THE EFFECT OF SUPPLY-SIDE FACTORS ON THE SUCCESS OF CONDITIONAL CASH TRANSFER PROGRAMS: EVIDENCE FROM NICARAGUA

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ABSTRACT

In this study, I ask how variation in supply-side factors affects the impact of conditional cash transfer programs (CCTs). CCTs have become a popular policy tool in poverty alleviation, and it is well known that they generally increase household expenditure and investments in the human capital of poor children. I examine how that impact may vary with initial supply of relevant public services. First, I use available CCT documentation and literature to review how supply-side factors have been taken into account in the design stage of CCTs. Then, I use primary data collected for the Nicaraguan CCT, *Red de Protección* Social (RPS), to quantitatively assess whether supply-side factors at baseline modified the average treatment effect from that program. I find that CCTs generally contain some supply-side interventions that are not a part of their randomized design, and that therefore it is difficult to separate the effects due to supply-side factors from the impact of the cash transfer. Th evidence from Nicaragua shows that, at least under the conditions of extensive supply-side intervention, poor initial supply-side factors do not necessarily constrain the functioning of the program.

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CONTENTS

List of abbreviations

BF	Bolsa Familia
CCT	Conditional cash transfer
IDA	International Development Association
IFPRI	International Food Policy Research Institute
PRAF	Programa de Asignación Familiar II
PROGRESA	Programa de Educación, Salud y Alimentación
RPS	Red de Protección Social
WHO	World Health Organizations

1. INTRODUCTION

1.1 Conditional Cash Transfer Programs and Their Evaluations

Conditional cash transfer programs (CCTs) have become a very popular policy tool for social assistance, poverty alleviation, and human development around the world. Since their first appearance in Mexico and Brazil in the 1990s, CCTs of various forms and scopes have been adopted by a number of developing countries (Townsend 2009, Fiszbein and Schady 2009). The programs focus on increasing demand among the poor for education and health–related services, combining cash transfers to poor households with conditionalities that are aimed at promoting human development. The increasing popularity of CCTs created a corresponding growth in the literature on this topic, not the least because the implementation of several programs was accompanied by randomized design and extensive data collection that allow social scientists to better evaluate their effect on a variety of outcomes. Much like in program design, however, supply-side factors relevant to the performance of CCTs such as the quality of health or educational services are often neglected in the literature. In this thesis, I address this gap by discussing what supply-side factors may be relevant for the success of CCTs, describing the extent to which supply-side factors are taken into account in CCT program design, and examining how variation in supply-side factors affected education outcomes on the example of Nicaraguan *Red de protección social* (RPS).

Conditional cash transfers (CCTs) are "programs that transfer cash, generally to poor households, on the condition that those households make prespecified investments in the human capital of their children" (Fiszbein and Schady 2009, 1). In most programs, the conditionalities relate to enrollment in school and regular attendance (usually 80-85% of

classes) of children in a certain age category, and to regular visits to a health service provider for children as well as for pregnant and nursing women (Fiszbein and Schady 2009).

CCTs are interesting not only as a policy tool, but also as an exciting research opportunity for social scientists. A number of CCT programs were associated with serious attempts at data collection, with the intent of measuring and evaluating their effect. Policy makers and scientists behind these programs relied on some form of random assignment of individuals, households or entire communities into the program in order to generate reliable treatment and control samples for quasi-experimental program evaluation design. This approach has proved fruitful, and the literature on evaluation of effects of CCTs on various outcomes in human capital accumulation grew quickly. However, as I note in the literature review below (section 2), these evaluations have tended to ignore something potentially very important: variation in supply-side factors that could lead to very heterogeneous effects, namely variations in the availability and quality of public services that treatment groups are supposed to attend. When average treatment effects are calculated without taking into account the variation in the supply of services needed to comply with CCT program conditionalities, those estimates will hide heterogeneity in effects driven by these supply-side factors. In an attempt to contribute to closing this gap in the literature, in this work I ask:

How does variation in supply-side factors change the effect of program treatment on targeted outcomes in conditional cash transfer programs?

My strategy for answering this research question is two-pronged. First, I use the available information about existing CCT programs in low-income and middle-income countries to describe whether and how relevant supply-side constraints were taken into account in the

design stage. Second, I use primary data collected for the evaluation of the Nicaraguan CCT, *Red de protección social* (RPS), in order to examine directly whether variation in initial supply-side factors changes the average treatment effect.

The remainder of this work proceeds as follows: in the second part of this introductory chapter I define the scope of my work and situate CCTs in the relevant policy context. Chapter 2 is reserved for a review of literature on the effects of CCTs and potential sources of heterogeneity. In Chapter 3, I provide the empirical and theoretical background for understanding why CCTs focus on creating demand for human capital investments; then I describe the provision of supply-side factors (public services) in low-income countries and how this is relevant to the design of CCTs. Relying on available project documentation and secondary literature, in Chapter 4 I provide examples of how CCT program designers have taken into account (or tried to circumvent) problems with supply-side constraints: in Burkina Faso, Eritrea, and Mexico. In Chapter 5, I turn to my case study, the Nicaraguan *Red de protección social*. This chapter consists of a description of the program including supply-side constraints, followed by a quantitative analysis of its impact with respect to those supply-side factors. Chapter 6 is the conclusion to this study.

1.2 Scope of the Analysis: CCTs in Context

1.2.1 The 'Conditional' of CCTs

This thesis takes into account *conditional* cash transfers only. CCTs combine two key characteristics that set them apart from other similar interventions: (1) cash transfers to poor households and (2) conditionalities that promote the accumulation of human capital. *Unconditional* cash transfers share the same goal of reduction of poverty, and similarly to

CCTs, operate by increasing household demand. However, the mechanisms operating behind these two kinds of programs have implications for how their effects should be assessed. When cash transfers are unconditional, households have more flexibility in deciding how to spend the additional income. And, while a portion of that income may be spent towards the same outcomes that are the focus of CCTs, such as more schooling and health care, the lack of an explicit incentive to do so suggests that other demands may take precedence.

Conditionality is thought to be the key feature that targets low investments in human capital (Garcia and Moore 2012). Conditionalities attached to cash transfers are supposed to overcome household constraints in demand for education and health services. Poor households underinvest (relative to household income) in the human capital of children for a number of reasons well known to development economists, including lack of information and myopia in decision-making, uncertainty and the resulting lack of incentives, partial altruism towards children, etc. (Garcia and Moore 2012, Regalia and Castro 2007). I elaborate more on household decisions about investment in human capital below (see Chapter 3).Thus, the link between additional income and human development outcomes in the targeted population is expected to be more direct and stronger when a portion of that additional income *must* be invested in human capital in form of additional education and health benefits. This is intuitive, but empirical evidence of the effect of conditionalities has so far been inconclusive (Schüring 2010). Nevertheless, in a study of the effects of conditionality in the Zambian CCT, Schüring (2010) found that an overwhelming number of beneficiaries thought of conditionalities as "empowering"; they appreciated guidance and information in investing additional household income. This seems to suggest that conditionalities at least have the potential to affect household decisions, as they offset at least one of the causes of underinvestment in human capital – imperfect information.

Behrman and Skoufias (2010) note that the use of the term "CCT" to refer specifically to cash transfers to households conditional on making investments in human capital (education, health and nutrition) is a convention. In principle, a cash transfer (including to providers of services on the supply side) conditional on *any* behavior could be called a "conditional cash transfer." However, Behrman and Skoufias argue, "such a broad use of the term CCT to refer to any subsidy would seem to weaken the usefulness of the term, and in fact the term has been used in the academic and policy literature […] to refer to demand-side conditionalities of fairly specific natures" (Behrman and Skoufias 2010, 127). In this thesis, I follow the same convention and use the term "CCT" to refer to precisely such demand-side interventions as defined by Fiszbein and Schady (2009, 1): "programs that transfer cash, generally to poor households, on the condition that those households make prespecified investments in the human capital of their children."

1.2.2 Why CCTs?

CCTs are intended to address first and foremost short-term and long-term poverty. They are meant to address short-term poverty through the targeting of poor households, i.e. transferring cash to those presently most in need, but they have also been shown to function as safety nets, protecting households from adverse income shocks and smoothing out consumption (Maluccio 2005, Morley and Coady 2003). It is their focus on children and the accumulation of human capital that reflects their intended role in long-term development. Investments in the human capital of the poor are seen as a way of alleviating long-term poverty (Maluccio and Flores 2004, Maluccio 2005, Akresh, de Walque and Kazianga 2011, Adato and Hoddinott 2010). This is also the reason why cash transfers are often given to women (typically the mother) in eligible households, as it is known that mothers tend to

invest more in their children's human capital than fathers (Behrman and Skoufias 2010, Regalia and Castro 2007).

In practice, CCTs have been used to address other, more specific, aspects of absolute poverty. A number of CCTs (as well as unconditional cash transfers) in Sub-Saharan Africa were designed specifically to address both day-to-day hunger and chronic food insecurity. In the Sub-Saharan context, these programs have also proved adequate in addressing long-term concerns endemic to the region, such as HIV prevalence and the growing population of orphans and vulnerable children (OVC) (Garcia and Moore 2012). This is why developing countries around the world have been quick at adopting various CCTs (Fiszbein and Schady 2009, Garcia and Moore 2012). The combination of effectiveness and rigorous evaluation made the Mexican PROGRESA (later *Oportunidades*) the model CCT, emulated widely since its inception in the late 1990s (Adato and Hoddinott 2010, Grosh, et al. 2008). Since then, a number of countries have adopted similar programs targeting poverty. By 2008, close to 30 countries – most of them in Latin America – had adopted CCTs varying in scope and size of the target population (Fiszbein and Schady 2009). Following the Latin American CCT wave, by 2012 CCTs have expanded to a number of countries in Africa, Asia and Europe (Garcia and Moore 2012).

2. LITERATURE REVIEW

In this chapter I review the most relevant parts of the growing literature field related to CCTs and their evaluations, with a focus on the Mexican and Nicaraguan programs as the two best studied ones. In sections 2.1 and 2.2 I establish that these CCTs have been successful at achieving their objectives in terms of improvements in human capital investments. Then, in section 2.3 I present evidence from these evaluations that the impact of CCTs is not identical for everybody, but that some personal and household characteristics are important sources of heterogeneity. Finally, in section 2.4 I present the few studies that have explicitly taken into account the role of supply-side factors and argue that they need to be given more attention.

