienced a substantial increase in food prices between 2005 and 2011, severely impacting poverty worldwide. For example, the increases in prices between 2005 and 2007 were estimated to have added approximately 100 million people to the ranks of the poor (Ivanic and Martin 2008).

In the last paper, we explore the effect of an increase in the price of maize on different groups of households in Kenya. Maize is the most important crop in Kenya and is grown by approximately 90% of farming households. However, most households also buy some maize on the market, making it more complicated to know who wins and who loses when its price increases.

In order to evaluate the effect of a price increase, we calculate the net benefit ratio (NBR). Households with a negative NBR will lose if the price increases and households with a positive NBR will gain. We find that approximately 80% of households would be negatively affected by an increase in the price of maize. To be able to give policy recommendations, we divide the households by their location, welfare level and land ownership. From this, we find that poor households would lose a larger proportion of their welfare than better-off households. Specifically, rural landless households would lose the most. Although a larger proportion of urban households lose, the magnitude of the effect is smaller than in the rural areas.

Simulating a 25% increase in the price of maize, we find that rural poverty would increase by approximately 1 percentage point and urban poverty by approximately 0.5 percentage points.

In addition, we suggest methodological improvements for analyzing the effect of a change in price. First, we build on the work of Dawe and Maltoglou (2014), who relax the standard assumption that consumer and producer prices change in equal proportion. However, Dawe and Maltoglou assume that the marketing margin, which is the difference between the consumer and producer price is constant among households. We relax this assumption and show that allowing the marketing margin to differ among districts can have a substantial impact when analyzing the spatial impact of a price increase. Taken together, our results point to the importance of considering what type of

price increase we are interested in, moving away from the standard assumption that all prices change in the same proportion.

### Policy conclusions

One of the Millennium Development Goals was that every child should have access to primary education. The work in this area has been impressive, and more children than ever attend school; however, in 2012, approximately 58 million primary-school-aged children were still out of school (UNDP 2014). In the first paper, we show that educational opportunities vary among children with different ethnolinguistic backgrounds. Specifically, we found that Somali and Maasai children had a lower probability of being in school compared to children from all other groups. These groups have nomadic traditions, and I believe that more research is needed to understand the specific constraints faced by these nomadic communities.

Furthermore, we find that gender and ethnolinguistic background create a double barrier to girls who are members of disadvantaged groups. Therefore, more policies must focus on getting these girls enrolled in school. This could be done, for example, through targeted conditional (or unconditional) cash transfer programs.

In the second paper, we found that children living in households who rely solely on the production of their own farms for income have a larger probability of working as their main activity and are thus less likely to be in school than children from more diversified households. Although working on the family farm might seem harmless, many tasks could be harmful to the child, such as handling sharp tools and exposure to potential harmful chemicals such as inorganic fertilizers and pesticides (ILO 2013). Therefore, it is important to determine what these children are doing. It is also important to form policies to enroll these children in school. Again, conditional cash transfers are a potential solution. Furthermore, more detailed data about children's total time allocations could improve understanding about the connection between livelihood diversification and time allocation.

In the third paper, I find that female-headed households are more dependent on agriculture for their earned incomes and have lower probabilities of entering non-farm wage employment, which has been identified as an important way out of poverty. To gain

access to this sector, women need to overcome some entry barriers. Policy should therefore focus on allowing these households to gain access to the labor market. It would also be important to explore whether the general patterns found in the Kenyan context generalizes to other countries.

In the final paper, we show that poor and rural landless households are especially vulnerable to increases in the price of maize. This vulnerability can be reduced by increasing their access to employment outside of agriculture or by increasing their productivity on the farm.

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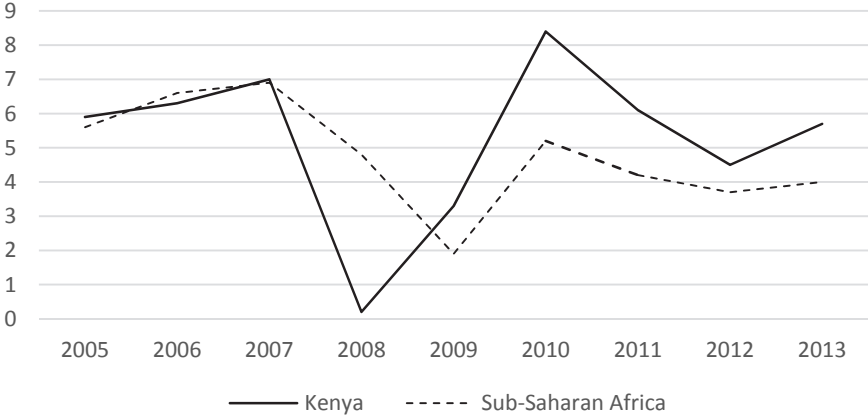
The papers in the dissertation focus on the situation in Kenya. In all papers we use data from the Kenya Integrated Household Budget Survey 2005/2006. Although most conclusions may generalize to other countries, it is important to understand the specific country context of our results.

