Impacts of school costs, school infrastructure and household wealth on girls' schooling under the Free Primary Education policy: the case of Benin, West Africa

Kumulative Dissertation

Inaugural-dissertation in der Fakultät: Sozial und Wirtschaftswissenschaften
Der Otto-Friedrich Universität Bamberg, Deutschland

Vorgelegt von

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in Cotonou, (Benin)

Bamberg, den 14 August 2015

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“Knowledge is power. Information is liberating. Education is the premise of progress, in every society, in every family.”
Kofi Annan, 7th Secretary-General of the United Nations, June 23, 1997

Acknowledgements

This work would not have come to fruition without the support of many people, and I would like to take this opportunity to express my appreciation and deepest gratitude to them. I am sincerely grateful to my supervisor Prof. Dr. Eveline Wittmann for her guidance and faith in me. She did not hesitate to give me the opportunity to work under her supervision, and I thank her for the academic researcher that I have become as a result of this support. I wish to express my sincere gratitude to Prof. Dr. Guido Heineck, who took the time in his busy schedule to read my work and offer advice on my research. I would like to thank Prof. Dr. Katharina Michaelowa for her advice and assistance in sourcing the data and other materials. I am also extremely grateful that she recommended me to my supervisor.

My gratitude goes to Prof. Dr. Michael Grimm for his advice, comments, and suggestions. Despite having no obligation towards me he took the time to read and correct all my papers, and I am very thankful to him for his assistance. I am extremely grateful to Dr. Honorat Satoguina who, was kind enough to help me with the process of the DAAD scholarship. I am also grateful to the German Academic Exchange Service (DAAD) for the Ph.D. scholarship, and for their support. I would like to thank Prof. Dr. Detlef Sembill and the department of Business Education and Educational Management (University of Bamberg) for the office made available to me for the duration of my doctoral studies.

I am grateful to Prof. Dr. Mareva Sabatier and the Laboratory "*Institut de Recherche en Economie et en Gestion (IREGE)*" of the University of Savoie, France, who kindly hosted me during my visiting research. They gave me the opportunity to discuss and work with other colleagues in my field, which was a priceless experience. I am thankful to Dr. Anna Risch for her suggestions and comments about my research. I would like to thank my colleagues of the Department of Business Education and Educational Management (University of Bamberg, Germany). I would like to express my sincere gratitude to the Bavarian Graduate Program in Economics (BGPE) for the opportunity to learn during the graduate courses and workshops. This program was essential for my doctoral studies, and I am thankful to everyone, who assisted me during our different workshops, graduate courses and after. I am also thankful to the Bamberg Graduate School of Social Sciences (BAGSS) for the different opportunities and the courses. I would like to acknowledge the *Bamberger Graduiertenschule für Betriebswirtschaftslehre*

(BAGSB). I also wish to acknowledge Prof. Dr. Franck Portier and Mrs. Aude Schoelsing of the Toulouse School of Economics (TSE) for their assistance.

Finally, I would like to express my gratitude towards my family and friends for their support and prayers. I dedicate this work to my parents Miftaou and Ernestine Fatoké, who taught me the importance of faith, dedication and perseverance. I am especially thankful to my husband Prudence Dato. Thank you for being my best friend, my love and my colleague, and for listening to me and pushing me when I needed it. None of this would be possible without your patience and your unwavering support. I would like to thank my siblings Farida, Yusuf and Aweni Fatoké for their prayers and support as well. I am also grateful to my family-in-law for their patience and prayers. I am thankful to my friends Alexandre Zoumenou, Arnaud Behanzin, John-Paul and Rose Bachani, Mounirou Abdoulaye and Etienne Duchâtel. Lastly, I would like to thank all the women in my extended family for being my role models.

Abstract

To reach the Millennium Development Goal of Universal Primary Education (UPE), developing countries have implemented numerous educational policies (United Nations, 2014). Despite the remarkable upsurge in schooling in these countries, gender-related inequalities are persistent, particularly in levels of attainment. A recent report of United Nations specified that only 23% of girls in poor rural households do complete the primary level of education in Sub-Saharan Africa in 2011 (UNESCO, 2014). This dissertation provides three potential explanations for these issues: the schooling costs; the school infrastructure; and the household wealth. The first explanation relates to the remaining schooling costs. Indeed, policies of removal of school fees often neglect that parents also support other kinds of schooling costs. These residual costs are the indirect costs and the opportunity costs, which are reasonably high in some developing countries. In the case of Benin, a West African country, despite the removal of school fees, the residual schooling costs remain high. Thus, the dilemma of which child to send to school is still relevant for poor households. The evaluation of the elimination of school fees in Benin provides evidence for this argument. The poor quality of schools' infrastructure in developing countries could be a second explanation for the gender gap in schooling. The long distances to the closest primary school, the large numbers of pupils in the classrooms, the lack of teachers and pedagogical materials are all factors that could discourage children—especially girls—in their school attendance. The evaluation of a demand-and-supply policy indicates the importance of a removal of school costs and the upgrading of the schools' infrastructure to reduce the gender gap in schooling. The third explanation relates to the importance of the household wealth on schooling decisions. A policy that eliminates school fees could maintain the dependence of schooling decisions on household wealth by neglecting the remaining schooling costs. In such a case, a wealth shock could be detrimental to the gender gap in schooling and on the efforts already engaged in to reach the goal of UPE. The assessment of the impact of a negative wealth shock on children's schooling and labor in Benin provides empirical evidence for this argument.

The contributions of this dissertation are both theoretical and empirical. On one hand, this research meaningfully extends the literature on impact evaluation in Benin. Crucially, the country lacks research studies that evaluate economic policies. On the other hand, the relevance of the dissertation also lies in the analysis of the relationship between price and wealth effects. These

effects are observed through the reactions of households to wealth or price changes. They indicate which policy—based on the schooling price or the household wealth—should be prioritized to enhance education in Benin. On the other hand again, the theory of the determinants of gender-related differences in schooling is also tested in the articles. Finally, this research uses novel methods in the field of impact evaluation with three natural experiments in the case of Benin to support the arguments.

Zusammenfassung

Um die Millenniumsentwicklungsziele (MDG) der Grundschulausbildung für alle Kinder (MDG2) vor 2015 zu erreichen, haben die Entwicklungsländer zahlreiche bildungspolitische Maßnahmen umgesetzt, aber die Ungleichheiten zwischen den Geschlechtern bestehen fort, besonders hinsichtlich der Bildungsabschlüsse der Schulleistung. Laut einem kürzlich veröffentlichen Bericht der Vereinten Nationen wurde festgestellt, dass nur 23% der Anzahl der Mädchen in armen ländlichen Haushalte das Grundbildungsniveau in Afrika südlich der Sahara im Jahr 2011 erreiche. Diese Dissertation liefert drei mögliche Erklärungen für diese Probleme: die Schulkosten, die Schulinfrastruktur und die Haushaltseinkommen. Die erste Erklärung könnte in verbleiben trotz der Abschaffung der Schulgebühren verbleibenden Schulkosten liegen. Beim Wegfall der Schulgebühren wird häufig vernachlässigt, dass für Eltern auch andere Kosten als die Schulgebühren anfallen, wie indirekte Kosten und , in die in einigen Entwicklungsländern recht hoch ausfallen. Dies trifft auf Benin zu. Das Dilemma, welches von mehreren Kindern in die Schule geschickt werden soll, ist für arme Haushalte also immer noch relevant. Die in der Dissertation vorgenommene Auswertung zur Abschaffung der Schulgebühren in Benin untermauert dieses Argument. Die zweite Erklärung der geschlechtsspezifischen Unterschiede bei der Beschulung könnte in der schlechten Qualität der schulischen Infrastruktur in einigen Entwicklungsländern liegen. Die weite Entfernung bis zur nächsten Grundschule, übergroße Klassenräume, der Mangel an Lehrern und von Unterrichtsmaterialien sind Faktoren, die Kinder, vor allem Mädchen, vom Schulbesuch abhalten könnten. Eine Auswertung zu einer sowohl nachfrage- als auch angebotsseitigen Politik zeigt, dass es wichtig ist, sowohl die Schulkosten zu beseitigen als auch die schulische Infrastruktur auszubauen, wenn die Kluft zwischen den Geschlechtern bei der Beschulung reduziert werden soll. Die dritte Erklärung betrifft die Bedeutung der Haushaltseinkommen bei Bildungsentscheidungen. Bei Vernachlässigung der verbleibenden Schulkosten könnte im Falle einer Politik der Abschaffung der Schulgebühren die Abhängigkeit von Beschulungsentscheidungen durch die Haushaltseinkommen weiterhin bestehen. In einem solchen Fall könnte ein Einkommensschock sich nachteilig auf die geschlechtsspezifischen Unterschiede in der Beschulung und die Bemühungen um die Erreichung der MDG2 auswirken. Eine Auswertung der Auswirkungen eines negativen Einkommensschocks

auf Schulbesuch und Arbeitstätigkeit von Kinder in Benin bietet empirische Evidenz für dieses Argument.

Die Beiträge dieser Arbeit sind theoretisch und empirisch. Diese Forschung erweitert bedeutsam das Publikationsaufkommen über Wirksamkeitsevaluation in Benin. Das Land fehlt Programmevaluierungsstudien.

Die Relevanz der Dissertation liegt auch in der Analyse der Beziehung zwischen Preis- und Einkommenseffekten. Diese Effekte werden durch die Reaktionen der Haushalte auf Einkommens- oder Preisänderungen beobachtet. Dies indiziert, welche politischen Maßnahmen basierend auf dem Preis der Beschulung oder dem Haushaltseinkommen für eine Verbesserung der Bildung in Benin priorisiert werden sollte. Der Forschungsstand über Bestimmungsfaktoren geschlechtsspezifischer Unterschiede der Beschulung war auch Gegenstand der Prüfung in den Artikeln der Dissertation. Abschließend werden in der hier vorgelegten Forschung mit drei natürliche Experimenten am Fall von Benin neue Verfahren im Bereich der Forschungsstand verwendet, um die vorgetragenen Argumente zu unterstützen.

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List of Abbreviations

ASECNA: Agence pour la Sécurité de la Navigation Aérienne en Afrique et à Madagascar

CFA: Communauté Financière d'Afrique

DHS: Demographic and Health Surveys (DHS)

DID: Difference-In-Differences

FPE: Free Primary Education

GER: Gross Enrollment Rate (GER)

GFDRR: Global Facility for Disaster Reduction and Recovery

GIR: Gross Intake Ratio (GIR)

INSAE: Institut National de la Statistiques et de l'Analyse Economique du Benin

MDG: Millennium Development Goals

OCHA: West and Central Africa of the Office for the Coordination of Humanitarian Affairs

OCS: Observatoire du Changement Social (OCS)

OLS: Ordinary Least Square (OLS)

PASEC: Programme d'Analyse des Systèmes Educatifs et de la CONFENEM

SSA: Sub-Saharan Africa

UNESCO: United Nations Educational Scientific and Cultural Organization

UPE: Universal Primary Education

Synopsis (Part 1)

The Millennium Development Goals (MDG) have been at the leading edge of numerous educational policies worldwide (United Nations, 2014). Developing countries were assisted through important educational investments to reach the goal of Universal Primary Education (UPE)[1] (Colclough and Al-Samarrai, 2000). From the implementation of the policies, two surprising facts can be observed. First, the statistics still indicate a huge percentage of out-of-school children, girls especially. A recent report of the United Nations stated that 57 million children were not enrolled, and half of those were girls in 2011 (UNESCO, 2014). Sub-Saharan Africa (SSA) still has some progress to make, with 22% of the population of school-going age not registered in primary schools in comparison to other parts of the world in 2011 (UNESCO, 2014). Second, the children enrolled at school performed poorly and dropped out. In 2010, only 56% of the population, who began a primary education, actually completed that level of education in SSA (UNESCO, 2014).

Background of education in Benin. One SSA country in particular faces similar issues of poor attendance in primary school and persistent gender inequalities: Benin. This West African country has low rates of enrollment and attendance coupled with critical gender inequalities. In 1998, the Gross Enrollment Rate (GER) was 91.2% for boys and 69.3% for girls (INSAE, 2008). The Gross Intake Ratio (GIR) is the number of children registered in the last grade of primary education―regardless of age―over the number of children who should be in this last grade (UNESCO, 2009). The GIR was 52.2% for boys and 24.8% for girls in 1998 (INSAE, 2008). This result indicates that more than double the population of children registered in primary school abandoned their schooling before its completion. This situation is even worse for girls. Fewer girls access the educational system, and their chances of completing a primary level of education are even lower. Surprisingly, these inequalities remain despite the different educational policies executed in the country. In 2001, the Benin government declared primary education free of charge for girls in rural areas. In 2006, this Free Primary Education (FPE) was extended to all

[1] Goal number two of the Millennium Development Goals is to achieve Universal Primary Education by 2015. The policies implemented in some Sub-Saharan African countries to reach this goal are called the *Universal Primary Education (UPE)* or *Free Primary Education (FPE)*, depending on the context.

children of primary school-going age. The first reform was an elimination of school fees for girls in rural areas. The second reform was an essential demand-and-supply side policy, which involved the abolition of school fees, the construction of schools and recruitment of teachers. In 2010, nevertheless, the GER was 114.02% for boys and 108.86% for girls in primary school. For the completion of primary education, in 2010, the GIR was 70.35% for boys and 57.30% for girls (INSAE, 2012). Despite the progress, it appears that the gender gap in schooling still exists in primary schools in Benin. This situation raises one research question, which is the main one: What is the impact of the Free Primary Education (FPE) on gender differences in schooling in Benin? More specifically, research questions include:

- ✓ What is the impact of the FPE of 2001 on children's schooling in Benin, on girls especially?
- ✓ What is the impact of the FPE of 2006 on children's schooling in Benin, on girls especially?
- ✓ Are the outcomes of these policies (FPE of 2001 and 2006) sustainable in the case of a wealth shock?

Conceptual Framework. The research questions of this dissertation investigate the impact of a removal of school costs (FPE 2001), a demand-and-supply side policy (FPE 2006) and of a wealth shock on girls' schooling in Benin. These different determinants of schooling decisions have been examined in the literature. In particular, in the literature on the economics of education three main factors may explain gender-related inequalities: schooling costs; the school's infrastructure; and the household wealth. In developing countries, the gender gap may stem from the budget constraints of the household. Two major factors from the budget constraint could influence parents in their decision: the schooling costs; and the household wealth. Given the restrictions of their budget, parents face the dilemma which child to send to school. According to some previous studies, boys are often chosen to send to school to the detriment of girls in SSA due to cultural considerations. The literature also indicates that the opportunity costs of schooling could be higher for girls than boys (Glick, 2008). Girls are needed to help with domestic chores in the households or to take care of newborn babies. This situation may worsen with wealth shocks. Priorities may shift from children's schooling to basic food consumption when budget constraints become tighter. Girls are likely the first to be dropped out of school to cope with a wealth shock. Additionally, the school's infrastructure itself could widen the gender gap. In some developing countries, schooling conditions are quite poor. The road to the closest primary school is often long and difficult of access, for girls in particular. The empirical literature also showed that the negative impact of the distance to school is stronger on girls than boys (Tansel (1997), Lloyd et al. (2000)). Many schools lack teachers and basic pedagogical materials, and these poor schooling conditions could motivate the choice of parents to keep girls away from schools (Birdsall and Orivel (1996), Glick and Sahn (2000), Michaelowa (2001), Glick (2008), Huisman and Smits (2009)). Potential ways in which to assist parents in their schooling decisions include the reduction of school costs, the improvement of schooling conditions, or the increase of the household wealth. In some developing countries, governments can only influence the schooling costs and conditions given their own restricted resources. Nevertheless, there are two potential issues with the empirical literature on program evaluation. On the one hand, there are only a few empirical studies on SSA. On the other hand, the literature diverges on the outcomes of the policies, depending on the context. Deininger (2003) shows that in Uganda the UPE drastically bettered the enrollment and attendance of children while reducing the gender gap. Other studies show that the program also lowered the delayed enrollment in Uganda (Grogran (2009), Nishimura et al. (2008)). Lincove (2012) found that poor households are still vulnerable in Uganda: although the gender gap has reduced, there are dropouts due to poor wealth. Lucas and Mbiti (2012) also found in Kenya that the policy enhanced access to education for boys and girls, but boys achieved more in school than girls. In Nigeria, selection into the UPE policy was unevenly targeted. Thus, household wealth still influences schooling (Lincove, 2009). Therefore, the impact of the UPE policy on schooling may not meet expectations.

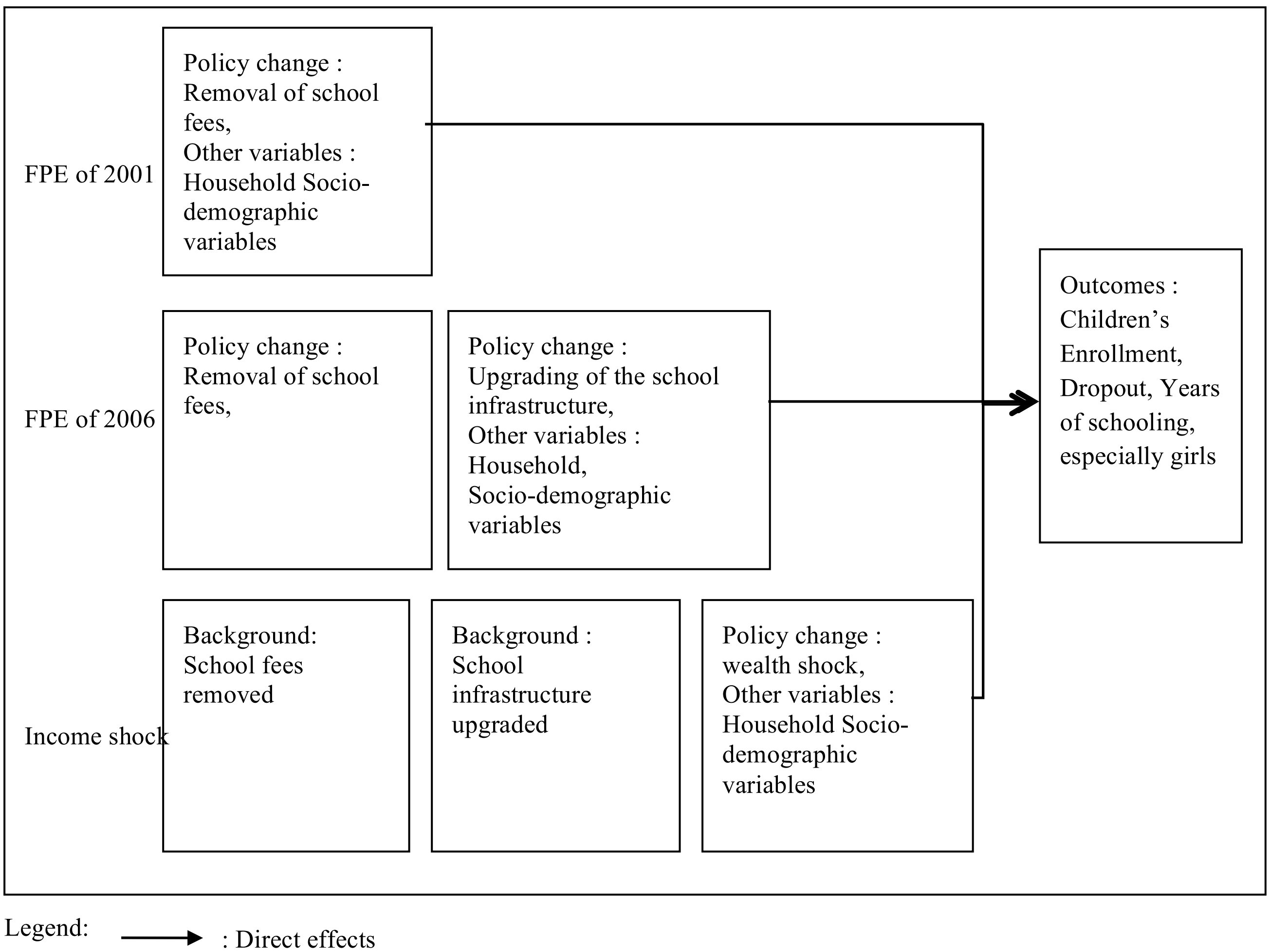
The first argument of this dissertation is that a policy of removal of school fees may have a "restricted" impact on attendance—especially for girls—because of the remaining additional education costs. The costs of schooling are the direct, indirect and opportunity costs. The direct costs are school fees. The indirect costs include transportation costs, uniform fees, and the parents-teacher association fees, for example. The opportunity cost is the time the child spends in school as an alternative to working to help its family. The policies of elimination of school fees usually neglect the indirect and opportunity costs, which are often significant in low-income households. As a reduction of school costs, the FPE could encourage parents to enroll their children due to the price effect. Indeed, the consumption theory states that a decrease (respectively increase) in the price of a given good leads *ceteris paribus* to an increase (respectively decrease) in the demand for this good, depending on the nature of the good. This is the price effect. However, the overall costs of schooling might still be high for some families after the removal of the school fees. It could explain the stable rates of attendance and completion over the years in Benin. This hypothesis is tested in Chapter 1 with a natural experiment on the FPE of 2001. This chapter presents a triple-differences method taking advantage of the differences in cohorts, in areas of residence and in time to evaluate the impact of the policy. The sensitivity analyses consist of two placebo experiments on non-eligible children and a control for potential migration effect.

The second argument is that a demand-and-supply side policy could reduce the gender gap in schooling because it considers more than one determinant of the schooling decisions. The policy of the removal of school fees possibly overlooks poor schooling conditions in some developing countries. The removal of school fees may encourage enrollment but the overpopulation in classrooms or the absence of the teachers can discourage the child from continuing, and this could explain the persistence of the gender inequalities in schooling. In contrast to the removal of school fees, a demand-and-supply side policy influences the school costs and the schools' infrastructure. Such a policy could be more beneficial for attendance, especially for girls. The assumption, is that if girls are negatively more affected by the school costs and the schools' infrastructure than boys, a policy that influence this two factors could have more effects on girls than boys. This hypothesis is tested in Chapter 2 with a second natural experiment, the FPE of 2006. This chapter focuses mainly on the differences in birth cohort in order to evaluate the impact of the policy. The sensitivity analyses confirm the robustness of the results with a placebo experiment.

The third argument is that a wealth shock could threaten the progress of the reduction of the gender gap in schooling. A removal of school fees possibly alleviates households' budget constraints. However, the household's income can still play a major role in schooling decisions, as long as it remains other schooling costs. One could wonder about the sustainability of these educational policies in the case of a wealth shock. The consumption theory specifies that a decrease (respectively increase) in income induces *ceteris paribus* a decrease (respectively increase) of consumption. This is the income effect. It is thus possible that parents continue to remove children―particularly girls―from school to help cope with a negative income shock.

This could also mean that the educational policies that do not consider the household income do not provide enough security for schooling, and this could be a valid threat to the realization of the UPE. This hypothesis is also tested in Chapter 3 with a natural experiment, discussing a major flood that occurred in Benin in 2010. The impact evaluation in this chapter compares schooling decisions of farm and non-farm households following the shock. The sensitivity analyses control the effects on children in non-farm and non-affected households. These considerations can all be summarized in the following conceptual framework:

Conceptual framework



Source: Based on Wolfe and Behrman (1984), Al-Samarrai and Peasgood (1998), Colclough et al. (2000), Glick and Sahn (2000), Birdsall and Orivel (1996), de Janvry et al. (2006), Lincove (2009), Huisman and Smits (2009), Grogan (2009).

Contributions of the dissertation. With the three articles, this dissertation makes numerous contributions with the research by meaningfully extending the literature on impact evaluation in Benin. The country lacks crucially of impact studies on public programs. The dissertation highlights the pros and cons of the FPE policies in Benin. The relevance of the dissertation lies in the analysis of the relationship between price and income effects; the effects of which are observed through the reactions of households to income or price changes. An elimination of school fees could cause an improvement in children's education, which is the price effect. A negative income shock could generate a relapse in children's education, which is the income effect. In the particular case of a low-income country, it could be of interest to determine the dominant effect. Does the income effect prevail over the price effect? In such a case, an income shock—during the implementation of the school fees removal—could result in a decrease in the number of children enrolled. Does the price effect overrule the income effect? In this case, an income shock—during the implementation of the elimination of school fees—could result in a negligible or no influence on children's education. In any case, it could indicate which policy—based on the schooling price for the household income—should be prioritized in order to improve education in Benin. The theory of the determinants of gender-related differences in schooling is also tested in the articles. The papers enable the analysis of the major role of schooling costs and the schools' infrastructure on household decisions. In contrast, to a demand policy, it discloses the benefits of a demand-and-supply side policy on girls' attendance. The dissertation also uses novel methodological models to estimate and check the robustness of the results. The articles investigate not only enrollment but also dropout rates and years of schooling as schooling outcomes.

The structure of this dissertation is as follows: Chapter 1 evaluates the impact of the FPE of 2001 on girls' schooling, Chapter 2 measures the impact of FPE of 2006 on girls' schooling, while Chapter 3 assesses the impact of a negative wealth shock on girls' schooling and labor. Chapter 4 concludes.

Chapter 1: Short- and Medium-Term Impacts of the Elimination of School Fees on Girls' Schooling in Benin, West Africa

Mafaïzath Fatoké Dato*

Abstract

This study measures the impact of the abolition of primary school fees for girls in rural areas of Benin, West Africa. The triple difference method has been applied using the National Demographic and Health Surveys (DHS) of 1996, 2001 and 2006, to assess the impact of this policy of 2001. The Free Primary Education (FPE) policy increased the probability of enrollment of the beneficiaries by 11% in the short-term and 13% in the medium-term. The policy influenced educational outcomes of children in all households; the impact was however greater on the wealthiest households than on others in the short-term. Furthermore, the FPE has no significant impact on the attendance of girls in rural areas in the short or medium-term. These results are robust as evidenced by two placebo experiments. In conclusion, the elimination of direct school costs may enhance access to education, but has no impact on the attendance of the beneficiaries.

JEL codes: H43, I24, I25, O15

Keywords: Impact evaluation, school fees, distance to school, girls' education, natural experiment.

I am grateful to Eveline Wittmann, Guido Heineck, Michael Grimm, Mareva Sabatier and Anna Risch for their useful comments. I would also like to thank two anonymous referees for their suggestions. I am thankful to all the participants of the 17th Research Workshop of the Bavarian Graduate Program in Economics (BGPE), the Third Lisbon Research and Workshop in Economics, Statistics, Econometrics of Education and the conference on development in Africa of the Center for the Study of African Economies (CSAE) 2015. I would also like to express my gratitude to the German Academic Exchange Service (DAAD) for the Ph.D. scholarship.

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1. Introduction

One subject extensively discussed in the literature is which public policies could reduce the gender gap in education in developing countries. Given limited resources, a government must be perspicacious in selecting policies that promote education. Some studies provide evidence that the enhancement of a school's infrastructure on the supply side increases achievement. Indeed, even a mere redistribution of public resources improves achievement, especially for girls and for the poor (Duflo, 2004; Chin, 2005). On the demand side, cash transfers, scholarships and the abolition of schooling costs are among other incentives used to encourage children's education. Considering subsidies, a conditional cash transfer influences the enrollment of the recipients, to a larger extent for girls than for boys (Schultz, 2004; Schady and Filmer, 2006). Most studies indicate that educational policies — whether gender neutral or not — enhance girls' education.

Specifically, the rationale behind the elimination of costs is that parents may decide not to send their children to school due to the lack of sufficient funds. One child could be sent to school to the detriment of another considering the marginal benefits and costs of education. This may explain the success of gender-targeted policies in cultural contexts that are more challenging for girls (Glick, 2008). In most cases, the abolition of school fees culminates in an upsurge in enrollment, and reduces gender gaps. However, a change mainly in direct costs may have only a "restricted" effect on schooling (Behrman and Knowles, 1999; Behrman and Wolfe, 1984). It might be explained by the fact that parents have to pay other indirect educational costs (e.g. transportation costs, uniforms fee….). This paper demonstrates that in the case of Benin, West Africa, the elimination of school fees improves enrollment, but may not substantially increase the average duration of schooling.

In Sub-Saharan Africa, most countries have implemented a Free Primary Education policy (FPE) to abolish school fees for school-aged children. Nevertheless, only a few studies have assessed these policies in Africa, possibly due to the scarcity of data. Benin is a remarkable country for the evaluation of gender-targeted policies. The government launched the implementation of FPE for girls living in rural areas in primary school in 2001. Benin was facing substantial gender disparities in primary education; enrollment and achievement rates of girls lagged behind those of their male counterparts. In 1998, boys' gross enrollment rate was 91.2%

with a promotion rate[2] of 52.2%, while girls' enrollment rate was 59.1% with a promotion rate of 24.8% in primary schools. Consequently, in 2001, Benin implemented the FPE policy for girls in rural areas; the state supported the reform with more subsidies to primary school to enroll girls. Nonetheless, discrimination against girls in primary education has been persistent. In 2002, the boys' gross enrollment rate was 103.9%, whereas the girls' enrollment rate was 76.2% in primary schools (INSAE, 2009)[3].

This paper evaluates the impact of the FPE policy on the schooling of girls living in rural areas in primary school in the short- and medium-terms. Essentially, it attempts to address one of the main criticisms of the impact of evaluations in developing countries, which is the tendency to focus on short-term analysis (Duflo, 2004). Hence, the triple differences method has been applied using the National Demographic and Health Surveys (DHS) of 1996, 2001 and 2006. The main challenges of the evaluation were to find a suitable control group for the beneficiaries and to identify the effect of the policy with the number of years of surveys available. In this regard, girls in urban areas are the most appropriate control group. Even so, the divergence between rural and urban areas could be a major weakness of the estimates. These issues are overcome with variations in the cohorts of birth, in the area of residence, and over time. The treatment group is girls living in rural areas and of primary school age. Thus, the girls in older cohorts of birth and living in urban areas could be a valid control group. This paper also analyzes the effect of distance to school as a proxy for the other educational costs. These costs might also explain school attendance. The study also includes two placebo experiments with older cohorts of birth and children living in urban areas. Consequently, the impact is measured on a large sample of birth cohorts over three years of surveys. An additional robustness check controls for potential migration between regions. All these robustness checks support the results of the evaluation.

The noteworthy aspects of this study are threefold. First, it is one of the first evaluations of the FPE in Benin and is a part of the literature on impact evaluation in Africa. Second, the paper

[2] The promotion rate per grade is the percentage of children per cohort from a given grade and in a given school year who actually continued on to the next grade in the following year (UNESCO, 2009).

[3] All the figures in this paragraph are from the report INSAE (2009). Furthermore, the gross enrollment rate could be over 100% because it is irrespective of age. In other words, children who are younger or older than the typical grade age level could be included.

considers more than one educational outcome, namely current enrollment, dropout[4] and years of schooling completed. Third, the analyses are of the short- and medium-terms. This assessment of FPE could help to improve the policy and to minimize girls' underachievement. The structure of the paper is as follows: Section 2 presents Benin's implementation of the FPE; Section 3 explains the methodology; and Section 4 provides the results of the evaluation. Section 5 presents the robustness checks and Section 6 draws the main conclusions.

2. Benin's implementation of the Free Primary Education policy of 2001

Article 3 of Benin's Fundamental Law of December 11, 1990, stated that, "… education is mandatory and the State and the communities are responsible for making it progressively free." Hence, within the framework of the Highly Indebted Poor Countries Initiative, the government decided to eliminate school fees for girls in rural areas and in primary education. This measure was only relevant for girls in public primary schools, and was implemented at the beginning of the academic year[5] 2000-2001. In 2001, the government provided financial support to primary schools to compensate for the elimination of fees. On October 14, 2006, the newly elected government[6] declared that access to pre-primary and primary education should be *free of charge* for every child of primary school age. However, this study focuses on the first FPE policy initiated in 2001. Analysis of the 2006 FPE policy will be the subject of a future study.

