EXIT CONDITIONS IN SOCIAL ASSISTANCE PROGRAMMES: EVIDENCE FROM CONDITIONAL CASH TRANSFERS

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ACRONYMS

ANSES: *Administración Nacional de la Seguridad Social* (Social Security National Administration).

AFDC : Assistance to Families with Dependent Children.

BR : Baland and Robinson (2000).

BWPI : Brooks World Poverty Institute.

CCT : Conditional Cash Transfer.

CIA : Conditional Independence Assumption.

DANE: *Departamento Administrativo Nacional de Estadísticas* (Colombian national statistics department).

DNP : *Departamento Nacional de Planeación* (Colombian national planning department).

DPS : *Departamento para la Prosperidad Social* (Department for the Social Prosperity).

GDP : Gross domestic product.

GPS : Generalised Propensity Score.

HI : Hirano and Imbens (2004).

ICV : *Indice de condiciones de vida* (Living conditions index).

IFPRI : International Food Policy Research Institute.

IFS : Institute for Fiscal Studies.

IADB : Inter-American Development Bank.

MIDEPLAN: Ministerio de Planificacion Nacional y Politica Economica.

PROGRESA: Programa de Alimentación, Salud y Educación.

OECD: Organisation for Economic Co-operation and Development.

NCU : National Coordinating Unit.

RCU : Regional Coordinating Unit.

RPS : *Red de Protección Social* (Social Protection Network).

SAP : Social Assistance Programme.

SEI : Servicios Especiales de Informacion.

Selben: *Seleccion de Beneficiarios* (Selection of Beneficiaries).

Sisben : *Sistema de Identificación de Beneficiarios* (Beneficiary identification system).

Sisfoh : *Sistema de Focalizacion de Hogares* (Households targeting system).

Siuben : *Sistema Unico de Beneficiarios* (Unique Beneficiaries System).

SNAP : Supplemental Nutrition Assistance Program.

UNU-WIDER: World Institute for Development Economics Research.

WTW : Welfare to work.

ABSTRACT

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Social assistance programmes (SAPs), understood as non-contributory transfers aimed at addressing poverty, have spread in developing countries since the late 1990s. National governments in Latin America have sought to extend the coverage of SAPs through human development conditional cash transfer programmes (CCTs).

CCTs share several implementation features. First, they employ targeting and selection methods based on means, and proxy means, tests. Research on targeting and selection methods has evolved hand in hand with the adoption of CCTs in Latin America, Africa and South East Asia. Second, CCTs involve the provision of cash transfers directly to households, but with conditions attached to human development objectives. Transfers are given to households in poverty contingent on investment in the human capital formation of their children. A third feature relates to the presence of programme exit conditions.

To date, scarce research is available on the design and outcomes associated with exit conditions from CCTs. This thesis thus contributes to the literature in the implementation of SAPs by providing a critical examination of exit conditions in SAPs with specific emphasis on CCTs. The thesis provides a systematic theoretical and empirical analysis of the role of exit conditions in the implementation of CCTs. The thesis develops and tests two basic principles underlying the role of exit conditions.

First, the exhausted-effectiveness principle suggests that the effectiveness of a CCT varies over time. The research reported in this examines the effectiveness of programme over time with the aim of identifying potential thresholds after which a given SAP's effectiveness declines. A two-period child human capital investment model is developed to study analytically the conditions in which programme effectiveness varies over time. This is examined empirically in order to demonstrate the existence of the time-varying effectiveness associated with the implementation of the Colombia's CCT, *Familias en Accion*. A continuous treatment effect model is estimated following Hirano and Imbens (2004), in which the length of exposure allows for the graphical analysis of dose-response functions. The results indicate that the design of SAPs must take account of time-varying effectiveness.

Second, a principle of the non-recurrence of poverty states that beneficiaries should be able to exit an effective programme when two conditions apply: (i) they are not in poverty; and (ii) they face a low probability of becoming poor in the near future. This principle acknowledges the implications of poverty dynamics for the implementation of SAPs with a particular focus on exit conditions. This thesis characterises the poverty dynamics of beneficiary households through the estimation of a Markovian poverty transition model using data from the *Familias en Accion* programme. The findings from the empirical work suggest that programme participation should not end when households are non-poor, but attention must be paid to probabilities of recurrence, in order to secure non-recurrence in the near future.

Taken together, the exhausted-effectiveness principle interacts with the non-recurrence of poverty principle in the sense that the first sets a maximum length of exposure to the intervention, while the second determines minimum levels of exposure.

DECLARATION

I declare that no portion of the work referred to in the thesis has been submitted in support of an application for another degree or qualification of this or any other institute of learning.

COPYRIGHT STATEMENT

DEDICATION

To my parents, *Orlando* and *Emelina*. To my siblings, *Orlando* and *Heidi*. To my wife, *Paola*.

ABOUT THE AUTHOR

Juan M. Villa is economist and Ph.D. researcher at the Brooks World Poverty Institute. He has work experience in the management, monitoring and evaluation of several social protection programmes in Colombia and Latin-America. This experience includes a role as research assistant at the Inter-American Development Bank where he worked on the assessment of social assistance and labour market programmes in Colombia, Peru, Mexico, Honduras and Dominican Republic. Mr. Villa also has work experience as consultant for several United Nations agencies, such as UNICEF, UNDP and UNODC in Colombia, China and Bangladesh. Academic publications include working papers and journal articles on the assessment of social assistance, labour market programmes and statistical software components.

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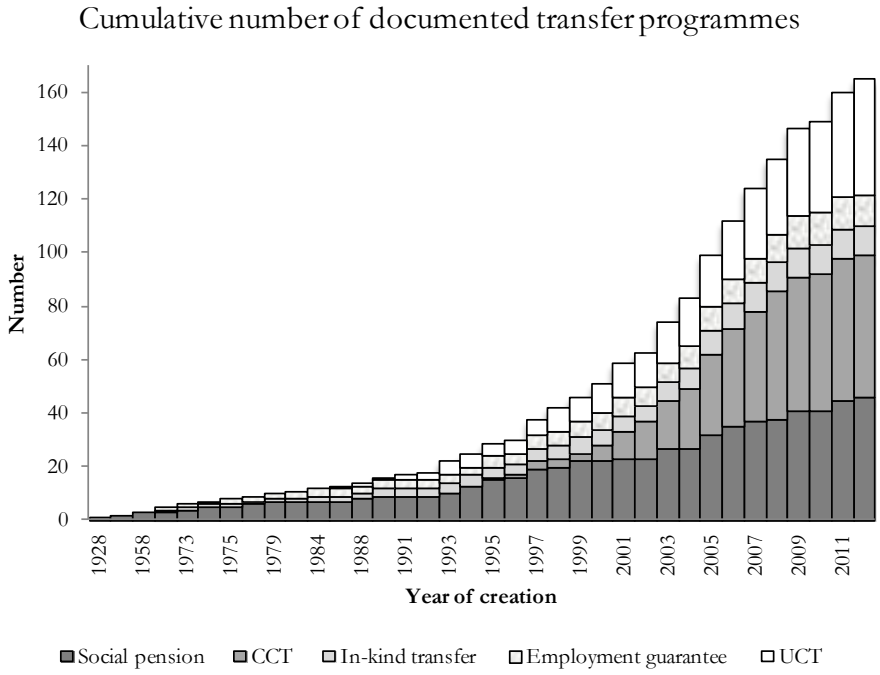
CHAPTER I: INTRODUCTION

Social protection is defined as a policy response to conditions of poverty and vulnerability that are considered unacceptable in a given society (Barrientos, Hulme, and Shepherd 2005). Three basic branches can be identified within social protection, namely, labour market policies, social insurance and social assistance programmes (SAPs) (Barrientos 2013a; Barrientos and Hulme 2008). This thesis focuses on the latter in the context of the definition provided by Barrientos (2013a: 5), in the sense that SAPs *"...are tax-financed (non-contributory) transfers to individuals and households aimed at addressing poverty."* There has been a significant growth of SAPs in the global south. While in the early 1990s the number of flagship SAPs in the developing world would add-up less than 20, by 2012 several approaches had identified roughly 160 ongoing SAPs with a significant proliferation after 2000 (Barrientos 2013c; World Bank 2010; Nino-Zarazua 2011). The design of SAPs has taken the form of cash or in-kind transfers with a defined objective of attacking poverty and vulnerability, while they have been implemented under a conditional or unconditional setting (see Figure I-1 below).[1]

Figure I-1. Estimated number of flagship SAPs in developing countries.



Source: Author with inputs from the BWPI's social protection database (Barrientos, Nino-Zarazua, and Maitrot 2010).
Note: CCT stands for conditional cash transfers; UCT stands for unconditional cash transfer.

Barrientos (2013a) defines three broad types of programmes in his conceptualisation of SAPs in developing countries. The first one identifies *pure income transfers* which deliver income to individuals or households in poverty on an unconditional basis. Examples of these pro-

[1] Conditions vary depending on the programme's approach. They are introduced to change the behaviour of the beneficiaries i.e. by compulsory school attendance of children or by mandatory work of adult household members. Conditionalities and in-kind transfers obey to a paternalistic point of view in the provision of non-contributory transfers (Currie and Gahvari 2008).

grammes are the South African Old Age Pension and the Child Support Grant with transfer income in cash to poor families. The second type of SAPs consists of *integrated poverty reduction programmes*, intended to alleviating poverty from different dimensions in which the income transfer does not play a central role. Examples of these programmes are the Chinese *Dibao* programme and the former *Chile Solidario*.[2]

Finally, the third type of SAPs is defined by *transfers combined with asset accumulation*, designed to introduce compulsion into their implementation which is supposed to generate higher endowments of physical, human and financial assets. Examples here are workfare interventions such as the Indian National Rural Employment Guarantee Scheme and human development conditional cash transfer programmes (CCTs) such as Mexico's *Oportunidades* or Brazil's *Bolsa Familia*. Given the recent dynamism of CCTs over the rest of antipoverty approaches (Fiszbein and Schady 2009), especially in Latin America, this thesis pays a particular attention to this type of SAPs.

An important number of CCTs have emerged in the developing world, with a particular regional relevance in Latin America (Barrientos and Villa 2013). It is estimated that around 20 percent of the population in this region participates in CCTs, which deliver income in cash to parents whose children attend regularly school and receive constant nutritional and health assistance from medical practitioners (Stampini and Tornarolli 2012). The proliferation of the Latin American model of CCTs has reached some other regions, such as the LEAP intervention in Ghana, the Cash Transfer for Orphan and Vulnerable Children in Kenya, the 4Ps in Philippines and the Family Hope Programme in Indonesia. CCTs have been adopted by subnational governments in developed countries, such as the Opportunity NYC in New York, USA (Aber 2009).

I-1. Objectives of this thesis

As it will be shown later, several features in the design and implementation of SAPs have been studied so far. Targeting methods and type of transfers have dominated the theoretical and empirical literature in this sense. Very little research has been done on the exit conditions as a relevant feature in SAPs. This thesis aims to bridge the gap by conceptualising the exit conditions of beneficiaries from SAPs with especial focus on CCTs.

The general and specific objectives of this thesis are based on a theoretical and empirical approach to the exit conditions in the design and implementation of SAPs with especial focus on CCTs. In particular:

[2] *Chile Solidario* was replaced by the *Ingreso Etico Familiar*.

- To identify and apply an analytical framework for the understanding of the exit conditions of beneficiaries participating in targeted SAPs aimed at alleviating poverty. This is achieved by:
    - Understanding how CCTs work from the microeconomics point of view and adapting and modifying existing models of human capital accumulation and programme participation. Theoretical models are reviewed in terms of their effectiveness, comparing the results with and without the intervention of a CCT.
    - Understanding the implications of poverty dynamics for the implementation of SAPs and for the definition of exit conditions. A particular attention is paid to ineligible participants who are subject to programme exclusion due to better socioeconomic conditions.
- To find empirical evidence that support the theoretical findings by focusing on the design and implementation of the *Familias en Accion* programme in Colombia. This is achieved by:
    - Analyzing household data from *Familias en Accion* programme that contain more than 30 million individuals over the period 2001-2010.
    - Evaluating the continuous effects of the programme on the human capital formation of beneficiary children according to their length of exposure to the programme.
    - Estimating the transition probabilities of households that have escaped extreme poverty and have become ineligible for the transfers.

The research questions related to these objectives are stated as follows:

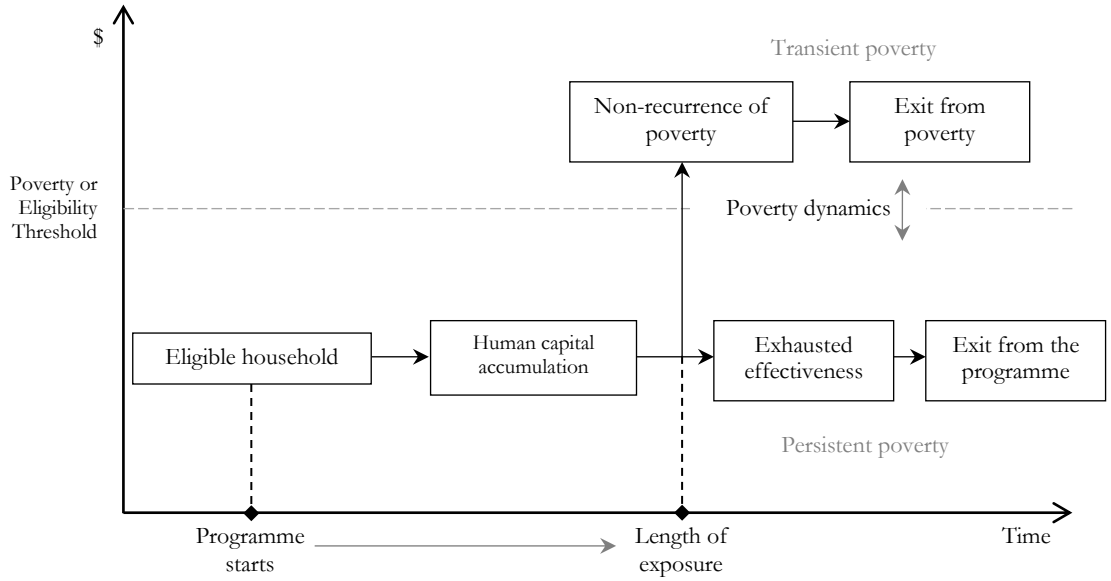
- Opening the black box: what motivates the household to invest in child human capital and how a CCT programme intervenes in this process?
- Is the effectiveness of a CCT programme constant over time? What is the dynamic of the impact of the intervention and how it is linked to the exit conditions?
- Given the fact that the programme remains effective and participating households become ineligible, what determines a reliable exit condition? How a programme should respond when ineligible participants face high probabilities of being eligible again in the future?