Kenya, a former colony of the United Kingdom, became independent in 1963. With a population of approximately 44 million (2009), it is one of the largest countries in sub-Saharan Africa. The poverty level in 2012, using the national poverty line, was an estimated 39 percent (World Bank 2014), and life expectancy in the same year was 61 years (World Bank data). In September 2014, Kenya became a lower middle-income country and the fifth largest economy in sub-Saharan Africa.<sup>1</sup>

Even though only about 15 percent of Kenya’s land area is suitable for agricultural production, agriculture dominates the economy and approximately 75 percent of the labor force worked in agriculture (Library of congress 2007). Tea, horticultural products and coffee are the main cash crops, while corn is the main food staple. The semi-arid areas in the north and east are dominated by livestock production. In 2013, agriculture contributed 30 percent of GDP, while the largest share came from services, which contributed approximately 50 percent of GDP (World Bank data).

During most of the 21st century, the growth rate in Kenya has been relatively high and stable, and since 2009, it has been above the average for sub-Saharan Africa. However, the country was strongly affected by the violence that followed the 2007 presidential election, resulting in a large decrease in growth (Figure 1).

Figure 1. GDP Growth rate (%)



Source: World Bank data

<sup>1</sup> Crossing the line into lower middle-income range was mainly due to a statistical improvement wherein the country's national income increased by 25% overnight due to a change in the base year used to calculate national accounts.

Kenya has made good progress toward the goal of universal primary education. One important step toward reaching this goal was the introduction of free primary education in 2003, which led to a large increase in the number of students. In 2012, the net enrollment rate in primary education was 84 percent, and there were as many girls as boys in primary education. However, the net enrollment rate in secondary education that same year was only 56 percent, and there were 93 girls for every 100 boys enrolled (World Bank data).

Although progress has been made, Kenya will not be able to fulfill the Millennium Development Goal of gender equality. In 2013, women constituted approximately 36 percent of employees in the non-agricultural sector (Oderoe al 2015), and held approximately 19 percent of the seats in parliament (World Bank data). As a way of increasing gender equality, the new constitution (2010) states that no gender can hold more than 2/3 of positions in an appointed or elected body.

Kenya is, in many aspects, a diverse country, and there is considerable variation in poverty levels, human capital, and access to services in different parts of the country. For example, in 2005, the poverty level in the rural parts of the North Eastern Province was approximately 74 percent, while the respective number in the Central Province was 30 percent (national poverty line, KNBS 2007). In an attempt to address these issues, the 2010 constitution changed the administrative division of Kenya, creating 47 county governments (Odero et al 2015).

Kenya is also one of the world's most ethnically diverse countries, where approximately 69 different languages exist (Lewis et al 2013). The role of ethnicity is strong and plays a central role in political mobilization and resource allocation (Kimenyi, 1997). When the first multi-party elections were held in Kenya in 1992, politics and ethnicity were strongly connected, with different parties representing different ethnic groups (Omolo 2002). According to Ajulu (2002), ethnic identity was constructed as an instrument to access power. Political parties were created along ethnic lines, and ethnicity became the most important factor in political competition. This was also the case in the 2007 election, where ethnic origins drove voting patterns (Bratton and Kimenyi, 2008). Ethnicity also played an important part in the postelection violence that followed the 2007 election.



## The Essays

### Ethnolinguistic background and enrollment in primary education

In the first paper, we ask whether the probability of being in school differs among children of different ethnolinguistic backgrounds. We expect this variable to capture several important aspects that have an impact on the expected costs and benefits of education, including culture, norms and language.

For example, households from the same ethnolinguistic group sometimes share the same way of living: some groups might be characterized by nomadic traditions, others by being traders, which would influence the expected return to education. Furthermore, the probability of being in school might be affected by gender norms, and that these norms might vary among ethnolinguistic groups. Another hypothesis about the differences in school attendance across ethnic groups comes from political economy's approach, which argues that political leaders in Sub-Saharan Africa are known to favor their own ethnic group (Franck and Rainer 2012).