At the time of writing, the statistics on the actual school fees on a national scale were not available, thus it was not possible to analyze the decrease in schooling costs. Instead, Figure 1 presents education expenditure or public spending on education and the gross enrollment rate (GER). These statistics suggest that the government made large investments in education in 2001. Education expenditure is the amount of financial resources that the government devotes to

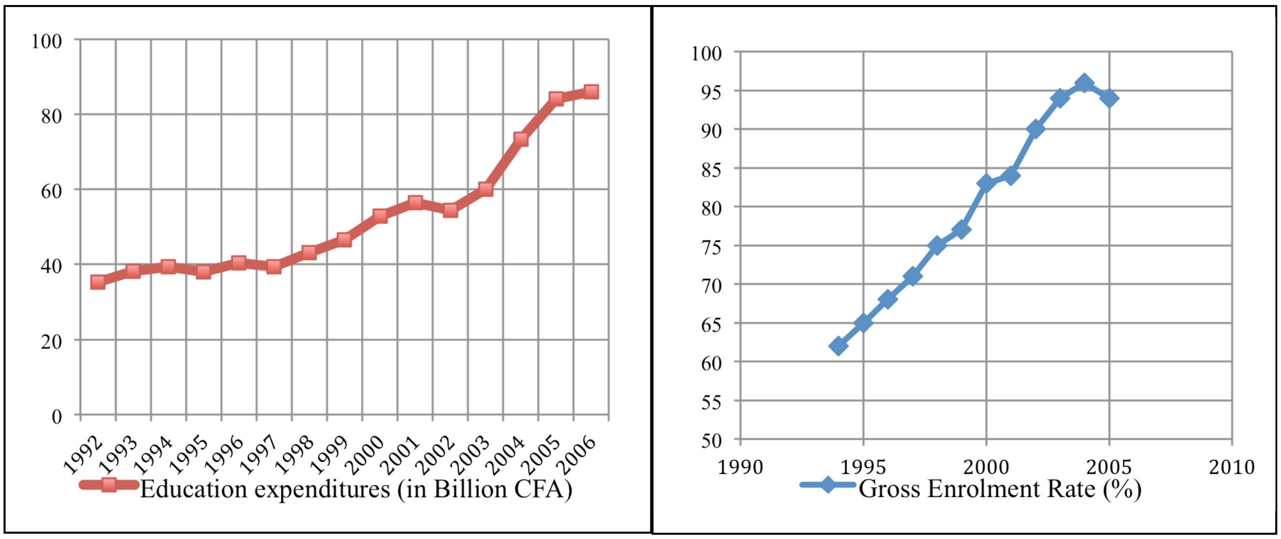
[4] The present study defines school dropouts as children who were registered in primary school, but did not enroll in school in the year of the survey. In other words, the variable *dropouts* refers to the children who had been registered in primary school in a given year, but did not complete the primary level of education.

[5] The academic year in Benin runs from October to July.

[6] Based on the National Report "*Impact de la gratuité de l'enseignement maternel et primaire sur la pauvreté, le social et les OMD*" a 2012 report of the "*Observatoire du Changement Social*" which is a division of the Benin Ministry of Development and Economic Analysis.

national education. It is expressed in billions of the local currency, the Franc CFA, which stands for *Communauté Financière d'Afrique* (CFA). The statistics are given at the constant price of 2006. However, the expenditure includes not only the primary level, but also other levels of education. Generally, Benin's investments in education increased from 35.3 billion CFA in 1992 to 86 billion CFA in 2006. With regard to the period studied (1996-2006), one of the statistical peak amounts of education expenditure, 56.8 billion CFA, took place in 2001, and corresponds to the start of the FPE policy for girls living in rural areas. The total includes all levels of education, so the amount spent on FPE cannot be directly observed.

Figure 1: Development of education expenditure and the GER (1992-2006)



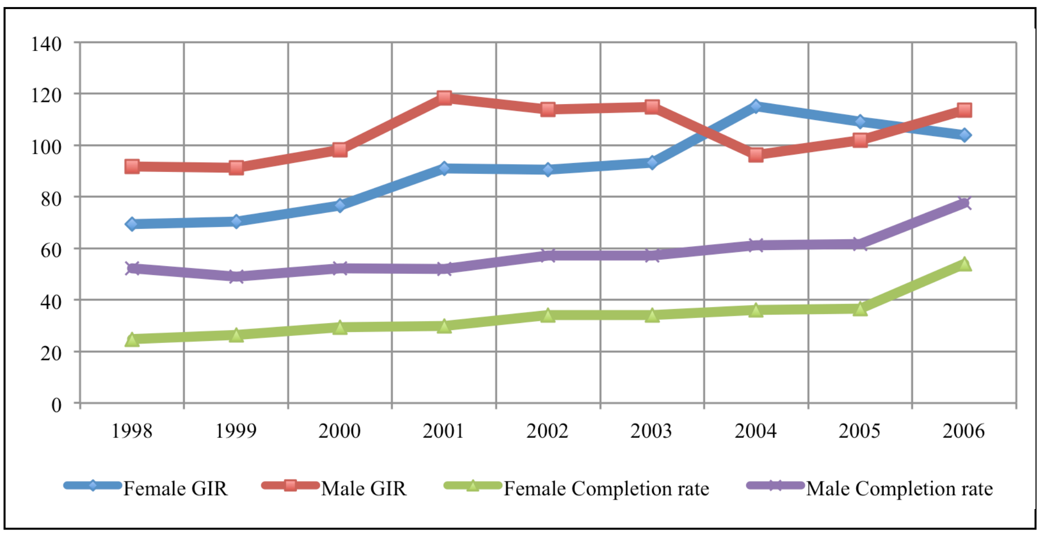
Education expenditures are given at a constant 2006 price to remove the effect of inflation. 1 billion CFA= 1,660 million US dollars (on 27/05/2015).
Source: Statistics from Mondiale (2009)

The Gross Enrollment Rate (GER) is the percentage of children registered in primary schools expressed in the percentage of the number of children who *should* be in primary schools. The main disadvantage of this indicator is that it does not take into account the age of the registered children. Hence, older or younger children in a cohort of pupils could be included in the statistics. The chart on the right of Figure 1 indicates that the growth of the GER is relatively stable.

This analysis would be incomplete without an examination of girls' education in Benin. The aim of Chart 2 is to provide an overview of enrollment and completion in primary schools per gender over the period of study. Figure 2 displays the development of the Gross Intake Ratio

(GIR) of primary schools and the completion rate from 1994 to 2005. The GIR is the number of children registered in the first grade of primary school (regardless of their age) over the number of children who *should* be enrolled in the first grade of primary school (UNESCO, 2009). It reveals the capacity of the system to receive children, and more importantly, the number of children who do access the first grade of primary school. The completion rate is the number of children from the initial cohort of children registered in the first grade of primary school who reached the last grade (UNESCO, 2009). The difference between the GIR and the female GIR is that the latter considers only girls. Figure 2 presents a chart illustrating that GIRs increased over time. The chart shows the development of the GIR and the completion rate per gender between 1998 and 2006.

Figure 2: Development of the gross intake rate and completion rates from 1998 to 2005



Source: Based on statistics from INSAE (2009)

Mostly, the male GIR remains higher than the female GIR up to 2003, after which it appears that the gender gap might have decreased. Additionally, the completion rate is relatively stable during this period. For example, in 2001, 91% of girls entered the first grade, with only 29.9% actually completing the primary level. Therefore, the number of school dropouts has only slightly changed, and so remains important. Furthermore, the elimination of fees for girls may not affect their achievement, which is the primary concern of this paper.

3. Methodology

This section covers the identification strategies, descriptive evidence and estimation procedures.

3.1 Identification strategies

One main assumption of the DID is the parallel trend between treatment and control groups. The assumption states that the outcomes of the treatment and control groups follow parallel trends. In this study, the comparison is between the schooling trends of treatment and control groups. The comparison of the groups at two different periods is possible because the schooling trends are assumed to be parallel. Even if there was a difference in the outcomes of the younger and older birth cohorts, due to the previous assumption, any jump in the trend of the treatment group is associated with the policy. Also, the regression models include characteristics of the groups to consider any additional differences in demographics. Duflo (2004) used a similar strategy to evaluate the medium-term impact of an expansion of primary schools in Indonesia. Among other strategies, the author compares a younger (about 20 and 40 years old) to an older (about 40 and 60 years old) birth cohort.

The FPE policy aiming at girls' schooling was implemented in rural areas from 2001 onward. This paper examines Benin's implementation of FPE as a natural experiment. The impact evaluation can take advantage of three variations: First, the policy targeted girls in rural areas; a comparison can be made between girls living in rural and in urban areas. Second, the FPE policy applied to girls in primary school. As a result, only children between six and 11 years old are eligible for the program. Hence, a second comparison is possible between younger cohorts of children that are of primary school age during the program, and older cohorts of children that are of secondary school age. The third comparison is then over time.

The first comparison of girls in rural and urban areas might be affected by the contrast between these areas. In the context of a developing country, rural and urban areas could be different, mainly in terms of infrastructure (e.g. number of schools, number of teachers, and the school environment in general). The alternative of comparing boys and girls in the same areas might be worse. Indeed, households might have a preference for boys' enrollment, to the detriment of girls. The fact that wealth constraints have an impact on a household's decision to enroll a child also cannot be ignored. In that case, a policy that affects girls might affect boys as well, so the best alternative is to compare girls living in rural and urban areas. It is assumed that the two groups of girls would have followed parallel paths in their schooling without the FPE. This assumption will be tested in the robustness checks.

Thus, the principal idea of the second comparison is to compare girls aged six to 11 with a population of girls aged 12 to 14 at two different periods: 1996 and 2001 for the short-term evaluation; and 2001 and 2006 for the medium-term evaluation. In the short-term, two treatment groups have been retained: the younger cohort of girls born between 1988 and 1990; and the middle cohort of girls born between 1985 and 1987. The control group called older cohort A consists of girls born between 1982 and 1984. In the medium-term, additional birth cohorts have been selected to capture the impact on girls who started primary school with the FPE. Hence, in the medium-term evaluation the younger cohort consists of girls born between 1993 and 1995; the middle cohort consists of girls born between 1990 and 1992 and the older cohort A consists of girls born between 1987 and 1989. The main advantage of this comparison is that the children in the older cohort A could not be the recipients of the program because they were likely to be registered in secondary school. Another advantage is that the comparison is made between those cohorts in two different periods, which should help eliminate any issues.

The third comparison takes advantage of the differences in birth cohorts over time. In the short-term analysis, the periods are 1996 and 2001. In the medium-term analysis, the periods are 2001 and 2006.

Table 1: Summary of identification strategies in the medium term (DHS 2001/2006)

		Treatment	Control
First difference	Areas of residence	Girls in rural areas	Girls in urban areas
Second difference	Birth cohorts	Younger cohort (1993-1995)	Older cohort (1987-1989)
		Middle cohort (1990-1992)	Older cohort (1987-1989)
Third difference	Periods	DHS 2001	DHS 2006

Source: Author

Finally, the triple differences evaluation method has been used due to the double comparison and to the time periods. The triple differences method can give more robust results than the difference-in-differences (DID) method (see Gruber (1994), Ravallion et al. 2005). In fact, the first difference is between rural and urban areas. The second difference is among younger and older cohorts. The third difference is in the periods of time (1996 to 2001 and 2001 to 2006).

One of the strength of these identification strategies is based on the parallel trend assumption of the triple difference method. Finally the parallel trend assumption will be verified in the robustness checks. More details on the different cohorts are given in the following section.

3.2 Data and descriptive evidence

The data are taken from the Demographic and Health Survey (DHS) of Benin for the periods 1996, 2001 and 2006 ("Enquête Démographique et de Santé du Benin"), which were gathered by the National Institute for Statistics and Economic Analysis (INSAE, Benin) in collaboration with Macro International Inc. The 1996 DHS was used for the pre-treatment year, because no child was a beneficiary of the policy at that time. Thus, a comparison of the 1996 and 2001 results could show the effect of the policy within the first year of its implementation. This corresponds to the short-term analysis. The 2006 DHS was a post-treatment year, and comparing it with the 2001 DHS may reveal the medium-term effects.

It is worth noting that the launch of the second FPE policy was within the data collection period of the 2006 DHS. The survey was conducted from August 3 to November 18, 2006, and relates to the end of academic year 2005-2006 and the beginning of academic year 2006-2007. The issue is that enrollment could have increased as a consequence of the new policy in October 2006. It is assumed, however, that the short period between the launch of the second FPE policy and the end of data collection would not be sufficient for any effects of the second FPE policy to be observed. Indeed, the information could have taken time to reach all regions of the country, so the impact might be negligible in a one-month period. The robustness check will control for and discuss the possible impact.

Table 2: Descriptive statistics of the sample based on DHS 1996 and 2001

Means of variables	Younger cohort	Middle cohort	Older cohort A
Child's age	9.284	11.971	14.976
	(2.670)	(2.610)	(2.640)
Current enrollment	.461	.501	.376
	(.498)	(.500)	(.484)
Current enrollment in rural areas	.394	.424	.306
	(.488)	(.494)	(.460)
Current enrollment in urban areas	.616	.641	.486
	(.486)	(.479)	(.499)
Current enrollment of girls	.372	.368	.251
	(.483)	(.482)	(.434)
Current enrollment of girls in rural areas	.298	.282	.166
	(.457)	(.450)	(.372)
Current enrollment of girls in urban areas	.532	.509	.372
	(.499)	(.500)	(.483)
Current enrollment of boys	.543	.622	.499
	(.498)	(.485)	(.500)
Mean of dropouts	.067	.106	.213
	(.250)	(.308)	(.409)
Mean of dropouts in rural areas	.066	.100	.196
	(.249)	(.301)	(.398)
Mean of dropouts in urban areas	.068	.114	.233
	(.253)	(.317)	(.423)
Mean of dropouts for girls	.064	.122	.204
	(.246)	(.328)	(.403)
Mean of dropouts for girls in rural areas	.065	.110	.171
	(.247)	(.313)	(.377)
Mean of dropouts for girls in urban areas	.063	.136	.237
	(.243)	(.343)	(.426)
Mean of dropouts for boys	.069	.094	.220
	(.254)	(.291)	(.414)
Years of schooling	1.371	2.253	2.699
	(1.930)	(2.965)	(3.228)
Years of schooling in rural areas	1.098	1.686	1.908
	(1.711)	(2.248)	(2.693)
Years of schooling in urban areas	2.007	3.288	3.947
	(2.236)	(3.738)	(3.589)
Years of schooling of girls	1.068	1.754	1.903
	(1.744)	(2.480)	(2.967)
Years of schooling of girls in rural areas	.793	1.152	1.240
	(1.468)	(2.007)	(4.647)
Years of schooling of girls in urban areas	1.663	2.744	3.596
	(2.109)	(2.840)	(7.678)
Years of schooling of boys	1.657	2.661	3.480
	(2.049)	(2.582)	(3.284)
Observations	5,511	4,255	3,786

Standard deviations are in brackets

Source: Author's own computation based on DHS 1996, 2001

Furthermore, the dataset for household members has been constrained to the population aged six to 22 years old, which is of interest in this paper. In Benin, the primary school age is theoretically between six and 11 years old, while the secondary school age is between 12 and 18 years old. The sample has been extended to 22 years of age to include older cohorts of children. Information on each individual in the sample has been completed with data on the head of household by merging the household member datasets with a dataset of heads of households.

Table 2 displays the mean and standard deviations of the different birth cohorts. The outcome variables retained are: current enrollment, dropout probability, and years of schooling completed. The table shows that current enrollment is higher for the younger birth cohorts compared to the older birth cohorts. Approximately 46.1% of children between six and eight years old are enrolled in school as opposed to 37.6% of children between 12 and 14 years old. The trends of enrollment in rural and urban areas are quite similar in every cohort. Yet, current enrollment is more noteworthy in urban than in rural areas. In fact, 61.6% of the children in the younger cohorts are enrolled in urban areas compared to 39.4% of children in the same cohort in rural areas. Moreover, current enrollment figures are also higher for boys compared to girls. On average, 54.1% of boys are enrolled in contrast to 37.2% of girls.

The statistical mean of dropout increases with the child's age. On average, 6% of children in the younger cohorts left school compared to 21% in the older cohorts. However, there is not much difference in the statistical mean of dropout in terms of gender and area of residence.

Table 2 indicates that children in the older cohort (aged 12 and 14) have completed 2.69 years of schooling on average, with a standard deviation of 3.22 years. It is important to note that around 40% of individuals in the sample have completed zero years of schooling, which might explain the very low statistics of years of schooling. The table also reveals some dissimilarity in years of schooling, according to gender and area of residence. Children in urban areas complete more years of schooling on average than children in rural areas. Children in the middle cohort living in rural areas have 1.68 years of schooling with a standard deviation of 2.24 years, while children in urban areas have an average of 3.28 years of schooling with a standard deviation of 3.73. Additionally, boys complete around one more year of schooling than girls.

In the main, the trend in current enrollment, school dropouts and years of schooling are roughly similar in urban and rural areas. It suggests that the assumption of parallel trends in schooling might be verified.

3.3 Estimation procedure

Following identification of the groups, estimation of the different effects is straightforward. The objective of the paper is to assess the impacts of the FPE policy on schooling: the outcome variables are the probability of current enrollment, of dropping out and years of schooling completed. As a reminder, girls living in rural areas are the treatment group and girls living in urban areas are the control group.

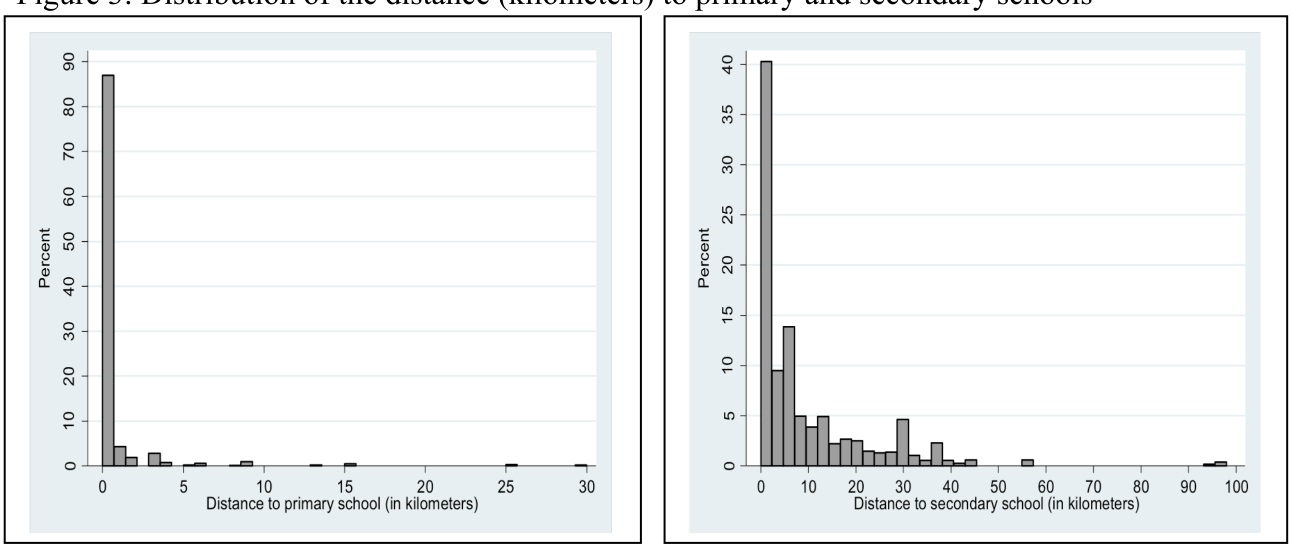
Nevertheless, it is important to analyze the effects of the policy on the schooling of boys. Indeed, households have limited resources, and a reduction in the marginal costs for a child could result in choosing education for that child to the detriment of the other children. In this particular case, the program may disadvantage boys. Given the plausible impact on boys, the estimates are run separately for boys and girls. The triple difference equation is:

$$\mathrm{Y} = \alpha_0 + \alpha_1 \mathrm{X} + \alpha_2 \mathrm{year} + \alpha_3 \mathrm{cohort} + \alpha_4 \mathrm{cohort} * \mathrm{year} + \alpha_5 \mathrm{rural} + \alpha_6 \mathrm{rural} * \mathrm{year} + \alpha_7 \mathrm{cohort} * \mathrm{rural} + \alpha_8 \mathrm{cohort} * \mathrm{rural} * \mathrm{year} + \mu \quad \text{(Equation 1)}$$

where *Y* is the schooling outcome; *X* a set of demographic variables for the child and the household; *cohort* equals 1 if the child is in the treatment cohort (e.g. younger or middle cohort) and 0 otherwise; *year* is a dummy variable for the post-treatment year (2001 or 2006) which represents the trend in the outcome; *rural* is a dummy variable that has value 1 if the child lives in a rural area and 0 otherwise; α_0, α_1, α_2, α_3, α_4, α_5, α_6, α_7 and α_8 are coefficients while μ is the error term. α_8 is the parameter of interest, which gives the impact of the FPE policy on schooling. The explanatory variables are: the head of household's age, gender and level of education, the number of children under five years old; the household's level of wealth; the child's age and regions are dummy variables. Chernichovsky (1985) showed that the presence of younger siblings could be a barrier to girls' education due to the need for childcare. Also, number of siblings in the household could reveal potential competition in terms of resources devoted to education (Glick and Sahn, 2001; Tansel 1997; Al-Samarrai and Peasgood, 1998; Bommier and Lambert, 2000). In this paper we used the household level of wealth to capture the influence of the household wealth. The DHS databases contain a standardized wealth index, which is computed based on the belongings of the households (see Filmer and Pritchett, 1998). This study uses the quintile of wealth to observe the heterogeneity of the impact of the FPE of 2001 according to the household's wealth.

In an extension of Equation 1, an additional variable of distance to school has been included. The parents' decision to provide education for their child could also depend on indirect educational costs. These include, for example, distance to school, uniform fees, and parent-teacher association fees. School fees might have decreased, but the remaining costs may still be a burden for parents. This could explain why, even with the elimination of direct costs, some children are still not enrolled in primary school. Other costs, such as distance to school, may have more of an impact on enrollment and years of schooling than the direct costs. Moreover, the distance to school is a proxy for educational costs and is commonly used in economics (Birdsal and Orivel, 1996; Lavy, 1996; Tansel, 1997). The distance to school represents the potential transportation costs that parents have to pay for their children to attend school regularly. Previous studies have found that the decision of parents to send their children to primary school also depends on the distance to secondary school. Tansel (1997) found that the distance to secondary school influences the schooling of children in primary school. Parents could be more reticent to send their children to primary school if there is no secondary school in their area of residence, for the child to further its education. The enrollment in primary school might be delayed or canceled in such a case. Both distances to primary school and to secondary school are introduced in the equations as indicators of indirect schooling costs.

Figure 3: Distribution of the distance (kilometers) to primary and secondary schools



Source: Author's own computation based on DHS 1996 and 2001

The DHS databases contain details of distance (in kilometers) in the DHS of 1996 and 2001 only, so distance to school can only be included in the short-term analysis. Figure 3 displays the distance to primary and secondary school as taken from the 1996 and 2001 DHS.

Figure 3 indicates that some individuals in the sample live up to 30 kilometers from the closest primary school and others live up to 100 kilometers from the closest secondary school. Despite the fact that such cases are rare, it shows that distance to school could influence decisions about schooling.

The chart on the left indicates that about 80% of children in the sample are less than one kilometer away from a primary school, and suggests that the distance to primary school does not vary much. However, the model includes the distance to primary school for theoretical reasons. In contrast, there is noticeable variability in the distance to the closest secondary school (figure on the right). Thus, it is possible to introduce distance to school in the analysis with the following equations:

$$\mathrm{Y} = \alpha_0 + \alpha_1 \mathrm{X} + \alpha_2 \mathrm{year} + \alpha_3 \mathrm{cohort} + \alpha_4 \mathrm{cohort} * \mathrm{year} + \alpha_5 \mathrm{rural} + \alpha_6 \mathrm{rural} * \mathrm{year} + \alpha_7 \mathrm{cohort} * \mathrm{rural} + \alpha_8 \mathrm{cohort} * \mathrm{rural} * \mathrm{year} + \alpha_9 \mathrm{distance\_zero} + \alpha_{10} \mathrm{distance\_zero} * \mathrm{year} + \mathrm{v} \quad \text{(Equation 2)}$$

$$\mathrm{Y} = \alpha_0 + \alpha_1 \mathrm{X} + \alpha_2 \mathrm{year} + \alpha_3 \mathrm{cohort} + \alpha_4 \mathrm{cohort} * \mathrm{year} + \alpha_5 \mathrm{rural} + \alpha_6 \mathrm{rural} * \mathrm{year} + \alpha_7 \mathrm{cohort} * \mathrm{rural} + \alpha_8 \mathrm{cohort} * \mathrm{rural} * \mathrm{year} + \alpha_9 \mathrm{distance\_zero} + \alpha_{10} \mathrm{distance\_zero} * \mathrm{year} + \alpha_9 \mathrm{distance\_1to5km} + \alpha_{10} \mathrm{distance\_1to5km} * \mathrm{year} + \mathrm{v} \quad \text{(Equation 3)}$$

Equation 2 includes only the distance to the closest primary school and Equation 3 includes the distance to the closest secondary school. Hence, *distance_zero* is a dummy variable that equals 1 if the child lives less than one kilometer from the closest primary school or secondary school and 0 otherwise; *distance_1to5km* equals 1 if the child lives between one and five kilometers from the closest secondary school. Estimates were made using the Ordinary Least Squares (OLS) method. The results of the evaluation are presented in Section 4.

4. Impact of the Free Primary Education policy of 2001

This section presents the results of the probabilities of current enrollment, of dropping out of school, and years of schooling completed in the short- and medium-term. The variables *current enrollment* and *years of schooling* are directly available from the database, but there is no direct information on *dropouts* in the 1996 DHS. For this year, the variable *dropouts*[7] was obtained from a question on whether or not the child is still enrolled. All estimates in the short-term have been performed with a pooled sample of the 1996 and 2001 DHS while the estimates in the medium-term have been performed with a pooled sample of the 2001 and 2006 DHS.

4.1 Impacts of the FPE policy of 2001 on current enrollment

4.1.1 Short-term impacts on current enrollment

Overall the estimates reveal that the likelihood of enrollment has significantly increased for girls in rural areas only.

Table 2 presents the impact of the FPE policy on current enrollment of girls and of boys. The estimates were performed using Equation 1. Columns 1 and 3 present the basic regressions without other explanatory variables. Columns 2 and 4 present the regressions with the additional independent variables and are the full models. The results of both models are roughly similar, apart from some significant parameters.

In the first and second columns of Table 3, there are two equations for girls of the younger cohorts of birth (aged 6 to 8) and two equations for the middle cohorts of birth (aged 9 to 11). The control group for all four equations is girls living in urban areas and in the older cohort A (aged 12 to 14). In the third and fourth columns the same equations have been used for boys. There are also two equations for boys in the younger cohorts and two equations for the middle cohorts of birth. Columns 2 and 4 suggest that children in the younger cohort are more likely to be enrolled than children of the older cohort A.

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[7] The DHS 1996 does not contain information on whether a child has dropped out *per se*. As a result, it has been assumed that a child who is enrolled in year *t-1* and not enrolled in year *t* has abandoned school. Thus, the answer “no” to the question “Is the household member still enrolled?” has been recorded as “yes” for dropout.

Table 3: Impacts of the FPE policy on current enrollment in the short-term (full DHS 1996/2001)

	Girls		Boys	
	(1)	(2)	(3)	(4)
Variables	OLS	OLS	OLS	OLS
Observations for the regressions on the younger cohort	4,515	4,509	4,723	4,715
R-squared for the regressions on younger cohort	0.088	0.179	0.095	0.221
Observations for the regressions on the middle cohort	3,874	3,869	4,101	4,094
R-squared for the regressions on middle cohort	0.073	0.171	0.068	0.205
Dependent variable: Current enrollment				
Treatment sample: individuals aged 6 to 8 in 1996 or 11 to 13 in 2001				
Control: individuals aged 12 to 14 in 1996 or 17 to 19 in 2001				
2001 dummy	-0.0955**	1.051***	-0.178***	1.320***
	(0.0378)	(0.281)	(0.0440)	(0.268)
Younger cohort	0.0785***	0.304***	-0.0882**	0.363***
	(0.0303)	(0.0702)	(0.0358)	(0.0689)
Younger cohort* 2001 dummy	0.168***	-0.346***	0.358***	-0.279***
	(0.0489)	(0.107)	(0.0470)	(0.101)
Dummy for rural areas	-0.222***	-0.0551*	-0.215***	-0.0473
	(0.0359)	(0.0311)	(0.0493)	(0.0394)
Dummy for rural areas * 2001 dummy	0.0210	-0.0152	0.0384	-0.0142
	(0.0482)	(0.0438)	(0.0637)	(0.0549)
Younger cohort*Dummy for rural areas	-0.0553	-0.0725**	-0.0608	-0.0916**
	(0.0377)	(0.0368)	(0.0459)	(0.0421)
Younger cohort* Dummy for rural areas*2001 dummy	0.0963	0.110*	0.0978	0.0855
	(0.0599)	(0.0578)	(0.0622)	(0.0577)
Treatment sample: individuals aged 9 to 11 in 1996 or 14 to 16 in 2001				
Control: individuals aged 12 to 14 in 1996 or 17 to 19 in 2001				
2001 dummy	-0.0955**	0.174	-0.178***	0.222
	(0.0378)	(0.302)	(0.0440)	(0.323)
Middle cohort	-0.222***	-0.0599*	0.120***	0.0835**
	(0.0359)	(0.0305)	(0.0314)	(0.0421)
Middle cohort* 2001 dummy	0.0210	-0.0257	0.0891**	0.0368
	(0.0482)	(0.0441)	(0.0637)	(0.0553)
Dummy for rural areas	0.119***	0.0340	-0.215***	-0.0486
	(0.0390)	(0.0493)	(0.0493)	(0.0395)
Dummy for rural areas * 2001 dummy	0.0414	-0.0317	0.0384	0.00138
	(0.0553)	(0.0716)	(0.0637)	(0.0553)
Middle cohort*Dummy for rural areas	-0.0365	-0.0428	-0.0751*	-0.0623*
	(0.0448)	(0.0431)	(0.0396)	(0.0352)
Middle cohort* Dummy for rural areas*2001 dummy	0.0443	0.0511	0.0964	0.0634
	(0.0660)	(0.0629)	(0.0592)	(0.0560)
Other covariates	No	Yes	No	Yes

Standard errors in parentheses adjusted (robust) for clustering at the Primary Sampling Unit (PSU). *** Significant at 1%, ** Significant at 5%, *Significant at 10%. The equations include other control variables on the head of household's age, gender and education level, the child's age, the number of children under five years old, districts' dummies and dummies for the quintiles of wealth, which are not presented.
Source: Author's own computation based on 1996 and 2001 DHS

Table 4: Impacts of the FPE on current enrollment with the distance to school in the short-term (full DHS 1996/2001)

	Girls		Boys	
	(1)	(2)	(3)	(4)
Variables	OLS	OLS	OLS	OLS
Dependent variable: Current enrollment				
Treatment sample: individuals aged 9 to 11 in 1996 or 14 to 16 in 2001				
Control: individuals aged 12 to 14 in 1996 or 17 to 19 in 2001				
Middle cohort*Dummy for rural areas	-0.0495	-0.0426	-0.0622*	-0.0505
	(0.0434)	(0.0431)	(0.0353)	(0.0353)
Middle cohort* Dummy for rural areas*2001 dummy	0.0550	0.0473	0.0636	0.0556
	(0.0630)	(0.0627)	(0.0562)	(0.0553)
Distance to the closest primary school				
Dummy for less than 1 kilometer	0.175***		0.299***	
	(0.0403)		(0.0745)	
Dummy for less than 1 kilometer* 2001 dummy	-0.153**		-0.102	
	(0.0665)		(0.0855)	
Distance to the closest secondary school				
Dummy for less than 1 kilometer		0.154***		0.162***
		(0.0456)		(0.0381)
Dummy for less than 1 kilometer* 2001 dummy		-0.0469		-0.0655
		(0.0573)		(0.0574)
Dummy for 1 to 5 kilometers		0.0823*		0.0981**
		(0.0461)		(0.0420)
Dummy for 1 to 5 kilometers* 2001 dummy		-0.00971		-0.0376
		(0.0556)		(0.0570)
Other covariates	Yes	Yes	Yes	Yes
Constant	0.833***	0.829***	0.682***	0.854***
	(0.157)	(0.163)	(0.168)	(0.164)
Observations	3,869	3,869	4,094	4,094
R-squared	0.177	0.178	0.216	0.213

Standard errors in parentheses adjusted (robust) for clustering at the Primary Sampling Unit (PSU). *** Significant at 1%, ** Significant at 5%, *Significant at 10%. The equations include other control variables on the head of household's age, gender and education level, the child's age, the number of children under five years old, districts' dummies and dummies for the quintiles of wealth, which are not presented. The dummies for the year 2001, the younger cohort, rural areas and their interactions are also included.
Source: Author's own computation based on DHS 1996 and 2001

In contrast, children in rural areas are less likely to be enrolled than children in urban areas. Column 2 indicates that girls in rural areas and in the younger cohorts have an 11% greater chance of being enrolled in 2001. It means that the FPE policy has significantly increased the probability of enrollment of girls in rural areas. However, there is no significant impact on the middle cohorts. Column 4 shows no significant impact of the FPE policy on the current enrollment of boys.