Looking at these objectives, the aim here is to identify two basic principles that determine the exit conditions from a SAP: the exhausted-effectiveness and the non-recurrence of poverty. The exhausted-effectiveness principle addresses the concerns on how long should recipients obtain the benefits from the programme insofar as they comply with the categorical and in-

come or welfare participation criteria and face persistent poverty. This point will be analysed from the point of view of the varying effectiveness of the programme over time. Current theoretical models analysing the effects of CCTs are based on a static framework (Skoufias 2005; Ravallion and Wodon 2000). This thesis develops a continuous effect model by modifying Baland and Robinson (2000) human capital accumulation model. Empirically, a conceptualization of an time-varying effectiveness is given by King and Behrman (2008), in which several characteristics in the implementation of transfer programmes define the cycle of the effectiveness they generate over time. A first graduation condition will entail a length of exposure that allows the exhaustion of the effectiveness of the intervention over the length of exposure. If the programme is not effective, then its benefit provision to specific households or individuals is not justified. The second principle, the non-recurrence of poverty, emerges implicitly form the design of targeted interventions. It addresses the concern of the implications of poverty dynamics for the participation of households or individual in targeted SAPs, in the sense that, despite participants initially are identified as poor and such status might change, non-poor participants may not meet the conditions to leave the intervention. Hulme and Shepherd (2003) offer a conceptualisation to poverty dynamics from with a framework can be inferred in the context of the implementation of targeted SAPs. Households with previous poverty or eligibility experience can be identified in transient poverty or persistent poverty. Such experience can influence future eligibility prospects, in the sense that poverty dynamics may obey to unit level heterogeneity and a "state dependence" of household's poverty or eligibility status (Heckman 1981). An exit condition of non-poor participants should verify that they face low risk of becoming poor back again when poverty is transient insofar the programme is still effective according to the exhausted effectiveness principle. The focus on varying effectiveness and poverty dynamics therefore provides an important opportunity to advance the understanding of the exit conditions of beneficiaries from SAPs.

Figure I.2 below illustrates how these exit principles or conditions interact in the context of the implementation of targeted SAPs. Eligible households start their participation as they are classified in poverty or extreme poverty by the targeting methods. The length of exposure is determined by the effectiveness of the programme when poverty is persistent and by the poverty dynamics when poverty is transient. The exit conditions are determined by the fact that the effectiveness of the programme is exhausted as households remain in poverty or extreme poverty. On the other hand, the exit condition is determined by the non-recurrence of poverty in which the household is identified as non-poor or ineligible while they face low risks of becoming poor in the near future. The conceptualization and empirical support of these principles, the exhausted effectiveness and the non-recurrence of poverty, are the main focus of analysis of this thesis.

Figure I-2. Programme participation and exit conditions



Source: Author

This thesis places particular focus on CCTs. They emerged as the result of a transition from in-kind to direct cash transfers with attached co-responsibilities. The emblematic experience of this transition emerged in Mexico where the administrative challenges associated with the provision of subsidised food led to the implementation of the CCTs. For example, the operational problems and the implementation of inaccurate targeting methods that would leak the transfers to non-poor population were the main factors that drove the Mexican government to rethink how subsidies were being delivered (Levy and Rodríguez 2005). Other factors determining this change were the food manipulation and the administrative dependency of in-kind from different government agencies. There was a need to overhaul the antipoverty approach in place that led to simplify of how subsidies were given to households in poverty. After years of trial and error, it was determined that providing cash instead of food transfers on a non-contributory basis could be an effective instrument in the overall poverty alleviation strategy.

The diffusion of CCTs in Latin-America and some countries from Africa and south-east Asia is a demonstration of its relevance within the recent developments in social assistance. According to Fiszbein and Schady (2009), in 1997 CCTs had been adopted by three countries (namely, Bangladesh, Brazil and Mexico) while ten years later the coverage global map of these programmes reached 28 countries at certain phase of implementation including piloting, scaling-up and consolidation. CCTs vary across countries, from transfers with soft conditions in Ecuador's *Bono de Desarrollo Humano* (Schady and Araujo 2006) through their use as components in integrated poverty alleviation strategies such as the *Puente* component in former *Chile Solidario*. The effectiveness of CCTs is also noticeable in the reduction of poverty rates. Despite the aggregate effects of CCTs on poverty rates could be confounded by the overall growth of these economies, some authors assert that without these programmes the poverty

headcount ratio in Latin-America would be 13 percent higher (Stampini and Tornarolli 2012). As a consequence, CCTs are becoming a must-have in the anti-poverty strategies of developing countries.

Restrictions on the transfers are included in some SAPs for making the recipients adopt certain behaviour. CCTs have the feature that they provide cash to families in poverty conditional on the school attendance and health check-ups of their children (Attanasio, Oppedisano, and Vera-Hernandez 2014). These restrictions to the transfer, disguised as co-responsibility, are intended to improve the nutritional status in the early childhood and increase the years of education during school time. Co-responsibilities are aimed at facilitating the spending of the transferred money on child human capital formation activities. Thus, the main objective of CCT programmes is to increase the human capital formation of minors while expecting a higher productivity when they become economically active when adults. [3]

One major drawback in the design and implementation of CCTs is that conditions on the CCTs can generate inefficient allocation of household resources. According to Currie and Gahvari (2008), Compulsion on the transfers could lead to an overprovision of human capital that the household would not choose if transfers were not conditional. The overprovision that results is justified by *paternalistic* or *interdependent preferences* models that dominate the CCT scheme. When unrestricted cash is transferred the government or donors expect the recipient to spend it on a particular good or service that will improve the whole society, instead of "wasting" it on what seems unnecessary goods and service. The latter could be achieved depending on the income elasticity of the recipient on the market of the socially desired good (Thurow 1974, 190). Thus, the co-responsibility component of CCT programmes assumes that the income demand of recipients for child human capital investment services is inelastic. Currie (1994) provides evidence demonstrating that restricted transfers that target poor children have larger effects, while those unrestricted programmes are less effective.

[3] Restrictions on transfers obey to a paternalistic approach about what beneficiaries must do with the money and which other complementary services they shall consume. Currie and Gahvari (2008) present an argument for non-resalable in-kind transfers that can be extrapolated to CCTs (in-kind and CCTs are similar because both are restricted transfers) in spite of the fact that unconditional cash transfers are superior in terms of the utility of the recipient. From the paternalistic or the interdependent preferences point of view, if high income tax-payers take care about the situation of the poorest, income transfers with unrestricted consumption would imply negative externalities for those who care for them. Das, Do, and Ozler (2004) criticize paternalistic models since they appeal to the efficiency losses arising from the overprovision of restricted transfers, since they are based on competitive markets and the decision made by individuals are optimal for the economy. They address how CCTs can rather improve market imperfections that hinder the child human capital decisions made by parents. For example, they cite a perception research of a insecticide-treated bed nets programme in Kenya aimed at combating malaria by Alaii et al. (2003). Despite malaria was devastating entire communities, when recipients were asked what they would purchase if they were given the money worth a bed-net, food and clothing were strongly prioritized.

Some other authors have highlighted the targeting role of conditions on the transfers. Álvarez, Devoto, and Winters (2008) consider that the compulsion of transfers also helps the programme to refine its targeting and selection methods. They found that the restrictions on the transfers work as a verification mechanism. In fact, recipients who refuse to comply with the conditions on school attendance and the health check-ups tend to be the less poor. The co-responsibility improves the performance of the targeting method by screening out some of the non-poor that participate in the programme due to targeting errors. The costs associated with the co-responsibilities seldom are considerable for the extreme poor as they do not dropout from CCT programmes (Álvarez, Devoto, and Winters 2008, 656). This evidence reveals that restrictions on the transfer help to refine the selection of non-poor beneficiaries that result from the implementation of the programme.

CCTs have demonstrated to generate positive effects (Janvry and Sadoulet 2006). They are possibly the most evaluated and monitored programmes amongst SAPs schemes in developing countries. The icon of these evaluations is the pioneering randomized controlled trial carried out by the Mexico's *Oportunidades* programme. In the piloting stage, the staff from the International Food Policy Research Institute (IFPRI) did an impact evaluation based on the random assignment of 60 percent of potential beneficiaries among 505 municipalities (Skoufias 2001). The positive and unprecedented effects on school attendance, nutrition status and time allocation of children were essential for scaling up the programme and for replicating it in other countries (Levy and Rodríguez 2005).

One of the main sources of supports behind the adoption of CCTs in many countries is the strong interest in their impact evaluations. There is plenty of evidence of the effectiveness of these CCT programmes on a variety of intended and unintended dimensions, including nutrition and school attendance (Rawlings and Rubio 2005), test scores (Baez and Camacho 2011), grade repetition (de Oliveira and Soares 2013), income, savings, consumption and labour supply (Skoufias and Gonzalez-Cossio 2008), cognitive abilities (Ponce and Bedi 2010), fertility and gender issues (Soares and Silva 2010), agricultural outcomes (Todd, Winters, and Hertz 2010), intra-household allocation (del Carpio and Macours 2009), economic growth (Villa 2014; Barrientos and Scott 2008; Miller 2011) and poverty and inequality (Bourguignon, Ferreira, and Leite 2002; S. S. D. Soares et al. 2007). The effectiveness of CCTs and the dissemination of a significant number of evaluation reports have contributed to their adaptation in most of the countries in Latin America, Africa and Asia (Barrientos and Villa 2013).

The positive effects associated with the implementation of CCTs are linked to the targeted selection of beneficiaries that receive the transfers. The development of targeting tools has provided the practitioners with a set of selection tools aimed at boosting the implicit distribu-

tional objective of CCTs. The implementation of these targeting tools implies the design and collection of household surveys which are used to combine categorical criteria (gender or age groups) with proxy mean testing or single mean testing. The adoption of a targeting method depends on their ability to mitigate their inclusion and exclusion errors (Coady, Grosh, and Hoddinott 2004). Examples of such instruments are the *Ficha de Protección Social* in Chile (Herrera, Larranaga, and Telias 2010) or the *Cadastro Unico* in Brazil (de Oliveira and Soares 2013). Targeting tools have helped the CCTs identify the poorest households whom are often the most sensitive to the programmes' objective, centred on children's human capital formation.

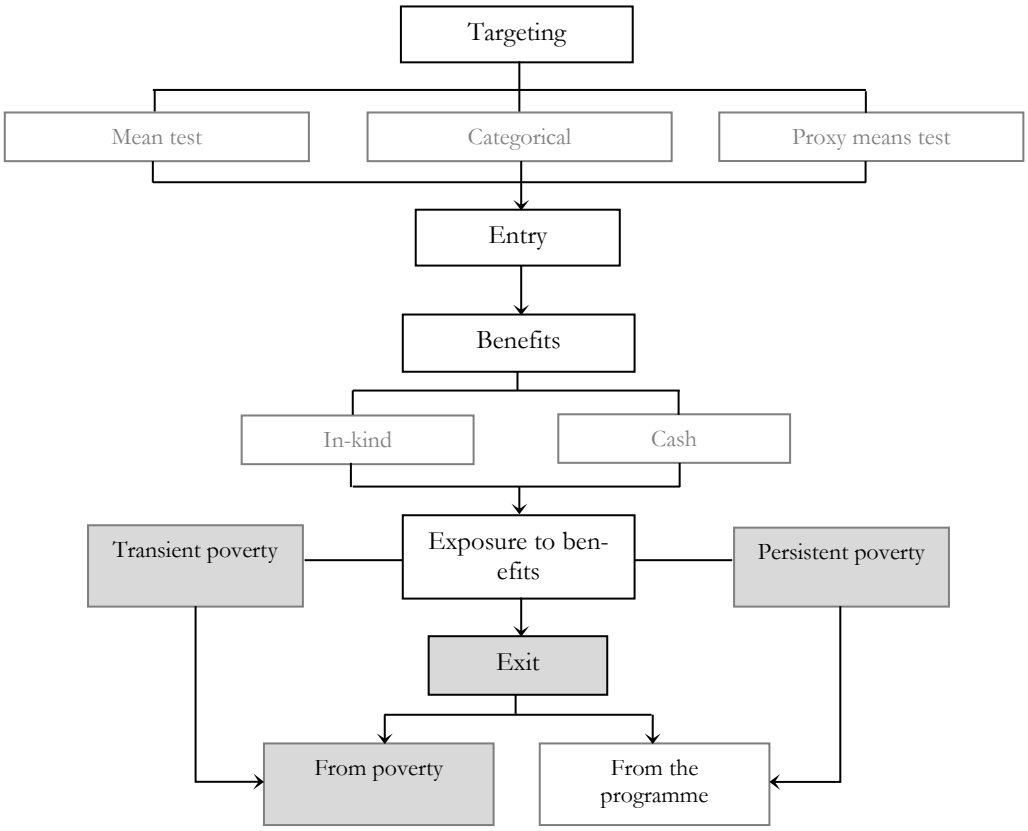
Targeting, as the main component of entry criteria, varies amongst programmes. Some of them like El Salvador's *Comunidades Solidarias* (former *Red Solidaria*) use geographic criteria with poverty maps to deliver transfers universally in the selected region. Despite Brazil's *Bolsa Familia* employs mean testing with limited sources of verification, there is a increasing number of programmes that implement proxy mean testing based on observable characteristics (Grosh and Baker 1995). Proxy mean tests are employed in CCTs in Chile, Colombia, Mexico, Dominican Republic and Honduras (Coady, Grosh, and Hoddinott 2004).[4] Despite the variations in these targeting tools, many evaluations have found high accuracy in the identification of the poorest households (Skoufias, Davis, and de la Vega 2001).

I-2. Relevance of this thesis

CCTs are a particular type of SAPs. Most of them share common characteristics. The design and implementation of SAPs have been supported by the identification of several operational features. Barrientos (2013a) defines the structure of a conventional SAP composed of several components that determine the programme participation of a single individual or household. Figure I-3 below shows the flow of these components, starting from targeting. In fact, targeting determines the entry to the intervention and facilitates the inclusion of individuals or households in poverty combined or complemented with categorical selection criteria. For instance, a SAP may select households with income below a food poverty line with members in old ages for a social pension intervention. The latter entails the identification of the household's income by a single income enquiry, means test, by a proxy means test which predicts the household's income based on observable characteristics. When enrolled, the household or the individual receives the benefits on a reliable and constant basis. In-kind transfers, cash income transfers or the combination of both are the traditional choices in the implementation of SAP.

[4] Given the fact that the proxy mean testing is, indeed, an approximation of deprived households, it may incur in inclusion and exclusion errors.

Figure I-3. Structure of a conventional SAP.



Source: Author.

The flow of programme participation entails the exposure of recipients to the benefits. The length of exposure is determined by the exit conditions of the programme. On one hand, programmes may set a maximum duration that could be tailored to the expected effect of the intervention. *Chile Solidario* was designed under the expectation that extreme poverty could be alleviated in a matter of two years with the benefits from the programme (MIDEPLAN 2009). On the other, the length of exposure may depend on the compliance of the targeting or eligibility criteria. If poverty is transient, the programme duration may depend on the specific poverty dynamics of the participating household (exit from poverty). If the participating household is identified as non-poor at some extent of exposure, then the benefits could be dropped under the premise of potential inclusion errors. If poverty is persistent, the programme duration depends on the compliance of the categorical eligibility criteria (exit from the programme). A SAP delivering a social pension would expect that the participating household leaves the intervention when the direct claimant passes away. Similarly, a SAP delivering a nutritional supplement to young children will expect that the household participates until its children become adults.