In Kenya there are 16 local languages approved for instruction in school, and until the fourth year the language of instruction should be the predominant language of the school's catchment area. Thereafter, English should be used as the language of instruction (Cleghorn et al. 1989). The goal of the language policy is to make primary education locally accessible to linguistic/ethnic minorities, but it is difficult to implement mother-tongue teaching in regions in which several ethnolinguistic groups co-exist (Ogle et al. 2010). Therefore, English or Swahili may be used as the initial medium of instruction in linguistically mixed schools

We identify our language groups in our questionnaire, which was designed to allow the respondent to answer in one of eleven local languages, Swahili or English, where the two later are the official languages of Kenya. The Kenyan census (2009) indicates that approximately 89 percent of the population belongs to one of these eleven language groups (Kenya National Bureau of Statistics 2010). Answering in a local language implies that the household uses this language at home, making it a good proxy for ethnolinguistic background.

Because our dataset has a multilevel structure, where each child belongs to a household and each household belongs to a small community (cluster of ten households), we expect

children to share observed and unobserved characteristics at several levels. To consider this, we use a three-level random intercept probit model, with random intercepts at the community and household levels.

Our results show that ethnolinguistic background is important for explaining the child's probability of being in school. Even after controlling for child, household, community and district characteristics, we find that ethnolinguistic background has a statistically significant impact, which supports our hypothesis that differences in culture and norms among language groups influence the expected costs and benefits of education. Regardless of the specification, Maasai and Somali children have lower probabilities of enrolling in school than children from all other groups. Both the Somali and Maasai groups have nomadic traditions, which might be a factor that influences the perceived costs and benefits of education. The effect is statistically significant for both genders but is strongest for girls, suggesting that girls in these groups are particularly disadvantaged.

#### Income diversification and working children

In the second paper, I analyze the connections among income diversification, child work and education. In recent years (2004-2008), the rate of child employment in sub-Saharan Africa increased (Diallo et al 2010). At the same time, there has been a shift in livelihoods toward households relying more on sources of income beyond their own farm. In this paper, I investigate how households' income diversification strategies influence a child's probability of working and/or going to school.

When the adult in the household diversifies away from production on their own farm, this is expected to influence the children's time allocation in several ways. Households will choose to diversify if the marginal value gained by doing so is larger than the value of the marginal production of their farm. Thus, when a household chooses to diversify, this will have a positive effect on its total income. Assuming that a child not having to work is viewed as a luxury good by the household, an increase in income will decrease the rate of working children. At the same time, decreasing the amount of adult labor on the household farm will increase the return to the child's farm work and, thereby, the opportunity cost of schooling. This effect is expected to increase the rate of working children. Because these two effects lead to different predictions, empirical re-search must

determine the relationship between income diversification and the rate of working children.

I focus on children whose main activity is working because these are the ones for whom working might have the most negative consequences. Since I am interested in what happens to the rate of working children when farming households diversify, I only include households living in the rural parts of Kenya that participate in farming.

Because work and school are expected to compete for the child's limited time, I use a bivariate probit regression, which allows these decisions to be correlated. However, because income becomes endogenous when analyzing child labor, we use an instrumental approach and extend our bivariate model to a three-equation mixed-process model (Roodman 2011). Since working more hours might be more harmful for the child, I also analyze how many hours they work.

I find that children living in households that rely solely on production of their own farm are approximately 3 percentage points more likely to work as their main activity and approximately 2 percentage points less likely to be in school than children from more diversified households. They also work more hours than children in diversified households. I do not find any differences in the rates of working children across a number of various income diversification strategies

Taken together with previous literature, my results support the conclusion that diversification is good for the household, and for the children. Therefore a policy recommendation would be to increase the farming households' access to the labor market.

Income diversification by female-headed households

Continuing with the subject of income diversification, in paper three, I analyze the income diversification of female headed households. In most rural parts of sub-Saharan Africa, production on one's own farm is still the main source of income. Even so, the importance of non-agricultural sources has increased, and these have been shown to provide an important way out of poverty. However, not everyone have access to the higher-return activities.

Female-headed households have been shown to have less education, labor, and productive as-sets as well as less access to credit than male-headed households. This will limit the diversification options available to them. In this paper, I analyze the income diversification of female-headed farming households. More specifically I analyze 1) whether female-headed household are less diversified than male-headed households; 2) whether female-headed households diversify their income in a different way than male-headed households; and 3) what determine the income diversification of female-headed households.