In Table 4, distance to school has been introduced into the models. The estimates in Table 4 were performed using Equations 2 and 3. The impact of the FPE policy on current enrollment does not change with the introduction of distance to school. In fact, the effect of the FPE policy on current enrollment is still not significant for girls and boys in rural areas and in the middle cohort of births. This effect is similar for all equations. Hence, the impact of the FPE policy on current enrollment does not change much after accounting for the distance to school.

In addition, the likelihood of being enrolled decreases with distance to school. In the first and second columns of Table 4, the dummy for distance to primary school was included in the regression. The results are only for children in the middle cohorts of birth. These columns show a significant effect of the distance to school on enrollment. Indeed, the likelihood of being enrolled increased by 17.5% for girls in rural areas compared to girls in urban areas if the closest primary school is less than one kilometer away from the household. This parameter is higher for boys. In columns 2 and 4 dummy variables for the distance to secondary school have been introduced in the regressions. The likelihood of being enrolled increased by 15.4% if a girl lives less than one kilometer from the closest secondary school, and 8.23% if a girl lives between one and five kilometers from the closest secondary school. Thus, a girl has a greater chance of being enrolled if she lives closer to the school. Moreover, the effects of distance to school are alike for the younger cohorts, but the parameters are lower. This might be explained by the fact that children aged six to eight are more likely to be accompanied to school by their parents or an adult household member. These results are similar to previous studies (Birdsall and Orivel, 1996; Tansel 1997) in other sub-Saharan countries.

In terms of heterogeneity of the impact, Table 5 reveals that the effect of the FPE policy on current enrollment of girls in rural areas increased with the level of wealth. Equation 1 with additional variables was used to estimate the results in Table 5. In 2001, the probability of being enrolled has not significantly improved for girls in the lowest quintile of wealth, but had increased by 38.0% for the girls in the fourth quintile of wealth. Despite the abolition of fees, it appears that the wealthy households have gained more from the policy than poor households. This result is in agreement with Lincove (2009). The author found that that Universal Primary Education (UPE) in Nigeria was unevenly targeted and resulted in persistent wealth differences. In contrast, Lincove (2012) found a low gap in wealth in Uganda.

In summary, the FPE policy has significantly increased the probability of enrollment of girls in rural areas and in the younger cohorts in the short-term. Nevertheless, poorer households have benefited less from the program that wealthy ones.

Table 5: Heterogeneity of impacts of the FPE policy on current enrollment of girls in the short-term (DHS 1996/2001)

	Girls
Variables	OLS
Dependent variable: Current enrollment	
Treatment sample: girls aged 6 to 8 in 1996 or 11 to 13 in 2001	
Control: girls aged 12 to 14 in 1996 or 17 to 19 in 2001	
Younger cohort*Dummy for rural areas*Dummy for Lowest quintile of wealth	-0.124
	(0.0867)
Younger cohort* Dummy for rural areas*Dummy for Lowest quintile of wealth*2001 dummy	0.137
	(0.115)
Younger cohort*Dummy for rural areas*Dummy for Second quintile of wealth	-0.225**
	(0.0887)
Younger cohort* Dummy for rural areas*Dummy for Second quintile of wealth*2001 dummy	0.325***
	(0.118)
Younger cohort*Dummy for rural areas*Dummy for Middle quintile of wealth	-0.281***
	(0.0857)
Younger cohort* Dummy for rural areas*Dummy for Middle quintile of wealth*2001 dummy	0.345***
	(0.114)
Younger cohort*Dummy for rural areas*Dummy for Fourth quintile of wealth	-0.180**
	(0.0833)
Younger cohort* Dummy for rural areas*Dummy for Fourth quintile of wealth*2001 dummy	0.380***
	(0.116)
Other covariates	Yes
Constant	0.142
	(0.161)
Observations	4,509
R-squared	0.186

Standard errors in parentheses adjusted (robust) for clustering at the Primary Sampling Unit (PSU). *** Significant at 1%, ** Significant at 5%, *Significant at 10%. The equations include other control variables on the head of household's age, gender and education level, the child's age, the number of children under five years old, districts' dummies and dummies for the quintiles of wealth, which are not presented. The dummies for the year 2001, the younger cohort, rural areas and their interactions are also included.
Source: Author's own computation based on DHS 1996 and 2001

4.1.2 Medium-term impact on current enrollment

In general, Table 6 shows a significant positive impact of the FPE policy on current enrollment in the medium-term.

Tables 3 and 6 have the same structure. In fact, the results in Table 6 were obtained after estimation using Equation 1 but with a pooled sample of DHS 2001 and 2006. The first two columns present the basic regressions (without additional variables), while columns 3 and 4 present the full regressions (with other independent variables). According to column 2 in Table 6, the probability of girls' enrollment in rural areas and in the younger cohorts of birth (aged 6 to 8) increased by 13.4% in 2006.

The impact is not significant for girls in rural areas and in the middle cohorts. This means that the enrollment of girls aged (9 to 11) has not significantly increased.

Table 6: Impact of the FPE on current enrollment in the medium-term (full DHS 2001/2006)

	Girls		Boys	
	(1)	(2)	(3)	(4)
Variables	OLS	OLS	OLS	OLS
Observations for the regressions on the younger cohort	8,208	8,200	8,912	8,902
R-squared for the regressions on younger cohort	0.084	0.186	0.069	0.146
Observations for the regressions on the middle cohort	6,880	6,873	7,989	7,982
R-squared for the regressions on middle cohort	0.064	0.177	0.034	0.165
Dependent variable: Current enrollment				
Treatment sample: individuals aged 6 to 8 in 2001 or 11 to 13 in 2006				
Control: individuals aged 12 to 14 in 2001 or 17 to 19 in 2006				
2006 dummy	-0.0972***	1.570***	-0.116***	-0.120**
	(0.0326)	(0.216)	(0.0312)	(0.0611)
Younger cohort	0.0158	0.422***	-0.120***	-0.112***
	(0.0397)	(0.0731)	(0.0294)	(0.0294)
Younger cohort* 2006 dummy	0.234***	-0.452***	0.289***	0.302***
	(0.0445)	(0.0888)	(0.0361)	(0.0356)
Dummy for rural areas	-0.156***	-0.0201	-0.163***	-0.0925***
	(0.0387)	(0.0385)	(0.0384)	(0.0357)
Dummy for rural areas * 2006 dummy	-0.0332	-0.0524	0.0215	0.0202
	(0.0451)	(0.0432)	(0.0472)	(0.0438)
Younger cohort*Dummy for rural areas	-0.0421	-0.0760*	-0.0613	-0.0565
	(0.0466)	(0.0441)	(0.0384)	(0.0383)
Younger cohort* Dummy for rural areas*2006 dummy	0.133**	0.134***	0.0924*	0.0771
	(0.0527)	(0.0502)	(0.0483)	(0.0474)
Treatment sample: individuals aged 9 to 11 in 2001 or 14 to 16 in 2006				
Control: individuals aged 12 to 14 in 2001 or 17 to 19 in 2006				
2006 dummy	-0.0972***	0.366	-0.116***	0.406**
	(0.0326)	(0.238)	(0.0312)	(0.206)
Middle cohort	0.122***	0.0745	0.0770***	0.0691*
	(0.0321)	(0.0485)	(0.0220)	(0.0378)
Middle cohort* 2006 dummy	0.0803**	-0.0281	0.0223	-0.0632
	(0.0372)	(0.0570)	-0.163***	-0.0821**
Dummy for rural areas	-0.156***	-0.0475	(0.0384)	(0.0339)
	(0.0387)	(0.0387)	0.0215	0.0303
Dummy for rural areas * 2006 dummy	-0.0332	-0.0185	(0.0472)	(0.0422)
	(0.0452)	(0.0431)	(0.0637)	(0.0553)
Middle cohort*Dummy for rural areas	-0.00132	-0.00439	-0.000785	0.0116
	(0.0416)	(0.0401)	(0.0317)	(0.0306)
Middle cohort* Dummy for rural areas*2006 dummy	0.0120	0.00220	0.0309	0.0121
	(0.0495)	(0.0475)	(0.0421)	(0.0398)
Other covariates	No	Yes	No	Yes

Standard errors in parentheses adjusted robust for clustering at the Primary Sampling Unit (PSU). *** Significant at 1%, ** Significant at 5%, *Significant at 10%. The equations include other control variables on the household head's age, gender and education level, the child's age, the number of children under five years old, districts' dummies and dummies for the quintiles of wealth, which are not presented.

Source: Author's own computation based on DHS 2001 and 2006

Table 7: Heterogeneity of impacts of the FPE policy on current enrollment of girls in the medium-term (DHS 2001/2006)

	Girls
Variables	(1) OLS
Dependent variable: Current enrollment	
Treatment sample girls aged 6 to 8 in 2001 or 11 to 13 in 2006	
Control: girls aged 12 to 14 in 2001 or 17 to 19 in 2006	
Younger cohort*Dummy for rural areas*Dummy for Lowest quintile of wealth	-0.198**
	(0.0837)
Younger cohort* Dummy for rural areas*Dummy for Lowest quintile of wealth*2006 dummy	0.110
	(0.0945)
Younger cohort*Dummy for rural areas*Dummy for Second quintile of wealth	-0.164*
	(0.0868)
Younger cohort* Dummy for rural areas*Dummy for Second quintile of wealth*2006 dummy	0.119
	(0.0991)
Younger cohort*Dummy for rural areas*Dummy for Middle quintile of wealth	-0.193**
	(0.0822)
Younger cohort* Dummy for rural areas*Dummy for Middle quintile of wealth*2006 dummy	0.145
	(0.0892)
Younger cohort*Dummy for rural areas*Dummy for Fourth quintile of wealth	-0.136*
	(0.0828)
Younger cohort* Dummy for rural areas*Dummy for Fourth quintile of wealth*2006 dummy	0.108
	(0.0923)
Other covariates	Yes
Constant	-0.285*
	(0.154)
Observations	8,200
R-squared	0.187

Standard errors in parentheses adjusted (robust) for clustering at the Primary Sampling Unit (PSU). *** Significant at 1%, ** Significant at 5%, *Significant at 10%. The equations include other control variables on the head of household's age, gender and education level, the child's age, the number of children under five years old, districts' dummies and dummies for the quintiles of wealth, which are not presented. The dummies for the year 2001, the younger cohort, rural areas and their interactions are also included.
Source: Author's own computation based on DHS 2001 and 2006

The girls in the middle cohorts had already started primary school before the launch of the policy. It implies that they have not really benefited from the program. There is also no significant effect on the current enrollment of boys in rural areas. It also appears that the effect of wealth reduced in 2006. Actually, there is no significant increase in enrollment of girls in any quintile of wealth in comparison to the fifth quintile of wealth, which suggests that there is no significant difference in enrollment with regard to the quintiles of wealth in 2006. Overall, in the medium-term, the FPE policy significantly increased the probability of enrollment of girls in rural areas regardless of the households' level of wealth.

4.2 Impact of the FPE policy of 2001 on dropout probability

4.2.1 Short-term impact of the FPE policy on dropout probability

Table 8 displays the impact of the FPE policy on dropout probability. The estimates were performed using Equation 1. Generally, the probability of dropping out has not significantly changed in the short-term for girls in rural areas who are in the treatment group. Surprisingly, the probability of dropping out increased for boys in rural areas.

In column 2 of table 8, the parameter for girls in rural areas is not statistically significant for the younger or middle cohorts of birth. Column 4 of table 8 suggests that the dropout probability has significantly increased by 10.5% for boys in rural areas and in the younger cohorts of birth. There is however no significant effect on boys in the middle cohorts of birth. The impact on boys could be explained by the constraint of household wealth. In fact, households decide to enroll or withdraw a child based on different factors, including wealth. If school fees are removed for girls, it is plausible that parents prefer to send girls to school instead of boys. Another explanation might be, that primary schools prioritized the enrollment of girls over boys. Indeed, the government provided funds to support primary schools according to the number of girls enrolled, which was meant to encourage girls' enrollment. This effect could be a drawback of the program.

In Table 9, distance to school has been included in the regressions. The results of Table 9 have been obtained using Equations 2 and 3. The impact of the FPE policy on dropout probability did not change after introduction of the distance to school, and its impact on the probability of girls dropping out is still not statistically significant. Moreover, the increase in the probability of boys in rural areas in the younger cohort who drop out went from 10.5% in the basic model to 10.7% in the models including distance to primary schools. In addition, the probability of dropping out significantly increased with distance to school. The probability of dropping out of school decreased by 30.9% for the girls in rural areas in the middle cohort who live less than one kilometer away from the closest primary school, according to Column 1 of table 9.

Table 8: Impact of the FPE policy on dropout probability in the short-term (full DHS 1996/2001)

	Girls		Boys	
	(1)	(2)	(3)	(4)
Variables	OLS	OLS	OLS	OLS
Observations for the regressions on the younger cohort	2,830	2,824	3,501	3,493
R-squared for the regressions on younger cohort	0.053	0.087	0.065	0.085
Observations for the regressions on the middle cohort	2,492	2,487	3,256	3,249
R-squared for the regressions on middle cohort	0.024	0.078	0.054	0.084
Dependent variable: Dropout				
Treatment sample: individuals aged 6 to 8 in 1996 or 11 to 13 in 2001				
Control: individuals aged 12 to 14 in 1996 or 17 to 19 in 2001				
2001 dummy	0.0537	-0.280	0.186***	-0.254
	(0.0368)	(0.265)	(0.0318)	(0.265)
Younger cohort	-0.167***	-0.136	-0.0538**	0.0117
	(0.0308)	(0.0926)	(0.0242)	(0.0613)
Younger cohort* 2001 dummy	-0.0145	0.0724	-0.191***	-0.0894
	(0.0388)	(0.111)	(0.0349)	(0.0878)
Dummy for rural areas	0.0224	-0.0140	0.0439	0.0295
	(0.0458)	(0.0441)	(0.0290)	(0.0304)
Dummy for rural areas * 2001 dummy	-0.129**	-0.0462	-0.104**	-0.0864*
	(0.0548)	(0.0529)	(0.0442)	(0.0467)
Younger cohort*Dummy for rural areas	0.0302	0.0341	-0.0506	-0.0544
	(0.0531)	(0.0526)	(0.0343)	(0.0346)
Younger cohort* Dummy for rural areas*2001 dummy	0.0568	0.0465	0.105**	0.105**
	(0.0608)	(0.0602)	(0.0477)	(0.0483)
Treatment sample: individuals aged 9 to 11 in 1996 or 14 to 16 in 2001				
Control: individuals aged 12 to 14 in 1996 or 17 to 19 in 2001				
2001 dummy	0.0537	-0.241	0.186***	-0.214
	(0.0368)	(0.302)	(0.0318)	(0.268)
Middle cohort	-0.128***	-0.0463	-0.0892***	-0.0328
	(0.0334)	(0.0591)	(0.0235)	(0.0359)
Middle cohort* 2001 dummy	0.0431	0.0733	-0.0795**	-0.0290
	(0.0482)	(0.0441)	(0.0365)	(0.0570)
Dummy for rural areas	0.0224	-0.0110	0.0439	0.0187
	(0.0458)	(0.0451)	(0.0290)	(0.0310)
Dummy for rural areas * 2001 dummy	-0.129**	-0.0302	-0.104**	-0.0697
	(0.0548)	(0.0530)	(0.0442)	(0.0465)
Middle cohort*Dummy for rural areas	-0.00697	0.00215	-0.0183	-0.0170
	(0.0517)	(0.0501)	(0.0317)	(0.0317)
Middle cohort* Dummy for rural areas*2001 dummy	0.0607	0.0493	0.0493	0.0523
	(0.0634)	(0.0619)	(0.0488)	(0.0491)
Other covariates	No	Yes	No	Yes

Standard errors in parentheses adjusted (robust) for clustering at the Primary Sampling Unit (PSU). *** Significant at 1%, ** Significant at 5%, *Significant at 10%. The equations include other control variables on the head of household's age, gender and education level, the child's age, the number of children under five years old, districts' dummies and dummies for the quintiles of wealth, which are not presented.

Source: Author's own computation based on DHS 1996 and 2001

Table 9: Impact of the FPE policy on dropout probability considering distance to school in the short-term (full DHS 1996/2001)

	Girls		Boys	
Variables	(1) OLS	(2) OLS	(3) OLS	(4) OLS
Dependent variable: Dropout				
Treatment sample: individuals aged 9 to 11 in 1996 or 14 to 16 in 2001				
Control: individuals aged 12 to 14 in 1996 or 17 to 19 in 2001				
Middle cohort*Dummy for rural areas	-0.00697	0.00215	-0.0183	-0.0170
	(0.0517)	(0.0501)	(0.0317)	(0.0317)
Middle cohort* Dummy for rural areas*2001 dummy	0.0607	0.0493	0.0493	0.0523
	(0.0634)	(0.0619)	(0.0488)	(0.0491)
Distance to the closest primary school				
Dummy for less than 1 kilometer	-0.309***		-0.0536	
	(0.0494)		(0.109)	
Dummy for less than 1 kilometer* 2001 dummy	0.368***		0.0906	
	(0.0601)		(0.116)	
Distance to the closest secondary school				
Dummy for less than 1 kilometer		-0.0996**		-0.0721***
		(0.0398)		(0.0218)
Dummy for less than 1 kilometer* 2001 dummy		0.112**		0.114***
		(0.0479)		(0.0380)
Dummy for 1 to 5 kilometers		-0.0641		-0.0549**
		(0.0447)		(0.0242)
Dummy for 1 to 5 kilometers* 2001 dummy		0.0725		0.0596
		(0.0504)		(0.0364)
Other covariates	Yes	Yes	Yes	Yes
Constant	0.147	-0.0843	-0.0415	-0.0497
	(0.222)	(0.236)	(0.168)	(0.137)
Observations	2,487	2,487	3,249	3,249
R-squared	0.081	0.080	0.085	0.088

Standard errors in parentheses adjusted robust for clustering at the Primary Sampling Unit (PSU). *** Significant at 1%, ** Significant at 5%, *Significant at 10%. The equations include other control variables on the head of household's age, gender and education level, the child's age, the number of children under five years old, districts' dummies and dummies for the quintiles of wealth, which are not presented. The dummies for the year 2001, the younger cohort, rural areas and their interactions are also included.
Source: Author's own computation based on DHS 1996 and 2001

With regards to Column 2 of table 9, the probability of dropping out of school decreased by 9.96% for girls who live less than one kilometer from the closest secondary school. The effect of distance to school on boys is less important than for girls. The probability of dropping out for boys who live less than one kilometer from the closest primary school decreased by 7.21%, according to Column 4 of table 9. For reasons of presentation, the table does not contain the equations for the younger cohorts.

In terms of heterogeneity in wealth, there is no significant difference in the probability of dropping out according to the household's level of wealth. This means that households in rural areas withdrew boys from primary school independent of wealth level. Thus, the increase in boys dropping out affected all wealth levels. Finally, the FPE policy had no significant impact on the probability of girls dropping out in rural areas. Yet, there has been a significant decrease in the probability of boys dropping out in the same areas.

4.2.2 Medium-term impact of the FPE policy of 2001 on dropout probability

The results of the medium-term impact of the FPE policy on dropouts are not presented. However, the probability of dropping out is not statistically significant in 2006 for girls in rural areas. There is also no significant impact of the FPE policy on the probability of boys dropping out in the medium-term.

In conclusion, the FPE policy has no significant impact on the probability of dropping out of school for girls in rural areas. Nevertheless, after the program was implemented, the probability of boys dropping out significantly increased in the short-term. However, the effect was no longer significant in the medium-term.

4.3 Impact of the FPE policy of 2001 on years of schooling completed

In the database used for the estimates, more than 40% of individuals between six and 22 years old have zero years of schooling. It is worth noting that people who have zero years of schooling have either never started primary school or have not been able to complete the first grade of primary school. The results in section 4.1 already considered the enrollment of children who started primary school under the program, which is not the focus of this section. The goal of this evaluation of years of schooling is to observe the impact of the FPE policy on children that have already started school. In other words, do children enrolled during the program stay in school longer? Therefore, the sample has been restricted to individuals with at least one year of education. Hence, the variable *years of schooling completed* starts with the first grade of primary school.

4.3.1 Short-term impact of the FPE policy of 2001 on years of schooling

The FPE policy has no significant impact on years of schooling in the short-term. This result is expected because the evaluation in the short-term falls within the first year of the program. The period is thus too short to expect significant results for years of schooling completed.

Nevertheless, Table 9 reveals significant effects of distance to school on years of schooling. The results in Table 9 were obtained using Equations 2 and 3. Column 2 shows that for girls in rural areas and in the middle cohort, the probability of completing one year of schooling increases by 58.9% if the secondary school is less than one kilometer from the household. The probability is about 30.1% if the closest secondary school is between one and five kilometers from the household. Hence, the likelihood to complete a grade decreases with increases in distance to school. The effect of distance to school is also more noticeable for girls than for boys. These results are in agreement with the literature.

Table 10: Impact of the FPE policy on years of schooling completed including distance to school in the short-term (full DHS 1996/2001)

	Girls		Boys	
Variables	(1) OLS	(2) OLS	(3) OLS	(4) OLS
Dependent variable: Years of schooling completed				
Treatment sample: individuals aged 9 to 11 in 1996 or 14 to 16 in 2001				
Control: individuals aged 12 to 14 in 1996 or 17 to 19 in 2001				
Middle cohort*Dummy for rural areas	0.333*	0.375**	0.271*	0.314**
	(0.192)	(0.189)	(0.141)	(0.144)
Middle cohort* Dummy for rural areas*2001 dummy	0.338	0.311	-0.320	-0.351
	(0.394)	(0.391)	(0.306)	(0.306)
Distance to the closest primary school				
Dummy for less than 1 kilometer	-0.121		0.332	
	(0.159)		(0.343)	
Dummy for less than 1 kilometer* 2001 dummy	-0.0915		0.687	
	(0.608)		(0.455)	
Distance to the closest secondary school				
Dummy for less than 1 kilometer		0.589***		0.384***
		(0.167)		(0.134)
Dummy for less than 1 kilometer* 2001 dummy		-0.179		-0.0150
		(0.324)		(0.255)
Dummy for 1 to 5 kilometers		0.301*		0.215*
		(0.161)		(0.128)
Dummy for 1 to 5 kilometers* 2001 dummy		0.243		0.151
		(0.310)		(0.248)
Other covariates	Yes	Yes	Yes	Yes
Constant	-1.416	-1.997**	-1.394**	-1.280*
	(0.871)	(0.892)	(0.696)	(0.662)
Observations	1,585	1,585	2,774	2,774
R-squared	0.435	0.440	0.502	0.502

Standard errors in parentheses adjusted robust for clustering at the Primary Sampling Unit (PSU). *** Significant at 1%, ** Significant at 5%, *Significant at 10%. The equations include other control variables on the head of household's age, gender and education level, the child's age, the number of children under five years old, districts' dummies and dummies for the quintiles of wealth, which are not presented. The dummies for the year 2001, the younger cohort, rural areas and their interactions are also included.
Source: Author's own computation based on DHS 1996 and 2001

4.3.2 Medium-term impact on years of schooling

In the medium-term, the FPE policy had also no statistically significant impact on the years completed for girls in rural areas. The results suggest that girls who have completed at least one year of schooling before the program was implemented do not stay longer in school. There are two possible explanations. First, it is possible that the evaluation period is not long enough. The effects might appear in the long run. Second, it could be a shortcoming of the program. Indeed, the FPE policy has just been an elimination of school fees, which are only a part of the cost of education. It is plausible that children who are already enrolled encounter difficulties with other costs and not just with the direct costs of education. That might explain why there is no effect with the FPE policy, but distance to school is significant.

In conclusion, the FPE policy has significantly increased the probability of current enrollment of girls in rural areas, but has no impact on the probability of dropping out and years of schooling. In the short-term, the probability of boys dropping out has increased, but the effect disappears in the medium-term. Distance to school, as a proxy for other educational costs (opportunity costs), had a significant negative effect on schooling. These results suggest that there are other plausible costs than direct school costs that may impinge on girls' schooling. The following section presents the robustness checks.

5. Robustness checks

5.1 Placebo experiment 1: Impact of the FPE policy of 2001 on the older cohorts of birth

The 2000 Banque Mondiale report on Benin's educational system reveals that children usually complete primary school by 14 years of age. This could be a threat to the identification strategies, because the older cohort A, which is the control group, includes children between 12 and 14 years old. It is thus necessary to run an additional control experiment comparing the older cohort A to other older cohorts of births. The comparison is between the older cohort A (aged 12 to 14) and the older cohort B (aged 15 to 17). Hence, the children born between 1979 and 1981 are included in the *older cohort B* in the short-term evaluation, while the children born between 1984 and 1986 are included in the *older cohort B* in the medium-term evaluation. The goal of this robustness check is to demonstrate that the older cohort A did not benefit from the FPE.

Table 11: Impact of the FPE policy on current enrollment of older children in the short-term (full DHS 1996/2001)

	Girls		Boys	
Variables	(1) OLS	(2) OLS	(3) OLS	(4) OLS
Dependent variable: Current enrollment *Treatment sample: individuals aged 12 to 14 in 1996 or 17 to 19 in 2001* *Control: individuals aged 15 to 17 in 1996 or 20 to 22 in 2001*				
2001 dummy	-0.179***	-0.586**	-0.171***	-0.220
	(0.0389)	(0.288)	(0.0488)	(0.362)
Older cohort A	0.0881**	-0.00341	0.144***	0.0511
	(0.0379)	(0.0560)	(0.0437)	(0.0511)
Older cohort A * 2001 dummy	0.0833*	0.119*	-0.00727	-0.00363
	(0.0475)	(0.0666)	(0.0537)	(0.0705)
Dummy for rural areas	-0.201***	-0.0622	-0.231***	-0.0476
	(0.0411)	(0.0413)	(0.0471)	(0.0422)
Dummy for rural areas * 2001 dummy	0.0785*	0.0447	0.0200	-0.00137
	(0.0471)	(0.0464)	(0.0602)	(0.0553)
Older cohort A *Dummy for rural areas	-0.0210	-0.0150	0.0160	-0.00746
	(0.0457)	(0.0424)	(0.0523)	(0.0449)
Older cohort A * Dummy for rural areas*2001 dummy	-0.0576	-0.0686	0.0184	0.0148
	(0.0569)	(0.0537)	(0.0682)	(0.0620)
Other covariates	No	Yes	No	Yes
Constant	0.330***	0.930***	0.554***	1.157***
	(0.0323)	(0.219)	(0.0382)	(0.214)
Observations	3,464	3,459	3,435	3,428
R-squared	0.093	0.181	0.084	0.214

Standard errors in parentheses adjusted robust for clustering at the Primary Sampling Unit (PSU). *** Significant at 1%, ** Significant at 5%, *Significant at 10%. The equations include other control variables on the head of household's age, gender and education level, the child's age, the number of children under five years old, districts' dummies and dummies for the quintiles of wealth, which are not presented.
Source: Author's own computation based on DHS 1996 and 2001

Table 11 displays the results of the estimates on current enrollment, according to the placebo experiment. The equations in Table 11 have been estimated using Equation 1. Overall, there is no significant change in the current enrollment of girls of the older cohort A in rural areas in 2001. The results are similar for the probability of dropping out and years of schooling. There is also no significant impact in the medium-term. These results imply that the older cohort A has not gained from the FPE policy, meaning that the impacts observed in the main evaluation are genuinely due to the program.

5.2 Placebo experiment 2: Impact of the FPE policy of 2001 on children living in urban areas

The identification strategies had three sources of variations: cohorts of birth, area of residence and time. The previous section 5.1 already controlled for the robustness of the control group used in combination with birth cohorts. It is thus necessary to control the robustness of the second variation with area of residence. It is important to check that no child living in an urban area has benefited from the FPE policy. For this control experiment, the difference-in-differences (DID) method has been used in the following equation.

$Y = \alpha_0 + \alpha_1 X + \alpha_2 \text{year} + \alpha_3 \text{cohort} + \alpha_4 \text{cohort} * \text{year} + w$ (Equation 4)

The difference between Equation 4 and Equation 1 is that the sample has been limited to children living in urban areas only. The explanatory variables and results are the same. The estimates were also performed separately for girls and boys. The estimates in Table 12 have been obtained with Equation 4. Columns 1 and 3 of Table 12 correspond to the equations for the younger cohorts of birth, while columns 2 and 4 represent the equations for the middle cohorts. Table 12 indicates there was no significant change in the complete OLS estimates of the current enrollment for children in urban areas in 2001. For instance, in the columns 1 and 3 of table 12, there is significant impact on children in urban areas. However, these equations correspond to basic equation without additional covariates. In the full sample, in columns 2 and 4, there is no significant impact of the FPE of 2001 on children in urban areas. There is also no significant change in the probability of dropping out and years of schooling. The results are the same in the medium-term. In other words, children in urban areas have not benefited from the FPE. It confirms that the impacts observed with children in rural areas are associated with the program and not with another policy.

Table 12: Impacts of the FPE policy on current enrollment of children in urban areas in the short-term (DHS 1996/2001 of children living in urban areas)

	Girls living in urban areas		Boys living in urban areas	
Variables	(1) OLS	(2) OLS	(3) OLS	(4) OLS
Dependent variable: Current enrollment				
Treatment sample: individuals aged 6 to 8 in 1996 or 11 to 13 in 2001				
Control: individuals aged 12 to 14 in 1996 or 17 to 19 in 2001				
2001 dummy	-0.0955**	0.278	-0.178***	0.683*
	(0.0378)	(0.467)	(0.0441)	(0.402)
Younger cohort	0.0785**	0.106	-0.0882**	0.259**
	(0.0303)	(0.128)	(0.0359)	(0.108)
Younger cohort* 2001 dummy	0.168***	-0.108	0.358***	-0.189
	(0.0490)	(0.178)	(0.0471)	(0.158)
Treatment sample: individuals aged 9 to 11 in 1996 or 14 to 16 in 2001				
Control: individuals aged 12 to 14 in 1996 or 17 to 19 in 2001				
2001 dummy	-0.0955**	0.278	-0.178***	0.683*
	(0.0378)	(0.467)	(0.0441)	(0.402)
Middle cohort	0.119***	0.0629	0.120***	0.0429
	(0.0390)	(0.0671)	(0.0314)	(0.0531)
Middle cohort* 2001 dummy	0.0414	0.0174	0.0891**	0.0555
	(0.0553)	(0.0973)	(0.0438)	(0.0907)
Other covariates	No	Yes	No	Yes
Observations for the regressions on the younger cohort	1,603	1,600	1,509	1,508
R-squared for the regressions on younger cohort	0.033	0.152	0.044	0.154
Observations for the regressions on the middle cohort	1,521	1,516	1,428	1,427
R-squared for the regressions on middle cohort	0.025	0.147	0.055	0.189

Standard errors in parentheses adjusted robust for clustering at the Primary Sampling Unit (PSU). *** Significant at 1%, ** Significant at 5%, *Significant at 10%. The equations include other control variables on the head of household's age, gender and education level, the child's age, the number of children under five years old, districts' dummies and dummies for the quintiles of wealth, which are not presented.
Source: Author's own computation based on DHS 1996 and 2001

5.3 Migration effect

Despite the improvement in girls' enrollment, another weakness in the evaluation could be the effect of migration. In fact, the launch of the FPE policy may provide an incentive for parents to move to rural areas to enroll their children in school. However, waves of migration in Benin are generally from rural to urban areas and urban areas are substantially more developed than the rural areas (INSAE, 2002). People are typically looking for job opportunities and better living standards, and as a result, migration from urban to rural areas is uncommon.