Table I.1 below shows a summary on how selected CCTs in Latin America implement the notion of exit from the programme and/or poverty. The information for each programme is

based on the review of its operating rules, issued as laws, decrees or bulletins in each particular case. The framework of analysis follows the Figure I.1, indicating the targeting criteria and the intended programme exit entailing whether the programme has a maximum length of exposure. Finally, the table includes the specific poverty exit strategy, involving the exit rule originated either by the eligibility dynamics of the household or by an explicit integrated strategy.

Table I.1. Targeting/selection and exit criteria in selected SAPs in Latin America

Country: programme	Targeting	Exit from the programme	Response to exit from poverty
Argentina: *Asignacion Universal por Hijo.*	· Means tested income below minimum wage. · Informal workers, unemployed or domestic service. · Households with children under 18 years of age.	Determined by youngest child.	Household becomes ineligible.
Brazil: *Bolsa Familia.*	· Means tested, income below poverty and extreme poverty lines. · Households with children under 18 years of age.	Determined by youngest child.	Household becomes ineligible.
Chile: *Ingreso Etico Familiar.*	· Proxy means test (*Ficha de Proteccion Social*) with assignment score. · Households with children and members in old ages.	Certain components, such as the "*Eje*," are limited to 24 months.	Time limit is completed or family becomes ineligible. Graduation is incentivised through an "exit transfer" when an adult member completes job training sessions.
Colombia: *Mas Familias en Accion.*	· Proxy means test (SISBEN) with assignment score. · Households with children under the age of 18.	Determined by youngest child.	Household becomes ineligible. Changes in the SISBEN algorithm may drive beneficiaries to graduation.
Costa Rica: *Avancemos.*	· Proxy means test (*Ficha de Informacion Social*) with assignment score. · Children and youths between 12 and 21 years of age.	Determined by youngest child.	Household becomes ineligible.
Dominican Republic: *Solidaridad.*	· Proxy means test (Siuben) with assignment score (ICV). · Households with children under 16 years of age.	Determined by age of youngest child for the education component. Not determined for the *Comer es Primero.*	Household becomes ineligible.
Ecuador: *Bono de Desarrollo Humano.*	· Proxy means test (Selben) with assignment score. · Households with children under 18 years of age.	After three years of participation	After completion of programme duration the household can receive other transfers.
El Salvador: *Comunidades Solidarias.*	· Geographic selection of municipalities employing a poverty map. · Individual selection of households with children under 18 years of age.	Determined by age of youngest child.	The programme includes income generation components but poverty graduation depends on poverty mapping.
Guatemala: *Mi Bono*	· Proxy means test with	Determined by age	Household becomes ineligible.

Country: programme	Targeting	Exit from the programme	Response to exit from poverty
Seguro.	assignment score. · Households with children under 18 years of age.	of youngest child.	
Jamaica: *Programme of Advancement Through Health and Education (PATH).*	· Proxy means test (Beneficiary Identification System) with assignment score. · Households with children under 18 years of age.	Determined by age of youngest child.	Non-poor households are able to participate for one additional year.
Mexico: *Oportunidades*	· Geographic criterion and proxy means test with assignment score. · Predicted income below the minimum welfare line (food poverty line). · Household with children or youths under the age of 22 years of age and/or women on fertile age.	Determined by age of youngest child.	Households with predicted income above the food poverty line are routed through a differentiated scheme. Households with predicted income above a second poverty line are graduated.
Peru: *Juntos.*	· Proxy means test (Sisfoh) with assignment score. · Households with children under 19 years of age.	Determined by age of youngest child.	Household becomes ineligible.

Source: Author with information from the operating rules for each programme.

Starting from the targeting criteria, only two of the selected programmes (namely, Argentina's *Asignacion Universal por Hijo* and Brasil's *Bolsa Familia*) included means tested components within their eligibility criteria. Despite El Salvador's *Comunidades Solidarias* employs a geographic selection criterion, the predominant socioeconomic classification is driven by the employment of proxy means tests with assignment welfare sore. In some cases, such as Colombia, Ecuador and Peru the proxy means tests are implemented by agencies different from the one in charge of the CCTs administration. Programme exit is mostly determined by the absence of the categorical selection criterion. The majority of CCTs in Latin America rely on the age of the youngest child in the household, which sets the maximum length of exposure to the intervention insofar as the household does not exit from poverty. Only Chile and Ecuador implement CCTs with a maximum duration explicitly detailed in the operation rules of *Ingreso Etico Familiar* and *Bono de Desarrollo Humano*, respectively. The Ecuadorian government has established a maximum duration of three years. After this period, the operation rules indicate that households may participate in other unspecified programmes. A recertification process in 2013 resulted in the programme graduation of 100 thousand beneficiaries to whom the government offered job training and micro-credit.[5]

[5] See news at Telegrafo (2014)

Exit from the selected CCTs are mostly dependent on the upward mobility of recipients as measured by means test and proxy means tests when poverty is transient. However, programme ineligibility due to changes in the socioeconomic conditions of participating households is also dependent on the frequency of the recertification process. Exit from poverty can occur as result of improvements in household's conditions or changes in the targeting tool. For instance, the operation rules of Colombia's *Familias en Accion* indicate that transfers must be stopped when a household becomes ineligible from changes in the *Sisben* algorithm. CCT administrators are able to detect changes in the welfare scores or predicted income only when new information is available. In this sense, a relevant exit from poverty strategy is followed by Mexico's *Oportunidades* in response to improvements in recipient's poverty status. After three years of participation the programme intends to update the survey that originated the eligibility of each household. If this recertification shows that the beneficiary is not eligible to continue, then the transfers are stopped. Paes-Sousa, Regalia, and Stampini (2013) found that more than one million beneficiaries participating in *Oportunidades* were recertified in 2011. Approximately 32 percent of them were identified not to be in poverty and dropped from the programme. The operation rules of *Oportunidades* also consider downwards mobility, allowing households returning to poverty to re-enrol in the programme. With the exception of Jamaica's PATH whose operation rules allow the participation of ineligible households for one additional year, the remaining CCTs abruptly stop the transfers when beneficiaries are found to be non-poor.[6]

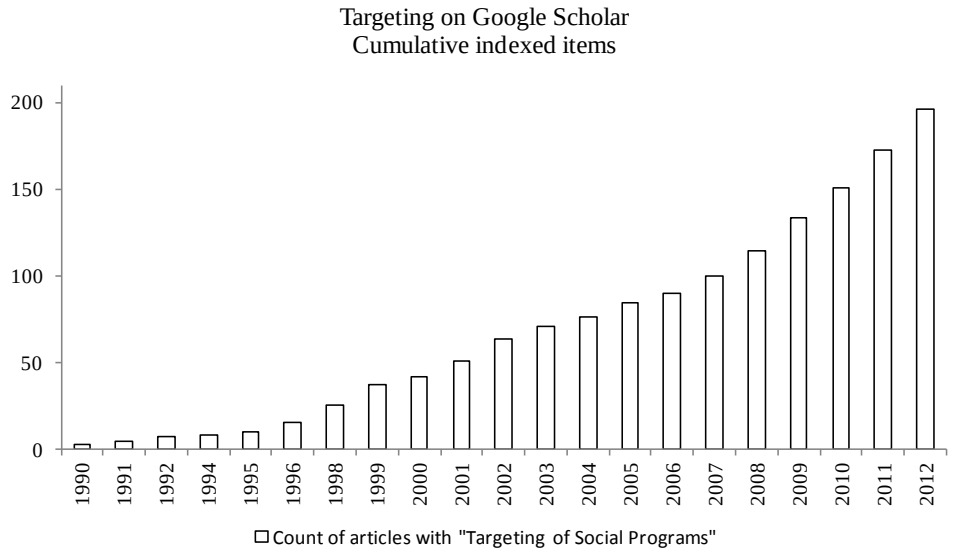
As it can be noticed CCTs designers have developed well defined entry criteria with outstanding effects. So far, however, there has been little discussion about how long should a beneficiary participate in SAP programmes. The study of the length of exposure has not evolved at the same pace as targeting methods. Most of the current programmes stop the transfer once participating households become ineligible according to the same selection criteria. Actual conditions could drive the beneficiaries to what Sen (1995) defines as the *incentive distortion*, in which the recipients change their behaviour in order to keep the eligibility criterion when they

[6] In contrast, exit form social assistance in some OECD countries has evolved in the form of welfare to work (WTW) and labour activation schemes while in developing countries exit approaches remain unclear. WTW strategies emerged from a combination of welfare benefits and activation programmes. Welfare benefits, mostly unconditional prior to WTW introduction, have taken the form of cash transfers whose amounts are dependent on age, gender of the worker and the number of children in the household. An example of such benefits is the former Food Stamps programme in the US, replaced by the Supplemental Nutrition Assistance Program (SNAP), and the Child Benefit in the UK (Ochel 2003). Activation programmes vary among countries and are traditionally composed of job search schemes (commonly known as work-first programmes) and short or medium term human capital formation. It has been understood that WTW can help households escape poverty and ease the fiscal pressure of welfare systems. Thus, the idea behind the combination of these two groups of programmes is that the best way to leave poverty is through work and, while low levels of labour participation drive individuals on welfare benefits to persist in poverty. Entry to social assistance is determined by poverty status, while exit is determined the labour placement of the beneficiaries.

anticipate the loss of the transfer.[7] Developing an appropriate length of exposure as the main component of the exit criteria could refine the design and implementation of SAPs.

The previous review of programmes in Latin America highlights the fact that, to date, very little attention has been paid to the exit conditions from SAPs. Most of the research on the features in the implementation of SAPs has been focused on the development of targeting methods, while programme exit has been an unexplored field of research. Figure I-4 below highlights the evolution of indexed working paper and journal articles on Google Scholar, which has been hand in hand with the introduction of SAPs in the developing world. In contrast, the surge of indexed items on exit from SAPs has evolved slowly, leaving behind a knowledge gap (see Figure I-5). Limited academic agreement on how SAPs must set exit condition rules has resulted from recent research on this field.

Figure I-4. Targeting on Google Scholar

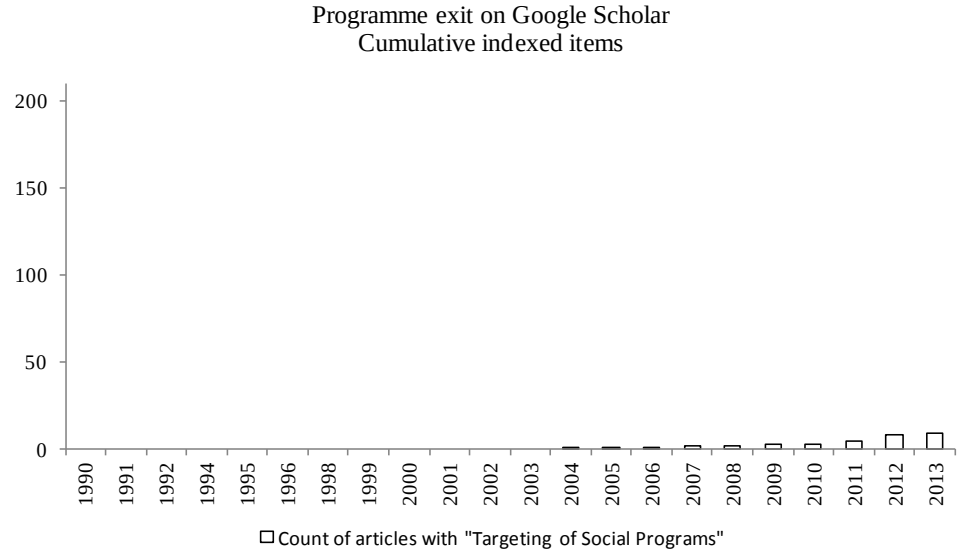


Source: scholar.google.com (visited: May 2013).
Note: search for words: targeting social programmes; targeting social transfers; targeting social safety nets; targeting social assistance; targeting social protection.

[*Continued on the next page*]

[7] Kanbur et al. (1994) provide a conceptual detail. Recent evidence of incentive distortion is provided by Firpo et al. (2013) in Brazil.

Figure I-5. Programme exit on Google Scholar



Source: scholar.google.com (visited: May 2013).
Note: search for words: exit, graduation social programmes; exit, graduation social transfers; exit, graduation social safety nets; exit, graduation social assistance; exit, graduation social protection.

The main aim of this thesis is to bridge the knowledge gap in the research of the exit conditions in the implementation of SAPs. The focus here is thus on the response that any SAP should take into consideration to determine the exit conditions of beneficiaries after certain length of exposure to the benefits. The central question asks how the exit from poverty and exit from the programme should be conceptualised and what kind of empirical evidence can be provided to support this idea.

I-3. Contribution to the knowledge

The contribution of this thesis to the knowledge is twofold. First, it looks into an unexplored field of research in the implementation of SAPs in developing countries, which consists of a conceptualisation and empirical analysis of the exit conditions of participating beneficiaries. Instead of proposing an intervention that will facilitate poverty alleviation, this first approach focuses on the conditions that any participating household or individual should meet in order to leave a SAP. In this sense, a first approach would indicate that participants should receive the benefits from a given SAP until the effectiveness of the intervention is exhausted. This contribution is aligned with the application of the medical trials method to the evidenced-based development (Banerjee, and Duflo 2011). Different from the assessment of a SAP considering treated and control groups, in this approach the treatment is addressed in terms of the length of exposure of current participants, in the sense that it is possible to identify to which extent its effectiveness can be trivial, negative or generate a side effect (i.e. low labour participation, higher poverty rates). To date, the effects of CCTs have been considered as constant over time as a one-off immunization from a permanent dose, the effects of the intervention could rather vary during the participation period. If SAP designers can learn if the impact of

the programme vanishes or achieves a steady state, the length of duration could allow the intervention to generate its potential effectiveness.

In the second approach, the original contribution to knowledge of this thesis is based on how programmes should respond when participating households or individuals are found not to be in poverty. Poverty can be persistent in some cases, but transient in others with relevant consequences to the antipoverty objective of the SAPs. Indeed, poverty dynamics have been confined to the study of chronic poverty and very few authors have focused on their implications for the implementation of antipoverty programmes (Baulch 2011). Exit from SAPs is only reliable when participants manifest low probabilities of becoming eligible in the future, as programmes may incur in prospective exclusion errors by stopping the transfers to those non-poor participants with welfare status just above the eligibility threshold. These conditions are irrespective to the type of transfer provided to households or individuals in poverty. CCTs are employed in the theoretical and empirical framework of this thesis. The general ideas and methods are applicable to any intervention aimed at alleviating poverty and vulnerability.