2.1 The Effects of CCTs on Human Capital Accumulation

The positive impact of CCTs on a variety of outcomes is well documented (for an extensive overview of evaluations of CCT programs see Fiszbein and Schady, 2009). This started with a series of evaluations by scientists at the International Food Policy Research Institute (IFPRI) of the Mexican CCT program, PROGRESA, later renamed *Oportunidades* (henceforth: *Oportunidades*). Started in 1997, it was not the first program that conditioned the receipt of a cash transfer on human capital investments. However, due to a combination of its effectiveness and an early, rigorous impact evaluation, *Oportunidades* had a very strong "demonstration effect" (Adato and Hoddinott 2010, 3). Scientists have evaluated the impact of this program on short-term and long-term educational outcomes, nutrition, health, household expenditure and other outcomes (Fiszbein and Schady 2009). Schultz (2000) examined the differences in school enrollment between *Oportunidades* treatment and control communities, and found that *Oportunidades* increased enrollment after grades 1-5 on average by between 3.1 and 9.4 percentage points, depending on the grade. Behrman, Parker and

Todd (2005) found a positive impact of longer exposure to the program on the highest level of education attained. On the side of health, Gertler (2004), Rivera et al. (2004) and Behrman and Hoddinott (2000) all found a positive effect of the program on children's height. Gertler (2000) found a positive effect of program treatment on a range of health measures both for children and for adults. And, in a demonstration that benefits from the program are neither limited to narrowly defined targeted outcomes nor bound to be short-term, Gertler, Martines and Rubio-Codina (2006) found that families that received cash transfers invested a part of that additional income in productive assets, increasing their income from agriculture.

Gertler's (2000) study of the impact of *Oportunidades* on health offers an important lesson on evaluating the benefits of CCTs that should be taken into account. The author found a positive effect of the program on the target substantive outcomes in health (such as children's height progression or incidence of illness). However, he found no effect on an important program output: surprisingly, people in treatment communities were not utilizing health services more than people in control communities. Perhaps an apparent paradox at first sight, this discrepancy is in fact easily explained by the opposing forces created by *Oportunidades* treatment. On the one hand, the number of visits to a health provider is expected to increase with treatment because of the "price effect" (visits to a health provider were among the conditionalities with which eligible households had to comply in order to receive the transfer) and the "income effect" (*Oportunidades* transfers could be used to purchase health services). On the other hand, people may visit health clinics less frequently precisely because of *Oportunidades*, or the conditionality may not be high enough relative to the baseline number of visits to produce a statistically significant difference. As the author explains:

> First, if PROGRESA's preventive interventions succeeded, then there should have been less illness, and therefore a lower demand for curative medical care. Another reason why we might not see an increase is that the number of public

> clinic visits by PROGRESA beneficiaries may have already outnumbered those required to obtain PROGRESA benefits (Gertler 2000, 8).

Gertler's study illustrates why it is important to make a distinction between program *outcomes* and program *outputs* (sometimes called *intermediate outcomes*). "Outputs are the amount of cash, goods or social services a program delivers during the reporting period," whereas "outcomes are events, conditions or behaviors that indicate progress toward achievement of a program's mission and objectives" (Grosh, et al. 2008, 186). In this case, the frequency of health clinic visits is closer to being a program output, whereas outcomes should include measures of participants' health. The difference is clearly an important one, as taking into account only program outputs would mean failing to recognize the true impact *Oportunidades* has had. This distinction should likewise be taken into account when studying the effect of supply-side factors in CCTs, as they may interact with program outputs and program outcomes in different ways. One important distinction is that the satisfaction of objectives in terms of outputs is easier with respect to supply-side factors. If program participants are required to make bimonthly preventive visits to a health provider, all that is necessary on the supply side is that enough health providers are available and accessible. On the other hand, if success of the program is measured by some more substantive outcomes, such as the number of work days lost to illness, the requirements on the supply side are more extensive – and this may not be easily measurable. For example, the success of the program in terms of this outcome may depend not only on the availability and accessibility of health providers, but also on their knowledge and training. Thus, it is possible that program participants comply with all conditionalities, but that the desired outcomes are not attained due to poor quality of health services.

2.2 The Effects of the Nicaraguan *Red de Protección Social*

The literature generated by *Oportunidades* alone to date is impressive, but the field has grown even more as other countries adopted similar programs coupled with data collection intended for rigorous evaluation. This is especially the case with B*ono de Desarollo Humano* in Ecuador, *Programa de Asignación Familiar* in Honduras, and the Nicaraguan *Red de Protección Social* and *Atención a Crisis* (Fiszbein and Schady 2009). *Red de Protección Social* was modeled after *Oportunidades* (Maluccio and Flores 2004), with IFPRI once again tasked with external evaluation.

IFPRI's evaluation of the pilot phase (Phase I, 2000-2002) provided an estimate of the average intent-to-treat effect of the Nicaraguan RPS on targeted outcomes. Maluccio and Flores (2005) showed that the program had a positive effect on current household expenditure, school enrollment, class attendance and grade progression for children, as well as on a number of health-related outputs and outcomes. RPS was associated with a dramatic increase in school enrollment of children between the ages of 7 and 13: the increase was 18.5 percentage points in the first year of the program and 12.8 percentage points over the first two years (as compared to the baseline enrollment rate for the target population). The program led to an overall improvement in grade progression of 7.3 percentage points (though the difference was statistically significant only for those progressing from 1st into 2nd and from 4th into 5th grade). These improvements in education outcomes went hand in hand with a decrease in child labor. Overall, there was a decrease of 5.6 percentage points in the number of working children in the targeted age group (age 7-13).

RPS led to an increase in utilization of health services: the number of children under the age of 3 who were taken to a health control for a preventative check-up rose by 16.3 percentage

points in the first year of the program. The increase over the two years of the pilot was 8.4%, but this estimate was not statistically significant because there was a substantive simultaneous improvement in the control group. The number of children with an up-to-date vaccination record increased substantively in the intervention group, by 32.6% over the two years, but this was almost entirely offset in the double-difference estimator by a simultaneous increase of 28% in the control group; thus the estimated effect of 4.6% was statistically insignificant. In terms of health outcomes, there was a decrease of 5.5 percentage points in the number of children who were stunted, and a 6.2% decrease in the number of children who were underweight (chronically malnourished), with no evidence of an effect on the number of children who were wasted (currently malnourished). And while the program led to an increase of 38% in the number of mothers receiving iron supplements for their children, this did not translate into a reduction in the prevalence of anemia in children under the age of 5 (Maluccio and Flores 2005). The program, then, led to an improvement in the most targeted indicators, and where the double-difference estimates were not significant at the conventional α=0.05 level, this was usually not due to lack of improvement in the treatment group, but due to simultaneous increases in the control group. Maluccio and Flores (2005) provide possible explanations for these improvements in the control group. These findings demonstrated the value of RPS in overcoming nutritional, health and educational deficits among the Nicaraguan poor, and contributed to the program being continued (Maluccio and Flores 2004, 63). A preliminary evaluation of Phase II of the program showed that gains in targeted outputs and outcomes were generally maintained (International Food Policy Research Institute 2005a).

In addition to the effect on targeted outputs and outcomes in education and health, the collected data have shown that RPS had other benefits, which are interesting because they do

not necessitate any input on the supply side. Among the most significant findings are those related to household expenditure and long-term effects of the program. Household expenditure increased in treatment areas in the first year of the program, but a large portion of that increase was reversed in the second year due to the economic downturn associated with a decrease of world coffee prices, on which Nicaraguan rural households are heavily dependent. However, even though household expenditure remained essentially flat over the course of two years of the program in the treatment group, the information about comparison group allowed the correct conclusion that RPS in fact *prevented* a steep decrease in household expenditure in treatment areas and shielded those households from the economic downturn. Maluccio (2005) argues that even though it was not intended for this purpose, RPS effectively served as a safety net during the coffee price crisis in 2001 and 2002, which severely affected the Nicaraguan economy. Maluccio (2007) also showed that RPS had a small positive effect on household investments in productive goods, which have a limited potential to make short-term increases in household income and expenditure more sustainable in the long-term. What these findings show is that supply-side factors are not always necessary for the success of CCTs; their relevance depends on what outputs and outcomes are used to measure that success. Thus, while the supply of public services is clearly crucial for health- and education-related outputs and outcomes, it is not necessary to increase household expenditure. This distinction helps define the scope of applicability of my study. It would make no sense to look for heterogeneity of effects from supply-side factors with respect to outcomes that do not depend on them.

2.3 Sources of Heterogeneity in Program Impact

Just as it is well known that CCT programs are associated with improvements in health and education outcomes, it is well known that improvements are not the same for everyone. Both

individual- and household-level characteristics are associated with heterogeneity in effects of the program. In education, benefits of program treatment are often more significant for girls. The average gain of 0.37 years of schooling as a result of *Oportunidades* treatment hides a wide gap in gains across genders: while boys are expected to gain only 0.26 years more of education by the age of 16, girls are expected to gain 0.5 years – and this translates into different gains in expected earnings later in life (Schultz 2000). There were no gender-heterogeneous effects on school enrollment in Nicaragua, but the gains in current attendance of about 20 percentage points were unevenly distributed between girls and boys, with boys improving more in regular school attendance than girls – 23 and 17 percentage points, respectively (Maluccio and Flores 2005).

Of household-level characteristics, household income is a known source of heterogeneity in the success of CCTs. Due to good targeting, the benefits of *Oportunidades* have been shown to accrue disproportionally to the poorest of the poor. In a simulation-based evaluation, *Oportunidades* outperformed an untargeted program in reducing both the poverty gap and the severity of poverty, indicators that over-represent the poorest parts of the population. Thus, "the largest reductions in poverty of PROGRESA are being achieved in the poorest of the poor population." (Skoufias 2001, 44). In the Nicaraguan RPS, the increase in school enrollment was the highest for the extremely poor, followed by the poor, such that "the relationship between enrollment and per capita expenditures largely has been erased" (Maluccio and Flores 2005, 38). Changes in regular school attendance followed the same pattern, while the extremely poor trailed somewhat behind the poor in improvements in grade advancement. RPS also led to a more substantive increase in the number of children taken to a health clinic for a preventative check-up among the extreme poor than among the poor or non-poor. The incidence of stunting was highest among children in the households belonging

to the poorest two deciles in Nicaragua before the program (Maluccio and Flores 2005, 51), and improvements in nutrition accrued disproportionally to the poor.

Thus, both individual-level and household-level characteristics determine to what extent targeted groups benefit from the program. In this work, I will add to this by exploring whether some measures of the quality of supply-side factors in education are also a source of heterogeneous effects. Although authors of CCT evaluations have often explored the methodological challenges of estimating the effects of these programs, they have largely focused on factors on the demand side. Fes studies discuss the potential heterogeneity of effects coming from supply-side factors relevant to the programs being implemented. I present them below.