Nevertheless, migration could be problematic for this strategy because the initial treatment group could vary simply due to migration, and may suggest a misleading effect of the policy. Therefore, the variable *moved* has been created. The DHS databases contain a variable on the number of years the household has lived in the current place of residence. This variable comes from the dataset containing mothers, which has been re-coded here to obtain the variable *moved*, which takes the value 1 if the household has moved in the last five years and 0 otherwise. Hence, if a household has lived less than five years in the current place of residence, they are considered to have moved. The period of five years has been retained because the interval of time between the DHS's data collection is about five years. In the sample used, around 10% of the population in each database had moved in the last five years.

Nonetheless, after merging the household members dataset with the individual dataset, which contains mothers, the sample is restricted to children under 11 years old in 2001. It is not possible then to consider older cohort A as a control group. This could be explained by the fact that the individual dataset is limited to women between 15 and 49 years old. As a result, it is difficult to find mothers for older cohorts of birth. Moreover, the variable on migration is only available in the individual dataset. It reduces the choice of datasets to use to build the databases for the estimates. However, it is important to check that the impacts noted in the main evaluation are not due to the effect of migration. Consequently, the solution was to use the middle cohort (aged 9 to 11) as a control group here. These estimates should be regarded with caution because the middle cohort could benefit from the FPE policy. In fact, children aged nine to 11 are eligible for FPE as well as children of the younger cohort (aged 6 to 8). As a result, the comparison might be biased because both groups are treatment groups. Yet, the main idea of the robustness check is to show that the results are not drastically different when migration is considered. Moreover, only the medium-term evaluation is controlled for robustness, because the sample is the most complete over the medium-term.

Table 13: Impacts of the FPE policy on current enrollment in the medium-term with migration (DHS 2001/2006)

	Girls in rural areas		Girls in urban areas	
	Full sample	Reduced sample	Full sample	Reduced sample
Variables	(1)	(2)	(3)	(4)
Dependent variable: Current enrollment *Treatment sample: individuals aged 6 to 8 in 2001 or 11 to 13 in 2006* *Control: individuals aged 9 to 11 in 2001 or 14 to 16 in 2006*				
2006 dummy	1.508***	1.629***	1.370***	1.471***
	(0.282)	(0.309)	(0.240)	(0.253)
Younger cohort	0.184**	0.221**	0.204***	0.166**
	(0.0760)	(0.0884)	(0.0636)	(0.0702)
Younger cohort* 2006 dummy	-0.215**	-0.248**	-0.205***	-0.163**
	(0.0843)	(0.0966)	(0.0713)	(0.0775)
Dummy for rural areas	-0.0340	-0.0138	-0.0860*	-0.141**
	(0.0610)	(0.0647)	(0.0520)	(0.0584)
Dummy for rural areas * 2006 dummy	-0.104	-0.122*	0.0189	0.0991
	(0.0687)	(0.0727)	(0.0599)	(0.0642)
Younger cohort*Dummy for rural areas	-0.0906	-0.114	-0.0673	0.00709
	(0.0687)	(0.0766)	(0.0595)	(0.0665)
Younger cohort* Dummy for rural areas*2006 dummy	0.149*	0.168**	0.0826	-0.0115
	(0.0770)	(0.0844)	(0.0655)	(0.0725)
Other covariates	Yes	Yes	Yes	Yes
Constant	-0.232	-0.351	-0.103	-0.359
	(0.232)	(0.258)	(0.204)	(0.218)
Pseudo R2	3,552	3,277	4,316	3,989
Observations	0.205	0.205	0.204	0.176

Standard errors in parentheses adjusted robust for clustering. *** Significant at 1%, ** Significant at 5%, *Significant at 10%. The equations include other control variables on the head of household's age, gender and education level, the child's age, the number of children under five years old, districts' dummies and dummies for the quintiles of wealth, which are not presented.
Source: Author's own computation based on DHS 2001 and 2006

The results in Table 13 have been obtained from estimates of Equation 1 on a restricted sample. Columns 1 and 3 of Table 13 correspond to estimates with the full sample. Columns 2 and 4 are the results of estimates of current enrollment with the restricted sample. The restricted sample excludes households that have moved in the last five years. Table 13 shows quite similar impact on current enrollment of children in rural areas with both the full and restricted samples. There is only a difference of two percentage points for the probability of current enrollment of girls in rural areas, but the program still has an impact. Therefore, the FPE policy had a real affect on the treatment group. The influence of the program is not due to potential migration.

In summary, the robustness checks confirmed the results of the main evaluation.

6. Conclusions

This paper intends to measure the impact of the FPE policy on the schooling of girls in the short- and medium-term in Benin (West Africa). The evaluation of this natural experiment takes advantage of several variations: birth cohorts, area of residence and time. The treatment group is girls living in rural areas who are eligible to be enrolled in primary school.

Essentially, the evaluation raises three interesting points. First, the elimination of fees significantly increased the probability of current enrollment of the beneficiaries by 11% in the short-term and 13% in the medium-term. The policy influenced all levels of wealth, but the impact is more pronounced on the wealthiest households in the short-term. As a result, wealth was a key determinant of current enrollment in the short-term. In the medium-term, the differences in wealth dwindled. Second, the FPE policy has no significant impact on the likelihood of dropping out and years of schooling for girls in rural areas. Consequently, attendance might be more influenced by other educational costs. Essentially, the policy has no impact on attendance, but the distance to school does have an effect. These results suggest the indirect costs (e.g.. transportation fees) might be better determinants of schooling decisions than direct costs. Third, the FPE policy increased the probability of dropout by boys in rural areas in the short-term. It is a drawback of the policy. In the medium-term, this effect disappeared. Households are constrained by their wealth. It is understandable that in the short-term, when enrollment still depends on wealth, that boys would be affected by the policy. The different robustness checks support the impact evaluation.

This study supports the idea that children's enrollment, and especially girls' demand for education, is responsive to the price of education (Glick, 2008; Iśçan et al., 2015). Nevertheless, it is necessary to make sure that the policy does not affect boys in the same areas negatively. Most important, this experiment indicates that abolition of direct educational costs may not be a sufficient reason for girls in rural areas to complete primary school. This result agrees with previous work by Lucas and Mbiti (2012). Fees are potential barriers to education, but other factors could also explain attendance issues. Future work should analyze in depth the impact of the opportunity and indirect costs on children's attendance. Indeed, the national investment in enrolling girls could be negligible if girls do not complete primary school. This paper suggests that the abolition of school fees is beneficial for education and should be generalized. However, the government should subsidize other educational costs and build schools to improve attendance.

One of the main limitations of this paper is the lack of data on actual educational costs. Indeed, the evaluation could not cover the extent of the cost reduction. In addition, data on school facilities, pupil performance, and community infrastructure would have allowed a thorough examination of supply-side factors. However, none of these limitations lessen the validity of the results.

Chapter 2: Impact of a Demand-and-Supply Side Policy on Girls' Schooling in Benin, West Africa

Mafaïzath Fatoké Dato*

Abstract

The present article argues that a demand-and-supply policy could be more beneficial for Sub-Saharan African countries. Indeed, the removal of direct costs might encourage parents to send their children to school, but the decision to continue could depend on the distance to school, the qualification of the teachers, or the school's equipment. This paper measures the impact of such a policy in Benin, West Africa. This country has introduced a program to eliminate school fees, build schools and recruit teachers in 2006. The data used come from the Benin Demographic and Health Surveys of 2006 and 2012. The difference-in-differences estimations reveal that the policy has increased enrollment and attendance of birth cohorts of children eligible for the program. Children stayed in average two more years in primary schools following the implementation of the program. Nevertheless, the gender disparities are still persistent.

Keywords: Policy evaluation, Education, Gender, Inequality.

JEL classification: H43, I24, I25, I28

I am extremely grateful to Professor Eveline Wittmann, Professor Guido Heineck and Professor Mareva Sabatier for the useful comments. My gratitude goes to the German Academic Exchange Service (DAAD) for the PhD scholarship. All responsibilities are mine for the remaining errors.

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1. Introduction

Several developing countries implemented an elimination of school fees in primary education to reach the Millennium Development Goal 2 (MDG2). However, these programs neglect the poor study conditions in these countries. A report from Education for All Global Monitoring reveals that 250 million children are not learning the basics in primary school due to the quality of the school systems (UNESCO, 2014). In some rural settings, the closest school is some considerable distance away. In others, schools lack fundamental pedagogical equipment. Glick (2008) informed that the fragile schooling conditions have a stronger negative impact on girls than boys, which may indeed widen the gender differences in schooling in developing countries.

Despite the tremendous accomplishment for primary enrollment, more work needs to be done to examine the issues around years of schooling completed and gender inequalities. This article argues that a demand-and-supply side policy could be beneficial for children's years of schooling completed, especially for girls'. This policy is a program that affects both the demand and supply sides of education. It could be an elimination of school fees and an expansion of schools' infrastructure. Indeed, the removal of direct costs may encourage parents to send their children to school, but the decision to continue could depend, for instance, on the distance to school, the qualification of the teachers, the class size or the school's equipment. The lack of basic equipment for the classroom or the absenteeism of teachers may inhibit the child's ability to learn and eventually discourage the child from remaining in school (Glewwe and Jacoby (1994), Michaelowa (2001), Glick and Sahn (2006), Orazem and King (2008); Frölich and Michaelowa (2011)). Demand-and-supply side policies are usually costly, even though the national budgets of developing countries are often restricted. Considerable funds could be lost in enrolling children who do not complete their primary education.

On the one hand, school fees partly determine the parents' choice to provide an education for their children in developing countries. This relationship has been evaluated through natural or randomized experiments on the removal of school fees (Ranasinghe and Hartog (2002), Deininger (2003), Lincove (2012), Lucas and Mbiti (2012)). On the other hand, numerous studies have examined policies aimed at the improvement of supply-side factors in primary schools. A large school expansion program in Indonesia increased the number of years of schooling, as well as the earnings of individuals exposed at different degrees (Duflo, 2001). Chin (2005) also found that a redeployment of teachers across schools in India increases primary school completion more for girls than boys. Handa (2002) found in Mozambique that raising adult literacy or building schools has more of an impact on schooling than the increase of household wealth. Nonetheless, only a few empirical studies have analyzed the impact of a combined demand-and-supply side policy in a developing country. Thus, the present study has a unique opportunity to assess the impact of such program in Benin, a Sub-Saharan African country.

This research considers the case of the Free Primary Education (FPE) of 2006 in Benin, which is a major demand-and-supply side policy. In this country, the government declared primary education to be free in October 2006. The decision coincided with an expansion in schools' infrastructure through the recruitment of teachers and the construction of schools. The data come from the Benin Demographic and Health Surveys (DHS) of 2006 and 2012. The National Institute for Statistics (INSAE) provides the data in collaboration with Macro International. The paper uses the method of double differences on birth cohorts to assess the impact of the FPE on schooling. Children eligible for the FPE are children of primary school-going age. Hence, the birth cohorts of individuals no more registered in primary schools are used as control groups for the evaluation. The estimations take advantage of the fact that the post-treatment year is five years after the launch of the program. Thus, it is possible to measure the medium term impacts on attendance. This research also distinguishes in the sample of children: the ones previously enrolled and, the ones never enrolled. It allows a proper investigation of children's attendance after the FPE. In other words, did children stay longer in schools following the policy? After the evaluation, the study uses different heterogeneity analysis to explain the gender disparities. Indeed, the preference for boys' schooling over girls might be explained by the household's wealth or the school infrastructure. A placebo experiment, on birth cohort not eligible for the program, confirmed the different results

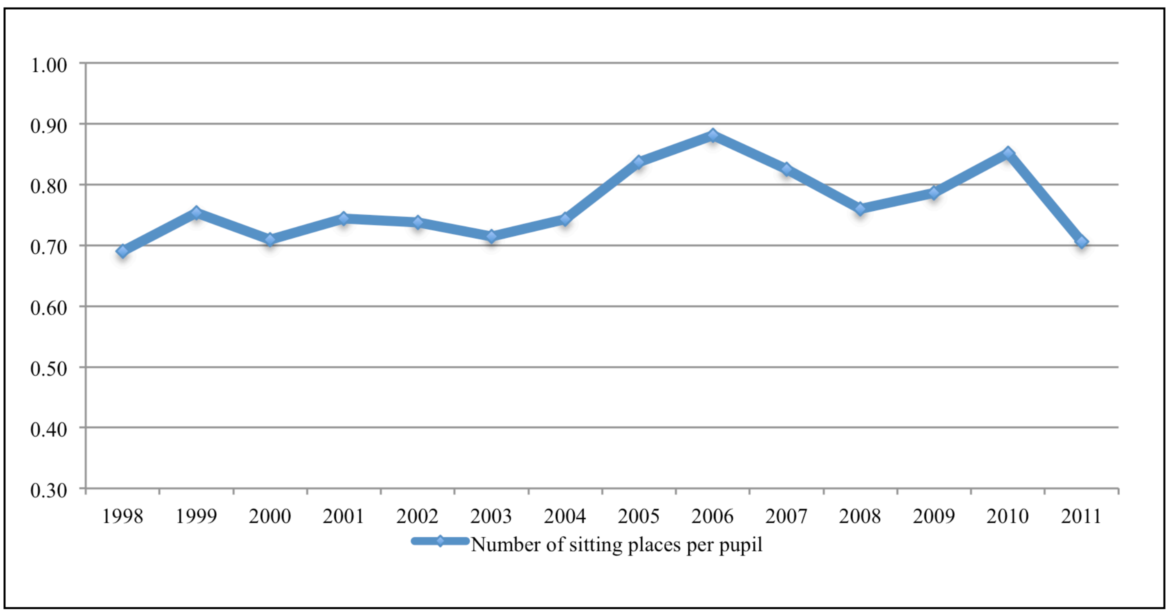
The contributions of this research are threefold. This article is one of the first evaluations of the demand-and-supply policy in Benin. It exposes the effects of the policy on gender and wealth disparities in schooling. The paper also examines the influence of the school infrastructure on enrollment and attendance. The article's structure is as follows: section 2 presents the policy, section 3 covers the methodology, section 4 discloses the results on current enrollment, section 5 displays the results on attendance, section 6 reveals the robustness check and section 7 concludes.

2. The context of primary education in Benin

On October 14, 2006, Benin launched the second Free Primary Education (FPE) policy. On the demand side, the government removed school fees for every child of school-going age. On the supply side, the recruitment of teachers and the building of schools improved the infrastructure of primary schools nationwide. It was thus a demand-and-supply side policy. This is one of the differences with the first policy, the FPE of 2001 (OCS, 2012; Fatoke-Dato, 2015(1)). The FPE of 2001 simply covered the removal of school fees for girls in rural areas in primary schools. This section presents some evidence of the FPE of 2006, which is the main topic of interest of this research.

The subsequent figures provide an overview of the situation in terms of the number of schools and teachers. Figure 4 presents the number of seats per pupils between 1998 and 2011, while Figure 5 presents the distribution of teachers between 1998 and 2011. In addition to these figures, Figure 6 and 7 give an idea of the regional distribution of teachers and schools on the period studied.

Figure 4: Distribution of the number of seats per pupil in primary schools in Benin



Source: Author's own computations based on statistics of INSAE (2008, 2009, 2010, 2011)

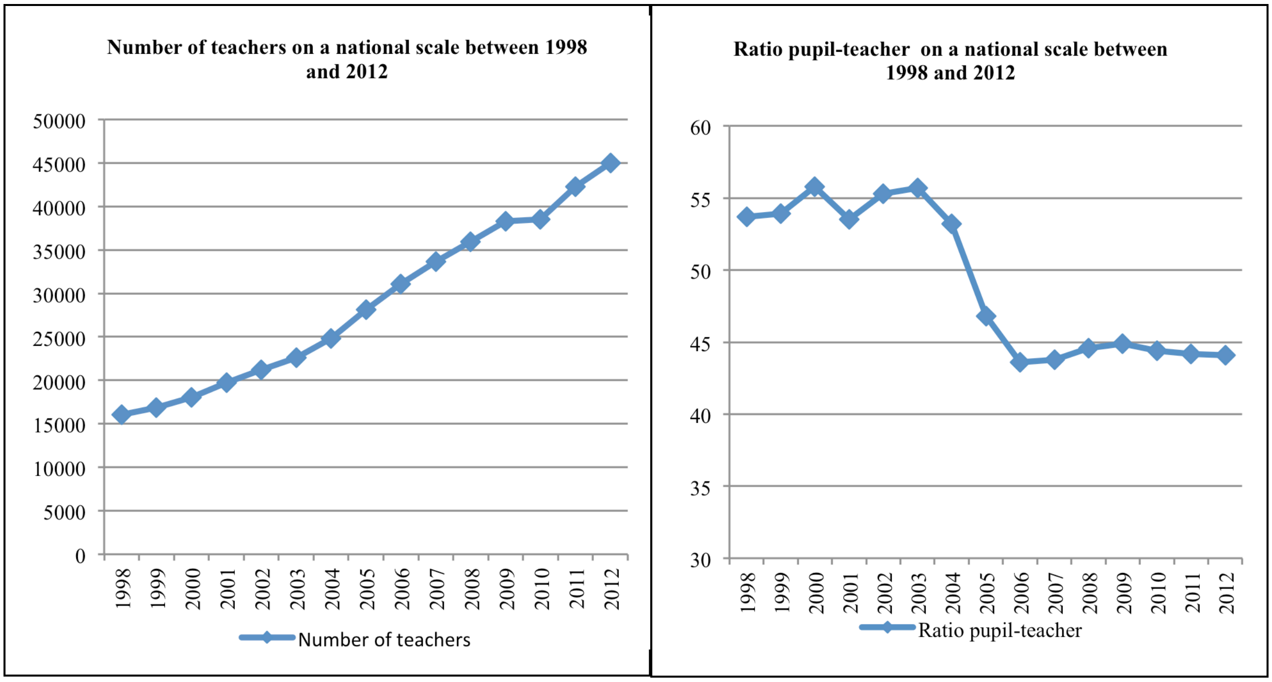
Figure 4 presents the development of the numbers of seats in primary schools per pupil between 1998 and 2011. This result is the total number of pupils in primary school over the total number of seats. It does not consider the different grades at the primary level. It is important to note that the primary level of education in Benin include six grades. Yet, this variable is a proxy to analyze the study conditions in schools. Overall, the percentage never reaches 1, which would mean that each child has a seat to sit on. In other words, despite the growth of the places in schools observed, the number of seats is still insufficient. In fact, the rate goes from around 0.69 seats for 1 pupil in 1998 to 0.74 seats for 1 pupil in 2004. Apparently, no major change occurred during this period. In 2006, there is an upsurge of the variable with the value of 0.88 places for 1 pupil—one of the highest statistics over the period—and could be linked to the expansion of school infrastructure with the FPE of 2006. The chart presents a decrease in the number of seats after the year 2006. These periods follow the launch of the FPE of 2006 and may indicate an overpopulation of primary schools.

Figure 5 presents the trend in the number of the teaching staff between 1998 and 2012. The chart on the left corresponds to the distribution of the number of teachers between 1998 and 2012, while the chart on the right represents the distribution of the pupil-teacher ratio over the same period.

Mainly, the number of teachers (chart on the left) increased steadily over time, however, the chart shows a change in the slope after 2005, which may indicate a slight change in the number of teachers. The chart on the right may provide more details on this point.

The pupil-teacher ratio is the number of pupils per teacher at the primary level of education in a given school year (UNESCO, 2009). It is also a proxy to analyze the study conditions in primary schools. The chart on the right represents the pupil-teacher ratio in primary schools between 1998 and 2012. It shows that from 1998 to 2004, the pupil-teacher ratio is approximately 55. However, there is a drop in the pupil-teacher ratio to 45 from 2006 onward. This statistics confirm that the number of teachers increased, which implies that teachers were recruited as planned to go along with the FPE of 2006. Figure 6 and 7 will give more details on the distribution of schools and teachers per region.

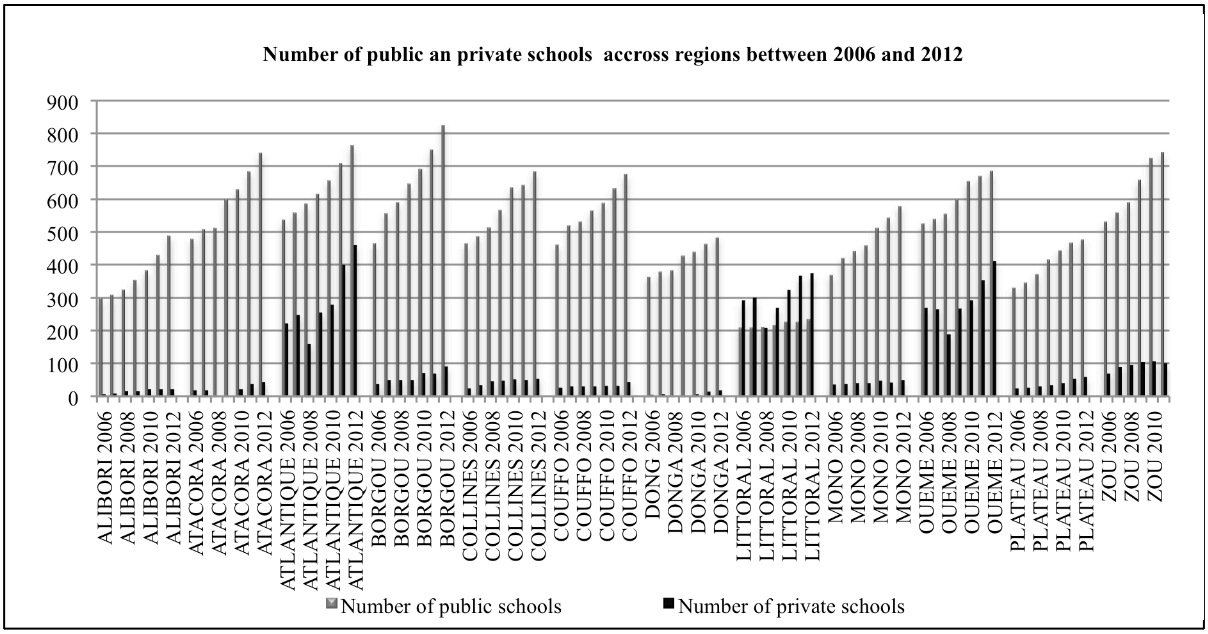
Figure 5: Distribution of the number of teachers



Source: Author's own computations based on statistics of INSAE (2008, 2009, 2010, 2011, 2012)

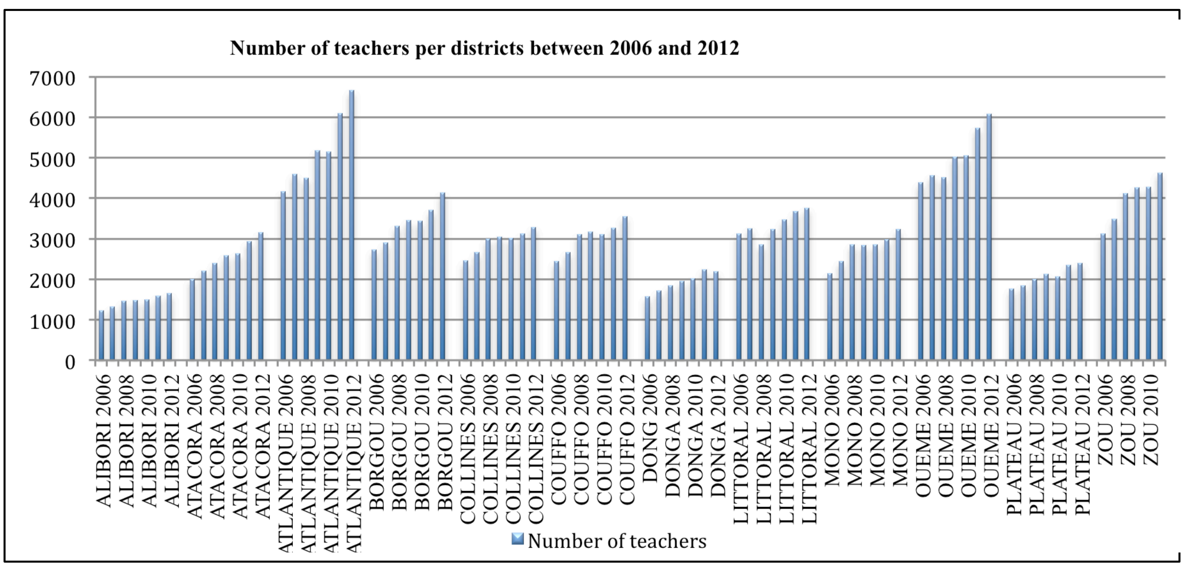
The following Figures 6 and 7 present the improvement in the school infrastructure according to the different regions of the country. Benin is divided in 12 regions or districts. Figure 6 indicates first that there are generally more public primary schools than private schools. The number of schools increased steadily over the period in every region without distinction. The rate of increase in the number of schools appears to be similar from a region to another. Concerning Figure 7, the number of teachers increased also over the period as planned with the FPE 2006. Mainly, there are regional differences in term of school infrastructure. However, these statistics are not compared with the number of pupils per districts so it is not possible to analyze the study conditions per region. More details about these conditions will be given in the results.

Figure 6: Distribution of the number of schools across regions between 2006 and 2012



Source: Author's own computations based on statistics of INSAE (2008, 2009, 2010, 2011, 2012)

Figure 7: Distribution of the number of teachers across regions between 2006 and 2012



Source: Author's own computations based on statistics of INSAE (2008, 2009, 2010, 2011, 2012)

These statistics show that the FPE of 2006 considered not only a removal of school fees, but also an expansion in the schools' infrastructure.

3. Methodology

The section specifies the identification strategies, the descriptive statistics, and the estimation procedures.

3.1 Identification strategies

The main challenge of this evaluation is to identify the impact of the FPE of 2006 given that it targeted all children. The solution for this evaluation is to consider older children who could not have benefited from the program. The primary school age in Benin is normally between six and 11 years old. Children older than 11 could not have benefited from the 2006 FPE and are potential counterfactuals for the evaluation. The treatment group is thus divided into two cohorts: the younger cohort 1 (aged 6 to 8) born between 1998 and 2000; and the younger cohort 2 (aged 9 to 11) born between 1995 and 1997. This distinction could be of interest because the impact may differ for the children who started primary school with the FPE and for those who were already enrolled before the FPE.

The control groups could be any cohorts of children born before 1994. However, the first FPE policy of 2001 targeted girls in rural areas and at primary school level. It is possible that this first policy has had consequences for children in primary school from 2001 onward. In other words, children 12 to 17 years old in 2006 were still in primary school in 2001 and may be affected by the FPE of 2001; therefore these cohorts of children cannot be used as control groups. Birth cohorts born between 1989 and 1994 are not considered in the evaluation. Hence, the control group is children born before 1989 who could not have benefited from either the FPE of 2001 or the FPE of 2006: they are the older cohort 3 (aged 18 to 20) born between 1986 and 1988.

The strategy consists of comparing the educational outcomes of the younger birth cohorts 1 and 2 with the older cohort 3 in 2006 and 2012. The difference-in-differences is used here to differentiate the difference between birth cohorts before the FPE of 2006 and after. Additionally, this strategy benefits mostly from the fact that the control group is the birth cohorts who have most likely completed primary school, and are no longer eligible for registration in primary school in 2006. The evaluation is performed five years after the implementation of the FPE of 2006, and accordingly, it is possible to properly capture the impact on variables such as the years of schooling.

3.2 Data and descriptive statistics

The data come from the National Demographic and Health Surveys (DHS)[8] for the years 2006 and 2012 produced by the National Institute for Statistics and Economic Analysis (INSAE) in collaboration with Macro International Inc. They are nationally representative cross-sectional data on economic and demographic information on at least 17,000 households for each survey. The sample includes 65,903 individuals from six to 28 years old in order to follow the same birth cohorts of individuals in 2006 and 2012. Two indicators are retained to measure access to education and attendance: current enrollment and the years of schooling completed.

3.2.1 Current enrollment

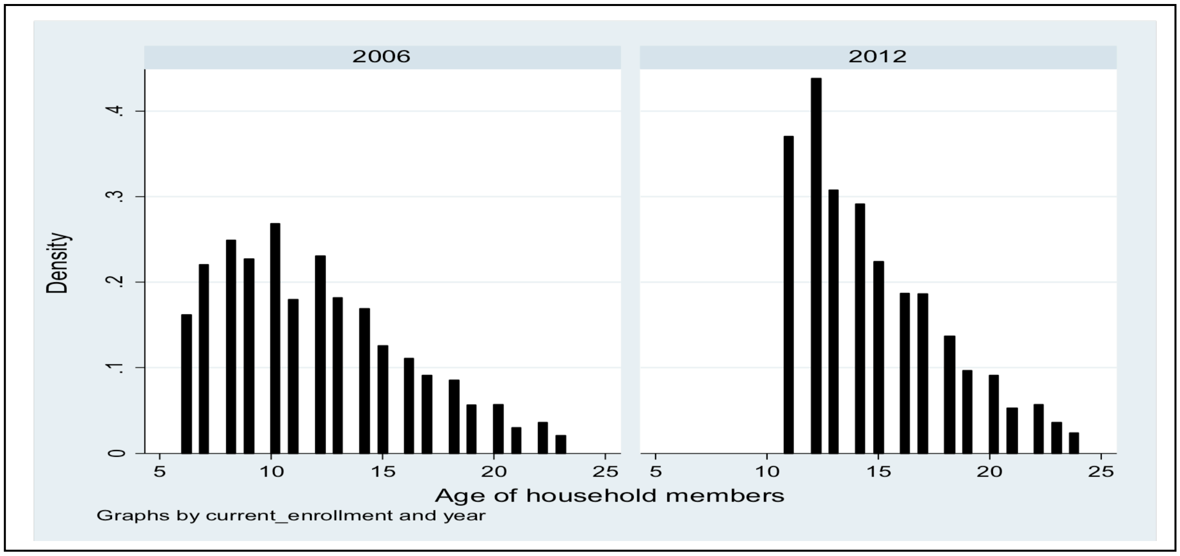
The variable "current enrollment" indicates whether or not an individual is enrolled in the year of the survey. Figure 8 presents the density of current enrollment per age in 2006 and 2012.

It is important to note that the younger cohorts 1 and 2 are between six and 11 years old in the DHS 2006, and between 11 and 16 years old in the DHS 2012. Figure 8 essentially shows that the proportion of children enrolled between the ages of 11 and 15 is higher in 2012 compared to 2006. This increase in enrollment could be linked to the FPE of 2006, as it is the birth cohorts who may have been affected by the FPE of 2006. The histogram of 2012 starts with the age 11 compared to the histogram of 2006 because the samples are composed of the same birth cohorts but five years older. The youngest children in the sample of 2006 are six years old, yet the

[8] Despite the launch of the FPE in October 2006, the DHS 2006 is considered to be a pre-treatment survey because the data collection was from August to November 2006. The survey began before the launch of the program so it is assumed that the impact of the FPE of 2006 in that period is negligible. Moreover, the evaluation considered a five-year gap between both DHS surveys, because the data for the DHS 2011/2012 were collected between December 2011 and March 2012.

youngest children in the sample of 2006 are now 11 years old in 2012. Enrollment has generally increased in 2012.