Although I am not aware of any previous study whose main interest is the income diversification of female-headed households, many studies include the gender of the head of household as a control variable. However, we argue that this could lead to misleading conclusions because the group of female-headed households is heterogeneous and thereby faces different constraint. To capture the different constraints faced by different groups of female-headed households, we control for both the gender of the head and for all types of marital status (monogamously married, polygamously married, divorced, widowed, never married).

Looking at the number of income sources, we do not find that female-headed households are less diversified than male-headed households. Instead, we find that households where the head is married have a larger number of income sources per adult than male-headed households.

However, female-headed households diversify their income in a different way. For example, they are more dependent on transfers (transfers make up 28 percent of the income of female-headed households compared with 14 percent in male-headed households).

In regard to earned income, female-headed households have a larger probability of relying only on earnings from the own farm. We also find that female-headed households are generally less likely to diversify into non-agricultural wage work. These activities have been shown to be important ways out of poverty. We show that for female-headed households to obtain access to this type of employment, they have to overcome entry barriers such as education and norms.

## Welfare impact of higher maize prices when allowing for price heterogeneity

The world economy experienced a substantial increase in food prices between 2005 and 2011, severely impacting poverty worldwide. For example, the increases in prices between 2005 and 2007 were estimated to have added approximately 100 million people to the ranks of the poor (Ivanic and Martin 2008).

In the last paper, we explore the effect of an increase in the price of maize on different groups of households in Kenya. Maize is the most important crop in Kenya and is grown by approximately 90% of farming households. However, most households also buy some maize on the market, making it more complicated to know who wins and who loses when its price increases.

In order to evaluate the effect of a price increase, we calculate the net benefit ratio (NBR). Households with a negative NBR will lose if the price increases and households with a positive NBR will gain. We find that approximately 80% of households would be negatively affected by an increase in the price of maize. To be able to give policy recommendations, we divide the households by their location, welfare level and land ownership. From this, we find that poor households would lose a larger proportion of their welfare than better-off households. Specifically, rural landless households would lose the most. Although a larger proportion of urban households lose, the magnitude of the effect is smaller than in the rural areas.

Simulating a 25% increase in the price of maize, we find that rural poverty would increase by approximately 1 percentage point and urban poverty by approximately 0.5 percentage points.

In addition, we suggest methodological improvements for analyzing the effect of a change in price. First, we build on the work of Dawe and Maltsoğlu (2014), who relax the standard assumption that consumer and producer prices change in equal proportion. However, Dawe and Maltsoğlu assume that the marketing margin, which is the difference between the consumer and producer price is constant among households. We relax this assumption and show that allowing the marketing margin to differ among districts can have a substantial impact when analyzing the spatial impact of a price increase. Taken together, our results point to the importance of considering what type of

price increase we are interested in, moving away from the standard assumption that all prices change in the same proportion.

### Policy conclusions

One of the Millennium Development Goals was that every child should have access to primary education. The work in this area has been impressive, and more children than ever attend school; however, in 2012, approximately 58 million primary-school-aged children were still out of school (UNDP 2014). In the first paper, we show that educational opportunities vary among children with different ethnolinguistic backgrounds. Specifically, we found that Somali and Maasai children had a lower probability of being in school compared to children from all other groups. These groups have nomadic traditions, and I believe that more research is needed to understand the specific constraints faced by these nomadic communities.

Furthermore, we find that gender and ethnolinguistic background create a double barrier to girls who are members of disadvantaged groups. Therefore, more policies must focus on getting these girls enrolled in school. This could be done, for example, through targeted conditional (or unconditional) cash transfer programs.

In the second paper, we found that children living in households who rely solely on the production of their own farms for income have a larger probability of working as their main activity and are thus less likely to be in school than children from more diversified households. Although working on the family farm might seem harmless, many tasks could be harmful to the child, such as handling sharp tools and exposure to potential harmful chemicals such as inorganic fertilizers and pesticides (ILO 2013). Therefore, it is important to determine what these children are doing. It is also important to form policies to enroll these children in school. Again, conditional cash transfers are a potential solution. Furthermore, more detailed data about children's total time allocations could improve understanding about the connection between livelihood diversification and time allocation.

In the third paper, I find that female-headed households are more dependent on agriculture for their earned incomes and have lower probabilities of entering non-farm wage employment, which has been identified as an important way out of poverty. To gain

access to this sector, women need to overcome some entry barriers. Policy should therefore focus on allowing these households to gain access to the labor market. It would also be important to explore whether the general patterns found in the Kenyan context generalizes to other countries.

In the final paper, we show that poor and rural landless households are especially vulnerable to increases in the price of maize. This vulnerability can be reduced by increasing their access to employment outside of agriculture or by increasing their productivity on the farm.

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