2.4 Supply-side Factors in CCT Impact Evaluations

Supply-side factors have not been the focus in CCT program design, so it is not surprising that they are overlooked in the impact evaluation literature (more on how sources of heterogeneity are treated methodologically in section 5.4). Much of the evaluation literature has focused on the demand – or users' – side (Maluccio, Murphy and Regalia 2006). The design of *Programa de Asignación Familiar II* (PRAF II) in Honduras was the one that most explicitly took into account the variation in supply-side services, which would allow for a separate evaluation of the effects of supply- and demand-side interventions on program outputs and outcomes. The program design called for four groups: in one households would receive the demand-side intervention (the conditional cash transfer), in another there would be a supply-side intervention of improvement of services, the third group would receive both treatments, and the fourth would serve as the control. However, the supply-side intervention was never implemented because there was no legal framework in place that would allow the

transferring of funding from the central government to local authorities. Consequently, this improved design did not translate into an improved evaluation (Morris, et al. 2004). Other programs have recognized the importance of supply-side factors, and the various ways in which this was dealt with, including in Nicaragua, are described below (Chapters 4 and 5).

Although this is rare, some authors have in fact looked at the effects of supply-side factors on CCT program success to the extent allowed by the data. Coady and Parker (2002) have taken into account the effect of some supply-side factors on program outputs in their cost-effectiveness comparison of supply- and demand- interventions in the Mexican Progresa. They found that distance to the nearest secondary school had a substantively and statistically significant impact on the probability of enrollment. Likewise, the type of school was shown to matter to some extent – the probability of enrollment was greater if the closest secondary school was a technical or general school rather than a *telesecondaria.*[1] The results of taking into account other measures of supply-side factors, the student-to-teacher ratio and a proxy for teachers' human capital, are not as conclusive (Coady and Parker 2002, 18-19). Behrman, Parker and Todd (2005, 13) likewise examined the variation in program impact as a function of type of school and pre-program student-to-teacher ratio, and concluded that "*Oportunidades* impacts do differ with the quality of schooling available, at least as captured by the two quality indicators considered here".

Additional examples of explicitly taking into account supply-side factors in the evaluation of CCT factors come from Argentina and Brazil. van Stolk and Patil (2015) examined how the quality of implementation of the Brazilian *Bolsa Familia* (BF) varies with some measures of municipal capacity. They found that municipalities with better education and health services,

[1] This type of school shows recorded lectures to students, and has an assistant instead of an instructor to aid students with exercises after watching video lectures (Coady and Parker 2002).

as well as those where services were more coordinated and integrated, were more effective at implementing BF. Another rare example is Heinrich's (2005) examination of demand and supply-side determinants of the effectiveness of the Argentinian CCT program, *Programa Nacional de Becas Estudientales*. Using data collected for this program program, Heinrich shows that the scholarships (*becas*) improved student performance more in schools with "greater institutional capacity, better conditions for learning and superior management" (2005, ii).

In the case of the Nicaraguan RPS, Maluccio, Murphy and Regalia (2006) have examined the effect of some supply-side factors on outcomes in education. They examined the effect of school autonomy[2], availability of fifth grade (or more), student-teacher ratio, ratio of textbooks to students and time necessary to reach school on enrollment, grade attainment and grade progression in various subgroups of school-aged children. They found that the program was more effective in autonomous schools, arguing that autonomy granted schools more flexibility in adapting to increased demand. Overall, however, RPS was in fact more effective where the situation was initially worse. Their interpretation is that this is because in those areas there was "more room for improvement" (Maluccio, Murphy and Regalia 2006). Regalia and Castro (2007) have described qualitatively the role of health-related supply-side factors in the success of the program, but could not disentangle the effects of demand-side benefits from supply-side interventions.

Apart from these few examples, the supply-side factors, which include the provision of public services and other potential community-level determinants of the success of CCT programs, have largely been neglected in the CCT evaluation literature, and this is cause for concern. In

[2] An autonomous school is one that, following decentralization reforms in the early 1990s, enjoys pedagogical, administrative and financial autonomy from the central government (Maluccio, Murphy and Regalia 2006).

a discussion of the use of randomized controlled trials to evaluate development policies, Deaton (2010, 449) laments that "[i]ncentivizing parents to take their children to clinics will not improve child health if there are no clinics to serve them, a detail that can easily be overlooked in the enthusiasm for the credibility of the Mexican evaluation". Indeed, if the supply of schools and clinics is not taken into account, the estimates of treatment effect will be distorted, no matter how good randomization is on the demand side. In what way they will be distorted depends on how we conceptualize CCTs and their effects. I discuss this below in section 4.3.

The focus in design of CCTs on relaxing the demand-side constraints has led to a focus on the demand side in the literature at the expense of paying attention to the supply of necessary infrastructure and services and the ways in which the latter might affect program outputs and outcomes. While CCT impact evaluations typically do not include an analysis of the effects of supply-side factors, the few studies that are an exception suggest that they can have some effect on the success of the programs. In the next chapter I describe both demand- and supply-side constraints that affect household decisions about nutrition, health and schooling of children. Chapter 3 clarifies what supply and demand factors matter and how, as well as how they are relevant to the design and evaluation of CCT programs.

3. DEMAND- AND SUPPLY-SIDE CONSTRAINTS AND CCTS

Suboptimal investments in nutrition, health, and education among the poor in the developing world are a result of both demand- and supply-side constraints. As already noted, CCTs are designed explicitly to address low *demand* for human capital investments. In this chapter I outline what is known about demand for human capital investments and the supply of necessary public services in the developing world, and relate these to CCT design. In section 3.1 I describe the demand for human capital investments among the poor in the developing world and provide some theoretical insights that account for this. In section 3.2, I turn to the supply of public services and how they may be important in the implementation of CCTs.

3.1 Demand for Human Capital in the Developing World

It is well established that poor households do not spend enough on high quality nutrition, and that they underutilize public services in education and health relative to their income. In other words, for a given level of income, poor households do not demand as much of these as they could. Subramanian and Deaton (1996) estimated the elasticity of calorie consumption among the poor in rural Maharasthra in the range of 0.3-0.5, echoing previous findings in the literature that, while the elasticity of calorie consumption is above zero, it is nevertheless substantively below unity (Behrman and Deolalikar 1987, Bouis 1994, Bouis and Haddad 1992). In other words, increases in income of poor households are associated with disproportionally small increases in calories consumption. Additional income does not lead to better nutrition because (1) in poor households it is spent on non-food items, and (2) additional expenditure on food does not necessarily purchase more calories or better nutrition (Todaro and Smith 2012). The poor also generally have a low demand for schooling.

Expenditures related to education make up as little as 2% of poor households' expenditure (Banerjee and Duflo 2006).

A number of theoretical insights have been offered to explain these low investments in the human capital of children. Imperfect information is one of them. There is plenty of evidence that parental – and especially maternal – education has "information processing" effects; i.e. better educated parents are more aware of what is beneficial for their children and thus invest more in them, leading to better outcomes in nutrition, health and education (Strauss and Thomas 1995). A widely-used model of investment in children's education takes into account both direct and indirect costs of schooling, where direct costs include school fees, books, uniforms, travel, etc., while indirect costs refer to opportunity cost of children's education in terms of lost income from child labor. In such models, parents may underinvest in children's education either because expected future benefits (taking into account future discounting) do not outweigh the combination of direct and indirect costs, or simply because they cannot afford the investment due to credit market constraints (future income from additional education cannot be collateralized) (Todaro and Smith 2012). Even more sophisticated models take into account parental utility from children's earnings over lifetime. These include not only foregone income from labor in childhood, when parents are assumed to have full access to children's earnings, but also a combination of expected future earnings and parents' access to those earnings. Different expectations of access to children's future earnings (e.g. due to personality or gender) translate into different incentives to invest in children's education (Behrman 2010). The recognition of these distortions on the demand side is what makes conditionality the key feature of CCT programs. Attaching conditions to additional non-labor income both compensates households for the opportunity cost (foregone

income) from schooling children and for the lack of incentives to invest in their human capital more generally.

An additional important feature of expenditure on human capital inputs in poor households is that they are often unequally distributed among household members, such that women and children – and especially female children – are often allocated disproportionally little (Behrman 1992, Behrman 1997). Economists have explained this in numerous ways, including credit market constraints (Strauss and Thomas 1998), variation in economic returns (Rosenzweig and Schultz 1982), or intra-household imbalances in power over decisions in human capital investments (Folbre 1984). These same distortions are behind low demand for schooling among the poor. CCT design takes into account what we know about household demand for human capital inputs and addresses such distortions directly, for example by transferring cash to women when it is possible. This practice in Latin American CCTs stems from findings such as those by Thomas (1990) that additional income translates into better health outcomes in children when mothers – instead of fathers – have the power over the allocation of that income (Behrman 2010). Thus, the design of CCTs is demand-oriented. In the next section I describe the situation in the supply of public services and offer reasons to take them into account more explicitly in the design and evaluation of CCTs.

3.2 The Supply of Public Services in the Developing World

While CCTs focus on overcoming demand-side constraints in human capital investments at the expense of the supply-side, the supply of public services and the availability of basic infrastructure may nevertheless have an immensely important role in the success of CCT programs, as suggested also in section 2.4. The focus on demand and randomization of treatment in the design of CCTs has important implications for the evaluation of their impact:

"The evaluation only allows us to assess most rigorously the effect of the program (or program components) that it was explicitly designed to assess" (Maluccio and Flores 2005, 15), meaning that all estimates of effects are for the effect of the program as a whole, with no attention to individual components or the interaction between them (this has been termed the "black box" design). Thus, "it is difficult to assess the relative importance of the demand-side stimulus versus the supply-side interventions for the observed improvements in health care—all the observed effects reflect the combination of supply- and demand-side influences" (Maluccio and Flores 2005, 15). The "black box" design and implementation contain a variety of factors both internal and external to the program, including the supply of public services (van Stolk and Patil 2015).

As Hall warns (2008, 817), CCT programs "can themselves only function properly in terms of strengthening demand for and democratizing access to basic social services such as education and health if the actual supply of such services is adequate in the first place". And yet, the developing countries that most need the investments in human capital targeted by CCTs are often in a dire situation when it comes to the provision of public health and education and even of basic infrastructure. Banerjee and Duflo (2006) found that the availability of basic infrastructure like clean water, electricity and sanitation to the poor varies considerably among low income countries, with the situation usually more difficult in rural than in urban areas.