Figure 8: Distribution of the current enrollment, according to the child's age



Source: Author's own computations based on DHS 2006 and 2012

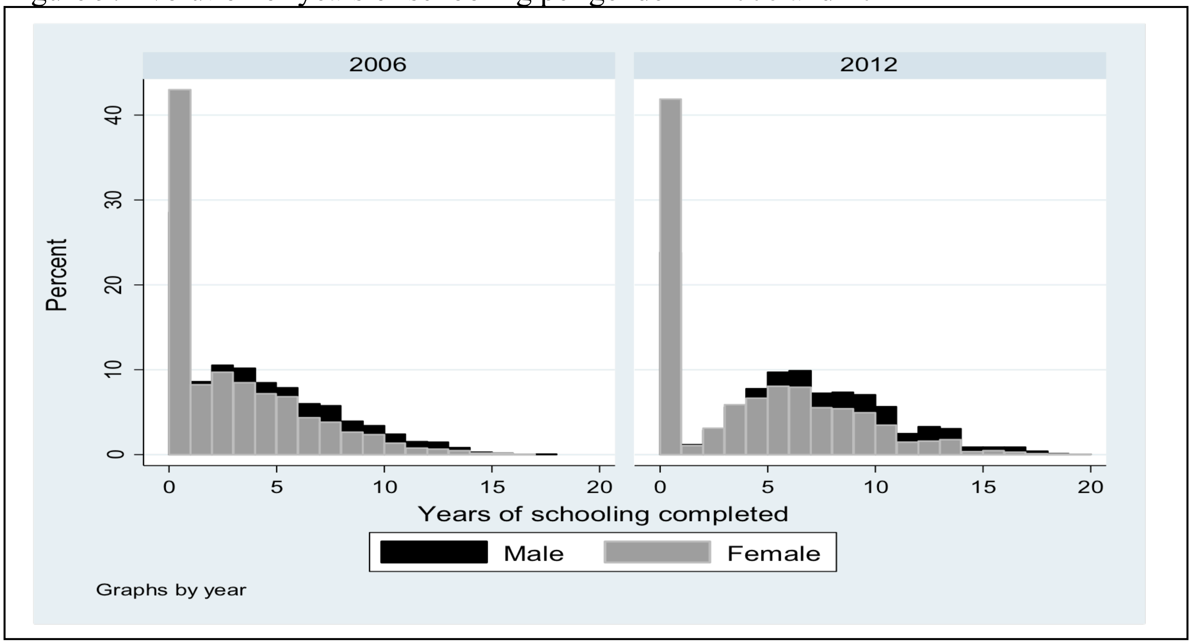
The impact evaluation will provide clarification on this point. Both histograms show that the current enrollment decreases with age.

3.2.2 Years of schooling completed

The "years of schooling completed" is a long-term measure of attendance. This variable corresponds to the number of grades completed by each individual in the sample. The primary level of education in Benin is composed of six grades. Figure 9 is a plot of the years of schooling before and after the FPE.

One main observation is that male pupils achieved more years of schooling than female pupils. It appears that this gender gap has not reduced in 2012. In addition, the chart is left-skewed, and indicates that an important proportion of the sample has zero years of schooling completed. This is mostly the case for individuals who have never been enrolled in school or who have not completed at least one grade of primary school. In 2006, approximately 40% of the sample have completed between one and five years of schooling, which corresponds to the primary level of education. After three years of schooling, the density decreases. This means that the proportion of individuals who complete more than six years of schooling is quite low. The histogram showing the years of schooling in 2012 is similar, however, the proportion of people who complete above five years of schooling has increased in 2012. This could be associated with the FPE of 2006. The impact evaluation should expose the genuine impact of the program.

Figure 9: Evolution of years of schooling per gender in 2006 and 2012



Source: Based on statistics of DHS 2006, 2012

3.3 Estimation procedure

The difference-in-differences estimation is as follows:

$$E = a_1 + a_2 X + a_3 X * dummy2012 + a_4 Cohort + a_5 dummy2012 + a_6 Cohort * dummy2012 + v\ .$$

with E the schooling decision (current enrollment or years of schooling), the parameters a being constants; *X* the household characteristics, *dummy2012 is* a dummy for the year of post-treatment 2012; and *Cohort* a dummy which equals 1 if the child belongs to one of the birth cohorts used as treatment groups and 0 otherwise. The parameter of interest is a_6, which gives the impact of the policy on the birth cohort. Moreover, the household's variables are household head's age, gender and level of education, the number of children under five years old in the household and the quintiles of wealth. The equations also include regions' fixed effects because of the disparities across regions. The DHS databases contain a proxy for the household wealth, which is *the wealth index*. The computation of the indicator is standard and based on the household's assets. It is useful to consider the characteristics of different groups in the model, especially when there seem to be non-negligible differences between treated and control groups before the policy, as indicated by the descriptive evidence (Abadie, 2005). That is the reason why the model includes not only treatment variables, but also the household characteristics. Due to inequalities in gender and area of residence, there is one estimate per gender and area of residence for each outcome. There are two area of residence considered: rural and urban areas. In Benin, an urban area is a location with at least 10,000 inhabitants and with at least one of the following infrastructure: a post office, an office of the national department of treasury, a water and electricity intake system, a health center or a secondary school (INSAE, 2002).

The current enrollment and years of schooling are estimated with an Ordinary Least Square (OLS) model. For the years of schooling, as mentioned, over 40% of the sample has zero years of schooling completed. Of interest in the evaluation is to determine whether or not the children stay longer in school after the FPE of 2006. As a result, the years of schooling have been restricted to the grades completed above grade one in order to retain only the individuals who have been enrolled and completed at least one year of schooling. This will allow more variability in the sample and avoid the results being driven by this important proportion of the sample with no years of schooling completed.

4. Impact of Free Primary Education of 2006 on current enrollment

This section covers the impact of the FPE of 2006 on current enrollment. In addition, the impact of the policy is analyzed according to the differences in wealth and school infrastructure. The estimations are performed with an Ordinary Least Squares (OLS) model, and are globally significant at the 5% level of significance. All standard errors are robust to clustering within the primary sampling units of the DHS surveys. The estimations also pass the link test of functional form of the conditional mean. This shows that there is not enough evidence to reject the null hypothesis that the conditional mean is correctly specified. In addition, the results tables present basic estimations without additional explanatory variables and full models with all variables in order to test for a potential omitted-variable bias. The omitted variables bias could come from missing variables in the specification of the model, which would cause a bias in the estimation of the effects of policy. In the present case, there is apparently no omitted variables bias because the results are roughly similar for both models. The results to consider are those of the full model.

4.1 Impact of the FPE of 2006 on current enrollment

Table 14 displays the impact of the FPE of 2006 on the current enrollment of children in rural areas. In general, the FPE significantly increases the likelihood of current enrollment, but with some differences per gender.

To observe the gender disparities, the estimations are presented separately per gender. All estimations in Table 14 are obtained after the estimation of Equation 1, but with some discrepancy. Columns 1, 3, 5 and 7 of Table 14 correspond to the basic models without additional explanatory variables, while columns 2, 4, 6, and 8 include all explanatory variables. The children in the younger cohort 1 are between six and eight years old. The children of the younger cohort 2 are between nine and 11 years old. The control group consists of children aged between 18 and 20 years old.

In general, the likelihood of enrollment improves significantly more for boys than for girls. According to columns 2 and 6 of Table 14, the probability of enrollment of children in the younger cohort 1 increases by 35% for girls and 57% for boys in rural areas in 2012. In columns 4 and 8 of Table 14, the probability of enrollment increases by 8% for girls and 23.1% for boys in the younger cohort 2 in rural areas in 2012. The effect is similar for urban areas, where boys' enrollment has progressed more than those of girls, according to Table 15. The gender gap may not have diminished.

It is worth noting that the enhancement of the current enrollment takes place not only for the younger cohort 2 but also for the younger cohort 1. The results show that the impact of the FPE is more prominent on the younger cohort 1 than on the younger cohort 2. This may lead to a reduction of late enrollment, while reinforcing the influence of school fees on the decision to enroll at a given time.

In summary, the FPE has significantly enhanced the probability of current enrollment, but the gender disparities appear to be persistent for enrollment.

Table 14: Impact of the FPE of 2006 on current enrollment for children living in rural areas

	Girls in rural areas				Boys in rural areas			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
VARIABLES	OLS	OLS plus	OLS	OLS plus	OLS	OLS plus	OLS	OLS plu
Dependent variable: Enrollment								
Treatment sample: population aged 6 to 8 in 2006 and 11 to 13 in 2012								
Control sample: population aged 18 to 20 in 2006 and 23 to 25 in 2012								
Dummy2012	-0.134***	-0.137***			-0.345***	-0.468***		
	(0.016)	(0.039)			(0.020)	(0.043)		
Younger cohort 1	0.305***	0.294***			0.046***	0.082***		
	(0.014)	(0.016)			(0.015)	(0.017)		
Younger cohort 1*dummy2012	0.337***	0.351***			0.608***	0.576***		
	(0.020)	(0.022)			(0.024)	(0.024)		
Treatment sample: population aged 9 to 11 in 2006 and 14 to 16 in 2012								
Control sample: population aged 18 to 20 in 2006 and 23 to 25 in 2012								
Dummy2012			-0.134***	-0.094**			-0.345***	-0.418**
			(0.012)	(0.038)			(0.020)	(0.042
Younger cohort 2			0.462***	0.434***			0.290***	0.312**
			(0.017)	(0.017)			(0.017)	(0.016
Younger cohort 2*dummy2012			0.074***	0.084***			0.262***	0.231**
			(0.023)	(0.024)			(0.024)	(0.024
Other control variables	No	Yes	No	Yes	No	Yes	No	Yes
Constant	0.147***	0.263***	0.147***	0.194***	0.436***	0.638***	0.436***	0.576**
	(0.011)	(0.032)	(0.012)	(0.028)	(0.013)	(0.037)	(0.019)	(0.035
Observations	8,184	8,175	6,403	6,398	8,027	8,018	6,689	6,681
R-squared	0.226	0.289	0.274	0.339	0.150	0.249	0.174	0.290

Standard errors in parentheses adjusted robust for clustering in the Primary Sampling Unit (PSU). The other variables are the household head's age, a dummy for female-headed households, the dummies for the household head's level of education, the dummies for the quintile of wealth, dummies for the region fixed effects, and the number of children under five years old in the households. *** Significant at 1%, ** Significant at 5%, *Significant at 10%.

Source: Author's own computations based on DHS 2006 and 2012

Table 15: Impact of the FPE of 2006 on current enrollment for children living in urban areas

	Girls in urban areas				Boys in urban areas			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
VARIABLES	OLS	OLS plus	OLS	OLS plus	OLS	OLS plus	OLS	OLS plu
Dependent variable: Enrollment								
Treatment sample: population aged 6 to 8 in 2006 and 11 to 13 in 2012								
Control sample: population aged 18 to 20 in 2006 and 23 to 25 in 2012								
Dummy2012	-0.248***	-0.285***			-0.396***	-0.489***		
	(0.019)	(0.044)			(0.021)	(0.051)		
Younger cohort 1	0.322***	0.354***			0.100***	0.147***		
	(0.016)	(0.019)			(0.017)	(0.020)		
Younger cohort 1*dummy2012	0.360***	0.319***			0.529***	0.498***		
	(0.024)	(0.024)			(0.026)	(0.028)		
Treatment sample: population aged 9 to 11 in 2006 and 14 to 16 in 2012								
Control sample: population aged 18 to 20 in 2006 and 23 to 25 in 2012								
Dummy2012			-0.248***	-0.244***			-0.396***	-0.398**
			(0.019)	(0.043)			(0.020)	(0.046)
Younger cohort 2			0.439***	0.443***			0.240***	0.274**
			(0.017)	(0.020)			(0.017)	(0.019)
Younger cohort 2*dummy2012			0.138***	0.114***			0.281***	0.254**
			(0.025)	(0.027)			(0.026)	(0.028)
Other control variables	No	Yes	No	Yes	No	Yes	No	Yes
Constant	0.313***	0.290***	0.313***	0.239***	0.596***	0.692***	0.596***	0.619**
	(0.013)	(0.035)	(0.013)	(0.034)	(0.013)	(0.040)	(0.013)	(0.036)
Observations	5,070	5,061	4,530	4,521	4,801	4,788	4,370	4,363
R-squared	0.260	0.327	0.286	0.337	0.180	0.271	0.211	0.296

Standard errors in parentheses adjusted robust for clustering in the Primary Sampling Unit (PSU). The other variables are the household head's age, a dummy for female-headed households, the dummies for the household head's level of education, the dummies for the quintile of wealth, dummies for the region fixed effects, and the number of children under five years old in the households. *** Significant at 1%, ** Significant at 5%, *Significant at 10%.

Source: Author's own computations based on DHS 2006 and 2012

4.2 Impact of the FPE of 2006 on enrollment, according to the level of wealth

Importantly, the analyses do not indicate an improvement in enrollment according to the level of wealth after the FPE of 2006.

Table 16 presents the results according to the level of wealth. Generally, the probability of current enrollment increases with the level of wealth in 2012. The results of Table 16 are for the younger cohort 2 of children living in rural areas. In the DHS databases, there are five quintiles of wealth: the poor households are in the first and second quintiles; the middle class households are in the third quintile; and the rich households are in the fourth and fifth quintiles of wealth. For presentation purposes, this study considers three levels of wealth: the poor, the middle-class and the rich. Equation 1 is run separately for each level of wealth.

Table 16: Impact of the FPE on current enrollment of children living in rural areas, according to the level of wealth (2006/2012)

	Girls in rural areas			Boys in rural areas		
	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	Poor	Middle	Rich	Poor	Middle	Rich
Dependent variable: Enrollment						
Treatment sample: population aged 9 to 11 in 2006 and 14 to 16 in 2012						
Control sample: population aged 18 to 20 in 2006 and 23 to 25 in 2012						
Dummy2012	-0.102*	-0.019	-0.123	-0.373***	-0.405***	-0.530***
	(0.059)	(0.070)	(0.077)	(0.068)	(0.085)	(0.073)
Younger cohort 2	0.380***	0.545***	0.459***	0.306***	0.350***	0.299***
	(0.021)	(0.030)	(0.033)	(0.021)	(0.030)	(0.029)
Younger cohort 2*dummy2012	0.035	0.021	0.252***	0.192***	0.213***	0.365***
	(0.028)	(0.045)	(0.048)	(0.033)	(0.042)	(0.053)
Other control variables	Yes	Yes	Yes	Yes	Yes	Yes
Constant	0.155***	0.109**	0.204***	0.155***	0.109**	0.204***
	(0.046)	(0.051)	(0.057)	(0.046)	(0.051)	(0.057)
Observations	3,427	1,627	1,344	3,632	1,699	1,350
R-squared	0.282	0.411	0.389	0.272	0.281	0.355

Standard errors in parentheses adjusted robust for clustering in the Primary Sampling Unit (PSU). The other variables are the household head's age, a dummy for female-headed households, the dummies for the household head's level of education, dummies for the region fixed effects, and the number of children under five years old in the households. *** Significant at 1%, ** Significant at 5%, *Significant at 10%.
Source: Author's own computations based on DHS 2006 and 2012

Table 16 reveals that the impact of the FPE is the most prevalent for children in wealthy households. In columns 4 and 6 of Table 16, the probability of current enrollment increases significantly by 36.5% for boys in rich households and by 19.2% for boys in poor households in 2012. For girls, the effect is only significant for those girls in rich households. This suggests that enrollment, for girls in poor households, has not significantly changed after the FPE. The impact is roughly similar in urban areas.

These results suggest that the FPE has increased access to education for children in rich households rather than for those in poor households. This result is consistent with Kadzamira and Rose (2003) in the case of Malawi. In particular, girls in poor households are left behind because parents often prefer to enroll boys in school, to the detriment of girls.

4.3 Impact of the FPE of 2006 on enrollment, according to region

One main difference between the regions is the schools' infrastructure. A regional comparison of the descriptive statistics indicates that some regions have the lowest number of schools, teachers and the highest pupil-teacher ratio compared to other regions. These poor schooling conditions may influence the schooling decision of a household. It could be of interest to observe how the changes in the regional differences affect the schooling outcomes in these regions assuming that these differences have genuinely lowered after the FPE.

Benin is divided into 12 regions and the heterogeneity analysis takes this classification into consideration. The impact of the policy is observed with regard to three categories of regions: the regions with "lower" statistics for the school infrastructure (Alibori, Donga and Plateau), regions with "middle" statistics (Atacora, Borgou, Couffo), and those with the "higher" statistics (Atlantique, Oueme, Zou). The classification considers nine regions because some of the regions have similar statistics for school infrastructure's variables used. They were not included to make sure that the classification is balanced and will not influence the results. The classification was made considering three indicators: the percentage of female teachers; the total number of teachers; the pupil-teacher ratio; and the number of primary schools per region. These groups should reflect the schools' infrastructure from the "least" favorable to the "most" favorable for education. This categorization has the challenge that it may reflect other characteristics of the regions, such as culture. Some regions may be reluctant to school girls or indeed children in general. This categorization also does not cover all determinants of a favorable environment for education, yet it is assumed that the groups are homogeneous so that only divergences in schools' infrastructure may appear. Moreover, the distribution of wealth is roughly the same in every region, ensuring that the differences observed are not due to any wealth disparities.

Table 17 displays the impact of the FPE of 2006 on current enrollment, according to this classification of the regions. It shows that the regions with the "lower" statistics on the school infrastructure have the lowest rates of current enrollment in any birth cohorts. The regions with the highest rates of enrollment are the regions with the "higher" statistics on the school infrastructure. It could be interesting to observe if there is any change following the FPE. The expansion of schools and the recruitment of teachers should improve the schools' infrastructure in the areas with a previously "lower" school infrastructure. Thus, the expected results would be an increased improvement of schooling outcomes in areas with a "lower" school infrastructure.

Table 17: Impact of the FPE of 2006 on current enrollment for children living in rural areas, according to region (2006/2011)

	Girls living in rural areas			Boys living in rural areas		
VARIABLES	(1) Regions Lower	(2) Regions Middle	(3) Regions Higher	(4) Regions Lower	(5) Regions Middle	(6) Regions Higher
Dependent variable: Enrollment *Treatment sample: population aged 6 to 8 in 2006 and 11 to 13 in 2012* *Control sample: population aged 18 to 20 in 2006 and 23 to 25 in 2012*						
Dummy2012	-0.085	-0.119	-0.124*	-0.211*	-0.394***	-0.546***
	(0.085)	(0.084)	(0.06)	(0.118)	(0.089)	(0.070)
Younger cohort 1	0.249***	0.263***	0.335***	0.110***	0.0842**	0.137***
	(0.028)	(0.030)	(0.02)	(0.033)	(0.035)	(0.030)
Younger cohort 1*dummy2012	0.226***	0.336***	0.364***	0.407***	0.526***	0.567***
	(0.038)	(0.044)	(0.036)	(0.051)	(0.046)	(0.038)
Other control variables	Yes	Yes	Yes	Yes	Yes	Yes
Constant	0.244***	0.258***	0.277***	0.567***	0.604***	0.642***
	(0.064)	(0.064)	(0.054)	(0.084)	(0.076)	(0.059)
Observations	1,815	2,310	2,733	1,690	2,249	2,707
R-squared	0.255	0.230	0.312	0.213	0.186	0.249

Standard errors in parentheses adjusted robust for clustering in the Primary Sampling Unit (PSU). The other variables are the household head's age, a dummy for female-headed households, the dummies for the household head's level of education, the dummies for the quintile of wealth, and the number of children under five years old in the households. *** Significant at 1%, ** Significant at 5%, *Significant at 10%.

Source: Author's own computations based on DHS 2006 and 2012

Table 17 indicates that the impact of the FPE on current enrollment increases with the school infrastructure in the regions. The results presented in Table 17 are only for children in the younger cohort 1 in rural areas. The results were obtained after the estimation of Equation 1, but on samples limited to each category of regions. In columns 1 and 3 of Table 17, the probability of current enrollment increases significantly by 34.1% for girls in regions with "higher" statistics and by 22.6% for girls in regions with "lower" statistics in 2012.

According to columns 4 and 6 of Table 17, the likelihood of current enrollment has increased by 56.7% for boys in regions with "higher" statistics and by 40.7% for boys in regions with "lower" statistics.

Table 18: Impact of the FPE of 2006 on current enrollment for children living in urban areas, according to region (2006/2011)

	Girls living in urban areas			Boys living in urban areas		
VARIABLES	(1) Regions Lower	(2) Regions Middle	(3) Regions Higher	(4) Regions Lower	(5) Regions Middle	(6) Regions Higher
Dependent variable: Enrollment *Treatment sample: population aged 6 to 8 in 2006 and 11 to 13 in 2012* *Control sample: population aged 18 to 20 in 2006 and 23 to 25 in 2012*						
Dummy2012	-0.0681	-0.464***	-0.330***	-0.443***	-0.640***	-0.598***
	(0.121)	(0.0772)	(0.0998)	(0.148)	(0.0942)	(0.103)
Younger cohort 1	0.373***	0.316***	0.383***	0.0957	0.0695**	0.177***
	(0.0475)	(0.0344)	(0.0379)	(0.0578)	(0.0346)	(0.0363)
Younger cohort 1*dummy2012	0.235***	0.296***	0.341***	0.570***	0.550***	0.503***
	(0.0623)	(0.0434)	(0.0492)	(0.0787)	(0.0518)	(0.0533)
Other control variables	Yes	Yes	Yes	Yes	Yes	Yes
Constant	0.213**	0.506***	0.444***	0.677***	0.887***	0.778***
	(0.105)	(0.0620)	(0.0747)	(0.108)	(0.0581)	(0.0859)
Observations	777	1,378	1,285	795	1,333	1,280
R-squared	0.319	0.313	0.372	0.293	0.255	0.302

Standard errors in parentheses adjusted robust for clustering in the Primary Sampling Unit (PSU). The other variables are the household head's age, a dummy for female-headed households, the dummies for the household head's level of education, the dummies for the quintile of wealth, and the number of children under five years old in the households. *** Significant at 1%, ** Significant at 5%, *Significant at 10%.

Source: Author's own computations based on DHS 2006 and 2012

In urban areas, the effects are opposite. Table 18 reveals that the impact of the FPE on the current enrollment of boys decreases with schools' infrastructure in the regions. These results are the same for the younger cohort 1. Columns 4 and 6 of Table 18 show that the probability of current enrollment increases significantly by 57% for boys in regions with “lower” educational statistics and by 50.3% for boys in regions with “higher” statistics. This is not the case for girls in urban areas where the effect on girls is similar to the results found in rural areas.

In summary, regions with a somewhat better school infrastructure for education have generally encountered more progress in children’s current enrollment than other regions. These results are unexpected. Indeed, the FPE of 2006 is a demand-and-supply side policy, which means that school fees were eliminated, schools were built and teachers were recruited. The expected results are that the disparities across regions would reduce following the implementation of the policy. Hence, there would be more of an effect on the current enrollment of children living in regions with “lower” school infrastructures, so that the previous differences could diminish. However, this is not the case. Results disclose that the efforts on the supply side of education may not be enough in rural areas. In urban areas, the supply side investments yield a significant impact on boys. Indeed, the regions with “lower” statistics have benefited more from the program than the regions with “higher” statistics. This result is expected. Surprisingly, the impact of the FPE of 2006—according to the schools’ infrastructure—is only beneficial for boys in urban areas. This may mean either that the level of improvement of the schools’ infrastructure is not enough to enhance schooling for the other groups or that the effects may appear later on.

5. Impact of the FPE of 2006 on years of schooling completed

This section presents the impact of the FPE on the years of schooling completed. To observe the impact on children already schooled, the sample has been limited to individuals that have completed at least one year of schooling. The descriptive statistics indicate an important proportion of the sample population that has zero years of schooling completed. The sample is restricted in order to avoid this proportion driving the results in a particular direction. In addition, the purpose of the analysis is to determine whether or not children already enrolled remain at school longer following the FPE. The estimations are obtained with the Ordinary Least Squares (OLS), and the standard errors are robust to clustering across the Primary Sampling Units (PSU). The estimations are also globally significant at 5%.

5.1 Impact of the FPE of 2006 on the years of schooling

The results of the impact evaluation of FPE on years of schooling are presented in Table 17, and are only for children in rural areas. Generally, the FPE significantly increases the number of years of schooling completed.

The children of the younger cohort 1 are between six and eight years old, while the children of the younger cohort 2 are between nine and 11 years old. Again, the control group is individuals aged 18 to 20 in 2006. Columns 1, 3, 5 and 7 of Table 19 display the basic model of Equation 1 without additional explanatory variables. Columns 2, 4, 6 and 8 of Table 19 are the full models including the additional explanatory variables. The estimations are also run separately for the younger cohorts 1 and 2. The estimations were performed with Equation 1 on the different groups.

Columns 2 and 4 of Table 19 reveal that the years of schooling increased significantly by 2.32 years for the younger cohort 1 and by 2.89 years for the younger cohort 2 for girls in rural areas in 2012. The outcomes are roughly the same for boys and girls in the younger cohort 1. In contrast, the results are higher for girls than boys in the younger cohort 2. In columns 4 and 8 of Table 19, the years of schooling increases by 2.89 years for girls and by 2.58 years for boys in rural areas in 2012. In urban areas, Column 2, 4, 6 and 8 of Table 20, there is a significant impact only for the years of schooling completed of girls in urban areas. In the full models, there is no significant impact on boys in urban areas. This result is surprising given the previous results on children in rural areas. It could be explained by the important differences between urban and rural areas in terms of children's years of schooling completed. There is more impact in rural areas, because more changes was needed in those areas, more improvement was essential for schooling than in urban areas.

The outcomes of the estimations suggest that the FPE has significantly enhanced the years of schooling completed, especially for girls. The gender gap in the years of schooling completed may have reduced.

Table 19: Impact of the FPE on the years of schooling completed for children living in rural areas

	Girls in rural areas				Boys in rural areas			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
VARIABLES	OLS	OLS plus	OLS	OLS plus	OLS	OLS plus	OLS	OLS plus
Dependent variable: Years of schooling								
Treatment sample: population aged 6 to 8 in 2006 and 11 to 13 in 2012								
Control sample: population aged 18 to 20 in 2006 and 23 to 25 in 2012								
Dummy2012	0.275**	0.678***			0.616***	0.196		
	(0.136)	(0.263)			(0.125)	(0.251)		
Younger cohort 1	-4.205***	-4.154***			-5.561***	-5.510***		
	(0.0977)	(0.0999)			(0.0914)	(0.0960)		
Younger cohort 1*dummy2012	2.500***	2.328***			2.439***	2.349***		
	(0.152)	(0.157)			(0.144)	(0.150)		
Treatment sample: population aged 9 to 11 in 2006 and 14 to 16 in 2012								
Control sample: population aged 18 to 20 in 2006 and 23 to 25 in 2012								
Dummy2012			0.275*	-0.767			0.616***	-0.447
			(0.158)	(2.420)			(0.136)	(0.351)
Younger cohort 2			-2.882***	-0.390			-4.169***	-4.171***
			(0.114)	(0.533)			(0.0948)	(0.119)
Younger cohort 2*dummy2012			2.899***	2.896***			2.802***	2.585***
			(0.182)	(1.025)			(0.157)	(0.262)
Other control variables	No	Yes	No	Yes	No	Yes	No	Yes
Constant	5.926***	5.430***	5.926***	0.230	7.319***	7.392***	7.319***	7.454***
	(0.083)	(0.182)	(0.097)	(1.095)	(0.074)	(0.183)	(0.080)	(0.203)
Observations	3,758	3,750	3,168	3,163	4,856	4,851	4,690	4,684
R-squared	0.452	0.462	0.336	0.367	0.520	0.528	0.426	0.434

Standard errors in parentheses adjusted robust for clustering in the Primary Sampling Unit (PSU). The other variables are the household head's age, a dummy for female-headed households, the dummies for the household head's level of education, the dummies for the quintile of wealth, dummies for the region fixed effects, and the number of children under five years old in the households. *** Significant at 1%, ** Significant at 5%, *Significant at 10%.

Source: Author's own computations based on DHS 2006 and 2012

Table 20: Impact of the FPE on the years of schooling completed for children living in urban areas

	Girls in urban areas				Boys in urban areas			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
VARIABLES	OLS	OLS plus	OLS	OLS plus	OLS	OLS plus	OLS	OLS plus
Dependent variable: Years of schooling								
Treatment sample: population aged 6 to 8 in 2006 and 11 to 13 in 2012								
Control sample: population aged 18 to 20 in 2006 and 23 to 25 in 2012								
Dummy2012	0.857***	-1.247			2.055***	-0.519		
	(0.150)	(2.446)			(0.140)	(2.216)		
Younger cohort 1	-5.693***	-1.758**			-6.595***	-0.967		
	(0.125)	(0.793)			(0.116)	(0.816)		
Younger cohort 1*dummy2012	2.323***	2.406*			1.261***	1.143		
	(0.184)	(1.354)			(0.175)	(1.220)		
Treatment sample: population aged 9 to 11 in 2006 and 14 to 16 in 2012								
Control sample: population aged 18 to 20 in 2006 and 23 to 25 in 2012								
Dummy2012			0.857***	2.924			2.055***	-0.395
			(0.164)	(2.975)			(0.247)	(2.415)
Younger cohort 2			-4.128***	-0.811			-4.818***	0.316
			(0.136)	(0.663)			(0.135)	(0.634)
Younger cohort 2*dummy2012			2.804***	0.937			1.616***	1.293
			(0.205)	(1.251)			(0.267)	(0.998)
Other control variables	No	Yes	No	Yes	No	Yes	No	Yes
Constant	7.677***	0.728	7.677***	0.0789	8.508***	-0.316	8.508***	-1.327
	(0.098)	(1.256)	(0.108)	(1.377)	(0.088)	(1.308)	(0.139)	(1.336)
Observations	3,317	3,313	3,105	3,101	3,755	3,744	3,638	3,634
R-squared	0.496	0.530	0.354	0.402	0.599	0.626	0.462	0.514

Standard errors in parentheses adjusted robust for clustering in the Primary Sampling Unit (PSU). The other variables are the household head's age, a dummy for female-headed households, the dummies for the household head's level of education, the dummies for the quintile of wealth, dummies for the region fixed effects, and the number of children under five years old in the households. *** Significant at 1%, ** Significant at 5%, *Significant at 10%.

Source: Author's own computations based on DHS 2006 and 2012

5.2 Impact of the FPE of 2006 on years of schooling, according to the level of wealth

In this section, the analyses point to the largest impact of the FPE on children in poor households compared to rich households. The sole exception is for the years of schooling completed by girls in rural areas. The results in Table 21 are for children in rural areas. They are obtained after the estimation of Equation 1 with the dependent variable the years of schooling completed on samples limited to each level of wealth.

Table 21: Impact of the FPE on the years of schooling completed for children living in rural areas, according to the level of wealth (2006/2012)

	Girls in rural areas			Boys in rural areas		
VARIABLES	(1) Poor quintile	(2) Middle quintile	(3) Rich quintile	(4) Poor quintile	(5) Middle quintile	(6) Rich quintile
Dependent variable: Years of schooling						
Treatment sample: population aged 9 to 11 in 2006 and 14 to 16 in 2012						
Control sample: population aged 18 to 20 in 2006 and 23 to 25 in 2012						
Dummy2012	0.266	0.485	-0.278	-0.00769	0.534	0.0770
	(0.570)	(0.573)	(0.784)	(0.466)	(0.538)	(0.675)
Younger cohort 2	-2.235***	0.0302	-1.169***	-3.974***	-3.860***	-4.504***
	(0.200)	(0.205)	(0.246)	(0.169)	(0.215)	(0.202)
Younger cohort 2*dummy2012	2.379***	2.904***	3.157***	3.072***	2.399***	1.875***
	(0.360)	(0.334)	(0.433)	(0.349)	(0.377)	(0.435)
Other control variables	Yes	Yes	Yes	Yes	Yes	Yes
Constant	4.685***	1.493***	3.339***	7.614***	7.428***	8.254***
	(0.368)	(0.401)	(0.455)	(0.321)	(0.353)	(0.333)
Observations	1,341	1,626	1,338	2,278	1,251	1,155
R-squared	0.358	0.244	0.241	0.443	0.499	0.550

Standard errors in parentheses adjusted robust for clustering in the Primary Sampling Unit (PSU). The other variables are the household head's age, a dummy for female-headed households, the dummies for the household head's level of education, dummies for the region fixed effects, and the number of children under five years old in the households. *** Significant at 1%, ** Significant at 5%, *Significant at 10%.
Source: Author's own computations based on DHS 2006 and 2012

Table 21 displays the results for children living in rural areas and in the younger cohort 2. Indeed, columns 4 and 6 of Table 21 disclose that the years of schooling of boys increase significantly by 3.07 years for poor households and 1.87 for wealthy households. The effect is similar in urban areas. The outcomes suggest that boys in poor households have gained the most from the FPE, and in fact, they are able to attend school longer than before the policy. It also shows the influence of the FPE of 2006 on years of schooling completed. Surprisingly, the wealth-related disparities in school completion for girls in rural areas have not changed. In columns 1and 3 of Table 21, the years of schooling completed for girls in rural areas increases significantly by 2.37 years for poor households and 3.17 for wealthy households. The girls in rural areas from rich households have gained more from the FPE than girls in poor rural households. These outcomes corroborate that girls are more affected by the household wealth than boys. It is possible that the FPE of 2006 is not enough to affect the school years of schooling completed of girls in rural areas.