This thesis also provides empirical support to the proposed exit conditions of beneficiaries considering the implementation of *Familias en Accion*, a Colombian CCT and flagship SAP. Another contribution here is the employment of a rich dataset of about 32 million people, which is explored to generate evidence on how the two suggested approaches of exit conditions can be observed and applicable to any other SAP setting. These data are used by the programme in the pre-intervention stage to calculate the proxy means test score know as *Sisben*. *Sisben* collects 74 different variables denoting the living conditions of the household, including house materials and household's physical and human endowments. Pre-intervention data are merged with the one generated in a recertification process conducted in 2010, with an attrition rate of 18.6 percent. By employing these data, the empirical evidence is divided into an analysis of the effectiveness of the CCT over the length of exposure and the implications of poverty dynamics for the decision making on whether non-poor participants must leave the intervention or not.

I-4. Structure and methods of this thesis

The overall structure of the study takes the form of five chapters, including this introduction. Chapters II-IV develops the exhausted effectiveness principle while Chapter V develops the non-recurrence of poverty principle. The second chapter addresses the theoretical foundation of the concern of the length of exposure in the implementation of SAPs aimed at alleviating poverty in a long term setting. This theoretical approach is based on a two period model of the parental decision on child labour and schooling allocation of children with the intervention of a CCT. The effect of the CCT varies in the theoretical approach achieving zero or neg-

ative effect when the household is overexposed to the intervention. In particular, this chapter develops a theoretical approach based on the Baland and Robinson (2000) model of human capital investment and child labour decision-making. An expansion of the model answers the question on the relation between effectiveness and duration of a typical household participating in a CCT programme. The importance of the length of exposure in CCTs is addressed by considering that the impact is time-varying and by identifying when it becomes positive, zero, negative or reaches a steady state.[8] By comparing to the human capital levels with those in absence of the CCT, the transfer should be stopped if children are better-off without the transfer. This issue is theoretically addressed, referring to previous attempts that explain the static effects of CCTs are summarized as a basis of a dynamic approach.

The third and fourth chapters present evidence on the theoretical findings in Chapter II. Instead of testing the parental decision model, it generates empirical support to the proposed varying effectiveness setting under the implementation of *Familias en Accion*. The recent research on CCTs to date has tended to focus on whether these interventions accomplish their objectives or not, rather than understanding to which extent the length exposure can generate intended or unintended effects. For this reason, the aim of the third chapter is to evaluate the response of the outcomes of *Familias en Accion* to different lengths of exposure. By employing the non-experimental impact evaluation methodology known as *Generalised Propensity Score* (GPS) (Hirano and Imbens 2004; Imbens and Wooldridge 2009; Imbens 2000), this study will be able to provide evidence of reliable quantitative estimates from secondary data and administrative records. Different from the classic impact evaluation based on binary treatment settings, the GPS can estimate the intervention's effects considering the treatment or exposure as continuous. Thus, the assessment of the programme by considering the response of the intended or unintended outcomes to the length of exposure will contribute to the understanding of how the effectiveness varies.

The fifth chapter addresses the implications of poverty dynamics for the implementation of SAPs through the characterisation of the welfare trends in the context of programme participation. Empirical evidence of such characterisation is provided by studying the poverty transitions of the beneficiaries participating in *Familias en Accion*. Relevant to the eligibility dynamics, the existing literature highlights that households or individuals with previous participation or eligibility in SAPs are more likely to participate in the future (Andrén 2007). Among other factors, stopping the transfers when participants are ineligible can make households more likely to become eligible back again, which affects eligibility dynamics. Jenkins and Cappellari (2008)

[8] Steady state is referred to the constant average effect of the intervention that is achieved when it stops a varying pattern.

encompass these ideas referring to the "state dependence", indicating that current household's eligibility status may be dependent on previous eligibility experience. The discussion on graduation of SAPs should not be limited by the poverty or eligibility transition of current beneficiaries. The main idea behind the empirical analysis of this chapter is to look into the current ex-post eligibility of former ineligible and participants. The interest of this chapter is not in the detailed factors that drive households in and out of eligibility thresholds. Instead, as SAPs attempt to identify and deliver transfers to households in poverty, the focus here is the assessments of the likelihood that current ineligible beneficiaries become eligible. Programme graduation is then possible insofar as ineligible participating households show low probabilities of being eligible and are identified to be on an out-of-eligibility trend.

The data employed by Chapters IV and V were obtained from the administrative records of the programme. Starting from the targeting survey, known as *Sisben*, the estimations count on a baseline round that corresponds to the pre-programme socioeconomic conditions of beneficiary and non-beneficiary households. *Sisben* covers at least two thirds of the Colombian population, in particular households in the lowest income quintiles. The number of observations adds up to 32 million people in 7 million households. These data were collected over the period 2000-2010 as the programme was scaled up as a consequence of different rounds of registration. A change in the *Sisben* methodology in 2010 led to the availability of post-programme information on the socioeconomic conditions of beneficiaries and non-beneficiaries in *Familias en Accion*. The analysis exhausted effectiveness principle takes into consideration the data from the pre-programme and post-programme status, while the analysis of the non-recurrence of poverty restriction focuses on the rounds collected in 2006 and 2010. The tens of millions of individuals in this survey allows for the estimation of econometric models without the conventional concerns on sampling errors and power and significance of the estimations.

The final chapter draws upon the entire thesis, tying up the various theoretical and empirical strands in order to include a discussion of the implication of the findings to future research into this area.

CHAPTER II: THE ECONOMICS OF CHILD HUMAN CAPITAL FORMATION AND THE EFFECTIVENESS OF THE LENGTH OF EXPOSURE TO CONDITIONAL CASH TRANSFER PROGRAMMES

CCTs have led the innovation of SAPs in developing countries since the second half of the 1990's.[9] Impact evaluations in Latin America and some other countries have detected important causal effects of CCTs on human capital formation of children and poverty reduction of their households. The intended and observed enhancements in the health status and education attainment of minors are deemed to break the intergenerational transmission of poverty. After more than a decade of operation, CCTs as a subcategory of SAPs, have received substantial research on the development of targeting and selection methods. However, little progress has been made on an appropriate length of exposure to these interventions.

Designers of SAPs have developed targeting methods determining the beneficiary participation. Targeting methods establish how beneficiaries start their participation but not when participation ends. Indeed, how long should beneficiaries participate in such programmes is still an unexplored field. This chapter contributes to this discussion by conceptualising the effectiveness of the transfers to understand what shapes its variation over time. Considering the potential effectiveness of a CCT programme, this chapter employs a two-period child labour choice model that addresses the human capital accumulation given the participation in these interventions. The potential results of the model are compared to those in absence of the programme. The differences in both cases determine when transfers are no longer effective, leading to the definition of an appropriate length of exposure.

This chapter develops a theoretical approach based on the Baland and Robinson (2000) model of human capital investment and child labour. An expansion of the model answers the question on the relation between the effectiveness and the length of exposure of a typical household participating in a CCT programme. The relevance of the length of exposure to CCTs is addressed considering that the impact is time-varying and identifying when it becomes positive, zero, negative or reaches a steady (or constant) state.[10] Comparing to the human capital levels with those in absence of the CCT, the transfer should be stopped if children are better-off without the transfer. This issue is theoretically addressed, referring to previous attempts that explain the static effects of CCTs that are summarized as a basis of a dynamic approach.

[9] Recall that SAPs are defined as those anti-poverty transfer initiatives that include supporting households to manage the social risk (Barrientos, 2013; Barrientos and Hulme 2008) and vulnerability to idiosyncratic and covariant shocks (Alwang, Siegel, and Jorgensen 2001).

[10] Steady state is referred to the constant average effect of the intervention that is achieved when it stops a varying pattern.

This chapter is organised as follows: in the next section the dynamic effects in general SAPs are explained and related to the exit conditions from the intervention. The third section summarises previous static models that explains the effects of the particular case of CCTs, namely, Skoufias (2005) and (Ravallion and Wodon 2000). In the fourth section the two-period model is developed based on Baland and Robinson (2000) with a CCT component embedded in the time allocation of a typical child. The last section addresses the concluding remarks.

II-1. Varying effectiveness and length of exposure

Any SAP should identify under which conditions it is not convenient to hold the recipients for an undetermined duration (Behrman and King 2008). SAPs are interventions that depend on administrative and time-dependent characteristics that may not be effective or even cause negative effects after certain length of exposure (Lindbeck 1995; Garrett and Ruel 2003; Forde et al. 2011). If the intended effectiveness of a SAP is dynamic in relation with its objectives or negligible the design of the intervention should consider when the desired levels of the outcomes are similar to those in absence of the programme.[11] On one hand, the intervention must allow a minimum length of duration that leads its effect to reach its potential level and, on the other, stop the transfers when the impact is not large enough to justify its implementation.

It was shown in the introduction that none of the CCTs that consider a length of duration provide clear justification for establishing such periods. Indeed, it seems that actual lengths of duration reflect the financial or funding constraints rather than the expectation in the achievement of desired outcome in the medium or long run. CCTs and general SAPs could harmonise their objectives according to the selection criteria and to the proposed length of duration.

II-1.1. Duration and type of programmes

SAPs can be divided into three categories according to their length of exposure considering the approach by Rogers and Macías (2004). The first group sets a time limit that is generally determined by the programme funding cycle. The second category is composed of those programmes that set an achievement of specific targets (e.g. complete certain degree of education or gain a given nutrition status). This is also common when programmes stop the transfers due to the natural cycle of the beneficiaries, such as the age of minors or the elderly receiving non-contributory pension schemes. The third category encompasses programmes that target

[11] Given the fact that CCTs are not a permanent effect generators, such as a one-off immunisation programme, if beneficiaries participate across different length of durations, it is sensible to think that the desired outcome may vary over time (Behrman and King 2008).

the achievement of a benchmark that ideally will drive the households to a desired situation (e.g. out of poverty).

The first and second categories are linked by the fact that some SAPs combine the dual objective of increasing the demand of goods and services that are deemed to be part of the human capital investment. They consider long term effects once children become adults and participate actively in the labour markets.[12] These categories of programmes are also associated with CCTs, in the sense that they focus on children whose benefits are stopped once they graduate from school or become adults. For example, El Salvador's *Red Solidaria* programme makes an agreement with the households who is provided with a CCT for three years, which is the average proposed period of duration in most Latin American cash transfers (Britto 2007).[13] According to Cohen and Franco (2006), *Juntos* in Peru provides transfers for a period of four years and an additional phase down period.

Mexico's *Oportunidades* suggests a graduation stage that entails the evaluation of the household after three years in the programme. According to a guideline of the Mexican Secretary of Social Development (SEDESOL 2005) when the participation in this CCT completes three years, each household is assessed to determine whether its poverty condition makes them still eligible for the programme. If the household remains eligible, the programme would keep receiving the full package of transfer until the child completes the proposed cycle of education or becomes adult. Otherwise, the household would be transferred to a differential transfer scheme with a length of four and six years in urban and rural areas, respectively.

An example of the third category of programmes that target the achievement of a benchmark target is the *'Puente'* component of *Chile Solidario* (replaced by *Ingreso Etico Familiar)*. Despite its operation was constrained by a time limit, it would provide a CCT for two years with a descending disbursement plan for six months. During this first period each household would be tracked by a social worker that advices the household to achieve a minimum living condition or benchmark. Subsequently, the household receives a graduation bonus for three years, period after which children and the elderly keep the transfers permanently (MIDEPLAN 2007).

The *'Puente'* component of *Chile Solidario* has inspired the design of similar interventions like *Tekoporá* in Paraguay, which targets a benchmark with exit doors and defined time limits. The intended effect is that households meet certain living standards that keep them apart from possible negative impacts or reliance on the benefits (Soares and Britto 2007). In summary, benchmarked SAPs incorporate time restricted achievements but they do not specify the rea-

[12] For a wider discussion about CCTs and other SAP alternatives see Hanlon, Hulme, and Barrientos (2010).
[13] Britto (2007) also concludes that a three-year period is a common threshold but the empirical or theoretical support remains unclear.

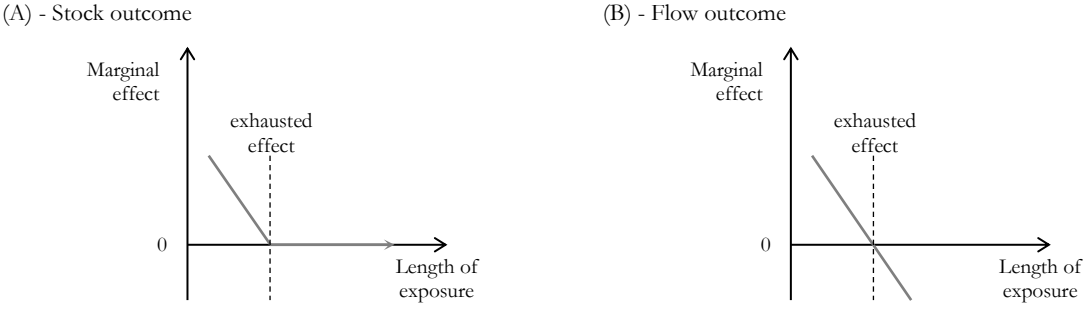
sons why a given stage of the programme has certain length of duration or how to proceed in the case that the expected effect is not accomplished.

II-1.2. Effects and length of exposure

Consider the analogy of the effectiveness and length of exposure to SAPs with the treatment of a given medical condition.[14] A patient would be given a medicine for the period of time that it has proven to relieve the treated disease. If the treatment is given to the patient for shorter, it would not achieve its potential effect. Similarly, if the treatment is given for longer, it would not cause further relief or may even lead the patient to manifest an overdose with negative effects. If in this case the poverty status is considered as the medical condition, the optimal length of exposure to an anti-poverty SAP is the one that allows the achievement of its potential healing capacity.

When comparing treatment and control groups, the view of the effectiveness in a length of exposure setting is dependent on whether the results are referred to stock or flow outcomes. In this sense, the effectiveness of stock outcomes over time is analysed in terms of non-negative marginal effect of the programme. The key assumption in the continuous length of exposure is that the marginal effect on stock outcomes is exhausted when it becomes zero (see panel (A) in Figure II-1). For instance, a programme aimed at increasing the number of years of education exhausts its effect when no additional units of education can be accumulated in response to an increase of one unit of length of exposure.

Figure II-1. Marginal effects for stock and flow outcomes.



Source: Author.

Similarly, the effectiveness of flow outcomes over time is analysed also in terms of marginal continuous effects, regardless they are positive or negative. For instance, a concave average continuous effectiveness on school registration or school attendance can be positive but marginally zero when it reaches its maximum. For some reason, after a longer participation spell the programme can lead children to drop out from school, generating a negative average con-

[14] The relevance of this comparison emerges from the fact that most of the terminology in the impact evaluation field is borrowed from medical trials, such as randomization, treatment, control, placebo, dose and overdose. Narayan-Parker, Pritchett, and Kapoor (2009) make a similar comparison between poverty and illness.

tinuous effect. The exhaustion of a marginal continuous effect is then relevant when it becomes zero and just before it turns negative (see panel (B) in Figure II-1). In sum, the difference in the analysis of stock and flow outcomes is that negative marginal continuous effects are feasible only in the case of flow outcomes. In both cases the effectiveness is exhausted when it achieves zero levels.