A cross-country survey by the World Health Organization (WHO) showed a great deal of variation in the functioning and performance of health systems at every level of national income (World Health Organization 2000). Less developed countries vary considerably in the balance between investments in physical infrastructure and recurrent costs such as health

personnel wages. Low income countries cannot afford large investments in the physical capital in health care, and what infrastructure there is tends to not be adequately maintained as most of the recurrent budget is used to pay wages (World Health Organization 2000). Low income countries often face severe shortages of skilled health professionals and other difficulties in the healthcare labor market. Of 83 countries that failed to meet the minimum threshold in health personnel availability for providing satisfactory health care coverage (estimated by the WHO to be 22.8 skilled health professionals per 10,000 population), 39 are low income countries and a further 30 are low middle income countries (World Health Organization 2014). These shortages are further compounded by "dual practice" among many health workers, wherein trained professionals employed in the public sector undersupply their services in the public facilities in order to supplement their earnings through private practice (World Health Organization 2014, 14). Consequently, health worker absenteeism is rather high. In a survey of six low income countries Chaudhury et al. (2006) found 35% of health workers missing from their post during an unannounced visit. In addition to skilled health providers' preference for working in the private sector, low income countries also face "brain drain" of health workers, often educated at taxpayers' expense, amounting to a significant loss from already low levels of human capital investment (World Health Organization 2000).

The situation in education can be just as bad. The developing world has experienced an explosion and a universalization of primary education in the previous decades. However, these improvements in quantity have not necessarily translated into improvements in the quality of education. Much like in the health sector, the people at the center of service provision to the poor – public school teachers – are not properly incentivized. Teacher absenteeism from the classroom is rampant across the developing world. Chaudhury et al. (2006) found 19% of teachers missing during random checks in six developing countries and

found that teachers were more likely to be absent in rural than in urban areas, but were not otherwise concentrated (i.e. data are not driven by few particularly bad places). Moreover, when teachers are present, they are not necessarily teaching. The PROBE survey in India found 33% of teachers missing during class, and in addition to that, 42% were engaged in non-teaching activities; only 25% of teachers were in fact teaching (The PROBE Team 1999). Although there is considerable variation, generally the relevant infrastructure is in poor shape, which further interacts negatively with teachers' motivation (Chaudhury, et al. 2006).

> Visitors from developed countries are often shocked at the conditions in many (but not all) schools in developing countries. Many schools lack the most basic equipment and school supplies – textbooks, blackboards, desks, benches, and sometimes even classrooms (in which case classes meet outside and are canceled when it rains (Glewwe and Kremer 2006).

Overall, the quality of educational services in many developing countries is far below satisfactory, resulting in much less learning than mandated by the curriculum (Lockheed and Verspoor 1991).

Although the CCT impact evaluation literature has mostly neglected the role of supply-side factors in program effectiveness, other research suggests that those factors can put a constraint on the extent to which the poor, who are usually the primary target of CCTs, can benefit from those programs. A World Bank report examining the utilization of public services by the poor describes a typical set of problems:

> teachers must be present and effective at their jobs, just as doctors and nurses must provide the care that patients need. But they are often mired in a system where the incentives for effective service delivery are weak, wages may not be paid, corruption is rife, and political patronage is a way of life. Highly trained doctors seldom wish to serve in remote rural areas. Since those who do serve there are rarely monitored, the penalties for not being at work are low. (World Bank 2004, 4)

This suggests that, even when the poor receive additional income that increases household demand, this may not lead to either more utilization of services or to improved final outcomes in education and health due to poor quality of services accessed. Rather, the availability, accessibility and quality of necessary services all play a role. Health and education facilities must be adequately staffed; teachers, doctors and nurses must show up to work and devote adequate attention to all. Facilities must be available within a certain distance, and their accessibility may depend on other factors: existence and quality of roads and/or public transport services and its cost. In addition to educated and trained staff, facilities must also be supplied with a certain infrastructure – schools and clinics need latrines, access to clean water and electricity, and they must not be structurally compromised. They also need to have the necessary materials: schools need blackboards, maps and books, while clinics need medication and medical equipment. There are clearly a number of obstacles between increased disposable income of a household and an improvement in education and health outcomes for its members.

This review of the provision of public services in the developing world has shown that, even though CCTs have focused on addressing demand-side constraints in human capital investments, there are good reasons to believe that supply-side factors equally constrain household decision making. In the following chapter, I qualify my claim that supply-side factors have been neglected by CCT authorities and relate their efforts to evaluation methodology.

4. SUPPLY-SIDE FACTORS IN CCT DESIGN

While the focus of CCT design is on increasing household demand, supply-side factors have not been completely ignored. In fact, possibly the most compelling reason for evaluating their effect on the performance of CCT programs comes from the creators of those programs themselves. Though supply-side factors are not a part of randomized evaluation strategy (except in the case of PRAF II, which was not implemented as designed), the authors of these programs have usually taken some steps to hold supply-side factors "constant" to some extent. The description of these strategies in this chapter represents the first substantive contribution of this work to answering my research question. I review the strategies for minimizing the variation in supply-side factors in section 4.1. Section 4.2 consists of three small case studies that synthesize the available information illustrating how CCT design addresses supply-side factors. I discuss the methodological implications of these strategies in section 4.3.

4.1 Five Strategies for Minimizing Variation in Supply-side Factors

Supply-side factors such as the provision of public services are a prerequisite in translating additional income from cash transfers into improvements in human development regardless of whether those cash grants are conditional or unconditional. Nevertheless, supply-side factors are more important in the design and evaluation of conditional cash transfer programs, as the need for adequate public goods and services is more obvious when program beneficiaries are explicitly instructed to increase demand for them.

> When a CT's major objective is to increase human capital investments, supply-side issues often need to be addressed. CTs, *and especially CCTs*, may expose limitations of the current services as increased demand is placed on

> those services. Such weaknesses may affect programs' long-term results. (Garcia and Moore 2012, 123) [Emphasis added].

As I showed in Chapter 3, local communities in which CCT programs are implemented do not always have adequate public services, infrastructure, or other supply-side factors to meet the increased household demand that comes with higher income. Program administrators have dealt with this obstacle in at least five different ways. Below is a short description of each approach, which generalizes findings from the review of the three cases presented below with additional reliance on the works of Garcia and Moore (2012) and Fiszbein and Schady (2009).

Some programs address supply-side deficiencies directly. Integrating the supply-side into the program itself would give program managers the power to modify the local infrastructure and public services according to the needs of the program. From the point of view of scientists working on program evaluations, this approach would also be ideal. It would give them the possibility to "hold constant" to some extent the relevant supply-side factors (for example, by ensuring the same student-to-teacher ratio in all schools in the program areas) or to manipulate supply-side interventions experimentally (in addition to household demand). However, this is also the least feasible approach, financially and politically. Even with focus on increasing household demand only, CCTs represent a significant re-distribution scheme and thus require broad political support, from local administration to top-level national political players. Adding to these expenditures the costs of addressing supply-side deficiencies can only make garnering that support more difficult. At the same time, addressing supply-side factors parallel to implementing the demand side of the program would complicate coordination; it would necessitate a prolonged and focused cooperation

effort between program administration and relevant state institutions at various levels. Garcia and Moore explain:

> [T]hese efforts often take significant time, resources, and patience to achieve. Ministries may need to expand their collaboration with other agencies both at the top and at the ground levels […] Buy-in of significant political players at multiple levels of government must be won, and this support has to be backed with appropriate resources […] Additional personnel may need to be hired and trained, and spheres of responsibility must be negotiated. Coordination efforts must be ongoing. (Garcia and Moore 2012, 125)

Other programs complement projects and programs already implemented. This reduces the monetary and coordination costs, as existing infrastructure is being used, but clearly this solution comes with potential complications. It may impose limitations on the program from the beginning. The supply-side factors developed for another program may not address particular needs of a CCT or may address them only partially. This would force CCT program administrators to either work with deficient or lacking supply-side factors, or alternatively change and mold the program in order to make it work with the existing supply-side factors. For example, the program may be limited geographically to areas where another program improved supply-side factors, which may not coincide with areas that most closely match objectives of the program.

Still other administrations cooperate with non-governmental organizations to supply the services needed to implement the program. While out-sourcing a part of the program in this way may have some benefits, it also requires additional coordination and monitoring effort. Programs that outsource parts of their operations to other agencies may also be subject to conflicts with NGOs over jurisdiction or other bureaucratic issues. Garcia and Moore recommend that NGOs be employed as "a stopgap measure rather than a long-term solution" (Garcia and Moore 2012).

The final two ways of dealing with inadequate supply-side factors are "cheating strategies." The first is to only enforce conditions in areas in which the supply of relevant services is sufficient. In effect, this turns the conditional cash transfer into an unconditional one for some beneficiaries. With this approach, the program administration must be careful about the message it is sending by not enforcing conditionalities. Garcia and Moore (2012) identify at least two potential problems that arise from this approach, depending on how precisely the program administration handles the situation. When the program administration finds it cannot enforce conditionalities as planned due to supply-side constraints, it has the option of switching instead to "soft conditionalities," i.e. encouraging beneficiaries of the program to use additional income as intended by the program, but not sanction them for failing to do so. In this case, the administration needs to communicate clearly with program beneficiaries in order to avoid inadvertently imposing unfair conditionalities on them. If the administration decides to enforce any conditionalities only when the relevant supply-side factors become available, it will probably face dissatisfaction among those who are first given the cash transfer without any conditions, but are forced to comply with specific demands later on.

The final strategy is to circumvent the problem instead of investing into resolving it. A number of programs have only been planned and implemented in areas that already have the infrastructure and other supply-side factors that meet the minimum requirements of the program. Again, this is far from perfect for the program administration, which may not be able to reach the population it wants to target with the program. On the other hand, data generated by such a setup can also disappoint scientists, as it would introduce a kind of location bias and interfere with evaluation of the effect of the program.

In the following section, I present three small cases illustrating these strategies. Together with this section, they complete the first part of the answer to my research question. The three examples were chosen for availability of information and because they cover a range of steps to minimize variation in supply-side factors that I identified above, but I make no claim that they are in any way representative.

4.2 Case Studies

4.2.1 Burkina Faso – Pilot Conditional Cash Transfer Program

In Burkina Faso, the National Committee against AIDS and the World Bank implemented the Pilot Conditional Cash Transfer Program between 2008 and 2011. The pilot was intended to assess whether a low-income African nation can implement a project characteristic of a middle-income Latin American country, given the difference in infrastructure and public services. The Government of Burkina Faso committed to taking into account the lessons learned from this pilot when designing the national social protection policy (World Bank n.d.).

The CCT was implemented in the Nahouri province in southern Burkina Faso, and it contained an experimental research design intended to assess the difference in effects on health and educational outcomes between conditional and unconditional cash transfer, and between giving the transfer to the mother or to the father in the household. 75 villages in the Nahouri province were randomly assigned to either the control group (no cash transfer) or one of the four treatment groups: (1) conditional transfer given to the mother, (2) conditional transfer given to the father, (3) unconditional transfer given to the mother, or (4) unconditional transfer given to the father (Akresh, de Walque and Kazianga, Cash Transfers

to Mothers or Fathers: Educational and Health Impacts of a Randomized Experiment in Burkina Faso 2011).