The results imply that the inequalities in schooling by wealth reduce after the implementation of the FPE of 2006, except for girls in rural areas. This suggests that the impact of the household wealth is potentially more significant for girls' years of schooling completed at school than for boys. However, this is not the case in urban areas where there may also exist other factors like opportunity costs or the cultural practices that influence the attendance of girls. It is possible that the opportunity costs of maintaining a girl in school are higher than the costs of maintaining a boy in school. These topics will be discussed in a future study.

5.3 Impact of the FPE of 2006 on years of schooling, according to the regions

The estimations per region suggest that the years of schooling increase significantly in every region. Table 22 presents the results for children in rural areas and in the younger cohort 1. The results are obtained after the estimation of Equation 1 with the years of schooling completed as the dependent variable, and on samples restricted to each type of region. The results are similar for children in the younger cohort 2.

Columns 1 and 3 of Table 22 indicate that in 2012 the years of schooling of girls increased significantly by 2.97 years in regions with "lower" statistics and by 2.03 years in regions with "higher" statistics. As expected, the girls in the regions with "lower" statistics for the schools' infrastructure gained the most from the FPE which implies that the FPE of 2006 encouraged girls' years of schooling completed when girls stayed in school on average two more years. In contrast, the boys in rural areas in regions with the "higher" statistics have gained more from the policy. In columns 4 and 6 of Table 22, the years of schooling of boys increased significantly by

1.50 years in regions with "lower" statistics on schools' infrastructure and by 2.74 in regions with "higher" statistics in 2012. As a reminder, the assumption is that the classification of the regions corresponds to the differences in schools' infrastructure only. It is possible to surmise that the level of improvement of the schools' infrastructure may not be enough to influence boys' years of schooling completed.

Overall, the results are in accordance with the previous literature that suggests that girls are more affected by the schools' infrastructure than boys (see Lloyd et al. (2000), Huisman and Smits (2009)). This could explain why girls have benefited more from the FPE than boys in terms of years of schooling completed.

Table 22: Impact of the FPE of 2006 on years of schooling completed for children living in rural areas, according to region (2006/2011)

	Girls living in rural areas			Boys living in rural areas		
VARIABLES	(1) Regions Lower	(2) Regions Middle	(3) Regions Higher	(4) Regions Lower	(5) Regions Middle	(6) Regions Higher
Dependent variable: Years of schooling						
Treatment sample: population aged 6 to 8 in 2006 and 11 to 13 in 2012						
Control sample: population aged 18 to 20 in 2006 and 23 to 25 in 2012						
Dummy2012	-0.729	0.0210	1.027*	1.133	0.227	0.321
	(0.922)	(0.722)	(0.563)	(0.927)	(0.608)	(0.504)
Younger cohort 1	-4.046***	-4.399***	-3.912***	-5.373***	-5.364***	-5.367***
	(0.347)	(0.264)	(0.227)	(0.303)	(0.283)	(0.198)
Younger cohort 1*dummy2012	2.968***	2.686***	2.028***	1.496**	2.066***	2.740***
	(0.531)	(0.472)	(0.361)	(0.708)	(0.464)	(0.377)
Other control variables	Yes	Yes	Yes	Yes	Yes	Yes
Constant	6.003***	6.132***	5.778***	7.598***	7.922***	7.948***
	(0.733)	(0.434)	(0.401)	(0.467)	(0.384)	(0.355)
Observations	612	947	1,404	776	1,144	1,893
R-squared	0.490	0.497	0.480	0.598	0.551	0.541

Standard errors in parentheses adjusted robust for clustering in the Primary Sampling Unit (PSU). The other variables are the household head's age, a dummy for female-headed households, the dummies for the household head's level of education, the dummies for the quintile of wealth, and the number of children under five years old in the households. *** Significant at 1%, ** Significant at 5%, *Significant at 10%.

Source: Author's own computations based on DHS 2006 and 2012

In conclusion, the FPE of 2006 significantly improves the years of schooling completed for children already enrolled. On average, children attend two more years of schooling following the launch of the policy. Nevertheless, there are some differences in the impact. The years of schooling have increased stronger for children of poor households than for children of rich households, except for girls in rural areas. On the contrary, the years of schooling have improved more for girls in rural areas and in regions with "lower" statistics on schools' infrastructure than in other regions. The outcomes on years of schooling are different from those on current enrollment conceivably because of the limitation to children already enrolled. These results imply that demand-and-supply side policy may have more of an impact on children already in school because of the improvement of study conditions.

6. Robustness checks

The outcomes presented above indicate an improvement in enrollment and years of schooling following the launch of the FPE of 2006. The strategies to identify the impact of the FPE could be weakened by the lack of appropriate control groups. In fact, the FPE of 2006 was national, and the control groups used are the birth cohorts before the implementation of the policy. It is possible that the older cohort 3 used as a control group had also benefited from the policy. The older cohort 3 is children aged 18 to 20 in 2006. Normally, they are not registered in primary school and are thus not eligible for the FPE. It is rare that older children will still be in primary school, yet it could be a mistake to not control for this hypothesis.

One of the ways to investigate the robustness of the results is by means of additional control groups. The additional control group is the older cohort 4; the children aged 21 to 23, born between 1983 and 1985. A placebo experiment is performed to check that the cohorts are not subjected to other policies than the FPE of 2006. The placebo experiment consists of comparing the older cohort 3 to the older cohort 4 before and after the FPE. The treatment group is children in the older cohort 3 and the control group is children in the older cohort 4.

The population of the older cohort 4 is likely to be enrolled at the university level. Despite the potential low enrollment rates of this birth cohort, the difference-in-differences assumes a parallel trend between treatment and control groups. This means that the trend in enrollment for the treatment group—in comparison with the control group—would not have changed without the policy. Thus, the first difference will remove any disparity in enrollment between the older cohort 3 and the older cohort 4, and the second difference will give only the residual effects over time.

This is the potential impact of the policy. In the case of this placebo experiment, there should be no residual impact, because the FPE targeted none of these groups.

Table 23 presents the results of this placebo experiment. Notably, the FPE has no significant impact on the older cohort 3. The estimations in Table 23 are obtained with Equation 1 with enrollment as the dependent variable.

Columns 1, 2, 3 and 4 of Table 23 suggest no significant change in the enrollment for children of the older cohort 3 in 2012. The outcomes are similar for every group and for the years of schooling completed as well. This means that the older cohort 3 is an adequate control group for the policy because children of this birth cohort have not gained from the program. The outcomes also indicate that the effects observed on the younger cohort 1 and 2 in the main evaluation are genuinely due to the FPE of 2006, because no other birth cohorts have gained from the policy.

Table 23: Linear regression of current enrollment for older cohorts of children

	Girls in rural areas	Girls in urban areas	Boys in rural areas	Boys in urban areas
	(1)	(2)	(3)	(4)
VARIABLES	OLS	OLS	OLS	OLS
Dependent variable: Enrollment *Treatment sample: population aged 1 to 20 in 2006 and 23 to 25 in 2012* *Control sample: population aged 21 to 23 in 2006 and 26 to 28 in 2012*				
Dummy2012	-1.555	-0.400	11.32***	25.86***
	(1.214)	(0.283)	(2.440)	(2.890)
Older cohort 3	-0.0352	-0.0645*	-0.0709	-0.0524
	(0.0223)	(0.0368)	(0.0453)	(0.0524)
Older cohort 3*dummy2012	0.0226	0.0354	0.0125	-0.0507
	(0.0228)	(0.0386)	(0.0468)	(0.0536)
Other variables	Yes	Yes	Yes	Yes
Constant	4.160***	1.222***	1.441	-1.591
	(1.016)	(0.253)	(1.691)	(1.940)
Observations	4,729	3,650	3,322	3,005
R-squared	0.200	0.259	0.314	0.324

Standard errors in parentheses adjusted robust for clustering in the Primary Sampling Unit (PSU). The other variables are the household head's age, a dummy for female-headed households, the dummies for the household head's level of education, the dummies for the quintile of wealth, dummies for the region fixed effects, and the number of children under five years old in the households. *** Significant at 1%, ** Significant at 5%, *Significant at 10%.
Source: Author's own computations based on DHS 2006 and 2012

7. Conclusion

This study aims to assess the impact of a demand-and-supply side policy on schooling outcomes in Benin, West Africa. Mainly, the FPE of 2006 improved enrollment and attendance of children in most settings. The probability of current enrollment increased by about 30% for girls and by 60% for boys in rural areas. The years of schooling completed increased significantly by about two years for children already enrolled. Theses results imply that gender disparities did not improve in access to education.

Moreover, the heterogeneity analysis provides arguments for the persistence of the gender gap in primary education. First, the wealth disparities in schooling may have diminished in attendance, but not in enrollment. There are however some differences according to the gender and the area of residence. For attendance, the evaluation is performed on children that have completed at least one year of schooling. These parents were able to pay school fees to enroll their children. Thus, the FPE of 2006—by abolishing school fees and through the expansion of the schools' infrastructure—allows them to maintain their children in school. The main difference with the variable "current enrollment" is the restriction to children already enrolled. In the sample, the majority of children had less than one year of schooling. Some children had never been to school. The abolition of school fees gave them the opportunity to start a primary education. Thus, there might be two levels of wealth involved. Some households were wealthier and could enroll their children whereas some others could not enroll theirs. For enrollment, there was a difference of wealth that the FPE of 2006 did not reduce. Consequently, the level of costs may still be an impediment. It might be of use to analyze the impact of wealth on schooling. Secondly, the differences across regions due to the schools' infrastructure have significantly improved for attendance but not for enrollment for girls in rural areas. This result confirms that the enhancement of the schools' infrastructure could be more influential on attendance than on enrollment. Despite the removal of school fees, the FPE of 2006 in Benin involved the construction of schools and the recruitment of teachers. The improvement of the schools' infrastructure was beneficial for every child, especially children in regions with "lower" statistics. After the FPE of 2006, girls in these "lower" statistics regions stayed, on average, more years in school than girls in other regions. However, there is no significant change for boys in urban areas.

These outcomes imply that the schools' infrastructure has a prominent effect on girls' attendance in rural areas. These results show that a demand-and-supply policy can help alleviate gender disparities.

Public policies on education may sometimes neglect the supply side of education. This study corroborates previous studies on demand-and-supply side policies (see Handa (2002)). The FPE of 2006 was successful in enrollment and attendance. It reveals that in developing countries, where some remote areas lack schools and teachers, demand-and-supply side policies may be more appropriate. There is a necessity to improve schooling conditions simultaneously or before the launch of any reform on costs. With the launch of an elimination of costs, it would be of great use to help reduce additional schooling costs in underprivileged settings.

Chapter 3: Impact of a wealth Shock on Girls' Schooling and Labor in Benin, West Africa.

Mafaïzath Fatoké Dato*

Abstract

This research measures the impact of a negative wealth shock on girls' schooling and labor in primary schools in Benin, West Africa. It investigates the prominence of the household wealth in households' schooling decisions, especially on girls' schooling. In 2010, a devastating flooding occurred and affected 55 municipalities of the 77 of the country. The data used are the National Demographic and Health Surveys (DHS) of 2006 and 2012. The identification procedures consider three different strategies to capture the impact of the shock: a comparison between affected and non-affected households, most affected and non-affected households, farm households and non-farm households. The difference-in-differences estimates point out a significant decrease in wealth for farm households compared to non-farm households, following the wealth shock. The study finds a substantial decrease in educational participation for children in farm households. However, there is no significant impact on the enrollment of boys in rural areas. The impact is greater on girls than on boys. Enrollment in farm households decreases by 7.8% for girls in urban areas and 6.1% for boys in urban areas. Robustness checks on other different groups, as well as a placebo experiment on non-affected and non-farm households, are in compliance with the results. Despite the removal of school fees in 2006, households still withdraw their children from school after a wealth shock.

Keywords: Natural disasters, Education, Wealth shock, Girls Schooling, Child labor.

JEL classification: I24, O55, Q54, I24

I am extremely grateful to Eveline Wittmann, Guido Heineck, Michael Grimm and Mareva Sabatier for their useful comments. My gratitude goes to the German Academic Exchange Service (DAAD) for the PhD scholarship. I would also like to thank all the participants of the 20th Bavarian Graduate Program in the Economics (BGPE) Research Workshop in Passau.

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1. Introduction

In the last decade, numerous developing countries have launched policies to reach the goal of Education for All (United Nations, 2014). These policies aim to promote children's education and to decrease gender and wealth inequalities. Despite the remarkable improvement of schooling on many levels, the disparities appear to persist. In Sub-Saharan African, a recent report on the Millennium Development Goals shows that enrollment in primary schools has more than doubled between 1990 and 2012, but that only 23% of girls in poor households complete their primary education (United Nations, 2014). These statistics raise the question the household wealth's prominence on schooling decisions, particularly on girls' schooling.

In this framework, many authors have examined the relationship between household wealth and the allocation of the child's time. In general, schooling and labor decisions are joint for households. In critical situations, underprivileged households may withdraw their children from school and send them to work (Jacoby and Skoufias, 1993, 1998; Jacoby, 1994). Depending on the context, girls could be worse off in comparison to boys. In some areas, the opportunity costs of girls' time are more valuable. Thus, they are more likely than boys, to be dropped out of school, to help cope with a shock. There is, however, only a minority of studies on African countries. Cogneau and Jedwab (2010) use the cut in cocoa price in 1990 in the Côte d'Ivoire, to compare schooling decisions in cocoa-growing families and other agricultural ones. The authors indicate a significant impact of parental wealth on enrollment, labor and health. Beegle et al. (2006) used data from Tanzania and found that transitory income shocks increase child labor and decrease enrollment. However, the household assets may help mitigate the shocks. Also, these studies' outcomes are controversial, on gender inequalities. In Burkina Faso, the drop in income for food crop farmers in the mid-nineties created a decrease in children's enrollment and an increase in child labor (Grimm, 2011), and the author found a greater impact on boys than girls. Kazianga (2012) also found similar results with the effects of uncertainty in the household's income on enrollment and years of schooling completed. Björkman-Nyqvist (2013) showed that the rainfall deviations have a significant negative impact on enrollment in Uganda. After the elimination of school fees, girls are more often removed from school, to help cope with an income shock, while boys are mostly non-affected.

Consequently, this paper adds to prior evidence on the impact of a negative wealth shock on girls' schooling and labor in Benin. Benin is a small West African country with agriculture as a predominant economic activity. Approximately 47% of the active population works in agriculture (INSAE, 2012 (2)). Two types of crops are cultivated: cereal crops (maize, millet, beans, etc.) and industrial crops (cotton, groundnuts, palm nuts, etc.). In October 2006, Benin launched a policy to eliminate school fees for primary school aged children, (called the Free Primary Education policy). Consequently, the gross school enrollment rate increased from 94.7% in 2005 to 104.27%[9] in 2008 (INSAE, 2012). The 2006 Benin Demographic and Health Survey (DHS) indicate that 88.3% of the population among the poorest and 27.8% among the richest had no formal education. In 2012, according to the DHS, 56.9% of the poorest and 7.0% of the richest had no formal education (INSAE, 2007, 2013). These statistics show that enrollment may have improved, but that wealth differences are still observable. In 2010, a major flood occurred over eight months in a large part of Benin that caused a costly aftermath throughout the country. An official report by the Global Facility for Disaster Reduction and Recovery (GFDRR) in 2011 estimated the economic losses to be around US $160 million. Approximately 680,000 people were affected at different levels, and 46 people died. Given the importance of the weather shock, the government declared a state of emergency in October 2010 (GFDRR, 2011).

The empirical strategies of this paper consider the negative rainfall deviation in 2010 to estimate the causal impact of wealth on girls' schooling and labor. The data used are the National Demographic and Health Surveys (DHS) of 2006 and 2012. This research focuses on agricultural activities because of their potentially high vulnerability to weather shocks in Sub-Saharan Africa. Burch et al. (2008) emphasizes the important conditionality of agricultural activities on rainfalls in Sub-Saharan Africa, due to insufficient irrigation infrastructure. GFDRR (2011) also categorizes the country in the affected and most affected municipalities. 55 municipalities are affected of the 77 of the country. The identification strategies thus consider three potential variations to capture the impact of the shock. Theses are differences between affected and non-affected households, most affected and non-affected, and farm and non-farm ones. Hence, the difference-in-differences analysis captures a significant difference in the outcomes of children's schooling and labor in farm and non-farm households after the shock. The outcomes are primary education enrollment, children domestic and market labors. An additional outcome is a combination of enrollment and labor. Enrollment decreases significantly for children in farm

[9] The gross enrollment rate is over 100% because older children are considered in the computation. It is an indicator of late enrollment.

households in comparison to non-farm households. The decrease in enrollment is larger on girls than on boys. However, the increase in market labor is greater on boys than on girls. The robustness checks control for the impact of the flood on farm households in the affected and most affected municipalities. Moreover, a placebo experiment, run on non-farm and non-affected households, confirmed the results. The different sensitivity analyses confirmed the results of the evaluation.

The interests of this study are threefold: This research is one of the first evaluations of the consequences of flood of 2010 on schooling and labor in Benin. Another interest is that it considers the often-overlooked variable, “enrollment and work”. The household can choose to send their child to school, and to increase the child’s time spent working in the family business. This alternative may not be the best, but it prevents parents from withdrawing their children from school. However, this option is only possible when school and work hours do not compete. Also, this study uses a gender-based approach to present the results. It enables a further analysis of the choice between girls and boys for child labor as a risk coping strategy in case of shock. This research contributes to the literature on wealth shocks in Sub-Saharan Africa.

The structure of the paper is as follows: Section 2 presents descriptive data on rainfall shocks in Benin, and Section 3 specifies the methodology. Section 4 shows the impact of the shocks on schooling and labor as well as the combination of both, while Section 5 displays robustness checks. Section 6 concludes.

2. Rainfall shocks in Benin

This section provides an overview of the rainfall shocks and the consequences of the flood of 2010 in Benin.

2.1 The flood of 2010 in Benin

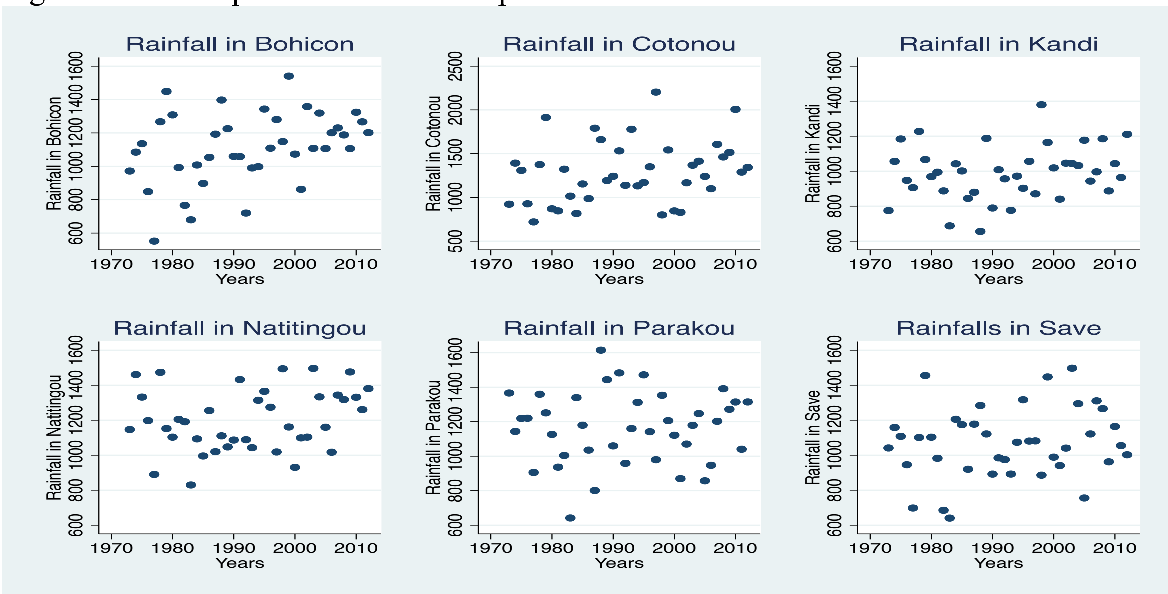
Benin has a tropical wet and dry climate with variations in weather from the north to the south of the country. There is a dry and a rainy season, the duration of each fluctuating, depending on the different regions of the country. In the coastal region for example, four seasons can be identified: two dry seasons and two rainy seasons—one after the other. Given the tropical nature of the climate of Benin, the country is subjected to a number of floods and droughts throughout the year. In particular, GFDRR (2011) considers the flood of 2010 to be one of the most devastating in recent years in West Africa. This section analyzes the rainfalls deviations in Benin during the last 30 years and explains the potential sources of the flood of 2010.

The national meteorological department, of the "*Agence pour la Sécurité de la Navigation Aérienne en Afrique et à Madagascar (ASECNA)"* collects the rainfall data from six weather stations: Bohicon, Cotonou, Kandi, Natitingou, Parakou and Save.

The weather stations are representatively distributed across the country because there is one station in each main region of Benin. The climate in each main region is quite similar in the different areas of the region. These data are gathered in annual reports called "*Tableaux de bord social*" by the National Institute for Statistics and Economic Analysis (INSAE). The database used in this section comprises the quantity of rainfall in millimeters per year and weather station from 1973 to 2012. Figure 10 presents a scatter plot of the rainfall data per station. The aim of this paper is to explain the impact of wealth shocks on child labor and schooling; therefore, it is necessary that the wealth shock be a random and unexpected shock. If the shock were expected, households would be able to anticipate and take decisions in order to cope with it. In agricultural areas, for instance, this could mean making more provisions than usual based on the predictions of weather shocks, and in this case, there may be no significant change in behavior. When the shock is unexpected, the usual insurance taken by the households prior to the shock may not be sufficient. The behavior of households under this constraint is the object of interest here.

After computing the long-term mean of each series, the differences of the series from their mean are calculated to obtain the deviation from the long-term mean. Usually the weather shocks are not observed at the same time in different regions of the country. A year of drought or flood noticed in one weather station may not be the same in another weather station. This could be explained by the variations in the climate of the regions. However, in the years 1975, 1978, 1979, 2004 and 2010, there were positive rainfall deviations in every region. One remark is the difference in intensity of the shock within the same year from one station to another. For example, the long-term means of the weather stations of Bohicon, Cotonou and Natitingou are among the highest, with 1110, 1282 and 1200 millimeters respectively per year over the period 1973-2012. In 2004, the deviations from the long-term mean for these weather stations are 18.78%, 10.25% and 11.04% respectively. Likewise, the weather station with the highest rainfall deviation fluctuates from year to year.

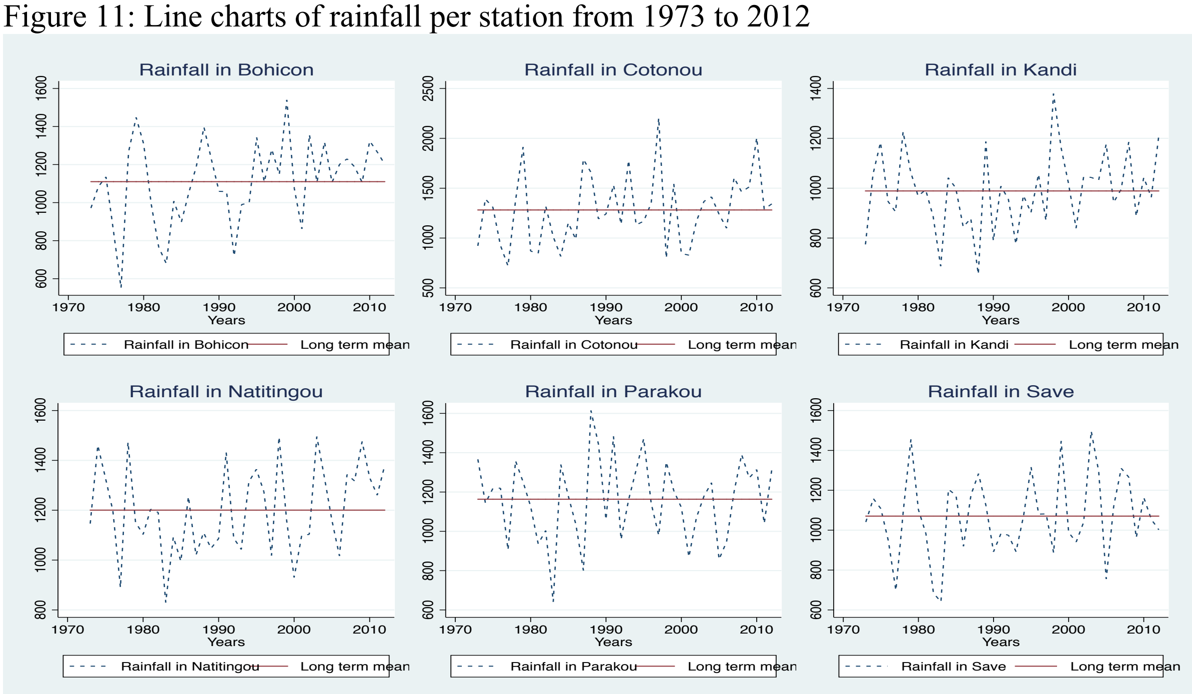
Figure 10: Scatterplots of rainfall data per station from 1973 to 2012



*The scale is the same for every scatterplot except the scatterplot of Cotonou because its range of data is the largest among all rainfall series.

Source: Author's computation based on INSAE, 2012

Figure 11: Line charts of rainfall per station from 1973 to 2012



Source: Author's computation based on INSAE, 2012

In 2004, the highest positive rainfall deviation is approximately 20% of the long-term mean for the weather station, Save in 2010, the highest positive rainfall deviation is 44% in the station, Cotonou. Some caution is necessary, since there is no information available on standards retained by ASECNA to define a year of flood.

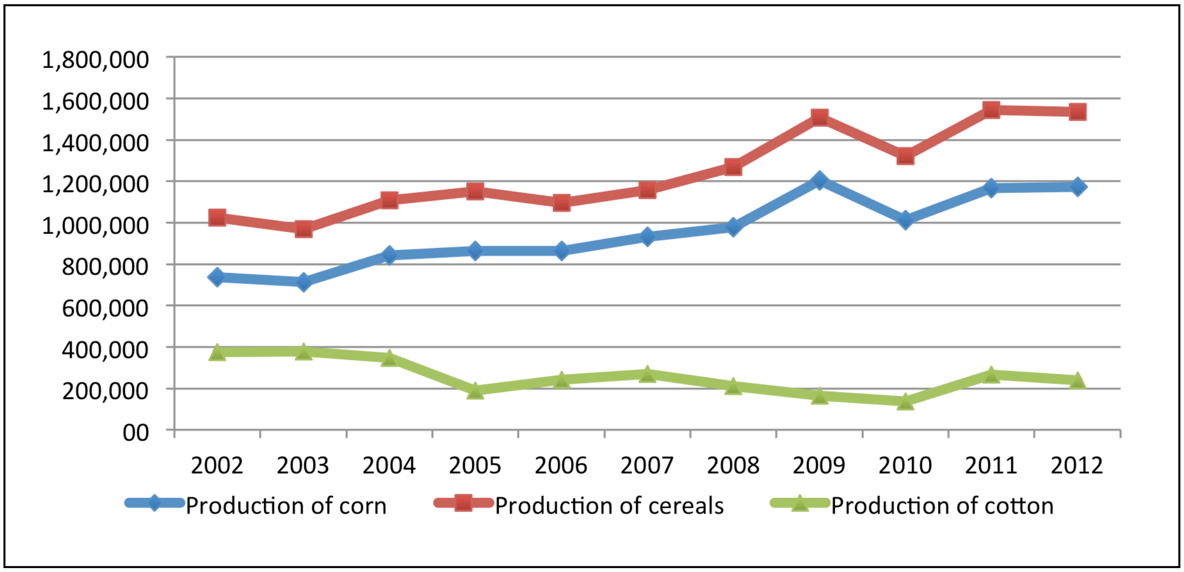
The heavy rainfalls of 2010, in combination with other urban management issues, resulted in the government of Benin calling for international assistance on October 1, 2010 (GFDRR, 2011). One of the specificities of the flood of 2010 is that instead of two rainy seasons separated by a dry season, the two rainy seasons occurred successively over eight months. This contributed to the overflowing of some rivers such as the Oueme, Niger and Mono from their banks. Moreover, the rapid growth of population in cities such as Cotonou was not accompanied by a corresponding development of a drainage system for wastewater. In some agglomerations of Cotonou, people have built their houses on swamp land which is not stable enough for the construction of these homes, due to of the particularity of the soil. These areas are among the first to be inundated in the rainy season. All these factors contributed to the flood of 2010.

2.2 The consequences of the flood of 2010

The aftermath of the 2010 flood was substantial in terms of agriculture and schooling, among other sectors. The weather shock affected 680,000 people and 46 people died.

According to the GFDRR (2011), the agricultural losses were estimated to be 82 billion of the local currency the CFA Francs (Francs de la Communauté Financière d'Afrique) or around US$138 million (on June 29, 2015). This amount corresponds to farm materials, crops, seeds, and farming land destroyed, and cattle lost. The flood overflowed into farming lands and destroyed the harvest of many households. Due to these losses, the level of poverty and food insecurity increased in farm households following the shock, hence the focus of this paper on farm households. Figure 12 provides an overview of the loss in agricultural production following the shock. The figure presents the evolution of three major crops in Benin: corn, cereal and cotton. Corn and cereals are among the main food crops, and cotton is one of the most important commercial crops exported by the country.

Figure 12: Development of agricultural production between 2002 and 2012



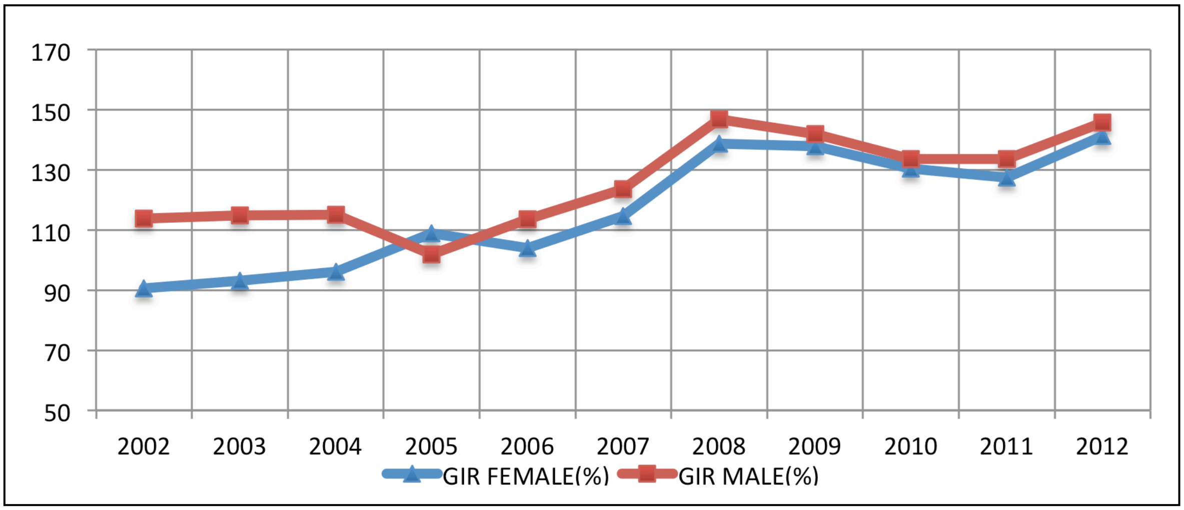
(): Agricultural production is presented in tons.

Source: Author's computation based on INSAE (2012)

Figure 12 indicates that there is a relatively steady growth of the different crops over the years. In 2009, there is, however, a diminution in production. For example, corn production went from 1,205,200 tons in 2009 to 1,012,603 tons in 2010, which is the largest decrease in production over the period. This reduction in production could be associated with the 2010 flood. The production patterns for cereal and cotton production follow almost the same pattern.