King and Behrman (2008) analytically address the length of exposure of social programmes and how this affects their average or marginal effectiveness. They place special emphasis on the dynamic effect of the transfers that so far has been deemed as constant in most of the impact evaluations. It is considered that these interventions are different from a one-off permanent treatment like a vaccination that immunise someone for the rest of her or his life. The latter is because the underlying marginal or average continuous effect may vary according to the length of duration. The marginal or average impact of the programme may obey to a dynamic cycle, which can be increasing or decreasing over time. King and Behrman introduce the notion of the steady state of the dynamic effectiveness, highlighting the identification of when it is appropriate to introduce a new stage in SAPs or even stop them. This is done by identifying when the intervention reaches its potential effect or becomes ineffective.[15]

An evidence of the varying effectiveness of CCTs is provided by Gertler (2004), who estimates the impact of *Oportunidades* in Mexico with a specification that allows him to obtain the effect of the programme considering its duration at the village level. The analysis relies on the initial random assignment of the programme among 505 municipalities. The estimations are focused on a discrete length of exposure of young children to the programme by specifying binary variables from six months of participation until two years. The results showed that, when the evaluation is done assuming the treatment as dichotomous with constant effect, the probability of illness declines 22.3 percent. However, when the discrete length of exposure is introduced, the results showed that the longer the child stays participating in the programme, the higher the impact on the probability of illness. Explicitly, the programme caused an increasing effect from the sixth months of exposure, reaching a maximum of 39.5 percent less probability of being ill after 24 months of participation.

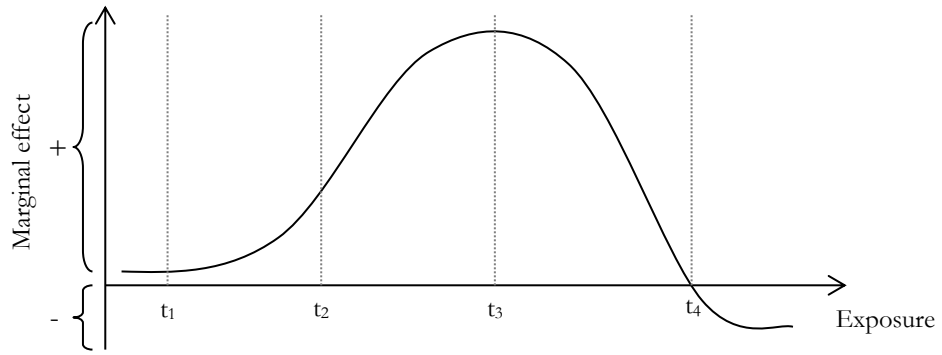
Similarly, Freije and Rodríguez-Oreggia (2012) made a contribution in this matter by estimating the short, medium and long term effects of *Oportunidades* on labour market outcomes, including earnings and work category of the youths from beneficiary households. They belong to the cohort of the programme who had benefitted from the CCT in the past and, consequently, were already occupationally active. They defined the length of exposure by a discrete

[15] Despite the fact that the approach of King and Behrman (2008) is mostly related to the perfect timing to carry out an impact evaluation, the steady state notion is essential in determining the duration of the programme.

duration by considering short run a length of duration less than three years, medium run as three up to six years and long run as more than six years. The empirical findings obtained by Freije and Rodríguez-Oreggia (2012) were revealing. The effects of the short and medium length of exposure on earnings turned out to be negative for youths that had attained the primary school. Youths with a long duration in the programme earn 11.2 percent higher wages than those in the control group. Similarly, none of the dosage seemed to cause important effects on the probability of working or on obtaining a better work category than their parents. Therefore, if the programme establishes a length of participation in a short or medium term, it may accomplish its human capital objective but will not contribute in breaking the intergenerational transmission of poverty. They conclude that the CCT will not contribute to the reduction of poverty of the next generation but would improve its poverty gap.

Figure II-2 from Behrman and King (2008) is modified and presented below to provide a better understanding of this point. The marginal effect of an intervention on a desired outcome might be either positive or negative. For instance, if three years of a CCT are obtained at period t_1 or t_2 in Figure II.2, the average effect on human capital would not be reached the maximum level that is attained in period t_3. However, after period t_3 the programme still cause a positive marginal impact up to period t_4 where it exhaust is average effect (becomes zero) and negative afterwards (the overdose).[16] In the last period the marginal or average effect achieves a steady state where it remains constant on the same negative level.

Figure II-2. Timing and marginal or average continuous effects of the programme.



Source: Author, based on Behrman and King (2008, 56)

Identifying the optimum dosage of a SAP in terms of its marginal continuous effects and length of exposure has low but significant theoretical and empirical evidence in the impact evaluation literature. For a similar SAP in Bolivia, Behrman, Cheng, and Todd (2004) present a model that explains the average effect of a public nursery programme given the length of exposure of beneficiary children. A mother maximizes her utility which depends on consump-

[16] The effect of the programme is relevant as well for its formulation. The cost-benefit analysis entails the impact of the intervention as a key component of the actuarial exercises. See for example Maluccio and Caldés (2004) for further detail about the application in CCTs.

tion level at the household level, her leisure and the quality of her child. At the same time, the quality of her child is a function of the time she allocates to him or her, the child's consumption and whether s/he attends a child care centre. The model's framework transcends from static into dynamic when all the variables are allowed to interact over several periods. Especially, the effect of the participation in the programme on child quality is expressed in terms of the time the mother sends her child to the public nursery. In spite of the fact that the theoretical analysis includes the effects on current and future child quality, it does not specify endogenously whether the effect if decaying or increasing over time. However, it is clear that current levels of child quality will affect future quality levels.

The empirical approach in Behrman, Cheng, and Todd (2004) is more explicit in terms of the design of time limits or exit conditions of participating recipients from a SAP. They plot the estimates as a dose-response function where the effect of the programme on a stock outcome variable responds to the length of exposure. For example, the marginal effect on the height-for-age of participating children reached its maximum level after 10 months and is exhausted by becoming zero after 35 months. Therefore, if the objective of the public nursery was to improve this indicator, an additional duration-dose will not yield any effect and it may be the moment to stop the programme or move towards an additional stage of intervention.

II-1.3. Sources of effectiveness variation

Behrman and King (2008) explain why the effectiveness of a programme may vary over time and stand out several reasons regarding implementation factors. From the supply side, they identify the implementation lags due the administrative learning in the initial stages of the intervention. Specifically, they point out that: *"For example, a program requiring material inputs relies on punctuality in the arrival of these inputs, such that the timing of the procurement of the inputs by a central program office is not necessarily an accurate indicator of the moment when these inputs arrive at their intended destinations"* (Behrman and King 2008: 149). The decentralisation of the administrative agency may also contribute to these lags, since a programme could take several months to reach its complete operational rhythm nationwide as a whole. Additionally, the administrative learning-by-doing of the operation and information campaigns encouraging the use of the services provided by the programme until it obtains the desired operational maturity.[17] Thus, the administrative characteristics of the programme are the first source of variation in the average effects.

[17] Another important issue in this matter emerges when the programmes are designed to deliver its benefits with a decaying pattern over time, such as the *Chile Solidario* programme which is proposed to give a cash transfer with a lower frequency throughout the two initial years of participation

From the demand side, Behrman and King (2008) highlight the time-dependency of the effects as a process that entails the reliance of the beneficiaries on the transfers as they are continuously available over time. The real implementation characteristics of a CCT are known once a recipient is enrolled and obtains enough information on how the programme is implemented. Indeed, *"The speed of the learning process may depend on many factors, including information campaigns to persuade potential beneficiaries to use the program and the extent to which the program requires active decisions by beneficiaries before there may be any impact"* (Behrman and King 2008: 154). In a CCT setting, the decisions that are made by the recipients are essential for their implementation, including the compliance of the co-responsibilities by sending their children to health and education centres. The allocation of time and resources within the household play an important role. Additionally, since CCTs are restricted transfers, the households may learn how to cheat the transfer cycle and modify the expected average effect on children.

The characteristics of the households have an essential role in the marginal and average effects of the programme over time. Examples of these characteristics are its member composition, children's gender, stage of the natural life course in which it is enrolled, etc. In fact, the targeted age group of the recipients may cause a duration-based sensitiveness of the effects. For example, children will respond differently to a nutrition programme if the same food supplement is given at age 2 or at age 6, in the sense that *"Moreover, because a significant portion of a child's physical and cognitive development occurs at this young age, the returns to improvements in the living or learning conditions of the child may be particularly high, and such programs, therefore, have the potential for a noticeable impact when the child is young*" (Behrman and King 2008: 155). Therefore, the heterogeneity of beneficiaries can lead to a time varying average effect.

Similarly, some interventions experience a clear duration-dependency of their effects even if they are fully operating without administrative delays. The programmes aimed at increasing the human capital of children may require some time before the full effect is manifested. For example, *"A World Bank (2005) study has concluded that it took over three decades of continued support before the health sector in Bangladesh obtained clear, positive improvements in the country's maternal and child health outcomes, while such results were not clearly discernible after the first decade of assistance*" (Behrman and King 2008: 156). Even if the programme is fully operating, its design itself may cause delays in the achievement of its potential effect.

CCTs have demonstrated the generation a positive effect on human capital outcomes in the short and medium term.[18] Nonetheless, their intrinsic objective of having better educated and healthy children has not been widely evaluated, particularly for the length of exposure analysis.

[18] See Rawlings and Rubio (2003) or Chronic Poverty Research Centre (2010).

II-2. Review of the economics of CCTs and human capital investment

A group of theoretical models addresses the efficient allocation of resources within households participating in CCT programmes. They also stand out the resulting substitution and income effects of the transfer on the decision of the parents. Barrientos (2012) details how different models address cash transfers interventions according to the effects of these programmes on household welfare. Some of them allow the targeted population to tackle poverty traps, such as credit constraints, nutrition, work capacity and lack of production assets or liquidity constraints in human capital investment. Other models focus their analysis on how poor households response to an income transfers and how the characteristics of the programme interact with their decision making. The theoretical approaches allow researchers to analyse the possible effects of CCTs and explain the mediating factors that relate them to the final outcomes.

Skoufias (2005) offers a static partial equilibrium model of child human capital investment with the interaction of the co-responsibilities from a CCT where parents choose the time allocation of their children. He collapses in one period the decisions that the household makes early in life with its consequent outcome when children become adults. It is supposed that human capital is produced by a technology that requires time and other goods. The production function of human capital depends on the time allocation of children and parents, purchased goods (books and medical care), child characteristics and biological factors. Skoufia's model allows a better understanding of the household behaviour when the government gets involved in it by establishing a CCT intervention.

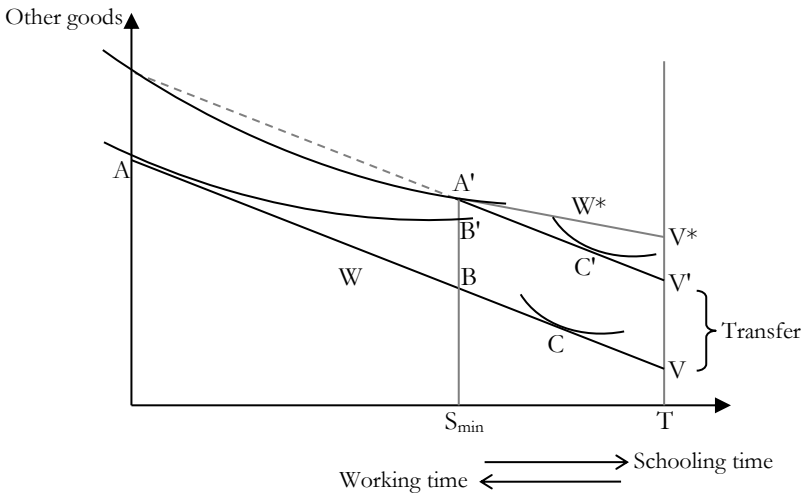
The model considers that the income of the child is a function of their abilities and the human capital production function. This income is also part of the utility function of their parents who decide whether each child works or not. In fact, parents allow the contribution of children to the income of the household when they are not engaged in activities of human capital formation. When they become adults, children altruistically support their parents with direct transfers. The solution to the problem of the model is explicit when parents select the children's time allocated to the human capital formation that matches its marginal cost.[19] Both, the income provided to the household and the production of human capital define the trade-off of the model.

[19] Indeed, Eswaran et al. (1996) analyse the assumption of altruism in children when they are altruistic toward their parents and adults make fertility decisions. If child labour is legal or culturally acceptable and child mortality rates are high, risk-adverse parents face a trade-off between education and child labour and decide how many children to have in order to ensure a secure old age. Parents decide to have low educated children in order to guarantee the breeding of the rest.

Skoufias (2005) allows the intervention of a CCT by the interaction of the parental decision on the human capital formation of their children combined with the compliment of the co-responsibilities. He includes the restriction on the cash transfers with the aim of boosting the investment in human capital. The marginal cost of the investment in human capital increases as parents comply with the conditions of the programme. Specifically:

> "Participation in and compliance with the conditions of PROGRESA (Oportunidades) are likely to result in changes in the shadow price or marginal cost of investment in human capital. For example, consider a household with a child enrolled in school and with an attendance rate less than the 85 percent rate required by PROGRESA. Assuming full compliance with the requirements of the program, the changes in the amount of time the child and the mother devote to schooling, and in the amount of the school supplies X (such as textbooks, pencils, and paper) made available by the program are likely to change the marginal costs or shadow prices of the household" (Skoufias 2005: 17).

Figure II-3. Decision choice between schooling and work.



Source: Skoufias (2005, 99).

Figure II-3 above summarizes the analysis by introducing a CCT and the decision making when the child already attends school and when she is totally engaged in paid labour. Skoufias employs a similar setting as Becker (1965) to show that the total time of the child can be divided into income-generating working time and schooling time, which add to T hours. The initial budget constraint AV represents the relative prices between the real prices of other goods and the wage of the child. V is the non-labour income, to which the cash transfer contributes. Thus, in the first case the child attends school for most of her time at point C in Figure II-3. The introduction of the CCT with a transfer value of $V' - V$ for current school at-

tendees would cause a pure income effect that slightly increases the schooling time, moving from point C to point C'.

Another case is that of a child whose time is completely devoted to working activities, placed in point A. Since the programme requires a minimum dedication of time to schooling (S_{min}), the minimum transfer that makes the parent indifferent between child's work or study is determined by the difference $B' - B$. Nevertheless, with the actual CCT the child moves to point A', where her welfare is lower than the one achievable with a unrestricted transfer over the hypothetical dashed new budget line. Hence, the cash transfer generates a pure income effect that increases the school enrolment, while the minimum attendance requirement causes a price effect led by the decrease of the shadow wage represented by W^* ($< W$). This wage denotes at the same time a lower price of schooling. The total income increase is then the amount of the transfer $V' - V$ in addition to the extra income resulting from the lower price of schooling. Hence, "*The discontinuity of the budget constraint of the household, in combination with the assumption of utility maximization, implies that there is a minimum conditional cash transfer that will induce the household to send its child to school*" (Skoufias 2005: 19).