The conditionalities attached to the cash transfer in those villages assigned to the two CCT groups related to children's health and education. The requirement for children under the age of six was a quarterly visit to a health clinic for growth monitoring, whereas children between the ages of seven and fifteen had to be enrolled in school and attending at least 90% of classes each quarter (Akresh, de Walque and Kazianga 2012). Clearly, an adequate supply of health and education services was needed to implement the program. The program administration ensured this by selecting only those villages in the province that had a school within a 5 km radius. The program authors "reasoned that it did not make sense to conduct a study about a demand-side education intervention where the supply of education is inexistent" (World Bank n.d., 9). Furthermore, the authors were forced to choose a province in which to implement the program such that it had an active World Bank HIV/AIDS program, suggesting that the CCT had to "synergize" with existing programs (World Bank n.d.), possibly for existing infrastructure or administrative support. The health sector in Burkina Faso is "relatively underdeveloped," and health institutions tend to be understaffed. The location selected for the program was something of an outlier. While the average distance from a treatment village to a health clinic was 2.83km, the national average was 7.5km (Akresh, de Walque and Kazianga 2012, 9). Arguably, then, the program was implemented in an environment with relatively good public services. It is not clear whether the province of Nahouri was selected for this reason in the first place. In order to ensure as good of a provision of services on the supply side as possible, the program administration met with local education and health authorities to ensure their collaboration in the program

implementation and monitoring. However, no additional funds were invested in the supply-side factors (Akresh, de Walque and Kazianga 2012).

4.2.2 Eritrea - CCT for Maternal and Child Health and Nutrition

Between June 2009 and June 2012, Eritrea implemented the Results-Based-Financing Pilot CCT for Maternal and Child Health Nutrition. Prior to the program, the Eritrean health sector was rather underdeveloped, with an inadequate infrastructure and insufficient number of personnel (World Health Organization 2006). Eritrea ranked at the bottom of the list even among Sub-Saharan African nations in terms of available doctors and midwives (Ayala 2009). Although Eritrea had made important improvements in health outcomes since the 1990s (World Health Organization 2009), in some areas – especially maternal and infant health – the utilization of public health services was very low and the corresponding health outcomes were accordingly poor. Thus, for example, prior to the program, only 28% of births were attended by a health worker in Eritrea, among the lowest rates in Africa (World Health Organization 2009, 17). The maternal mortality ratio (MMR) was 450 per 100,000 live births – about one half of the African average and on par with some middle income countries – but numbers like these masked wide disparities between rural areas and the capital within Eritrea (Ayala 2009, 7). The objectives of the Pilot CCT were to improve both the utilization of health services and the substantive outcomes in maternal and child health.

The Eritrean CCT was among those that explicitly addressed the supply-side factors relevant in the implementation of what would otherwise be a demand-oriented project. The program combined three of the approaches described above: location targeting, complementing an existing program, and improving the supply-side factors through the program itself. The

program was rolled out gradually over the period of three years in order to ensure that the supply-side factors are in place, among other reasons (Garcia and Moore 2012).

First, all sub-zobas (sub-regions) with health facilities were eligible to participate in the pilot as long as the pre-pilot assessment showed that those facilities met minimum standards in terms of health supply-side factors. According to the program operations manual, the facilities had to have: adequate lighting, sanitation and access to clean water, a covered vehicle, and personnel that satisfies a minimum standard of birth-related training (Ayala 2009, 16). Thus, sub-regions with the lowest supply-side capacities were excluded from the program from the very beginning, partially circumventing this problem.

Second, the Eritrean CCT was designed to capitalize on and complement the supply-side investments that were made as a part of another program, the International Development Association (IDA) funded HIV/AIDS/STI, tuberculosis, malaria and reproductive health project (HAMSET II) (Ayala 2009). Among HAMSET II objectives were improving the intervention coverage in reproductive health and strengthening the overall capacity of Eritrea's health care system. The indicators for improvements in reproductive health included not only targets in the utilization of services, but also an improvement on the supply side of reproductive healthcare: the program was to "ensure all public hospitals and health centers offer basic emergency obstetric care" (World Bank 2010, 4). This goal was indeed attained by the project deadline, although the project was unsuccessful in improving other targeted indicators in the area of reproductive health, including antenatal care, assisted birth and contraceptive prevalence rate (World Bank 2010, 22). The latter objective was evaluated entirely in terms of supply-side factors with a focus on human resources. The relevant deliverables were to "train at least 200 nurse midwives, 200 public health technicians and 200

laboratory technicians" and to "increase the percentage of health stations with at least 1 nurse from 28% to 50% by" by the project deadline (World Bank 2010, 4). The program succeeded in training the targeted number of nurse midwives and laboratory technicians, but not in the number of public health technicians (only 133 were trained). Likewise, the proportion of health stations staffed with at least one nurse was 35% at project completion (World Bank 2010, 22). The Eritrean Pilot CCT was designed to make up for HAMSET II's shortfall in the utilization of reproduction health services, while taking advantage of the expanded supply-side resources (Ayala 2009, 8).

Finally, supply-side factors were targeted through the program itself. The Eritrean CCT program design included both demand-side and supply-side interventions. The demand side included three sub-components: (1) monetary incentives for pregnant women and mothers children aged 0-2 years to use public health services – pregnancy monitoring, labor assisted by a health professional, and child growth monitoring, (2) redeemable transport vouchers to be given to drivers who take women in labor to a health clinic, and (3) a lottery-type game in which women who used public health services during pregnancy and labor are eligible to win valuable prizes. The supply side included two sub-components: (1) performance-based monetary incentives for zoba-level health authorities for meeting agreed-upon aggregate targets in maternal and child health in each eligible zoba, and (2) performance-based monetary incentive for the national Ministry of Health for meeting agreed-upon national-level aggregate targets in maternal and child health (Ayala 2009).

4.2.3 Mexico – Progresa/Oportunidades

The government of Mexico introduced PROGRESA (Programa de Educación, Salud y Alimentación – the Education, Health, and Nutrition Program, later *Oportunidades*) in 1997 with the goal of breaking the cycle of poverty. *Oportunidades* is hailed as an iconic case of CCT due to its thoughtful evolution, success in attaining set goals, and thorough data collection and evaluation (Fiszbein and Schady 2009, 6). The program had two components. The education component was designed to improve school enrollment and regular attendance, as well as actual performance. The health and nutrition component was designed to increase the utilization of preventative health care services and improve health-related outcomes among the Mexico's poorest, with the special focus on maternal and child health. (Skoufias 2001). Transfers related to these various components were conditioned on: (1) school enrollment of all school-aged children and attendance of 93% of classes during the school year (a minimum of 80% in any given month), (2) grade progression and middle/high school completion, (3) the number of preventive visits to a health clinic by all household members (variable by age), and (4) attendance of at least one family member at educational seminars about health and nutrition (Fiszbein and Schady 2009).

Supply-side factors were taken into account in the design of Progresa, and improvements in the supply of both educational and health services were listed among the program's target outputs. Program administration foresaw a possible deterioration in the quality of educational services as demand for schooling increases in treatment groups, and thus expanded resources to rehabilitate and repair existing schools and construct new ones. State-level ministries of education were responsible for supplying additional classrooms and teachers, while other necessary supplies were to be procured through other means (Coady and Parker 2002, Fiszbein and Schady 2009, Adato, Coady and Ruel 2010). In the area of health, the program

explicitly aimed to ensure that health care units have an adequate supply of equipment, materials and medicines, as well as to improve health care services by encouraging long-term employment of medical staff in remote areas and providing additional training (Skoufias 2001).

The adequacy of supply-side factors has been assessed in an operations evaluation of *Oportunidades* based on surveys and interviews with key stakeholders – beneficiaries, promotoras, and school and health center representatives. The study showed that the improvements of the supply side were such that, at the very least, increased demand for educational and health services did not lead to deterioration in the quality of those services. Beyond this, results of the evaluation were mixed. The study confirmed that *Oportunidades* had a significant impact on enrollment rates and showed that in some schools this put pressure on existing resources and led to concerns about quality of education provided (Adato, Coady and Ruel 2010). Interviews with school staff showed that most schools saw some improvements in infrastructure and new supplies, but this did not represent a radical change, as the initial situation was poor. Furthermore, significant time and resources were necessary to apply for new supplies with the relevant authorities, and thus the supply-side adjustment lagged behind increased demand for educational services (Adato, Coady and Ruel 2010, 65). With respect to supply-side factors in the health sector, the study showed some improvements associated with *Oportunidades*. However, it also revealed a number of problems with availability and cost of health care services, as well as with the quality of service and staff attitudes and professionalism (Adato, Coady and Ruel 2010, 112). Thus, even in the case of *Oportunidades*, where supply-side factors were explicitly taken into account in the design stage, there was likely significant variation in the supply of relevant educational and health services for beneficiaries in different communities.

4.3 Methodological Implications

Clearly, all the strategies of circumventing supply-side constraints described in section 4.1 and illustrated in these cases have implications for the evaluation of true impact of CCTs. This represents one part of the answer to my research question: how supply-side factors change the effect of the program depends in part on what strategy of addressing the supply side policy-makers follow. Furthermore, in the end it also depends on how we conceptualize CCTs and how we think about their effects. Following the definition of CCTs by Fiszbein and Schady as being interventions on the side of demand, strictly speaking, the impact of a CCT should be the impact of the demand-side intervention – of giving poor households cash. Yet, as I have just showed, CCT design tends to include a host of supply-side interventions. These are, however, not a part of randomized design (with the exception of PRAF II), and thus their impact cannot be estimated separately. The "black box" design of CCTs means that treatment effects reported in a CCT evaluation is the effect of the whole package of interventions contained within it. Ultimately, how all this distorts the effects reported in those evaluations depends on what we want to learn from them. We have two choices. We may want to know

a) the effects of CCTs under the conditions where all relevant supply-side factors are at a minimum sufficient to respond to higher demand created by the CCT, or
b) the effects of CCTs in the supply-side environment in which the targeted poor households generally make their human capital investment decisions.

With the first option, the supply-side interventions I described above would simply be necessary steps to ensure the functioning of CCTs. The efforts to reduce variation in supply-side factors would be a part of estimating true effects, unhindered by deficiencies in the provision of public goods. In this case, deficiencies in supply-side factors leftover after the

supply-side intervention would result in *downward*-biased estimates. With the second option, however, the opposite is the case: supply-side interventions would be a source of bias, and true effects would be those estimated in the presence of constraints in the provision of public goods. The supply-side interventions would be thought of as creating an artificial environment for the implementation of CCTs that takes their effects out of context. In this case, estimates would be biased *upward*.