This change can also be observed in schooling rates. Schools were submerged under water in affected areas. This delayed the start of class in certain regions. Most of the schools, constructed of poor building materials (e.g. twigs), were completely destroyed in flooded areas. Overall, 455 schools were damaged. The schools also lost pedagogical materials (GFDRR, 2011). The primary level of education in Benin includes six grades. Figure 11 allows an examination of the evolution of the Gross Intake Ratio (GIR) in the first grade of primary school from 2003 to 2012. The GIR is the number of children registered in the first grade of primary school—regardless of age—against the number of children who *should* be in primary school (UNESCO, 2009).

Figure 13: Development of Gross Intake Ratio (GIR) per gender from 2003 to 2012



Source: Author's computation based on INSAE (2012)

Figure 13 shows a growth of the GIR at a constant rate from 2003 to 2012. There is a decrease in the GIR in 2010 and 2011. One observation is that the GIR for males appears to almost always be superior to the GIR of females. In 2005 and 2010 however, the statistics are quite similar for girls and boys in the first grade of primary school. Yet after 2010, the gender differences return, with these years being those that followed the flood of 2010. The impact evaluation could provide more insight into the actual impact of the shock.

3. Methodology

This section presents the data, identification strategies, model and descriptive statistics for the impact evaluation.

3.1 Data

The data used are from the Benin Demographic and Health Survey (DHS) of 2006 and 2012. The National Institute for Statistics produces the data in collaboration with Macro International Inc. The databases cover at least 17,000 households in each year and are representative at three levels: region, municipality and cluster levels. The cluster level is the primary sampling unit of the Benin DHS. Benin has 12 regions and 77 municipalities, according to the law 97-028 of

January 15 1999. The DHS contains socio-demographic and economic information on a sample of households drawn randomly from the clusters defined in the surveys. In order to have additional information on the household characteristics, two databases are constructed with the different datasets of the surveys: a database of children between six and 14 years old, and a database of household heads. The children's database is then merged with the household head database. The final sample covers approximately 45,491 children aged six to 14. The DHS surveys of 2006 and 2012 are the most complete and reliable databases available for Benin, before and after the weather shock of 2010.

3.2 Identification strategy

The flood of 2010 is examined as a wealth shock because of its potential impact on the earnings of households. It is thus necessary to determine an appropriate channel through which households could be affected.

The influence of the shock may change depending on the household's area of residence. Section 2 shows that the amplitude of the weather shock fluctuates from one region to another. Therefore, the flood may affect each household in different ways. Hence, a variation in the shock that could be used for the identification strategy is the difference in the location of the households. GFDRR (2011) pinpoints 55 municipalities as being affected out of the 77 municipalities of the country. In addition, a map drawn by the Regional Office for West and Central Africa from the Office for the Coordination of Humanitarian Affairs (OCHA) categorizes three types of municipalities: the most affected, the less affected and the non-affected. From this different classification, the study makes two experiments. The first experiment compares children from six to 14 years old living in the affected municipalities (most and less affected municipalities) to children of the same age living in the non-affected municipalities. The second experiment compares the outcomes of children from six to 14 years old in the most affected municipalities to the children in the other municipalities. The advantage of these experiments is that they consider a pre-established categorization of municipalities according to the damage caused by the flood of 2010. The disadvantage is that the sources of wealth are not considered. For instance, certain municipalities (e.g. urban municipalities) may predominantly have people working in the tertiary sector of the economy. This sector—also called the sector of services—does not greatly depends on the weather, where workers are paid regardless of the weather conditions. In the case of Benin, public servants rarely loose their job. They can be moved in other activities or other regions when they are no more required in a given sector. It may be difficult to observe a change in the household wealth.

Another plausible variation can be identified in the sources of income of the household. Section 2.2 indicates important damages for the agricultural sector, especially the serious loss of harvests and materials. These damages could influence the household income and its ability to be self-sufficient. One possible variation to identify the impact of the shock is the differences between farm and non-farm households before and after the 2010 flood. This is the third experiment. The feature of this strategy is the consideration of the sources of income. In this low-income country, households deriving their livelihood from agricultural activities are more likely to be affected by this weather shock than other households. For instance, public servants are paid regardless of weather fluctuations. The disadvantage is that the DHS databases do not contain enough information on the different types of farm and sources of income. There could be a difference in the income shock for food crop farmers in comparison to commercial crop farmers. The databases contain a variable on whether or not a household owns agricultural land, collected as hectares of agricultural land. A household that owns a hectare of agricultural land would likely have farming as one of its sources of income. This variable serves as a criterion to define farm and non-farm households.

A potential threat to these strategies is migration. There is a possibility that people move from one area to another because of a flood. Section 2 shows that houses have been destroyed by flooding, in which case, the changes in wealth to capture may not actually be for the concerned households, but for their hosts. The impact may suffer from selection bias. It is thus necessary to control for migration. In the sample studied, for about 91% of the children the current place of residence is their place of birth. The sample was limited to households that have not moved since the birth of their child. The municipality of birth of the children has been considered in creating the treatment variable instead of the current place of residence. The treatment variable will be, for example, that the child is born in an affected municipality instead of the child living in an affected municipality.

Another potential weakness of the strategies is the comparability of the sample before and after the flood. One important assumption of the impact evaluation methods is the comparability of the groups. The suggestion is that the outcomes of the treated and controls could follow a parallel trend without the treatment, which is the wealth shock. As a solution, the propensity score matching method allows the control of any observed differences between the control and treatment groups before the shock. The propensity score matching method has therefore been used to create propensity scores for children in the database of 2006 and to merge them with the children in the database of 2012. The variable, used to compute the scores, is the treatment variable for experiment 1, and the child's place of birth is one of the affected municipalities.

Once the different issues are taken into account, the difference-in-differences estimations may reflect the impact of the flood of 2010 on the different groups. The following table provides an overview of the samples:

Table 24: Summary statistics of different treatment groups after matching

Experiment 1: Children born in an affected municipality	Year 2006	Percentage	Year 2012	Percentage	Total	Percentage
Yes	14,793	65.45	14,805	64.67	29,598	65.06
No	7,808	34.55	8,085	35.33	15,893	34.94
Total	22,601	100	22,890	100	45,491	100
Experiment 2: Children born in a most affected municipality	Year 2006	Percentage	Year 2012	Percentage	Total	Percentage
Yes	8,497	37.59	8,699	38,00	17,196	37,80
No	14,104	62.41	14,191	62,00	28,295	62,20
Total	22,601	100	22,890	100	45,491	100
Experiment 3: Children born in a household that owns agricultural land	Year 2006	Percentage	Year 2012	Percentage	Total	Percentage
Yes	15,096	66.91	14,816	64.72	29,912	65.81
No	7,463	33.09	8,074	35.28	15,537	34.19
Total	22,559	100	22,890	100	45,449	100

Source: Author's computation based on DHS 2006, 2012

It is worth notifying that the samples in Table 23 are different because of the criterion used to retain the treatment and control groups.

3.3 The model

The main research focus of this paper is to analyze the impact of the flood of 2010 in Benin on gender differences in schooling. Yet, the model considers not only the educational outcome but also the labor outcomes. In situations of crisis, parents may choose to either send their children to work (to increase the household income), or to keep them at home (to reduce the household consumption level). The wealth shock could then influence both decisions (enrollment and work). In addition the reallocation of the child's time in both work and schooling activities could depend on the gender of the child, considering the following outcomes: enrollment, market work, domestic work, and a combination of enrollment and work.

In the case of a wealth shock, parents may be more willing to send their children to market work instead of to domestic work in order to increase the household income. The market work is defined as activities performed by the child in the production of goods for the consumption of people other than their family members, for example, work on a farm or in a family business. Domestic work is defined as activities performed for the family members such as cooking, cleaning and taking care of other family members, see Edmonds (2007). The market job could provide an immediate and much-desired supplementary income for the family in a time of crisis. In the context of this study, the market work may not be paid, but could provide more satisfaction for the household income constraint than the domestic work. This distinction could be of interest because the market work could have more impact on school years of schooling completed than domestic work. Previous studies indicate that market laborers work on average more hours than domestic workers (see Edmonds (2007), Bandara et al. (2015)).

Moreover, this study adds another alternative, which is the combination of enrollment and work. If schooling and work times do not compete, households have the choice to combine enrollment and work for their children. This choice could be somewhat more beneficial for the children's learning process than the dropout option. Previous studies also show that the removal of children from school―in the case of a wealth shock―could have a detrimental impact on their attendance, see Björkman-Nyqvist (2013), Dillon (2013), Maurin (2002). Thus with the combination of schooling and work, children could have the opportunity to continue school on a regular basis in spite of the shock. Yet, the challenge of this combination could be in terms of the skills actually acquired in schools. Children who combine enrollment and work may face more difficulties in learning at school because of the labor they undertake in their work. However, it could prevent parents from ultimately removing their children from school. In this study, since 2006, Benin has abolished school fees for children of school-going age. The direct schooling costs are thus abolished, and this removal of fees could alleviate household consumption constraints. In such settings, the expectations are that the households could continue to enroll their children, or to at least combine enrollment and labor. This hypothesis will be tested with the impact evaluation. Consequently, the standard model to determine the impacts of the flood of 2010 is:

$$Outcome_i = a_1 X_i + a_2 X_i * year2012_i + a_3 year2012_i + a_4 treatment_i + a_5 treatment_i * year2012_i + u1_i$$

(Equation 1)

X is a set of child and household characteristics; *Outcome* represents enrollment, domestic work, market work, and the combination of both; the outcomes are binary variables with value 0 or 1; *year2012* is a dummy variable that takes 1 if the year is 2012 and 0 otherwise; *treatment* is a binary variable that equals 1 if the child belongs to one of the treatment groups and 0 otherwise; the coefficients *a* are constant parameters; and *u* is the error term. The child and household characteristics are: child's age, household head's age, household head's gender, household head's level of education, the relationship with the head, the number of children under five years old in the household, the number of household members, and region dummies. The DHS 2012 data was collected two years after the flood of 2010, which is not enough to capture a long-term impact of the shock, and may explain the reason for the retention of enrollment as an indicator for education instead of the years of schooling, for example. The number of households that own agricultural land may be more important in rural areas than in urban areas. Children in rural areas could spend more hours working than those in urban areas. This impact may vary among those areas. Moreover, cultural considerations of parents regarding girls' enrollment could be different in both areas, and is the reason why separate estimations have been performed according to the gender and area of residence.

The estimations are run with the Ordinary Least Squares (OLS) separately according to the child's gender. The OLS estimations are used as basis with which to compare further estimations. The literature on impact evaluation recommends the use of OLS method for DID estimations (Meyer, 1995; Card and Krueger, 2000; Cameron and Trivedi, 2005; Wooldridge and Imbens, 2009; Wooldridge, 2010; Khandker et al. 2010). In fact the DID main assumption is that the selection on unobservables is time invariant. It means that there might exist characteristics of the participants that influences the outcomes that are not measurables, but these differences remain the same over time so that they can be removed over time. This restrict the choice of estimations models for the DID to a linear functional form. Thus, the OLS complies the most with the DID's assumptions. If the model is non-linear, the fixed effect is non additive and cannot be differenced out. The estimations results are potentially biased. It explains why this study only presents OLS results for the estimations of the different outcomes.

Table 24 provides an overview of the descriptive statistics of the dependent variable, and shows that 26.61% of children were enrolled, 24.91% combined enrollment and domestic work and 13.79% combined enrollment and market work.

Table 25: Summary statistics of the outcome variable per group

Modalities	All sample	Farm households	Non-farm households	Frequency (%)
Enrollment	12,106	6,910	5,182	26.61
Enrollment and domestic work	11,333	6,760	4,568	24.91
Enrollment and market work	6,273	5,008	1,261	13.79
Domestic work	4,012	2,721	1,287	8.82
Market work	4,766	3,816	942	10.48
None	7,001	4,697	2,297	15.39
Observations	45,491	29,912	15,537	

Source: Author's computation based on DHS 2006, 2012

As a remainder, a "farm household" is defined as having at least 1 hectare of agricultural land while a "non-farm household" has no agricultural land. In addition "none" corresponds to children that neither go to school nor work. Edmonds (2007) defines this category as "idle" children and states that this is common in numerous household surveys.

In this research, the flood of 2010 is a proxy for a wealth shock. In an ideal setting, the shock could be used as an instrument in a two-stage model to evaluate the elasticity wealth of enrollment. However, the proxy of income available in the DHS surveys is the wealth index. It is a standardized index computed on the basis of the household's assets; see Filmer and Pritchett (1998). The wealth index could be use as a proxy for the permanent income of the households. In this case, the parameter to compute in a model of instrumental variables will be a wealth elasticity of enrollment rather than the income elasticity of enrollment. This is not the purpose of the study. Thus, the paper considers the flood of 2010 as a potential income shock and evaluates the impact of the shock on household reactions. The wealth index is only used to verify that the flood of 2010 genuinely is a wealth shock.

4. Impact of the wealth shock on child schooling and labor

This section presents the results of the estimations of the impact evaluation. The estimations have passed the link test of functional form of the conditional mean, which is a specification test. The null hypothesis that the conditional mean is correctly specified is not rejected. This indicates that there is not enough evidence to reject the specification of the models. The estimations also passed the global significance F-test, which means that the models are globally significant. The standards errors are also clustered in the Primary Sampling Unit (PSU) of the DHS, which are the clusters.

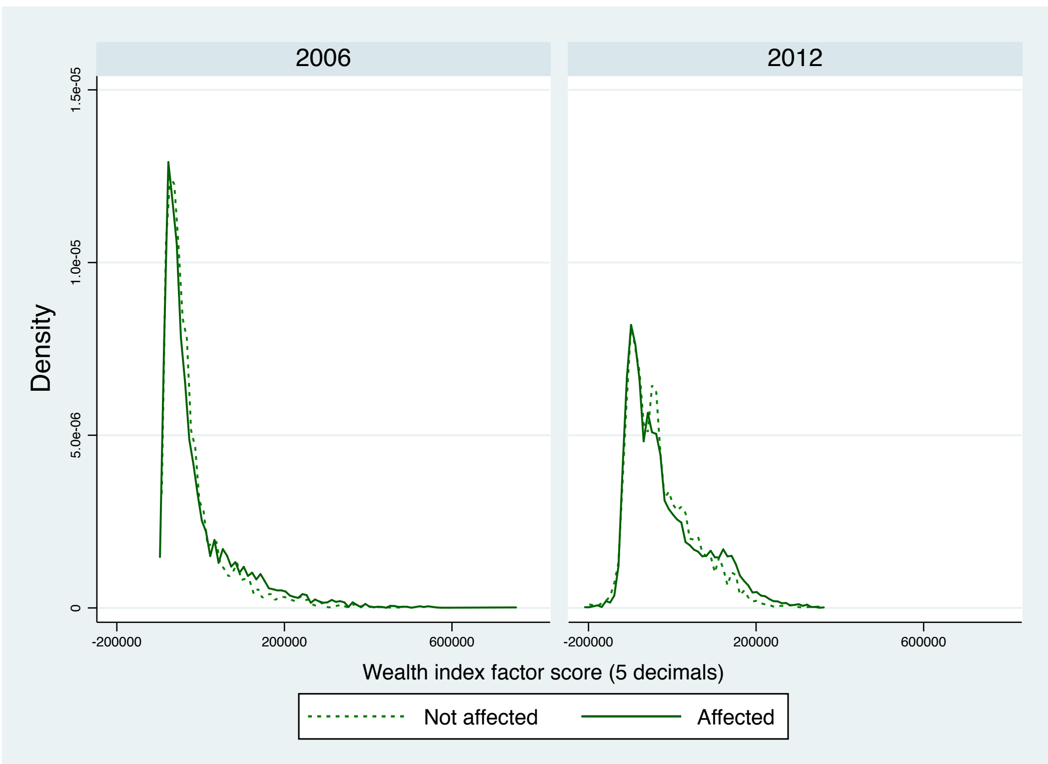
4.1 Impact of the flood of 2010 on household wealth

Once the methodology is retained, the impact evaluation can be performed. Before this, it is necessary to check that the flood of 2010 actually has an impact on the household wealth. For this purpose, the following paragraph presents figures and regressions on the household wealth of different groups.

The sole proxy for income in the DHS Surveys is the wealth index. This index is a proxy for permanent income, and may not be suitable to observe the transitory fluctuations in the household income. Yet, this statistic could provide an overview of the impact of the flood of 2010 on the household wealth. Moreover, the wealth index reduces the number of non-responses or missing values on wealth in the surveys. It is approximately between -250,000 and 800,000. For simplicity in the analysis, the wealth index is divided by 1,000. The index is not in log because it includes negative values. Those negative values become zero if the log function is used, which is not the result required. The study would rather consider every value of the wealth index. Typically, households with a positive value are either in the middle or in the richer quintiles of wealth. The following figures present charts of the household wealth according to the each experiment. Figure 14 presents Experiment 1, which is the comparison between affected and non-affected households. Figure 15 shows Experiment 2, which is the comparison between most affected households and non-affected households. Figure 16 shows Experiment 3, which is the comparison between farm households and non-farm households.

First, Figure 14 indicates that the treatment and control groups, before the flood of 2006, have a similar distribution of wealth. Due to the propensity score matching, the groups are more comparable. The treatment group is the children born into households in affected municipalities, and the control group is the children born into households in non-affected municipalities. The distribution is left-skewed suggesting that the majority of the population is in the poor quintiles. Only a few households are among the richest.

Figure 14: Development of households' wealth, according to Experiment 1 (affected and non-affected households) per year and group

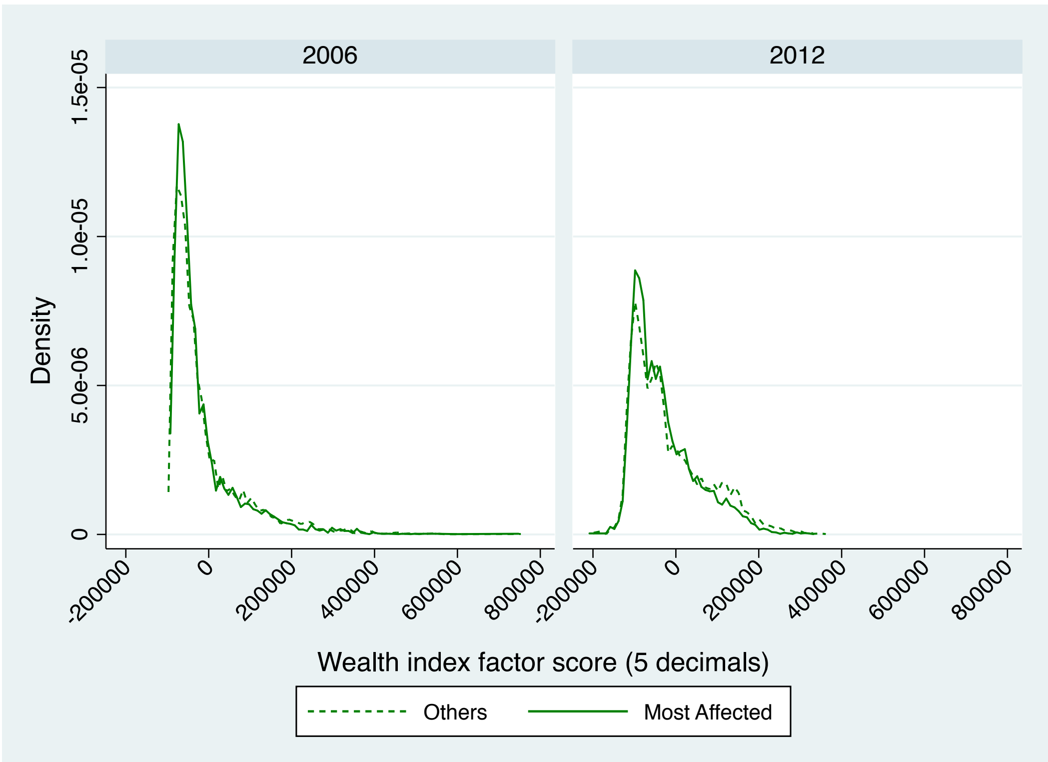


Source: Author's computation based on DHS 2006, 2012

Second, in 2012, the distribution of wealth seems more equitable than in 2006. The curve is still left-tailed but there are more households in the rich quintiles. This does not mean that wealth has increased within the population. Rather it may signify that people are poorer but that the distribution is more even. The wealth is in CFA francs (Communauté Financière d'Afrique), which is the national currency of Benin. One US Dollar equals 621.55 CFA francs on April 13 2015. In fact, the maximum of the wealth in 2006 is 756,601 CFA francs (US$1271.27) against

370,786 CFA francs (US$596.55) in 2012. There is also a slight difference between the distribution of wealth of treatment and control groups.

Figure 15: Development of households' wealth, according to Experiment 2 (most affected and non-affected households) per year and group

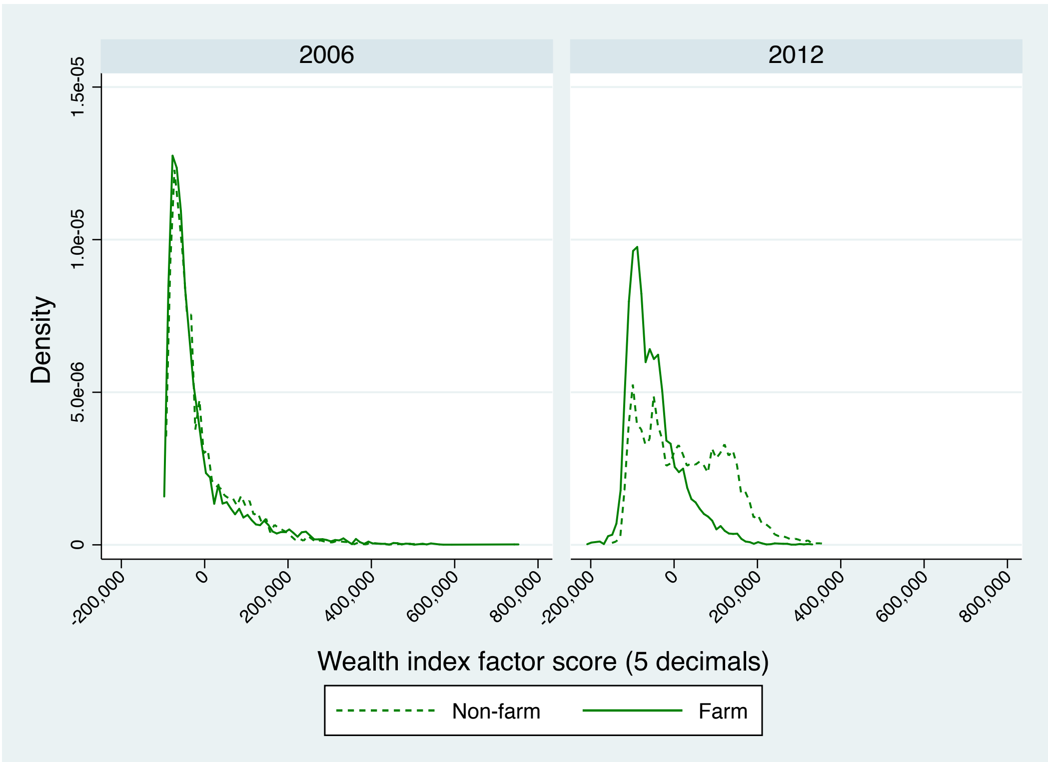


Source: Author's computation based on DHS 2006, 2012

The main difference between Figures 14 and 15 is that households in the most affected municipalities seem to have less wealth than those in the other municipalities in 2012. Figures 14 and 15 also indicate that experiments on the affected and most affected municipalities may not be adequate, because the difference in the wealth of both groups is not really important.

In Experiment 3, the treated are children living in farm households, while the controls are children living in non-farm households. Figure 16 shows that the difference in wealth between both groups is more pronounced in 2012. The treatment group appears to have less wealth than the control group after the flood. Nevertheless, the different remarks on the link between household wealth and flood should be further analyzed in the estimations. The estimations of the impact of the flood of 2010 on the household wealth may provide more precision on these different remarks.

Figure 16: Development of wealth of households, according to Experiment 3 (farming and non-farm households) per year and group



Source: Author's computation based on DHS 2006, 2012

All these observations are tested with estimations on the household wealth, which indicate the actual correlation between the treatment variables and the household wealth.

A treatment variable to be used as proxy for wealth should have a significant correlation with the household wealth. It is thus necessary to determine which variable amid the three treatment variables of the experiments—1. a child born in an affected municipality; 2. a child born in one of the most affected municipalities, and 3. a child born in a household that owns agricultural land—most notably captures the impact of the shock. This treatment variable could then have a significant impact on schooling and labor through the channels of wealth.

The estimations of Table 25 are computed with Equation 1 with the household wealth as dependent variable. The results presented in Table 25 are for girls in rural areas. Yet, the results are similar for girls and boys living in rural or urban areas.

Table 26: Linear regressions of the impact of each treatment variable on the household wealth for girls in rural areas over the period 2006-2012

VARIABLES	(1) Wealth	(2) Wealth	(3) Wealth
Dependent variable: Household wealth			
Sample: Girls in rural areas age 6 to 14 in 2006 and 2012			
Experiment 1			
2012 dummy	-1.804		
	(8.386)		
Affected household	-3.433		
	(2.604)		
Affected household in 2012	-2.837		
	(2.749)		
Experiment 2		-2.166	
2012 dummy		(8.347)	
		2.420	
Most affected households		(2.538)	
		-3.146	
Most affected households in 2012		(2.694)	
Experiment 3			
2012 dummy			0.397
			(8.389)
Farm household			10.01***
			(1.924)
Farm household in 2012			-25.51***
			(3.424)
Constant	-1.297	-4.491	4.931
	(8.088)	(7.973)	(7.815)
Observations	14,236	14,236	14,221
R-squared	0.221	0.220	0.178

Standard errors in parentheses adjusted robust for clustering across households in the same primary sampling unit (PSU). The equations include the child's age, the household head's gender, number of household members, number of children under five years old in the household, and districts dummies that are not presented. *** Significant at 1%, ** Significant at 5%, *Significant at 10%.
Source: Author's computation based on DHS 2006, 2012

Columns 1 and 2 of Table 26 indicate no significant effect of the treatment variables of Experiments 1 and 2 on wealth. Being a child born in one of the affected or the most affected municipalities has no significant influence on the household's wealth. This means that the mere classification of the municipalities after the flood of 2010 does not yield enough variation in wealth, and cannot be used as proxy for wealth. Consequently, Experiments 1 and 2 are dropped. On the contrary, the treatment variable of Experiment 3 has a significant impact on wealth after the flood of 2010. Experiment 3 compares the outcomes of children living in farm and non-farm households before and after the flood. Column 3 of Table 26 reveals a significant decrease in wealth for farm households in 2012, after the shock.

In column 3 of Table 26, the statistics imply that farm households gained on average 10,000 CFA Francs (US$16.09) more than non-farm households in rural areas before the shock. Yet after the flood of 2010, their wealth had decreased by 26,000 CFA Francs (US$41.83) less than non-farm households.

Table 27: Linear regressions of the impact of the shock on the household wealth over the period 2006-2012 with Experiment 3

	Girls in rural areas	Girls in urban areas	Boys in rural areas	Boys in urban areas
	(1)	(2)	(3)	(4)
VARIABLES	Wealth	Wealth	Wealth	Wealth
Dependent variable: Household wealth Sample: Children age 6 to 14 in 2006 and 2012				
2012 dummy	0.397	1.809	11.81	11.08
	(8.389)	(14.20)	(8.609)	(15.59)
Farm household	10.01***	19.94***	9.723***	14.23**
	(1.924)	(5.695)	(1.736)	(5.816)
Farm household in 2012	-25.51***	-96.40***	-26.68***	-89.20***
	(3.424)	(7.328)	(3.221)	(7.749)
Constant	4.931	163.5***	-14.58**	114.6***
	(7.815)	(11.72)	(6.897)	(11.05)
Observations	14,221	7,758	15,532	7,860
R-squared	0.178	0.411	0.160	0.394

Standard errors in parentheses adjusted robust for clustering across households in the same primary sampling unit (PSU). The equations include the child's age, the household head's gender, number of household members, number of children under five years old in the household, and districts dummies that are not presented. *** Significant at 1%, ** Significant at 5%, *Significant at 10%.
Source: Author's computation based on DHS 2006, 2012

Unexpectedly, the impact on wealth of farm households seems larger in urban areas compared to rural areas. The results of Table 27 were obtained after the computation of Equation 1 with wealth as the dependent variable. Columns 2 and 4 of Table 27 indicate the results for children in urban areas. Specifically, column 2 indicates a decrease of 96,400 CFA Francs (US$155.107) in wealth for urban farm households in comparison to urban non-farm households.

The proxy of wealth used in this study (wealth index) could explain this larger impact for farm households in urban areas. Filmer and Pritchett (1998) stated that one of the weaknesses of the wealth index is the comparison between urban and rural areas. Essentially, the computation of the index includes the different infrastructures in the zones. Urban areas usually have more infrastructures than rural areas. The index thus classifies households living in urban areas as wealthier than households living in rural areas. In this experiment, the flood certainly has damaged the infrastructures in urban areas. This can be observed in the decrease in wealth in urban areas, but it does not necessarily mean that the impact is significant on farm households in urban areas.

In summary, the treatment variables of Experiments 1 and 2 have no significant influence on the household wealth. On the contrary, the treatment variable of Experiment 3 indicates a significant negative impact on the wealth of farm households. Therefore, the treatment variable of Experiment 3 is used as sole proxy to measure the impact of the wealth shock on schooling and labor in the subsequent sections.

4.2 Impact of flood of 2010 on enrollment

Primarily, the outcomes of the estimations reveal that the likelihood of enrollment decreased significantly in farm households after the shock. This paragraph covers the results obtained with OLS estimates of Equation 1. The estimations in Table 28 were computed with the method of OLS on Equation 1 and "current enrollment" as the dependent variable. Columns 1, 2 and 4 of Table 28 presents a significant decrease in the probability of enrollment by 5.9% for girls in rural areas, 7.7% for girls in urban areas, and 6.1% for boys in urban areas following the wealth shock in 2012.

The results suggest that girls are more likely not to be enrolled in comparison to boys in urban areas. The effect is not significant for boys in rural areas, but significant and negative for girls in the same area. This result implies that the flood of 2010 significantly decreased the probability of enrollment.

Table 28: Impact of the wealth shock on enrollment for children in rural areas over the period 2006-2012 with Equation 1

	Girls in rural areas	Girls in urban areas	Boys in rural areas	Boys in urban areas
Variables	(1)	(2)	(3)	(4)
	OLS	OLS	OLS	OLS
Dependent variable: Current enrollment *Sample: Children age 6 to 14 in 2006 and 2012*				
2012 dummy	0.091	-0.065	-0.053	-0.087
	(0.056)	(0.067)	(0.052)	(0.070)
Farm household	0.036**	-0.012	-0.010	-0.028
	(0.017)	(0.019)	(0.016)	(0.019)
Farm household in 2012	-0.059***	-0.078***	-0.019	-0.061**
	(0.023)	(0.029)	(0.023)	(0.029)
Constant	0.623***	0.540***	0.778***	0.845***
	(0.042)	(0.052)	(0.036)	(0.045)
Observations	14,206	7,735	15,506	7,838
R-squared	0.138	0.160	0.176	0.182

Standard errors in parentheses adjusted robust for clustering across households in the same primary sampling unit (PSU). The equations include dummies for the child's age, household head age, level of education, the number of children under five, the dummy for biological child, and the district dummies and their interactions with time that are not presented. *** Significant at 1%, ** Significant at 5%, *Significant at 10%.

Source: Author's computation based on DHS 2006, 2012

Finally, one of the main findings on this modality is that girls are more likely not to be enrolled in comparison to boys in urban areas. By way of interpretation, it must be taken into consideration that according to previous research, the gender-differentiated impact of wealth varies depending on the countries. In Burkina Faso, Grimm (2011) and Kazianga (2012) have found that the impact of an income shock is more important for boys' enrollment than for girls'. Björkman-Nyqvist (2013) discovered in Uganda that when schooling is not free of charge, a negative income shock affects both girls and boys. However, when schooling is free of charge, an income shock influences mostly girls. In Benin, school fees were removed in 2006. The results indicate that the flood of 2010 affects the girls' non-enrollment more than the boys'. The results of the present research align more with Björkman-Nyqvist (2013). Finally, the gender dissimilarities in enrollment persist in Benin.