In a similar analysis, Ravallion and Wodon (2000) address the substitution and income effects of a restricted transfer in the parental decision making. This analysis is helpful for assessing the extent that schooling is displaced by chid labour, inspired by the Bangladesh's Food for Education Programme. They introduce the leisure time of the children related to domestic labour at home (H) as a third element in addition to child labour (L) that pays a wage, w, and schooling (S) for which the household receives a transfer of b that reflects the monetary value of the Food for Education Programme. They assume that the utility of the parents (U) is determined by current consumption (C), school attendance of their children (S), child leisure (H) and geographic variables (Z) that determine their income, $Y(Z)$. The utility function, $U = U(C, S, H;\ Z)$, is maximized subject to the time restriction of the children, $S + H + L = T$, and the budget constraint given by $C = wL + bS + Y(Z)$.[20]

The Slutsky equation derived from the solution of this problem, given a change in the benefits from the programme is presented as follows:

$$\frac{\partial L}{\partial b} = \frac{\partial S^*}{\partial (w-b)} + \frac{\partial H^*}{\partial (w-b)} - S\frac{\partial (H+S)}{\partial [wT+Y(Z)]} \qquad \text{(II.1)}$$

The first and third terms on the right have a negative sign, manifesting a decrease of child labour by increasing the transfer. The second term would be positive if schooling and leisure are

[20] Substituting the time restriction into the budget constraint: *C + (w-b)S + wH = wT + Y(Z)*

substitutes and negative if they are complements. Specifically, the total effect is equal to the income effect. Hence, the substitution effect helped to protect current incomes from the subsequent higher school attendance induced by the transfer. The authors conclude that:

> "...it is unclear on theoretical grounds whether a reduction in the price of schooling generated by a higher stipend will reduce child labour; the extra time spent at school may well come out of children's leisure. And, by the same token, if the substitution effects between schooling and leisure are strong enough, child labour will not come at much cost to longer-term prospects of children escaping poverty." (Ravallion and Wodon 2000: 165).

If the transfer were unrestricted like unconditioned cash or a complete resalable in-kind subsidy, then *"The programme may still be likely to reduce child labour, but only via the income effect, assuming that children's leisure is a normal good for parents. However, since the programme exists as a response to low school attendance amongst the poor, we will not assume that the constraint on maximum school attendance is binding."* (Ravallion and Wodon 2000: 163).

Finally, another group of partial equilibrium models have been developed for justifying the paternalistic and interdependent preferences in social protection programming, rather than a human capital accumulation problem. An emblematic model is presented by Besley and Coate (1991), in which the conditionality of a cash transfer is justified by the fact that the utility function of the tax-payers depends on their own preferred goods and those consumed by the poor (in the form of restricted transfers) (Fiszbein and Schady 2009).[21] Das, Do, and Ozler (2004) criticize this kind of models since they appeal to the efficiency loss arising from the overprovision of restricted transfers. The reason is that the poor obtain more than they would have consumed in absence of the restriction on the goods and services provided by the programme. These models are based on competitive markets and on the fact that the decisions made by individuals are optimal for the economy. They address how CCTs can instead improve the market imperfections that may hinder the child human capital decisions made by parents.[22] The interdependent preference approach may be helpful for addressing general equilibrium effects but barely specifies how children's resources are allocated within the household. Despite these models are useful to understand the pertinence of CCTs with a micro-founded justification, they are unable to address particularly the poverty traps faced by poor households that deter children's human capital accumulation.

[21] This point of view is focused on the deadweight loss of restricted transfers by the overprovision of goods to the poor (Currie and Gahvari 2008).

[22] For example, they cite a perception research of a insecticide-treated bed nets programme in Kenya aimed at combating malaria by Alaii et al. (2003). Despite malaria was devastating entire communities, when recipients were asked what they would purchase if they were given the money worth a bed-net, food and clothing were strongly prioritized.

II-3. Dynamic alternatives and the Baland and Robinson (2000) model with CCTs

Despite they have made a significant contribution to the understanding of CCTs considering the decision making as a static process, the previous models have failed to incorporate a dynamic framework in their analysis. Several dynamic and representative models can be used as input in the characterisation of CCTs along multiple periods from a similar emphasis on poverty-traps. For example, Basu and Van (1998) present a child labour model based on the idea that parents send their children to work if the household consumption drops below a subsistence threshold. Child and adult labour are supplied according to whether the consumption levels and given the labour demand from by firms. Likewise, Behrman, Cheng, and Todd (2004) develop a dynamic model of human capital investment in early childhood in the short run, by allowing mothers to choose the quality of their children's human capital depending on the time she spends on their care and the participation in a preschool programme (a restricted transfer). The scope of the Behrman, Cheng, and Todd (2004) model is limited by the focus of the assumptions on children in the early childhood that may not be realistic when they devote their time to school attendance or work. Todd and Wolpin (2009) employ a dynamic discrete choice model to predict the short and long term outcomes of a CCT intervention that includes the allocation of child time between schooling and paid work in an initial period. They conclude that public policy based on restricted cash transfers increases school attendance. The specification based on discrete choice justifies an econometric analysis of ex-ante evaluation rather than study the insights of the human capital investment.[23]

On the other hand, Moav (2002) addresses the human capital accumulation of children. He develops a model based on an overlapping generation framework that does not entail the trade-off between schooling and child labour. Instead, the model shows an income poverty trap when parents are unable to bequeath or support their children. This low income steady state can be overcome when the returns to the education are sufficiently high. In this case, the income generation of households has a strong dependency on the technology of the firms. In a similar overlapping generation model, Emerson and Souza (2003) study how the education of parents affects investment in child human capital. Essentially, they suppose that "*the child labor decision is made by the head of the household and that parents decide to send their child to work only if by doing so the child's contribution to the present consumption of the family outweighs the future consumption benefit the family would enjoy from keeping the child in school*" (Emerson and Souza 2003: 376). In this model the parents maximise a utility function that depends on the consumption in the first period obtained from adult and child labour. Consumption is also generated by the human

[23] A similar econometric approach is made by de Janvry, Finan, and Sadoulet (2004) with a human capital investment model by Hyslop (1999) which is tested using the impact evaluation data from Mexico's *Progresa/Oportunidades*.

capital of the child in the second period whose input consists of the time devoted to school attendance in the first period. With the solution of the optimisation problem, they obtain two steady states and one unstable (or saddle) point of human capital accumulation. In a graphical representation the first steady state indicates a low human capital level (a low education trap) that must be overcome until a higher but unstable saddle point. On the saddle point, a slight change would either re-establish the initial poverty trap or achieve the highest level of human capital accumulation. In other words, child labour must be considerably low in the first period to guarantee that the next generations attain a higher and sustainable education level.

II-3.1. The Balan and Robinson (2000) model[24]

Previous work on the role of CCTs in facilitating human capital investment has relied on the static models reviewed in the previous section. Static models of human capital investment are very helpful in examining the linkages existing between programme design and short run programme objectives, including school attendance and utilization of health care interventions. However, static models fail to provide a framework to understand longer marginal continuous effects of CCTs whose future results may affect current decision making.[25] In particular, dynamic models of household human investment are required to understand and assess the optimal length of exposure to CCTs as well as their long term effects on human capital and future income.

In this section, the Baland and Robinson (2000) (BR henceforth) dynamic model of household investment in children's human capital is adapted and expanded. The BR model focuses on the parental decision on the allocation of children's time to work and schooling in a context in which parents face liquidity constraints and capital markets are imperfect. Liquidity constraints imply that households in poverty are severely restricted in their capacity to save or bequeath. The imperfections of the capital markets prevent poor households from buffering the reduction in the consumption levels due to the investment in child human capital. Poverty and imperfect capital markets force altruistic parents to choose inefficient high levels of child labour. A CCT intervention may modify this choice and lead the households to cope with these constraints considering that its effect is not constant over time. Adapting the BR model to include the features of CCTs provides a dynamic framework to examine the length of exposure and the associated longer term effects.

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[24] Some notation has been changed from the original article.

[25] There are some other suitable inter-temporary decision making models based on the overlapping generation model, such as Emerson and Souza (2003) and Moav (2002). However, they address the poverty traps that emerge from the low investment in human capital with stronger assumptions about the mediating altruism in the relation between parents and children. Similarly, the resulting steady states and saddle points of human capital that may not be realistic in the medium run, when parents still interact with their children once the allocated education is completed.

The BR model starts with the decision making of parents on the allocation of the time of their children. The time of the children in a first period is divided between work and schooling activities that deter and generate human capital, respectively. The model is based on the idea that the consumption level of the household can decrease if the children do not work but study. If parents are not poor, savings and bequests are used to internalize the impact of the investment in human capital of their children on current and future consumption. If child labour is culturally accepted and there is no enforceable ban on it, poor parents will force their children to work.[26] Specifically, BR explain how poor parents would underinvest in the human capital of children in presence of imperfect capital markets and no bequeathing capacity.[27]

Altruism and the initial wealth endowment of the household are exogenous to the model. Here, the only case considered is that in which parents are altruistic toward their children but not vice versa. The degree in which parents are altruistic towards their children combined with the initial wealth endowment will exogenously determine child labour. The more altruistic and wealthier the parents, the lower the child labour levels that result.[28]

The BR model is emphatic on the welfare loss that lead to high levels of child labour when parents are poor and unable to either save or bequeath. They consider that the future earnings of current children are compromised by actual decisions of parents on their human capital investment. They assert that:

> "Central to our analysis is the impact of labor on a child's future earning ability as an adult. Child labor is socially inefficient when it has a sufficiently adverse effect on such ability, but it may nevertheless persist either when parents leave their children no bequests or when capital markets are imperfect" (Baland and Robinson 2000: 664).

Hence, the inefficiency of the model will always lead to high levels of child labour and low levels of human capital accumulation.

The inter-temporary decision is made by parents in two discrete periods, $t = I, II$, over a co-existing life with their children. In the first one, $t = I$, parents have one child whose available time is allocated to child labour in the form of a fraction of the first period, $l_c \in [0,1]$. The time that the child does not spend at work, $1 - l_c$, is instantaneously transformed into human

[26] Ranjan (1999) discusses how poverty in combination with credit constraints and no bequest causes child labour. Similarly, Basu and Van (1998) argue that non-working children from poor households are a luxury good and that once their income rises above a certain subsistence threshold, parents withdraw children from the labour market.

[27] Savings and bequests are parameters of the utility function of the parents. Bequests are differentiated from inheritance or gifts because they can be allocated according the utility maximization problem according to the parents' will. See Nordblom and Ohlsson (2011) for a further detail on bequests, inheritances and *inter vivos* gifts.

[28] Ranjan (1999) discusses how poverty, credit constraints and no bequests cause child labour.

capital by the function $h(1-l_c)$ which is continuously differentiable, strictly increasing and strictly concave.[29] If children work full time in the first period, $l_c = 1$, they will still have one unit of human capital, such that $h(0) = 1$.[30] On the other hand, parents inelastically supply $\bar{L}_p$ constant efficiency units of labour in both periods. Consumption at competitive prices in the first period is equal to the total income obtained from the work of parents and children altogether who earn competitive wages, $w_{p,I}, w_{c,I}$, respectively. If capital markets are imperfect, then parents cannot borrow. Instead, they can transfer part of the household income from the first to the second period in the form of precautionary savings, S, with no rate of return. Savings are essential to allow parents to internalise the impact of child human capital formation on future consumption. Formally the budget constraint in $t = I$ is given by $C_p^I = w_{p,I}\bar{L}_p + w_{c,I}l_c - S$.[31]

In the second period, $t = II$, parents and children earn wages denoted by $w_{p,II}$ and $w_{c,II}$, respectively. The income of parents is given by the savings from the first period minus the transfers from parents to their children in form of bequests, b. Children earn labour income independently according to the human capital accumulated in the first period. BR highlight the relevance of bequests because when they are positive "*...parents completely internalize the adverse impact of child labor on the future income of their children since, by reducing bequests accordingly, they can compensate themselves for the current income they lose when not making their children work*" (Baland and Robinson 2000: 664). Thus, the budget constraints for parents and children are given by $C_p^{II} = w_{p,II}\bar{L}_p - b + S$ and $C_c = w_{c,II}h(1-l_c) + b$, respectively.[32]

For the sake of simplicity, the BR model assumes one parent and one child. Additionally, firms have a linear technology, wage rates are supposed to be per unit of human capital and equal to one, $w_{p,I} = w_{p,II} = w_{c,I} = w_{cII} = 1$. This simplification implies that there are no fertility choices to be made and that incomes can be considered in real terms.

BR follow Becker (1991) and formulate a separable parental utility function, W_p, that depends on the consumption in both periods, C_p^t, and the children's utility, W_c, weighted by a parame-

[29] There are no direct schooling costs as they are deemed to be the forgone child labour income. This assumption is realistic, since in some medium income countries school fees or related costs (tuition, uniforms, transportation, books and supplies) are completely subsidised. See for example Jagero (2011).
[30] This can be the human capital accumulated from work experience.
[31] Parents live along with their children in both periods. This overlap simplifies the analysis but this setting may fail to provide further details of the life of children when they become parents in a third period as shown in Eswaran, Reform, and Center (1996), which contribute to the analysis of the poverty traps when human capital converges to a steady state.
[32] Bequests are, in fact, transfers from parents to children in the second period that allow them internalize the forgone consumption in the first period with no effects in the consumption in the second period, if credit markets were perfect. Parents could borrow scarifying bequests but not future consumption.

ter, $\delta \in [0,1]$, denoting the extent to which parents are altruistic toward their children. Formally:

$$W\left(C_p^I, C_p^{II}, W_c(C_c)\right) \equiv U\left(\bar{L}_p + l_c - S\right) + U\left(\bar{L}_p - b + S\right) + \delta W_c(h(1 - l_c) + b) \quad \text{(II.2)}$$

The parent chooses the optimal level of child labour, bequests and savings that maximises their utility function subject to the budget constraints from both periods. The first order conditions are defined as follows:

$$U'\left(\bar{L}_p + l_c - S\right) = \delta W_c'(h(1 - l_c) + b) \cdot h'(1 - l_c) \quad \text{(II.3)}$$

$$U'\left(\bar{L}_p - b + S\right) = \delta W_c'(h(1 - l_c) + b) \quad \text{(II.4)}$$

$$U'\left(\bar{L}_p + l_c - S\right) = U'\left(\bar{L}_p - b + S\right) \quad \text{(II.5)}$$

The BR model focuses on the model's efficiency that leads to low choices of child labour. The efficiency of the model emerges when equation II.3, II.4 and II.5 hold, this is, when bequest and savings are positive. If l_c^* is considered as the solution of the socially efficient level of child labour in the first period, then it can be inferred from these first order conditions that $\partial l_c^*/\partial \delta$ and $\partial l_c^*/\partial \bar{L}_p$ are negative. Therefore, the more altruistic and productive the parents, the lower the levels of child labour.