In the following chapter, I provide the second, more precise, part of the answer based on data collected for the Nicaraguan CCT.

5. CASE STUDY: RED DE PROTECCIÓN SOCIAL

5.1 Introduction

Having described how supply-side factors have been treated in the design of CCTs in Burkina Faso, Eritrea and Mexico, I now turn to the case study with which I address my research question using evaluation data. I decided to look into the case of the Nicaraguan *Red de Protección Social* (RPS, *Social Protection Net*) for two reasons, which should be taken into account when evaluating the contribution of this work. My decision was driven primarily by data availability. RPS was characterized by extensive data collection, and a considerable portion of this data is available to the public, not just to a small team of scientists tasked with the formal evaluation. More importantly, given RPS's randomized implementation design and the fact that data was collected for a large number of same households over the period of five years, the resulting dataset lends itself well to empirical analysis (data is described more thoroughly in Section 5.3).

The second reason to give attention to the RPS is that the Nicaraguan case may be a particularly good one for studying the importance of supply-side factors. As I described above, deficiencies in the availability (quantity) and quality of relevant supply-side factors are a concern associated with the developing world – and Nicaragua is a fairly typical developing country. In 2000, when RPS was beginning, Nicaragua was the Latin American country with the lowest GDP per capita. The country still remains among the poorest in the West – its GNI per capita places it at the very low end of low middle-income countries (The World Bank 2015). This means that Nicaragua is not very different from many low-income countries participating in the "second wave" of CCTs or that may consider implementing CCTs in the future. The availability of data in this case allows us to look at how supply-side

constraints affect the success of the program. Nevertheless, there are limitations to what we can learn from this case; they are discussed in more detail in section 5.4.

The remainder of this chapter proceeds as follows: first, for the benefit of the reader, I describe all aspects of RPS necessary to understand how the program worked (Section 5.2). This includes the description of program objectives, its basic structure and how supply-side factors were taken into account. In Sections 5.3 and 5.4, I describe the data I use and develop the empirical strategy to answer the research question. Finally, I present the results of my analysis in Section 5.5.

5.2 Case Description

Following Brazil and Honduras, Nicaragua was the third country to introduce a CCT with randomized evaluation design inspired by the Mexican *Oportunidades* (then PROGRESA) (Maluccio and Flores 2005). Here, I describe only the most important features of RPS 2000-2004; IFPRI (2005a), IFPRI (2005b) and Maluccio and Flores (2005) all contain a more comprehensive account of the program design and implementation.

5.2.1 RPS Objectives and Targeting

Like others before it, RPS was designed to address both current poverty (through supplementing the income of poor households) and future poverty (through improvements in human capital). RPS had several specific objectives related to three broad target components:

(1) Nutrition: RPS was supposed to lead to increased expenditure on food in poor rural households,

(2) Education: the program was designed to reduce dropout rates for children between the ages of 7 and 13,

(3) Child health: the program aimed at improving nutrition and health of children under the age of 5.

The targeting of the program reflected its objectives. The program was implemented in two *departments* (larger administrative and territorial units in Nicaragua), Madriz and Matagalpa. These departments were not the poorest in Nicaragua at the time of program design, but were nevertheless very poor: 80 percent of the rural population in the two departments was poor, and of those, one half was extremely poor. The next stage of geographic targeting was also successful in targeting poverty: in the six municipalities chosen within Matagalpa and Madriz, between 78 and 90 percent of the rural population was poor (International Food Policy Research Institute 2002). The choice of departments and municipalities for RPS implementation was only partially based on poverty targeting; the other consideration was the capacity of local infrastructure and administration (more on this in Section 5.2.3). To complete geographic targeting, 42 out of total 59 *comarcas* (smaller administrative areas) in these municipalities were chosen for the pilot (Phase I) of RPS. This step was a combination of geographic and more explicit poverty targeting: an index of marginality (indicating more impoverished areas) was constructed for each *comarca*, based on the mean size of the family, percentage of inhabitants above age 5 who were illiterate, and the percentage of households without a latrine and access to clean water. Forty-two households within each *comarca* were randomly selected into the program.

Program treatment was randomized at the *comarca* level with stratification: the 42 comarcas were divided into seven strata of six according to the marginality index, and three *comarcas*

from each stratum were randomly selected into the treatment (or intervention) group, resulting in 21 treatment *comarcas* and 21 control *comarcas*. These were the Phase I intervention and control group. In 2003, this Phase I control group also started receiving intervention (thus becoming Phase II treatment group), while Phase I intervention group continued receiving supply-side benefits only. An additional group of *comarcas* were assigned to be the new control group. These new *comarcas* were selected from the same two *departments* with the addition of Boaco, but they were selected by matching, which means that any evaluation in Phase II does not enjoy the same benefits of randomized design as Phase I (International Food Policy Research Institute 2005a).

5.2.2 Demand-Side Intervention and Conditionalities in RPS

RPS had two components – one relating to health and nutrition, and the other relating to education – and each of the two had a set of benefits and conditionalities attached to them. All households were eligible for the bimonthly *bono alimentario* (food transfer), conditional on: (a) attending bimonthly educational workshops, and (b) bringing children under the age of 5 to a prescheduled healthcare appointment (monthly for children 0-2 years old and bimonthly for children 2-5 years old). *Bono alimentario* was also designed to be conditional on weight gain in children under the age of 5, but it was discontinued in Phase II due to concerns about measurement error and potential bias against the poorest households (Maluccio and Flores 2005).

Households with children between the ages of 7 and 13 who had not completed fourth grade of elementary school were eligible for two other benefits: a bimonthly *bono escolar* (school attendance transfer) conditional on enrollment in grades 1 through 4 and regular school attendance (minimum 85%), as well as *mochila escolar* (school supplies transfer), a one-time

transfer for each child aged 7-13 starting a new school year. Grade advancement was also built into the program as a conditionality, but was not enforced because some schools practiced automatic grade promotion (Maluccio and Flores 2005).

5.2.3 Supply-Side Interventions and Other Factors

The importance of supply-side factors was recognized already in the design stage of RPS, and this was addressed by a combination of all five strategies described in section 4.1.

(1) Deficiencies in supply-side factors were partially addressed through the program itself. In addition to the demand-side benefits, households in the treatment areas had access to several supply-side benefits. The program organized the aforementioned educational workshops, focusing on topics such as reproductive health, nutrition and hygiene. Participating households were given a complete package of health care services free of charge for children under the age of 5 necessary to comply with the program, including monthly or bimonthly appointments with the healthcare provider with necessary vaccines, vitamins, iron supplements, and anti-parasites all included. Households with eligible school-aged children also received *bono a la oferta* (teacher transfer), a small transfer for each eligible child to be given to the teacher. The teacher was supposed to keep one half of the transfer and leave the other one to the school. *Bono a la oferta* was included in order to incentivize the teachers, who had additional work related to RPS, and to increase school resources (Maluccio and Flores 2005).

(2) RPS also capitalized on supply-side improvements implemented as a part of another program. The six municipalities chosen in the second stage of geographic targeting (out of twenty in total in the two departments) were the participants of another development

program, *Microplanificacion Participativa* (Participatory Micro-planning), whose goal was to improve the capacity of municipal governments for the implementation of infrastructure-related projects. However, the success of this program was unknown, so it is uncertain whether the selected municipalities had better capacity to implement RPS than other municipalities in Madriz and Matagalpa (Maluccio and Flores 2005).

(3) Instead of relying on the public provision of healthcare services in the area where the program was to be implemented, RPS hired, trained and paid private providers to supply the necessary services (educational workshops and healthcare appointments) (Maluccio and Flores 2005).

(4) RPS relaxed some conditionalities in relation to deficiencies in supply-side factors. Up-to-date vaccination records for children under the age of 5 were originally one of the conditionalities for *bono alimentario*, but it was not enforced due to delays in the supply of necessary vaccines (Maluccio and Flores 2005, International Food Policy Research Institute 2005b).

(5) Finally, geographic targeting in the first stage, in addition to being based on poverty, explicitly took into account the infrastructure and administrative capacity in order to minimize supply-side costs: Matagalpa and Madriz "had easy physical access and communication (including being less than a one-day drive from the capital, Managua, where RPS is headquartered), relatively strong institutional capacity and local coordination, and reasonably good coverage of health posts and schools" (Maluccio and Flores 2005, 4).

Thus, RPS authorities did plenty to minimize variation in supply-side factors in the areas targeted by the program. This has important methodological consequences for the evaluation of the program. The methodological implication is that it is impossible to separate strictly the effects of supply-side factors from the effects of demand-side benefits. The implementation of the same program in areas with very different capacities would probably be more informative in evaluating the role of supply-side factors. All these efforts of the RPS team – from implementing the program in areas selected on some measures of quality of supply-side factors to providing some supply-side services through the program directly, amount to some extent to holding the supply-side factors "constant." It is impossible to say with certainty to what extent they were in fact kept constant, but the effort clearly works against finding heterogeneous effects by supply-side factors. Nevertheless, here I try to exploit whatever variation in their quality exists within the areas where RPS was implemented.

5.3 Sources and Data

To answer my research question, (How does variation in supply-side factors change the effect of program treatment on targeted outcomes in conditional cash transfer programs?) I use primary data collected towards the evaluation of the impact of RPS by the International Food Policy Research Institute (IFPRI) between 2000 and 2004. The data is based on the household questionnaire providing a wealth of information both about the household and about individual household members. Household-level information includes items such as the size of the household, head of household, expenditure (imputed), and assets. In addition to the basics such as age and sex, the data also includes individual-level items relating to health, education and labor for each household member. The data I work with is an unbalanced panel dataset consisting of information from questionnaires from Phase I intervention and control households in 2000, 2001, 2002 and 2004, and Phase II comparison group in 2002 and 2004.

Data from the 2000 data collection wave is supplemented by data collected in the census conducted earlier in 2000 for the purpose of household selection.

The 2000 census dataset and household questionnaire data 2000-2002 are publicly available on IFPRI's website: http://www.ifpri.org/dataset/nicaragua. The data for the 2002 comparison group and the 2004 dataset were obtained through private correspondence, as they are not publicly available.