4.3 Impact of the flood of 2010 on child labor

The outcomes on child labor are presented in Table 29. The estimations are performed with Equation 1 with the dependent variables "market work".

Columns 1 and 3 of Table 29 indicate that the probability of being a market worker increases significantly by 9.04% for girls in rural farm households and by 10.6% for boys in rural farm households compared to non-farm households. The effect is not significant for children in urban farm households.

Table 29: Impact of the wealth shock on market work for the period 2006-2012 with Equation 1

	Girls in rural areas	Girls in urban areas	Boys in rural areas	Boys in urban areas
VARIABLES	(1)	(2)	(3)	(4)
	OLS	OLS	OLS	OLS
Dependent variable: Market work Sample: Children age 6 to 14 in 2006 and 2012				
2012 dummy	-0.095	0.108	-0.609***	0.086
	(0.091)	(0.086)	(0.100)	(0.145)
Farm household	0.035	0.077***	0.073**	0.211***
	(0.030)	(0.028)	(0.030)	(0.054)
Farm household in 2012	0.090**	0.061	0.106***	-0.073
	(0.039)	(0.041)	(0.038)	(0.060)
Constant	0.292***	0.005	0.639***	0.029
	(0.071)	(0.063)	(0.077)	(0.115)
Observations	5,226	2,073	4,460	1,490
R-squared	0.138	0.119	0.335	0.371

Standard errors in parentheses adjusted robust for clustering across households in the same primary sampling unit (PSU). The equations include dummies for the child's age, household head's age, level of education, the number of children under five, the dummy for biological child, the district dummies and their interactions with time that are not presented. *** Significant at 1%, ** Significant at 5%, *Significant at 10%.
Source: Author's computation based on DHS 2006, 2012

Columns 1, 3 and 4 of Table 30 suggest that the probability of being a domestic worker increases significantly by 10.5% for girls in rural farm households, by 8.6% for boys in rural farm households and by 24.3% for boys in urban farm households. The effect on girls in urban farm households is not significant. However, the outcomes on children in urban areas should be taken cautiously because the sample has reduced in size, and may not be representative.

Table 30: Impact of the wealth shock on domestic work for the period 2006-2012 with Equation 1

	Girls in rural areas	Girls in urban areas	Boys in rural areas	Boys in urban areas
	(1)	(2)	(3)	(4)
VARIABLES	OLS	OLS	OLS	OLS
Dependent variable: Domestic work Sample: Children age 6 to 14 in 2006 and 2012				
2012 dummy	0.187*	-0.079	0.149	0.124
	(0.106)	(0.111)	(0.109)	(0.147)
Farm household	-0.005	0.001	-0.017	-0.172***
	(0.029)	(0.036)	(0.022)	(0.049)
Farm household in 2012	0.105***	0.052	0.087**	0.243***
	(0.040)	(0.062)	(0.037)	(0.061)
Constant	0.424***	0.708***	0.124*	0.425***
	(0.077)	(0.077)	(0.067)	(0.108)
Observations	5,226	2,073	4,460	1,490
R-squared	0.138	0.125	0.147	0.170

Standard errors in parentheses adjusted robust for clustering across households in the same primary sampling unit (PSU). The equations include dummies for the child's age, household head's age, level of education, the number of children under five, the dummy for biological child, the district dummies and their interactions with time that are not presented. *** Significant at 1%, ** Significant at 5%, *Significant at 10%.
Source: Author's computation based on DHS 2006, 2012

Finally, the 2010 wealth shock significantly increases the probability of being a worker for almost every child in farm households, except girls in urban areas. The results imply first that a potential response to the flood of 2010 for farm households was to increase child labor, especially market and domestic work. Despite the shock, cultural considerations remain: boys have a higher likelihood of working on a farm and girls of working at home in rural areas.

4.4 Impact of the flood of 2010 on enrollment and labor

The estimations in Table 31 are obtained after the estimation of Equation 1 with the variables "enrollment and market work" as the dependent variable. The estimations in Table 32 are obtained with Equation 1 with "enrollment and domestic work" as the dependent variable. The method used is OLS. Overall, the likelihood to be enrolled and work significantly increases for boys in rural farm households after the shock.

Table 31: Impact of the wealth shock on enrollment and market work for the period 2006-2012 with Equation 1

	Girls in rural areas	Girls in urban areas	Boys in rural areas	Boys in urban areas
VARIABLES	(1)	(2)	(3)	(4)
	OLS	OLS	OLS	OLS
Dependent variable: Enrollment and market work				
Sample: Children age 6 to 14 in 2006 and 2012				
2012 dummy	-0.104	0.023	-0.317***	-0.080
	(0.076)	(0.077)	(0.074)	(0.085)
Farm household	0.035	0.043*	0.125***	0.112***
	(0.024)	(0.023)	(0.024)	(0.029)
Farm household in 2012	0.049	0.066**	-0.006	-0.017
	(0.030)	(0.028)	(0.029)	(0.035)
Constant	0.138**	0.035	0.337***	0.071
	(0.064)	(0.057)	(0.064)	(0.082)
Observations	7,210	4,413	8,839	4,853
R-squared	0.120	0.119	0.259	0.279

Standard errors in parentheses adjusted robust for clustering across households in the same primary sampling unit (PSU). The equations include dummies for the child's age, household head's age, level of education, the number of children under five, the dummy for biological child, the district dummies and their interactions with time that are not presented. *** Significant at 1%, ** Significant at 5%, *Significant at 10%.

Source: Author's computation based on DHS 2006, 2012

Columns 1 and 3 of Table 31 indicate that the probability of being enrolled and a market worker significantly increases by 6.57% for girls in urban farm households compared to non-farm households. The effect is not significant for other groups.

Column 3 of Table 32 suggests that the probability of being enrolled and being a domestic worker increases significantly by 9% for boys in rural farm households. On the contrary, this probability decreases significantly for girls in urban farm households according to Column 2 of Table 32. This result means that parents could choose to decrease enrollment and work for girls in urban farm households, and to increase another type of work, such as enrollment and market work.

Table 32: Impact of the wealth shock on enrollment and domestic work for the period 2006-2012 with Equation 1

	Girls in rural areas	Girls in urban areas	Boys in rural areas	Boys in urban areas
VARIABLES	(1)	(2)	(3)	(4)
	OLS	OLS	OLS	OLS
Dependent variable: Enrollment and domestic work *Sample: Children age 6 to 14 in 2006 and 2012*				
2012 dummy	0.114	0.251**	0.099	0.129
	(0.086)	(0.100)	(0.074)	(0.097)
Farm household	0.052**	0.042	-0.035*	-0.023
	(0.024)	(0.028)	(0.018)	(0.025)
Farm household in 2012	-0.011	-0.069*	0.090***	0.037
	(0.033)	(0.040)	(0.027)	(0.032)
Constant	0.511***	0.536***	0.402***	0.499***
	(0.067)	(0.067)	(0.050)	(0.068)
Observations	8,145	5,327	10,120	6,046
R-squared	0.075	0.075	0.130	0.101

Standard errors in parentheses adjusted robust for clustering across households in the same primary sampling unit (PSU). The equations include dummies for the child's age, household head's age, level of education, the number of children under five, the dummy for biological child, the district dummies and their interactions with time that are not presented. *** Significant at 1%, ** Significant at 5%, *Significant at 10%.
Source: Author's computation based on DHS 2006, 2012

Finally, the OLS estimates indicate that the probability of enrollment and work has increased mainly for boys in rural farm households and girls in urban farm households. These results are of particular interest for this study. One of the questions asked by this research is whether or not a parent would choose the combination of enrollment and work in the context of Benin. The payment of school fees was abolished in 2006, before the wealth shock. With the removal of school fees, the budget constraints of the household could be alleviated, and could allow parents to choose to keep the child in school or to combine enrollment and work in response to the shock. This choice may be less harmful for the children's education in comparison to completely removing them from school. In the case of this study, the wealth shock significantly increases the probability of enrollment and work only for boys in rural areas and girls in urban areas.

This result is in accordance with the results of Bandara et al. (2015) in the case of Tanzania, where the authors found that crop shocks in Tanzania increased the likelihood of dropout more for girls than for boys. In terms of work, there is a diversification of the strategies for the allocation of the child's time, depending on the area of residence.

5. Robustness check

The purpose of this section is twofold. First, we consider whether or not the results are consistent when using other groups of households potentially affected by the flood of 2010. The main assumption is that the classification in GFDRR (2011) is accurate. In this case, though the mere categorization of affected areas may not yield enough variations in the household wealth, it is possible to account for additional variations between farm households. A plausible difference could exist between farm and non-farm households in the affected municipalities or in the most affected municipalities. The expectations are that the impact of the flood on these subgroups should be similar to the impacts observed in the main evaluation. These variations would thus reveal the consistency of results across the groups. Second, a placebo experiment on non-farm and non-affected households is run. This last experiment provides evidence of any other treatment that could influence the groups, other than the flood of 2010.

5.1 Impact of the flood of 2010 on the affected farm households

Equation 1 has been estimated on a sample of households "*affected*" by the shock. The treatment is still "*farm household in 2012*". The difference with the main evaluation is that the samples have been reduced to households whose children are born in an affected municipality. Two points are important. First, the new samples take into consideration the classification between affected and non-affected municipalities. Second, this restriction of the samples also helps to control for migration. As seen in Section 3, the place of birth is the current place of residence for 90% of children. To avoid a potential migration effect, the municipality of birth is used to create the variable "affected", instead of the current place of residence.

Table 33 was obtained after computation of equation 1 on the restricted samples of affected households. Columns 4 and 8 of Table 33 present a significant decrease in wealth of approximately 28,000 CFA francs (US$45.09) in rural farm households in 2012. This decline in wealth is more important for the affected farm households than for the farm households in general. Instead of the reduction by 26,000 CFA francs (US$41.83) for a farm household in rural areas noted in the main evaluation, the reduction is about 28,000 CFA francs (US$45.09) for affected farm households in the same area.

Table 33: Linear regression of the impact of the shock on affected farm households over the period 2006-2012

	Girls in rural areas				Boys in rural areas			
VARIABLES	Enrollment	Domestic work	Market work	Wealth	Enrollment	Domestic work	Market work	Wealth
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	OLS	OLS	OLS	OLS	OLS	OLS	OLS	OLS
2012 dummy	0.166**	0.247*	-0.167	-3.371	-0.037	0.206	-0.541***	2.174
	(0.065)	(0.135)	(0.113)	(10.70)	(0.059)	(0.142)	(0.124)	(10.38)
Affect. farm househ.	0.038*	0.008	0.030	10.31***	-0.004	-0.023	0.060	11.24***
	(0.019)	(0.032)	(0.031)	(2.282)	(0.019)	(0.027)	(0.037)	(2.014)
Affect. farm househ. in 2012	-0.076***	0.099*	0.097**	-28.17***	-0.047*	0.048	0.113**	-28.91***
	(0.028)	(0.050)	(0.045)	(4.163)	(0.028)	(0.052)	(0.050)	(4.260)
Constant	0.604***	0.430***	0.277***	7.200	0.791***	0.172**	0.591***	-12.43
	(0.050)	(0.094)	(0.086)	(9.766)	(0.044)	(0.083)	(0.090)	(8.522)
Observations	9,109	3,326	3,326	9,120	9,899	2,813	2,813	9,915
R-squared	0.157	0.142	0.160	0.188	0.188	0.142	0.348	0.172

Standard errors in parentheses adjusted robust for clustering across households in the same primary sampling unit (PSU). The equations include dummies for the child's age, the household head's age and the household head's gender. *** Significant at 1%, ** Significant at 5%, *Significant at 10%.
Source: Author's own computation based on DHS 2006, 2012

In addition, the probability of enrollment also significantly decreases for every child. According to columns 1 and 4 of Table 33, this likelihood reduces significantly by 7.6% for girls and 4.7% for boys in affected farm households in rural areas. This suggests that the flood of 2010 affects girls' enrollment more than boys'. Further, the likelihood of working increases significantly in affected farm households in 2012. Column 2 of Table 33 indicates that the probability of being a domestic worker increases by 9.9% for girls in rural areas. Columns 3 and 7 of Table 33 indicate that the probability of being a market worker increases by 9.7% for girls in rural affected farm households and by 11.3% for boys in similar households. The effects are roughly the same for children in urban farm households.

In summary, the flood of 2010 has similar and even worse impacts on affected farm households than on farm households in the main evaluation. Wealth and enrollment has decreased, but child labor has increased. The outcomes on affected farm households are thus consistent with those on the farm households.

5.2 Impact of the flood of 2010 on the most affected farm households

Another variation may exist between the most affected farm households and the most affected non-farm households. A second classification of farm households is considered in this case. The treatment group is the farm households whose children are born in the most affected municipalities.

Table 34: Linear regression of outcomes and wealth for farm households living in the most affected municipalities from 2006 to 2012

	Girls in rural				Boys in rural			
VARIABLES	Enrollment	Domestic work	Market work	Wealth	Enrollment	Domestic work	Market work	Wealth
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	OLS	OLS	OLS	OLS	OLS	OLS	OLS	OLS
2012 dummy	0.098	0.319**	-0.142	-2.455	-0.093	0.199	-0.469***	-4.567
	(0.089)	(0.159)	(0.131)	(12.85)	(0.062)	(0.151)	(0.137)	(13.19)
Most affect. farm househ.	0.029	0.024	0.004	14.91***	-0.026	-0.067**	0.166***	12.07***
	(0.026)	(0.040)	(0.041)	(2.840)	(0.025)	(0.030)	(0.046)	(2.458)
Most affect. farm househ. in 2012	-0.076**	0.049	0.110*	-27.51***	-0.068*	0.099	0.005	-21.25***
	(0.038)	(0.068)	(0.062)	(5.007)	(0.037)	(0.066)	(0.061)	(4.771)
Constant	0.574***	0.440***	0.339***	-4.451	0.808***	0.196**	0.579***	-14.82
	(0.067)	(0.101)	(0.096)	(10.61)	(0.047)	(0.089)	(0.111)	(10.12)
Observations	5,272	1,955	1,955	5,279	5,900	1,801	1,801	5,899
R-squared	0.140	0.166	0.191	0.194	0.179	0.134	0.345	0.172

Standard errors in parentheses adjusted robust for clustering across households in the same primary sampling unit (PSU). The equations include dummies for the child's age, the household head's age and the household head's gender. *** Significant at 1%, ** Significant at 5%, *Significant at 10%.
Source: Author's own computation based on DHS 2006, 2012

The sample for this subgroup is limited to the most affected municipalities. This limitation also controls for migration effects. Equation 1 is run on the most affected municipalities. Table 34 presents the results of these estimations.

Primarily, wealth decreases significantly for the most affected rural farm households by 27,000 CFA francs as shown in column 4 of Table 34. With the decrease of wealth, the probability of enrollment diminishes significantly by 7.7% for girls and 6.8% for boys in rural farm households in columns 1 and 4 of Table 34. In terms of enrollment, the impact is still more noticeable for girls than boys. In column 3 of Table 34, the probability of being a market worker increases significantly by 11% for girls in rural areas. There is no significant impact on domestic or market work for boys. A possible explanation is that boys might work in paid jobs rather than unpaid jobs. Domestic and market labors are likely to be unpaid jobs, because the children work in the households or in the family business. Given the importance of the wealth loss, some parents may send their children to remunerated jobs that could yield more wealth. In general, the impact of the shock on the most affected farm households is consistent with the impact on farm households.

5.3 Impact of the flood of 2010 on non-affected and non-farm households

The third subgroup to observe is a placebo case. The samples for this estimation are non-farm households whose children are not born in any affected municipality. Once the sample is retained, the method used is the simple difference before and after the shock. The linear regressions of the wealth in Table 35 present no significant modification in household wealth in 2012.

Of main importance here is that the wealth has not significantly changed in either rural or in urban areas. After controlling for no significant change in non-affected, non-farm households in 2012, it is also important to check that the children's outcome is not influenced by other policies. Hence, the placebo experiment is conducted with Equations 1 and 2 to further check the robustness of the results.

Table 35: Linear regression of wealth for non-farm households living in non-affected municipalities from 2006 to 2012

	Wealth			
VARIABLES	Girls in rural areas	Girls in urban areas	Boys in rural areas	Boys in urban areas
	(1)	(2)	(3)	(4)
	OLS	OLS	OLS	OLS
Househ. head no formal educ.	-56.38***	-114.3***	-47.71***	-99.92***
	(15.84)	(14.34)	(12.69)	(14.24)
Househ. head no formal educ. in 2012	-14.55	6.300	-40.74**	-11.04
	(19.24)	(17.14)	(18.66)	(19.37)
Househ. head prim. educ.	-33.87**	-77.95***	-31.97**	-58.25***
	(15.66)	(15.72)	(12.69)	(14.05)
Househ. head prim. educ. in 2012	2.272	28.81	-19.78	13.97
	(19.42)	(18.74)	(18.89)	(18.31)
2012 dummy	21.78	23.95	32.29	0.659
	(20.68)	(19.09)	(19.67)	(27.61)
Constant	14.90	135.7***	-1.701	121.6***
	(13.41)	(17.87)	(15.42)	(18.72)
Observations	1,473	1,091	1,544	1,026
R-squared	0.250	0.372	0.289	0.358

Standard errors in parentheses adjusted robust for clustering across households in the same primary sampling unit (PSU). The equations include dummies for the child's age, the household head's age, the household head's gender, district dummies, number of children under five years old in the households and the relationship with the head. *** Significant at 1%, ** Significant at 5%, *Significant at 10%.
Source: Author's own computation based on DHS 2006, 2012

The outcomes in Table 36 were obtained after estimations of Equation 1 with an OLS model. Additionally, in all of the columns of Table 36, there is no significant effect in any of the children's outcomes in 2012. Enrollment and child labor have not significantly changed for non-affected and non-farm households after the flood of 2010. There is no evidence of any other shocks or policies on the household wealth during the same period. Thus, these results confirm that the impacts observed in the main evaluation on households are essentially the impacts of the flood.

Table 36: Linear regression of wealth for non-farm households living in non-affected municipalities from 2006 to 2012

	Girls in rural areas			Boys in rural areas		
VARIABLES	Enrollment	Domestic work	Market work	Enrollment	Domestic work	Market work
	(1)	(2)	(3)	(4)	(5)	(6)
	OLS	OLS	OLS	OLS	OLS	OLS
Househ. head no formal educ.	-0.223***	0.097	0.150	-0.237***	-0.183	0.256
	(0.064)	(0.142)	(0.111)	(0.056)	(0.199)	(0.227)
Househ. head no formal educ. in 2012	-0.102	-0.300	-0.390	0.069	0.239	-0.174
	(0.075)	(0.276)	(0.262)	(0.083)	(0.226)	(0.228)
Househ. head prim. educ.	-0.139*	0.310**	-0.036	-0.104*	-0.117	0.245
	(0.070)	(0.147)	(0.116)	(0.056)	(0.229)	(0.232)
Househ. head prim. educ. in 2012	-0.056	-0.344	-0.137	0.104	0.225	-0.094
	(0.083)	(0.289)	(0.261)	(0.082)	(0.251)	(0.246)
2012 dummy	0.054	0.255	0.094	-0.077	-0.072	-0.390
	(0.157)	(0.280)	(0.270)	(0.102)	(0.229)	(0.265)
Constant	0.686***	0.308**	0.295***	0.996***	0.218	0.408
	(0.107)	(0.150)	(0.108)	(0.069)	(0.197)	(0.257)
Observations	1,470	514	514	1,541	394	394
R-squared	0.158	0.233	0.168	0.192	0.174	0.373

Standard errors in parentheses adjusted robust for clustering across households in the same primary sampling unit (PSU). The equations include dummies for the child's age, the household head's age, the household head's gender, district dummies, number of children under five years old in the households and the relationship with the head.*** Significant at 1%, ** Significant at 5%, *Significant at 10%.
Source: Author's own computation based on DHS 2006, 2012

In conclusion, the sensitivity analyses comply with the main evaluation. The flood of 2010 significantly decreases the probability of enrollment and significantly increases the probability of work in farm households.

6. Conclusion

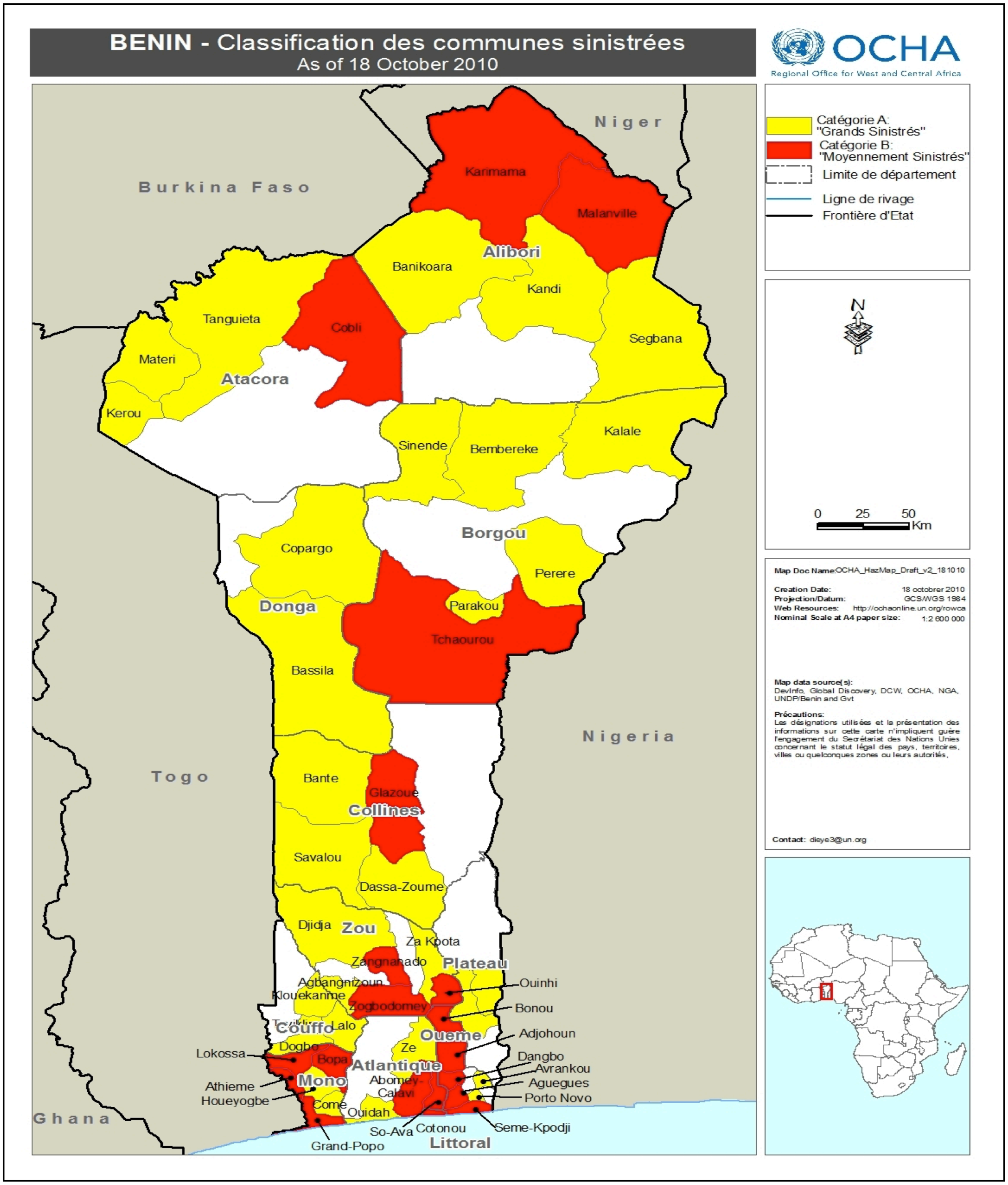
This study investigates the impact of a wealth shock on girls' schooling and labor. The wealth shock is the devastating flood in Benin in 2010. The impact evaluation points to a reduction in wealth for farm households compared to non-farm households. With this drop in wealth, the households choose to diversify their coping strategies. First, the flood of 2010 has a greater impact on girls' enrollment than on boys. The probability of enrollment decreases significantly by 7.8% for girls and 6.1% for boys in urban farm households. Second, the likelihood to work increases more for boys than for girls. The probability of being a market worker also increases significantly by 9% for girls and 10.6% for boys in rural farm households. Third, the probability to combine enrollment and work significantly increases. The sensitivity analyses on affected, most affected and non-affected municipalities confirm the results of the evaluation.

On the one hand, the outcomes of this study suggest that the gender gap in schooling could likely widen in the case of a wealth shock. Although there are no school fees to pay, the households may decide not to school their children, especially girls, to cope with the shock. Girls are more likely than boys, to be removed from school. This could be a valid thread to the realization of the Universal Primary Education goal.

On the other hand, this research implies, that the wealth effect prevails over the price effect, in Benin. Even if schooling is free of charge, parents' reactions to a wealth shock could be to remove their children from school. These findings reveal that a reduction or elimination of school fees may not serve as a safety net in the case of a wealth shock in Benin. There is the opportunity cost of the child's time at school instead of working for the family. In times of crisis, this opportunity cost rises, and the situation becomes more difficult for parents to maintain their children in school.

National and international efforts to reach the goal of UPE could be at risk in Benin, with wealth shocks. It could be difficult to acquire skills if schooling is interrupted each time there is a weather shock. In addition to the removal of school fees, the main recommendation is to provide subsidies to parents in order to maintain their children in school, especially in a case of crisis. It could also be an advantage to improve the school calendar by making it more flexible, especially for children in rural areas.

Appendix paper 3: Map of Benin



Source : OCHA/ http://reliefweb.int/map/benin/benin-classification-des-communes-sinistr%C3%A9es-18-october-2010

Synopsis (Part 2)

The aim of this dissertation is to analyze the determinants of the gender gap in schooling in Benin, West Africa. This country has launched several policies aimed at improving the level of education and decreasing the gender disparities. However, national statistics indicate inequalities between girls and boys in schooling, especially in attendance. This dissertation proposes three arguments to explain these gender inequalities: schooling costs, schools' infrastructures, and households' wealth. This synopsis presents the evidence to support the arguments, the policy recommendations and the limitations of the dissertation.

Policies that eliminate school fees may disregard residual schooling costs. These residual schooling costs are the indirect and opportunity costs, which could be higher than the direct school fees. It could explain that in spite of the removal of school fees, boys are often chosen for registration in schools to the detriment of girls. The first case study thus analyzes the impact of the removal of school fees for girls in rural areas on their schooling. It is the Free Primary Education policy of 2001. The estimations suggest that the removal of school fees improves enrollment for girls and not boys. This outcome advocates that girls' schooling is indeed price responsive, in concordance with the literature on the gender gap in schooling (see Glick and Sahn (2000), Glick (2008)). The results also conform to the empirical literature on the impact of user fees elimination (see Deininger (2003), Lincove (2009 and 2012), Lucas and Mbiti (2012)). Second, the estimations also show that the distance to school as a proxy for the residual schooling costs influences both enrollment and attendance. The results confirm the existence of residual schooling costs. They are a potential hindrance for girls' schooling in Benin.

The poor schooling conditions in some developing countries could also explain the low attendance of girls in primary school over boys. In a second case study, the evaluation of a demand-and-supply policy indicates a significant increase in enrollment greater for boys than girls. The demand-and-supply policy is an elimination of school fees and an upgrading of the schools' infrastructure at the primary level of education. This policy is the FPE of 2006. In contrast to the FPE of 2001, the FPE of 2006 has a greater impact on boys' enrollment than girls'. This means that programs focusing on the education of girls could be beneficial in the reduction of the gender gap in schooling. This result also complies with the previous empirical literature on the gender gap in education (see Glick (2008), Schady and Filmer (2006), and Lincove (2009, 2012)). Nevertheless, the gender inequalities do not seem to have reduced in enrollment with the

FPE of 2006; if there are no school fees to be paid—regardless of gender—boys are often chosen for schooling over girls. It indicates that other considerations, such as culture, could also influence household decisions to school a child in Benin. This result complies with Colclough et al. (2000). The second case assesses the impact of the FPE of 2006 on attendance of children schooled already in primary education. The estimations results show a significant increase in years of schooling, greater for girls than boys. The gender inequalities in the attendance of primary school could be diminishing. In the sample, children stay in school two more years on average. Girls, in particular, stay longer in school than boys. In contrast to the FPE of 2001 that had an impact solely on enrollment, the FPE of 2006 has an impact on enrollment and attendance. These results could have two explanations. On the one hand, the upgrading of the schools' infrastructure in the FPE of 2006 could be an explanation for the difference in the results and confirms previous literature on the effect of the schools' infrastructure on schooling (Michaelowa (2001), Lloyd et al. (2000), Chin (2005), Duflo (2004) and Banerjee et al. (2007), Frölich and Michaelowa (2011)). It confirms that schools' infrastructures were indeed a hindrance to girls' attendance in primary school in Benin. On the other hand, the FPE of 2006 removes school fees and reduces the distance to school. The overall schooling costs have reduced more with the FPE of 2006 than with the FPE of 2001. It could also explain the difference in the outcomes of both policies. Finally, a demand-and-supply policy could also have a beneficial impact on the reduction of the gender gap in education.

The third case study of this dissertation investigates the impact of household wealth on the gender inequalities in schooling. The FPE of 2001 and 2006 do not consider the major role of wealth in households' schooling decisions. Households' wealth will be determinant in girls' schooling decisions, as long as there are residual costs. This article thus argues that a wealth shock could be a valid threat to the efforts engaged in the reduction of the gender gap in schooling. The estimations outcomes show a significant decrease in enrollment for children affected by a wealth shock. The results are in concordance with the literature on impacts of income shocks (Beegle et al. (2006), Cogneau and Jedwab (2010), Grimm (2011), and Kazianga (2012), Günther and Harttgen (2009)). The effect of the shock is stronger on girls than on boys. This result implies that the gender gap in schooling may be worsening due to wealth shocks. This outcome complies with the results of Björkman-Nyqvist (2013).

The recommendations for policymakers include three points: schooling costs, infrastructures, and households' wealth. The overall costs should be removed—not only the school fees. The financial resources conceivably restrain governments in the promotion of education. Stakeholders and governments should invest in promoting children's primary education achievement. First, this dissertation proposes that the government reduces the indirect and opportunity costs of schooling instead of the direct ones. The indirect and opportunity costs could be higher than the direct ones, thus, may have more impact on schooling than the school fees. When public authorities cannot afford to remove all schooling costs, they can improve schools' infrastructures (a reduction of transportation fees); they can provide pedagogical materials or uniforms (a reduction of indirect costs); they can also offer alternatives to child labor (a reduction of the opportunity costs). A potential alternative to child labor could be to provide financial assistance to households in the case of a wealth shock so they will not use child labor as a coping strategy. The dissertation provides evidence that the removal of fees, the construction of schools and the recruitment of teachers are useful for the reduction of the gender gap in schooling; and this program should be sustained. Several reforms can help improve the schools infrastructures: the renovation and increase of schools, the implementation of feeding programs, the recruitment of female teachers, and the introduction of school buses. Second, this dissertation suggests additional gender-targeted policies to encourage girls' schooling, in the case of a generalization of FPE for every child. It is crucial that these gender-related policies be not only based on the school costs but also on other incentives for girls' schooling. A plausible gender-targeted policy could be a scholarship for children in poor households, but with a greater number of scholarships available for girls than boys. Another possibility could be a cash transfer, for the schooling of two girls and one boy in the same household.

This dissertation was limited mostly by the data available. Up to the time of writing, there are no existing surveys for the FPE. The alternative was to use the DHS. They are the best option because the surveys are nationally representative of the population. However, the surveys have a time gap of five years, which provides an additional challenge for the impact evaluations. Furthermore, the DHS surveys are more focused on health issues. Hence, the information on schools, classrooms, study conditions and scores is lacking. One recommendation of the dissertation is the investment in surveys on education, in particular on educational policies. It is also important that the information gathered at the administrative level be centralized and fully available to the public. Some information on education is available in the "*Programme d'Analyse des Systemes Educatifs et de la CONFENEM (PASEC)"* survey of Benin in 2005. However, there is no post-treatment survey yet to allow an evaluation of the impact on children's performance in primary school. It will be a topic for future research. Another interesting topic is the impact of the reform on fertility and early marriage. Indeed, the programs improved schooling, especially for girls. The change in education could affect fertility choices.

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