Efficient outcomes of the model are evident from the first order conditions. When substituting equation II.5 into equation II.4 and it into equation II.3, the efficient choices of child labour require that the marginal human capital accumulation equals one: $h'(1 - l_c) = 1$. In other words, child labour is considerably low because parents are wealthy enough to save and bequeath and the equations in the first order conditions hold.

Nonetheless, when poor parents are unable to save or bequeath, the efficiency condition does not hold and the marginal human capital accumulation becomes greater than one, $h'(1 - l_c) > 1$. Formally, if bequest are zero, $b = 0$, the equality of equation II.4 from the first order conditions does not hold, while it becomes $U'\left(\bar{L}_p - b + S\right) > \delta W_c'(h(1 - l_c) + b)$. This inefficiency generated in equation II.4 implies that a poor parent would reach a higher marginal utility in the second period than the marginal utility that the child would obtain in absence of bequests. In fact, the absence of bequests would lead the child to obtain lower consumption levels in the future. The parent would like to borrow to invest in his child's human capital in the first period. However, the imperfection of the capital markets prevents the parent from borrowing and the child is forced to work at inefficient levels. The immediate consequence of

poverty implies that child labour choices are high enough to hinder human capital accumulation.

Similarly, if savings are zero, $S = 0$, the equality of equation II.5 leads to the inefficiency condition $U'(\bar{L}_p + l_c - S) > U'(\bar{L}_p - b + S)$. At this point, the choices of l_c will be inefficiently high because the transfers of current income to the future are unfeasible. The parent will not be able to buffer the decrease in the consumption in the second period that results from lower bequests. Therefore, the parent will make the child work harder in the first period since the parent anticipates that the household will obtain low consumption levels in the future.[33]

II-3.2. CCTs and the Length of Exposure

In this section public transfers are introduced into the BR model.[34] Becker and Murphy (1988) justify the intervention of the state in the intra-household decision making. According to their hypothesis, the government mimic the agreements that children would make in the case that they were capable to arrange their care. Regulations and laws often improve the economic efficiency in the allocation of resources in domestic activities. Low income households can allocate children's time between school and work inefficiently due to market failures. Thus, the intervention of the government seeks for allocating the human capital investment at children that otherwise could not be made, especially if parents do not have bequest to leave.[35] Hence, here it is addressed how the intervention of the government through the implementation of a CCT programme affects decision making in a continuous length of exposure in an expansion of the BR model.

The public intervention in this case is relevant in the sense that the mitigation of the consequences of the market failures is often justified in the introduction of the co-responsibility component in the CCT setting. Several arguments give reasons for the introduction of this kind of compulsion upon the receipt of the transfers. In particular, liquidity constraints, imperfect credit markets, household bargaining, misleading beliefs, undervaluation of child human capital investment and imperfect altruism dominate the argumentation on the co-

[33] This liquidity constraint and imperfect credit markets is also addressed by Ranjan (1999), who discusses how poverty in combination with credit constraints and no bequest causes child labour. Similarly, Basu and Van (1998) argue that non-working children from poor households are a luxury good and that once their income rises above a certain subsistence threshold, parents withdraw children from the labour market.

[34] Previous attempts to allow for the transfers in BR model are made by Martinelli and Parker (2003) and Rey and Estevan (2011).

[35] Another important point made by Becker and Murphy (1988) is that social norms from low income countries may drive children to support their parents. Public expenditure in children education and non-contributory pensions can fill the gap caused by the failure of norms.

responsibilities in of transfer schemes.[36] Despite a ban on child labour could be established, the enforcement from the State is often weak and sometimes inexistent in developing countries.[37] Therefore, CCTs are deemed to affect the decision making of poor parents since the transfer plays an efficiency improving role in a second-best scenario where households are poor and bequest and savings are zero. The government intervention is based on the compensation to the household for sending their children to school and the subsequent decrease in income.[38]

In this section, the expansion of the BR model considers that CCT programmes do not just give money to households in poverty. Instead, they provide some other services and in-kind goods that beneficiaries are encouraged to consume. Some programmes complement the cash transfer with nutritional supplements and specific training for parents on how to look after their children. For instance, Mexico's *Oportunidades* supply nutritional supplements, mandatory training and health checkups for adults in addition to the transferred income in cash (Levy 2006a). Another example is the 4Ps programme in the Philippines that includes the *Family Development Sessions* in which parents must attend order to comply with their co-responsibilities (Fernandez and Olfindo 2011). Evidence on the effectiveness of similar complementary activities is documented by Fitzsimons et al. (2012) with positive results in child nutrition. The cash transfer, in addition to other type of services, belongs to the same bundle that composes the whole CCT programme.[39]

The effectiveness of CCT programmes in these cases can depend on the cash and complementary interventions.[40] In addition, relevant to the main focus of this section, there are strong reasons to believe that the effects of the CCTs are time-varying. Recall that Behrman and King (2008) point out that the implementation of these programmes can be delayed or phase in slowly due to administrative reasons. Similarly, they highlight that beneficiaries take their time to rely on the transfer and to learn the programme rules. The transfer also depends on demographic composition of the household and the age of the children that may affect how its budget constraint in the short or medium run. Therefore, the size and effect of the

[36] Indeed, a further development of the BR model involves an alternative to government subsidies, including a ban on child labour.
[37] Despite the existence of banning laws, according to ILO (2007) nearly 10% of Latin-American children between 5 and 14 years old work regularly or seek for a job.
[38] Unconditional cash transfers may have a similar effect in terms of human capital accumulation, nonetheless, they are compatible with child labour, while in this case CCTs require the children to engage their time exclusively to schooling activities.
[39] When transfer are purely unrestricted, the government or donors expect the recipient to spend it on a particular good or service that will improve the whole society, instead of wasting it on what seems unnecessary goods and service. The latter could be achieve depending on the income elasticity of the recipient on the market of the socially desired good (Thurow 1974). In this case the desired outcome is the human capital formation of children, such that the co-responsibility is part of the paternalistic component of CCT programmes.
[40] See Rivera et al. (2004) for evidence on the effects of Mexico's *Oportunidades* programme on child nutrition as a consequence of the whole package of interventions.

total transfer as well as the response from the beneficiary households may vary over time as the programme is implemented.

The following example can be helpful to the understanding of how the transfer can vary over time. Consider a typical poor household composed by one parent, one infant and one child attending an elementary school. The participation in the CCT programme requires the parent to keep her child at school and take her infant to health checkups. The household receives the income in cash according to the number of children plus other transfers: the children are given a nutritional supplement and the parent must get together with other participants to receive additional training on child care and domestic medical treatment. After a while, the infant joins the school and the other is promoted to high school. Given the fact that the children are older and well-nourished, the programme stops the nutritional support and discontinues the adult training on child care. Years later, the oldest child completes the conventional school cycle while the youngest keeps attending school. At this last point the transfer is reduced to the cash money that corresponds to the participation of the household with just one child until she graduates from school and exit the programme. At the end, the total transfer varies from the enrolment through the completion of the school cycle.

The previous example is essential for understanding the role of CCTs in the BR model. The CCT programme is introduced not only as a constant term but as a function that depends on the transfer and the fraction of the first period dedicated to the child human capital formation. The decision of parents on school attendance will be influenced by the CCT while the fraction of the children's time allocated to non market activities is considered as the length of exposure. The duration of the participation of the household in the programme will entail some human capital formation activities by the child as required in the co-responsibility. Once the household participates in the programme, the co-responsibility will drive the parent to engage the child in education-related activities only. The available time of the children is constrained by the fact that child labour cannot absorb the total disposable time, that is, $l_c \in [0,1)$. From the start of the model the participation in the programme is taken for granted. The latter means that the parental binary decision on whether to participate or not is not addressed as showed in Skoufias (2005). Instead, the decision on how long the child studies will be under the influence of the CCT in a continuous setting.

According to a previous classification of programmes considering their intended length of duration, this model considers that the intervention is designed to make the children to achieve their complete education cycle as participants are persistently in poverty. Formally, the length of exposure of the programme will be determined by the fraction of the first period that is not engaged in labour activities, $1 - l_c$, which is chosen by the parent. In fact, the time devoted to

human capital formation is exclusive from child labour, such that both activities cannot be carried out simultaneously. For example, if the total available time of a typical child is 10 years, the parent may send the child to school continuously for eight years while she can work for two years. Both activities cannot be done at the same time.[41] Despite the programme may tolerate some level of child labour before or after (but not during) the chosen length of participation, its intention is to make parents opt for full accumulation of years of education.

In addition to the restriction on child labour for a fraction of the available time in the first period, the programme's treatment or benefits are introduced in the form of an exogenous income embedded in the budget constraint. Given that the participation/schooling time determines the total transfer received by the household, the benefit of the programme is defined by the function $cct = f(\$, 1 - l_c | a, h)$, which is linear in $\$ but continuous and double differentiable, increasing and strictly concave in $1 - l_c$. This function represents the CCT the household receives after the exogenous transfer, $\$, is combined with the endogenous fraction of the first period devoted to human capital formation activities, $1 - l_c$. These elements determine the total transfer given two essential facts: the first one represents the exogenous characteristics of the supply-side or administrative traits of the programme, a. The second, h, represents the exogenous household characteristics that might shape the participation in the programme.

It is assumed that there are indirect and direct sources of variation in the transfers contained in a and h. This variation sources may cause a non-linearity in the total transfer and parental decision making. Indirect sources could involve the characteristics of the administration of the programme that were previously mentioned in King and Behrman (2008). Similarly, there are two main direct variation sources according to the length of exposure. The first one emerges from the fact that the transfer, $\$, is composed of the cash in addition to other in-kind components of the CCT programmes whose supply and demand vary over the participation period.[42] This component of the transfer is often designed according to the lifecycle of the household as shown in the previous example. The second direct source of variation of the transfer is related to the delivery plan of the cash and in-kind components of the transfer. For example, if a nutrition supplement is required at the beginning of the intervention and its provision will last until the children gain the desired weight for a limited period. On the other hand, the cash transfer may not be constant over time given the design of the disbursement plan that often is

[41] In fact, child labour is considered a substitute to schooling.

[42] These in-kind transfers and services can take the form of nutritional supplements, complementary health check-ups, compulsory attendance in special training sessions, and other administrative requirements of the programme implementation. For example, if there are one infant in the household, the bundle of total transfers would be different from that of another household with a school-age child.

declining over time. In summary, indirect sources could emerge from the implementation of the intervention while direct sources are related to the design of the transfer.

II-3.2.1. CCTs and positive savings and bequests

The budget constraint in the first period is defined by the initial BR setting plus the transfers: $C_p^I = \bar{L}_p + l_c + cct - S$. As an alternative, an unrestricted transfer would be introduced as a single constant term to be consumed in the first period, while the cct depends on the length of exposure determining participation. As previously mentioned, the size of the transfer is exogenously determined according to the budget constraint of the government whose funds are obtained from levying taxes from other segment of the population.[43]

In the second period, the parent keeps the same budget constraint as the initial BR setting, $C_p^{II} = \bar{L}_p - b + S$. Thus, the parent maximises the utility function with the new CCT scheme in the first period, while in the second one there are no additional government transfers for the household. However, in the second period the parent obtains utility derived from the new consumption level of her children and the availability of greater resources for savings in the first period:

$$W_p\left(C_p^I, C_p^{II}, W_c(C_c)\right) \equiv U\left(\bar{L}_p + l_c + cct - S\right) + U\left(\bar{L}_p - b + S\right) + \delta W_c(h(1 - l_c) + b) \tag{II.6}$$

The new first order conditions are presented as follows:

$$U'\left(\bar{L}_p + l_c + cct - S\right) \cdot f'(\$, 1 - l_c | a, h) = \delta W_c'(h(1 - l_c) + b) \cdot h'(1 - l_c) \tag{II.7}$$

$$U'\left(\bar{L}_p - b + S\right) = \delta W_c'(h(1 - l_c) + b) \tag{II.8}$$

$$U'\left(\bar{L}_p + l_c + cct - S\right) = U'\left(\bar{L}_p - b + S\right) \tag{II.9}$$

The importance of the size of the transfer can be analysed from these first order conditions. The existence of the benefits or treatment function, cct, has a direct and immediate effect on the household decision in both periods. If the cct is lower than the forgone child labour income, then the result will be the same as that in absence of the programme, previously denoted by l_c^*. Similarly, if the value of the transfer level in the evaluation of cct at l_c^{cct} is higher than the foregone child labour income, then the efficient level of child labour is lower than that in absence of the programme. Intuitively the restriction of the transfer on the increase of human schooling and its immediate effect is only feasible if $cct \geq l_c^{cct} - l_c^*$. In other words, parents are willing to participate and stay in the programme as long as they are able to cope

[43] The government's problem is not addressed by this expansion of the BR model.

with the decrease in child labour. This last point has a strong implication for the administrative determination of the value of the transfer over time: if the design of the transfer can predict or observe the forgone income due to a lower engagement of the child in labour activities, then the difference between the human capital levels with and without the intervention can be positive.

When the parent is able to save and bequeath and $cct \geq l_c^{cct} - l_c^*$, the efficient choice of child labour will imply the equality of the marginal human capital achieved by the children and the marginal transfer obtained by the household. From equation II.9 and equation II.8 it is known that equation II.7 turns into the new following efficiency condition:

$$f'(\$, 1 - l_c^{cct}|a, h) = h'(1 - l_c^{cct}) \quad \text{(II.10)}$$

The optimum condition of the model shown in equation II.10 becomes important when the CCT programme is provided to the household and savings and bequest are positive. At this optimum point the parent will invest in the child's human capital until the marginal variation of the CCT equals the marginal human capital accumulation. Given the previous finding from the BR model in absence of the programme where $h'(1 - l_c) = 1$, the interaction of a CCT will imply that the condition $f'(\$, 1 - l_c^{cct}|a, h) \geq 1$ holds. The CCT could lead the household to choose a lower level of child labour even if the parent is able to save and bequeath. This finding is relevant in the sense that irrespectively to the length of exposure to the programme, the proportion of time in the first period devoted to school-related activities that results under the influence of the programme is always higher that in absence of the programme even if the household is not in poverty.

II-3.2.2. The second best

The previous efficient choices are based on the fact that savings and bequests are positive yielding a first best solution. However, households in poverty to whom CCT programmes are designed seldom are able bequeath or save. In addition, these households face the imperfections of the credit markets that make them unable to transfer income from the second to the first period. Similarly, the incapacity to save makes it impossible for the parent to transfer income from the first to the second period in the form of savings. Consequently, the child is forced to spend more time on market activities and to considerably reduce the accumulation of human capital in absence of the programme. In formal terms, if savings and bequest are zero, then equation II.8 and equation II.9 do not hold and neither can be introduced into equation II.7. An inefficient solution is inevitable in this context. Therefore, given that any decision on the allocation of the child's time in the first period will be inefficient without the

availability of savings and bequests, the child labour choice under de presence of the CCT is considered as a second best.