5.4 Empirical Strategy

Impact evaluations, such as that by Maluccio and Flores (2005) of RPS, assess how well the program has attained its specific objectives, where "impact" (or effect) is the change in a targeted outcome "that can be *causally* attributed to the program" (Ravallion 2007, 3789) [emphasis added]. These evaluations rely on a combination of randomization of treatment and panel structure to estimate the effect of program treatment. Randomization removes both the doubt about the direction of causality and selection bias. The latter is not a source of concern because an important feature of random assignment into treatment and control groups is that "it removes any systematic correlation between treatment status and both observed and unobserved participant characteristics" (Burtless 1995, 7). Burtless concludes that "In a carefully designed and well-administered experiment, there is usually a persuasive case that the experimental data can produce an internally valid estimate of average treatment effect" (Burtless 1995, 7).

Average treatment effect (ATE) is the effect of some "treatment" or a policy "averaged across the population" (Wooldridge 2009). The term has become important in the literature

on program impact evaluations (Wooldridge 2002); ATE is the main estimate for program's impact on each targeted outcome and the number that is then cited as a proof that the program was successful. The term "average" implicitly acknowledges that the (causal) effect of some treatment is not the same for every individual. Of course, when the effect is estimated from survey data, a portion of that variation (heterogeneity) in impact can be attributed to sampling and is expected to be random, but some individual attributes are systematically correlated with this variation. For example, gender and household income are known sources of heterogeneity in CCT program effects, as I described above (section 2.3). Thus, for example, in Maluccio and Flores (2005), the impact of RPS on enrollment is estimated separately for boys and girls, for children from very poor, poor and non-poor households, and for groups of children of different age.

The purpose of this analysis is to use the available data to see whether variation in supply-side factors is also a source of heterogeneity in effects. To clarify, I do not challenge the magnitude of ATE attributed to RPS in its evaluation, so I do not seek to revise it; I seek to *refine* it. Just like Maluccio and Flores (2005) showed that the impact of RPS was different for children from poor and extremely poor families, I want to explore whether RPS impact varies among those with access to supply-side factors of varying quality. Supply-side factors, like personal and household characteristics, are precisely those "observed and unobserved" characteristics that random assignment "randomizes" so that they do not bias the ATE. Methodologically speaking, they are hidden away from sight. In data with panel structure, where the program ATE is estimated using difference-in-differences, this is usually accomplished by including a "fixed effects" term. Maluccio and Flores (2005, 14) in the evaluation of RPS include a term for "all (observed and unobserved) individual-, household- or *comarca*-level time-invariant factors". The goal here is to explicitly take supply-side

factors out of fixed effects and assess whether and how they modify the ATE, not because it will give a more correct estimate in any way, but because they are interesting in and of themselves.

Maluccio, Murphy and Regalia (2006) have already examined the effect of some supply-side factors on enrollment, grade attainment and grade progression. Using both RPS household survey data and RPS administrative data collected in the monitoring process (not publicly available), they found that program effect was higher in autonomous schools. In this case, program impact was positively correlated with a "better" supply-side factor, as autonomous schools had more flexibility and could adapt better to increased demand for schooling. With respect to other examined supply-side factors, however – availability of fifth grade (or more), student-teacher ratio, ratio of textbooks to students and time necessary to arrive to school – the program was in fact more effective where the initial situation was worse. Their interpretation is that this is because in those areas there was "more room for improvement" (Maluccio, Murphy and Regalia 2006, 26). Their findings are enlightening, and they illustrate precisely that the effect of supply-side factors cannot be clearly distinguished from the effect of other components of the program.

5.5 Analysis

In the analysis presented below, due to the scope of this study, I focus on one outcome: grade progression. As Maluccio, Murphy and Regalia (2006) note, grade progression is a statistic that sufficiently well represents all other measured outcomes – enrollment, dropouts, and grade repetition. I argue there is another advantage to studying supply-side factors in association with grade progression; however, in the case of Nicaragua, it also comes with a potential disadvantage. First, grade progression is where the effects of supply-side factors

should show more easily. The conditionality of grade advancement was abandoned in the RPS, and this is what presents both an opportunity and a problem to the analysis of the effects of supply-side factors. It is an opportunity because grade advancement reflects in part the quality of education the student receives (in addition to enrolling and attending class, the student must achieve some milestones in knowledge and skills), and this is not driven by demand due to conditionality. It is also a problem, however, because the reason this conditionality was abandoned was that some schools automatically promoted students to the next grade. In those schools, grade advancement does not reflect the quality of education, nor does it, indeed, reflect students achieving milestones.

Nevertheless, grade advancement is a good outcome to look at despite this for two reasons. First, the 2002 and 2004 household survey datasets contain an item inquiring whether the student was promoted automatically. These records show that few students were promoted in this way 1.5% of students in the targeted group[3] in 2002 and 2% in 2004. I use this information to adjust the number of grades progressed downward, by 2 if the student reported being promoted automatically in both years, or by 1 if the student was promoted in this way in one of the years only. Second, this distortion would only be a cause of concern if there were reasons to believe that the practice of automatic promotion is correlated with the quality of supply-side factors.

As there are no such reasons, below I model a total of five outcomes using regression analysis: for the Phase I intervention and control groups: the number of grades progressed[4] 2000-2001, 2000-2002, 2000-2004 and 2002-2004; and for the Phase II intervention and control group the number of grades progressed 2002-2004. Only the first two estimations

[3] Children between the ages of 7 and 13, inclusive, who had not finished fourth grade of primary school. This is based on the subset of all children who were enrolled in pre-school or primary school in 2000.
[4] It was not unusual for students to progress by more than one grade in a single year.

benefit fully from the randomized program design. Phase I 2000-2004 is a comparison of a group that has had full program treatment for three years followed by supply-side only benefits for a year with a group that has received full program treatment for a year. This is also reflected in the grades progressed 2002-2004 for Phase I groups. Phase II grades progressed 2002-2004 compares two groups that were not randomized.

Methodologically, I follow Maluccio, Murphy and Regalia's approach, with some modifications:

$$\Delta E_{ihc} = \beta_0 + X_{i0}\beta_1 + P_{c0}\beta_2 + X_{h0}\beta_3 + X_{h0}P_{c0}\beta_4 + K_{i0}\beta_5 + K_{i0}P_{c0}\beta_6 + \Delta\varepsilon_{ihc}$$

ΔE_{ihc} is the number of grades, adjusted for automatic grade promotion, advanced between the baseline survey and the one done at later time for individual *i* in household *h* and *comarca c*. Because the outcome is first-differenced at child level, individual, household and *comarca* fixed effects cancel out (Maluccio, Murphy and Regalia 2006).

X_{i0} is the vector of relevant variables measured at individual level at baseline[5]: age, age squared and gender.

X_{h0} is the vector of relevant household-level variables at baseline: predicted log(per capita expenditure) and squared predicted log(per capita expenditure), literacy of the head of household[6], age and gender of the head of household, household size, the number of children age 0-5 and the number of children age 7-13 (inclusive).

[5] Baseline for the 2002-2004 panel consists of observations from 2002.
[6] I use the head of household instead of mother or father because the information for a large number of parents is missing from the dataset (they are reported to be living elsewhere). In fact, in a handful of cases, there was no

P_{c0} = 1 if the household is in treatment *comarca*. Following Maluccio, Murphy and Regalia study (2006)., I do not take into account cross-contamination and estimate the more conservative intent-to-treat effect from being a household in the treatment *comarca*, regardless of whether the household received treatment or not. Likewise, I ignore the stratified design, as *comarca*-level weights made no difference in their study.

K_{i0} is the vector of relevant school characteristics at baseline, measured at the *individual level*. Because I use the household survey and do not have access to school-level data available in the RPS administrative dataset, the vector bears indices *i0* and not *c0* as in the Maluccio, Murphy and Regalia study (2006). I do not have access to RPS administrative data used by the authors, but I use some variables from the household survey they did not take into account. The household survey contains information on:

- Whether the child attends in a multi-grade classroom[7],
- Distance to school (in meters),
- Whether the child receives food in school,
- School autonomy, and
- Whether the child received school books for free from the school.

The parameter of interest here is β_6. It is the estimate of differential average effect of the program for each supply-side factor K_{i0}. β_5 indicates the association between the supply-side factor and the outcome variable. β_2 is the difference-in-difference ATE.

designated head of household among members. In these cases, I designated as the head of household the person who declared to be (1) spouse, (2) mother/father, or (3) child of the head of household, in that order.

[7] Multi-grade classroom (*aula multigrado*): a school in which students at different grade levels share the same classroom and the same teacher (Instituto Nacional de Estadisticas y Censos 2000).

Table 1. Association between the number of grades progressed and supply-side factors at baseline, Phase I sample

	2000-2001		2000-2002		2000-2004	
	(1)	(2) Interaction	(1)	(2) Interaction	(1)	(2) Interaction
Treatment						
Treatment area	0.085**	-0.035	0.237***	0.053	0.324***	-0.073
	(0.035)	(.067)	(0.051)	(0.098)	(0.090)	(0.190)
Male	-0.053	-0.034	-0.090**	-0.063	-0.298***	-0.292***
	(0.033)	(0.030)	(0.046)	(0.044)	(0.081)	(0.082)
Age in 2000	0.199**	0.239***	0.676***	0.685***	0.926***	0.813***
	(0.092)	(0.084)	(0.125)	(0.122)	(0.249)	(0.249)
(Age in 2000)^2	-0.008*	-0.010**	-0.031***	-0.031***	-0.044***	-0.037***
	(0.005)	(0.004)	(0.006)	(0.006)	(0.013)	(0.013)
Household						
Pred. log p.c. expenditure	-0.085	-0.018	0.307	0.319	1.311	0.887
	(0.400)	(0.390)	(0.598)	(0.587)	(1.324)	(1.299)
(Pred. log p.c. expenditure)^2	0.007	0.004	-0.022	-0.021	-0.078	-0.049
	(0.0252)	(0.025)	(0.038)	(0.037)	(0.082)	(0.081)
Head of household literate	0.101***	0.114***	0.186***	0.199***	0.381***	0.408***
	(0.0349)	(0.034)	(0.054)	(0.052)	(0.101)	(0.101)
Head of household age	0.001	0.000	0.002	0.001	0.002	0.000
	(0.001)	(0.001)	(0.002)	(0.002)	(0.004)	(0.004)
Household head a woman	-0.071	-0.078	-0.094	-0.088	-0.096	-0.035
	(0.064)	(0.060)	(0.100)	(0.099)	(0.177)	(0.178)
Household size	0.009	0.005	0.015	0.014	-0.002	-0.011
	(0.010)	(0.010)	(0.015)	(0.015)	(0.028)	(0.027)
Number of children age 0-5	-0.033	-0.028	-0.049	-0.043	-0.064	-0.049
	(0.021)	(0.019)	(0.030)	(0.029)	(0.053)	(0.052)
Number of children age 7-13	-0.0222	-0.025	-0.030	-0.035	-0.014	-0.029
	(0.019)	(0.019)	(0.026)	(0.027)	(0.051)	(0.051)

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Supply-side factors								
Multi-grade classroom		-0.098*	0.127*		-0.154*	0.250**		-0.179	0.436**
		(0.056)	(0.072)		(0.089)	(0.108)		(0.160)	(0.205)
Distance to school (m)		0.000	0.000		0.000	0.000		-0.000	0.000*
		(0.000)	(0.000)		(0.000)	(0.000)		(0.000)	(0.000)
Receives food in school		-0.001	0.061		0.055	0.045		-0.064	0.172
		(0.077)	(0.099)		(0.112)	(0.168)		(0.240)	(0.440)
School autonomy		-0.067	0.199		-0.046	0.178		-0.135	0.648**
		(0.141)	(0.156)		(0.162)	(0.195)		(0.293)	(0.326)
Receives books for free		-0.039	0.054		0.027	-0.004		-0.149	.034
		(0.056)	(0.072)		(0.087)	(0.108)		(0.152)	(0.206)
Constant	-0.218	-0.662		-3.252	-3.29		-7.210	-4.734	
	(1.677)	(1.613)		(2.433)	(2.38)		(5.288)	(5.242)	
N	1153	1113		1073	1030		775	736	
F-stat [p value]	4.43 [0.00]	4.33 [0.00]		9.56 [0.00]	7.22 [0.00]		9.21 [0.00]	6.65 [0.00]	

Standard errors clustered at household level in parentheses.
* 0.05<p<0.1 ** 0.01<p<0.05 *** p<0.01

Table 1 shows the results of regressions of grades progressed between 2000-2001, 2000-2002 and 2000-2004 for the Phase I intervention and control group. Specification (1) does not include supply-side factors and is provided for reference. Specification (2) includes the supply-side factors outlined above, with main effect (β_5) listed in the middle column and interaction effect (β_6) listed in the last column of each group. Of the supply-side factors of interest, only multi-grade classroom mediates the effect of the program. The negative coefficient for the main effect shows that attending a multi-grade classroom at is negatively associated with grade progression. This suggests that multi-grade classrooms potentially have a constraining effect on the program. However, the positive and substantively significant coefficient on the interaction effect shows that, even if this supply-side factor had a constraining effect by itself, in interaction with the program it did not have that effect. By 2004, attending multi-grade classroom at baseline was associated with almost half a grade more in program effect. In 2004, school autonomy was also associated with substantially higher impact of the program; a child who attended an autonomous school in 2000 progressed by about 0.65 grades more than another child in treatment group. None of the other supply-side variables modify the ATE, nor are they associated with grade progression. Table 2 shows output from regressions for the 2002-2004 panel, for Phase I and Phase II intervention and control groups. Multi-grade classroom shows the same negative association with grade progression in the Phase II comparison, but no interaction effect. Likewise, no other supply-side factor influences the outcome between 2002 and 2004.

In conclusion, my analysis shows that attending multi-grade classroom and potentially, attending an autonomous school at baseline modified the effect of RPS on grade progression upwards. Taken together with the findings from the analysis by Maluccio, Murphy and Regalia (2006), this suggests that at least some supply-side factors are a source of

Table 2. Association between the number of grades progressed and supply-side factors at baseline, Phase I control group and Phase II control sample

	Original treatment and control			Original control, 2002 comparison		
	(1)	(2)		(1)	(2)	
			Interaction			Interaction
Treatment						
Treatment area	0.018	-0.136		-0.057	-0.337	
	(0.064)	(0.143)		(0.063)	(0.216)	
Male	-0.159***	-0.175***		-0.115**	-0.147***	
	(0.058)	(0.060)		(0.056)	(0.052)	
Age in 2000	0.024	-0.021		0.162	0.239	
	(0.204)	(0.202)		(0.162)	(0.160)	
(Age in 2000)^2	-0.000	0.002		-0.005	-0.008	
	(0.011)	(0.011)		(0.009)	(0.008)	
Household						
Pred. log p.c. expenditure	0.445	0.133		0.795	0.792	
	(1.176)	(1.115)		(0.802)	(0.741)	
(Pred. log p.c. expenditure)^2	-0.023	-0.002		-0.040	-0.039	
	(0.073)	(0.069)		(0.051)	(0.048)	
Head of household literate	0.087	0.107		0.061	0.065	
	(0.076)	(0.074)		(0.067)	(0.065)	
Head of household age	-0.002	-0.003		-0.011***	-0.010***	
	(0.003)	(0.003)		(0.003)	(0.003)	
Household head a woman	-0.135	-0.097		-0.013	-0.046	
	(0.113)	(0.110)		(0.083)	(0.082)	
Household size	-0.024	-0.022		0.077***	0.058***	
	(0.020)	(0.020)		(0.020)	(0.018)	
Number of children age 0-5	-0.005	-0.008		-0.051	-0.048	
	(0.039)	(0.040)		(0.039)	(0.039)	
Number of children age 7-13	0.010	-0.009		-0.044	-0.036	
	(0.035)	(0.035)		(0.035)	(0.035)	
Supply-side factors						
Multi-grade classroom		-0.012	0.211		-0.199**	0.021
		(0.120)	(0.155)		(0.091)	(0.121)
Distance to school (m)		-0.000	<0.001**		<0.001	<0.001
		(0.000)	(0.000)		(0.000)	(0.000)
Receives food in school		-0.081	0.192		-0.068	0.247
		(0.129)	(0.281)		(0.101)	(0.179)
School autonomy		-0.084	0.211		0.004	0.007
		(0.203)	(0.235)		(0.178)	(0.209)
Receives books for free		-0.036	-0.195		-0.022	0.030
		(0.095)	(0.142)		(0.101)	(0.149)
Constant	-0.350	1.194		-3.185	-3.341	
	(4.621)	(4.428)		(3.259)	(3.023)	
N	731	695		1028	1012	
F-stat [p value]	2.80 [0.00]	2.25 [0.00]		4.87 [0.00]	5.80 [0.00]	

Standard errors clustered at household level in parentheses.
* 0.05<p<0.1 ** 0.01<p<0.05 *** p<0.01

heterogeneity in the impact of CCTs. But how do they matter? The evidence is mixed: the positive coefficient on multi-grade classroom (which is an indicator of worse supply of education services) suggests RPS had a higher effect where initial supply-side conditions were poorer. The coefficient on school autonomy, however, says RPS was less effective where initial supply-side factors were worse (if we take school autonomy to be superior). Because I am uncertain that school autonomy is necessarily an indicator of better initial supply-side factors, I focus on the first finding.

It is not easy to interpret the positive association between attending multi-grade classroom at baseline and higher grade progression. It is tempting to conclude that this means that deficiencies in supply-side factors do not constrain the functioning of CCTs or that CCTs perform better where initial supply-side factors are poor. However, given my discussion in section 4.3, the relevant question to ask about RPS is not whether poor initial supply-side factors constrained its functioning, but whether the authorities did enough to offset them. RPS intervened extensively on the supply side, and thus the interpretation of its ATE is as in case (a) – it is the effect of the program as a whole, not just the actual cash transfer. In this case, ATE is biased downward by poor supply-side factors, and thus accounting for them explicitly in a regression would result in a positive coefficient (or no association). My finding (and the ones in the Maluccio, Murphy and Regalia (2006) study) is expected if the program worked well, meaning that – yes – the authorities have done enough to offset the initially inferior supply-side factors; a negative coefficient would mean they have not. Most likely then, the positive coefficients suggests that the *supply*-side interventions of RPS were successful. If RPS did not include supply-side interventions, the interpretations of regression coefficients would be different: a negative association would be expected, no association would mean supply-side factors do not matter (because, for example, any constraining effect

they have is drowned by the demand-side effects), and a positive association would be very unusual.

6. CONCLUSION

In the introduction to this work, I asked how variation in supply-side factors might change the effect of program treatment on targeted outcomes in conditional cash transfers. Extant literature suggested that poor initial supply-side factors may constrain the functioning of CCTs. I gave one part of the answer in Chapter 4, where I described the strategies that policy makers follow in addressing supply-side constraints in association with CCT programs. Very generally, whether and how supply-side factors influence the success of the program depends on what strategy policy makers follow in the program design to minimize variation in supply-side factors. Perhaps more importantly, to what extent they intervene on the supply-side changes the meaning of estimated program effects. In the presence of supply-side interventions, whatever effect is attributed to the program treatment in the evaluation is not the effect of the CCT itself (the relaxation of demand-side constraints by the cash transfer), but the effect of the program implemented in an artificially created environment. The implication is that those results cannot be replicated elsewhere by simply providing cash.

My second strategy consisted of an analysis of the association between grade progression and initial supply-side factors in the Nicaraguan RPS. I found that in the case of one supply-side factor – multi-grade classroom – worse initial conditions are associated with greater grade progression. Strictly answering my research question, the evidence from Nicaragua suggests that supply-side factors do modify the effect of CCT treatment, such that programs are more effective in areas with inferior supply-side factors. However, this should be interpreted with caution. Given that RPS included extensive supply-side interventions in addition to the cash transfer changes the interpretation of this finding. The best conclusion that follows from my

analysis of RPS is that the supply-side interventions were sufficient to offset any constraining effects of poor supply-side factors at baseline.

Ultimately, the design of RPS makes it impossible to disentangle the effects due to relaxation of demand-side constraints from the effects due to supply-side interventions. This means that the analysis presented here is an asymmetrical test with respect to the results, and this is the greatest weakness of the study. Had I found that poor initial supply-side factors revised ATE downward, that would represent very convincing evidence that poor supply-side factors are an impediment to the functioning of CCTs. This is because, in the presence of supply-side interventions, it would be difficult for such an effect to show – so if it did show, it would mean it is strong. However, for the same reason, the finding that inferior supply-side factors increase the magnitude of ATE does not represent strong evidence that poor supply-side factors do not interfere with the functioning of CCTs. At most, it means that they do not *when they are explicitly addressed in the program*.

Clearly, a CCT with supply-side interventions explicitly randomized would be a better one for studying the effects of supply-side factors. With this in mind, it would be easy enough to recommend to policy makers to implement more such programs (such as the incompletely implemented PRAF II, which was designed to enable the estimation of effects from demand- and supply-side interventions separately). However, the design of CCTs demands many ethical considerations, such as that funds be allocated in a manner that lifts most people out of poverty, regardless of whether scientists can then tell precisely how that happened. Some of those considerations certainly outweigh the benefits to scientists from implementing a program with a particular design. Of course, there is always the benefit of learning what works – which can then be used to implement even better programs. However, in the end

CCTs ought to be designed in a way that maximizes their impact on poverty, and sometimes less than perfect knowledge of underlying mechanisms will have to do.

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