When the household is in poverty and the parent is unable to save or bequeath, equation II.10 becomes: $f'(\$, 1 - l_c^{cct}|a, h) < h'(1 - l_c^{cct})$. The interaction of the CCT in the problem reveals that inefficient allocation of child labour in the absence of the programme is higher than the inefficient allocation when CCTs are present. Formally, this is inferred if $h'(1 - l_c^*)$ is the marginal human capital in absence of the programme with l_c^* child labour. Then the condition $h'(1 - l_c^*) > h'(1 - l_c^{cct}) > 1$ represents the second best. This second best condition emerges from the fact that, for zero bequests and savings, $U'(\bar{L}_p - b + S) > \delta W_c'(h(1 - l_c^*) + b) > \delta W_c'(h(1 - l_c^{cct}) + b)$ and that $U'(\bar{L}_p + l_c^* + S) > U'(\bar{L}_p + l_c^{cct} + cct - S) > U'(\bar{L}_p - b + S)$, respectively. In other words, the programme directly decreases the marginal utility of consumption in the first period and the marginal utility of children in the second period due to the increase of the human capital. Hence, even if the household is in poverty, then the programme could be inefficient-improving since the final levels of child labour with interacting CCTs are lower than the efficient outcome. At the same time, lower than the inefficient level in absence of the programme. As a consequence, the less inefficient the outcome, the lower the child labour that results.

One final question emerges from the second best condition regarding whether the CCT helps the parent to cope with either the absence of savings or the absence of bequests. In fact, since the function cct interacts with a fraction of the first period devoted to schooling, it could help the parents cope with the absence of savings and with the imperfection of the capital markets. Depending on the size of the transfer function at the optimum, the CCT may be assigned to actual consumption or savings. This last option balances the marginal utility from the consumption in both periods as shown in equation II.9. As for the bequests, the CCT cannot directly replace them because children do not participate in human capital activities in the second period given that equation II.8 does not specify any school-related activity. However, equation II.8 could be positively affected by the higher human capital that allows parents to obtain a higher utility from the child's consumption in the second period. CCT programmes allow the parent to internalise the eventual decrease in consumption in the first and second period due to child human investment.

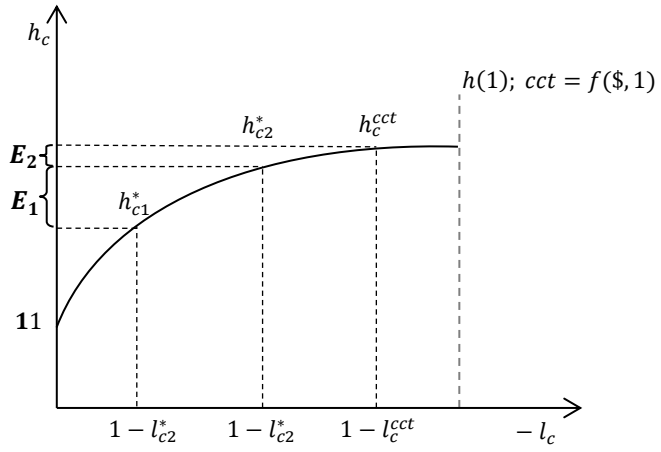
II-3.2.3. Length of exposure, effectiveness exhaustion and the 'overdose' effect

In this section the varying effectiveness of the CCT is addressed according to the length of exposure. Given the concavity of the functions $f(\$, 1 - l_c^{cct}|a, h)$ and $h(1 - l_c^{cct})$, every choice of schooling could lead to a higher level of human capital accumulation at a decreasing

marginal change. The effectiveness of the programme is defined as $E = h(1 - l_c^{cct}) - h(1 - l_c^*)$, that is, the difference between the human capital levels under the presence of CCTs and that in absence of the programme. Hence, any convenient length of exposure to the CCT shall guarantee that $l_c^{cct} < l_c^*$.

Figure II-4 below compares a hypothetical effectiveness path by comparing the human capital level with and without the intervention. The Figure plots the human capital as the second best solution to the maximisation problem, $h(1 - l_c)$, at different solutions of schooling time $1 - l_c$. Two initial human capital levels in absence of the programme are illustrated at the h_{c1}^* and h_{c2}^* points. Similarly, h_c^{cct} represents the human capital level in the presence of the programme:

Figure II-4. Hypothetical human capital path.



Source: Author.

Looking at Figure II-4, the effectiveness varies at different choices of child labour with a defined pattern. E_1 indicates an effect of the programme when the schooling levels are initially low. A programme implemented under this initial setting generates a significant effect given the shape of the human capital function. If one compares the human capital under the presence of the programme to that in absence of it at an initial level of $1 - l_{c2}^*$, the resulting impact, E_2, indicates a lower effect of the CCT, to the extent that the effect is more exhausted at this point. An overdose effect is feasible as long as E becomes smaller due to a higher level of $1 - l_c$ generated by the programme. The overdose effect is important to the extent that it can define this hypothetical length of exposure. According to the exhausted-effectiveness principle, participation in the intervention is allowed insofar as the household still experiences poverty and the effect of the programme is positive.

II-4. Conclusions

This chapter has given an account of the varying effectiveness of SAPs in response to time-varying property of the transfers at different levels of length of exposure. There are several reasons to consider that the effects of the SAPs as variable over time. On the supply side, the introduction of the intervention requires setting up the inputs for its operation as long with the development of specific working skills by the administrative staff. SAPs also may deliver the transfers with a varying pattern, giving more benefits at the beginning and phasing down when the programme's cycle ends. On the demand side, as the programme operates the beneficiaries learn how the programme works and they may absorb the transfers differently over the participation period. There could be indentified an important threshold of the programme's effect on which the intended outcomes are similar to those in absence of the intervention.

In the specific case of CCTs, the varying effects on the human capital formation of children can be analysed from the economics of schooling and child labour. The two-period child labour framework proposed by BR was modified to allow the interaction of the CCTs when parents cannot borrow or bequeath. The CCTs contribute to a higher, but still inefficient, investment in human capital as children devote a higher proportion of their time to school attendance instead of work. In the light of the comparison between the results of the model with and in absence of the programme, the net effect on human capital is non-linear given the characteristics of the transfer. The non-linearities of the effects of the CCT are shaped decreasingly as the beneficiaries are exposed continuously to the programme.

The analysis of the effects of the programme and the length of exposure can lead to the definition of an exit criterion of SAPs. The BR model with the interaction of the CCTs focuses particularly on the case when the transfers attain an ineffective level. The identification of the threshold on which the transfers can be ineffective or cause a negative effect is the first input in determining the end of any SAP with these features.

Potential enhancements could be introduced into this theoretical approach. Especially, the dichotomous distribution of the child's time between schooling and work can be expanded to the additional definition of leisure. As transfers lead to the substitution of child labour for school attendance, it is worth understanding how the leisure time complements the schooling time and the reduction of child labour. On the other hand, the assumption of altruism of parents towards their children could be extended to a mutual altruism of children towards their parents. Since the CCTs demonstrated to help the parents to cope with the absence of savings or borrowing, the two sided altruism could mitigate the effects of the absence of bequests.

CHAPTER III: HUMAN DEVELOPMENT CONDITIONAL CASH TRANSFER PROGRAMMES IN COLOMBIA: *FAMILIAS EN ACCION*

Familias en Accion, a CCT programme, was introduced in Colombia in response to the 1999 economic crisis that hit most Latin-American countries. It was conceived as an counter-cyclical intervention to prevent the poorest households reduce the investment in the human capital of their children (Accion Social 2010). The main component of this programme that would lead to the achievement of this objective was the delivery of direct cash subsidies to households in poverty, conditional on school attendance and health checkups of their children. The strategy of *Familias en Accion* is to alleviate current poverty, while preventing children to inherit low levels of human capital when adults. Although the programme was proposed to run over a three years window, after the country recovered from the economic crisis the policy makers opted for its extension instead of phasing it out.

One of the factors that contributed to the extension of *Familias en Accion* was the positive results evidenced in its official impact evaluation (IFS-Econometría-SEI 2006; Nuñez 2011). Independent evaluators found how the programme had increased the school attendance and had improved the nutritional status of beneficiary children. They also detected how the programme eradicated child labour and drove to the consumption of better quality foods in participating households. After more than a decade of operation, an important question that arises is whether those outstanding impacts could be different over a longer or shorter length of exposure.

This chapter provides the details on the design and implementation of *Familias en Accion* between 2000 and 2010, years within which the empirical evidence of this thesis focuses its analysis. Therefore, this chapter has been organised in the following way: section III-1 explains how CCTs were introduced in Colombia, starting from their diffusion in Latin America; section III-2 describes the design and implementation of *Familias en Accion* by detailing its objectives, operation cycle and results. Finally, section III-3 presents some brief conclusions.

III-1. CCTs in Colombia: the *Familias en Accion* programme

III-1.1. Background: CCT diffusion in Latin America

Contextualising the origin of CCTs in Colombia requires an understanding of several structural reforms that took place in Latin America between the end of the 1990s and the beginning of the 2000s. The economic crisis that hit the region during the 1980s triggered the implementation of market liberalisations policies in response to recommendations delivered from multi-

lateral organizations (Barrientos and Santibáñez 2009). As an illustration, Lora (2001) develops an index indicating 0 as the absence of reforms and 1 the highest reforming activity in Latin America. He highlights that while the region scored a 0.35 in 1985, the average in the following decade was 0.58. For instance, the import tariff averaged around 50 percent by the end of the 1970s whereas in year 2000 only two countries had an average rate above 15 percent. These structural reforms addressed almost every tradable sector of the economy with the substantial reduction of tariffs, flexibility on the labour markets and the fiscal behaviour of the government over the privatisation of state-owned firms. Similarly, financial markets suffered sharp deregulations of interest rates, loan periods, maximum level of interest rates, obligatory investment, among others. In summary, the 1990s was a decade of transition in Latin American, from a protectionist model to a more liberal model.

Social policy did not remain static within these dynamics. Cohen and Franco (2006) describe how the region has implemented a significant transformation of contributory and non-contributory subsidies in the last 50 years. They spell out that after the World War II Latin American countries put a strong emphasis on the supply side of social basic services, especially health and education. Nonetheless, only formal workers who were able to participate in social security (contributory) schemes were able to access health, pensions and housing programmes. Since social assistance (non-contributory) programmes had remained marginal in response to informality and poverty levels, aggressive interventions were introduced to subsidise the consumption of food from the supply side. Some food subsidies and price controls were put into practice with a low accuracy on the targeting of the poorest households or individuals. By the second half of the 1990s social security had not reached its intended goal of universal coverage, while social assistance for informal poor households were focused on the provision of food as the most important in-kind transfer.

Barrientos and Santibáñez (2009) contribute to the analysis of the interventions that emerged in Latin America under non-contributory features. They highlight that the crisis of the 1980's triggered a new generation of social policy interventions, especially in the form of social insurance and pensions with private and public providers. The increase in the coverage of health insurances and pensions was tailored to the design of social security systems for salaried formal workers. Salaried jobs were commonly offered to high skilled workers while the unskilled workers were predominantly low educated and poor. In this sense, the poorest remained uncovered by the social security services and welfare programmes. Therefore, given the demand of inclusive strategies for uncovered groups of the population, during the 1990's governments of the region started the creation of social investment funds. These funds were aimed at filling the gaps that the social security was unable to bridge. Most of these initiatives were created to

cope with economic crisis in the short run, by implementing emergency social employment schemes and institutionalising the social assistance with anti-poverty strategies. One of the components of such strategies was the implementation of the Conditional Cash Transfer programmes.

In this context, the emergence of the Mexico's *Progresa/Oportunidades* programme initiated the diffusion of CCT programmes throughout the region (Pena 2014). Three elements were presented in this process that diffused the Mexican experience in Latin-America. The regional spill-over of the Mexican experience was facilitated by its practicality, the credibility of its impact evaluation and the interaction of multilateral banks. The origin of *Oportunidades* is explained by Levy (2006b), who describes that in the mid-1990s around 15 in-kind food subsidies programmes were in operation under the management of the Mexican government. These untargeted interventions evidenced mixed effects on the poverty reduction and human capital formation of children. On one hand, not all the beneficiary households would include the subsidised food into their preference; on the other, non-poor households or individuals would benefit from the in-kind transfers due to an imprecise targeting method. Policymakers decided to stop those programmes and give the cash directly to poor households in rural areas with a stronger targeting-the-poor emphasis. This new idea would stop the speculation on subsidised food prices and allow the households to choose what to consume according to their preferences. Instead of giving money on an unconditional basis, the new scheme would introduce compulsion by conditioning the transfer on child human capital formation activities. This new subsidy scheme was thought to help households alleviate current poverty while increasing the human capital of the children to prevent them to stay poor when adults.

Oportunidades combined the features that the Mexican government was demanding given its previous experience with food subsidies that yielded vague effects on poverty alleviation. The programme would transfer cash subsidies to the poorest households while requiring them to comply with co-responsibilities regarding the human capital formation of their children[44]. Indeed,

> "...a program that delivers income transfers in cash is different from one in which food items (bread, tortillas, milk, maize flour, beans) are purchased by poor households that may not know that the price they pay is below the market price because a subsidy is involved. And a program that requires certain behavior from the poor before they receive an income transfer is different from one in which they are given a transfer just because they are poor or they consume a given good.

[44] The restrictions on the transfer obeyed to a paternalistic decision on how the beneficiaries should allocate their resources (Currie and Gahvari 2008).

> Progresa-Oportunidades was built, along with other considerations, on the recognition that poor households had to play a more substantive role in overcoming their circumstances; to that end, households were being given both increased freedom with regard to how they spent their income transfers and greater responsibility for taking the actions required to obtain the transfers" (Levy 2006b: 17).

The initial implementation of the programme was administratively committed with its evaluation. The Mexican *Secretaria de Desarrollo Social* (Secretary of Social Development), the main agency in charge of *Oportunidades*, commissioned an experimental evaluation of the programme to the independent Washington-based International Food Policy Research Institute (a World Bank funded organization). A series of reports since 2000 revealed the unprecedented effectiveness of the intervention. For instance, Hoddinott, Skoufias, and Washburn (2000) detailed that the CCT increased the consumption of beneficiary households in nearly 15 percent; Handa et al. (2000) found a 4 percentage points decrease in the poverty gap in treated municipalities in comparison to their control peers. Parker and Skoufias (2000) detected that children were less engaged in labour activities and that parents did not decrease their labour supply in response to the subsidy; Schultz (2000) found that the programme increased school enrolment in 9.4 percentage points and that children accumulated 0.37 more years of education due to the programme. Finally, Gertler (2000) also found that *Oportunidades* decreased the prevalence of illness in children between 0-5 years of age by 12 percentage points due to a higher utilization of health services, while Behrman and Hoddinott (2001) found a relevant decrease in the malnutrition of children.

The positive results evidenced by the impact evaluation of *Oportunidades* provided multilateral banks with stronger arguments to influence other governments to adopt CCTs. CCT programmes were rapidly implemented in most of Latin American countries whose social policy-makers were in need to implement non-contributory policies in the light of the economic crisis of the late 1990s and the beginning of the 2000s. The fiscal constraints in some cases led the governments to look for the financial support from multilateral institutions with loan projects. The documentation of such projects often mentions the success of *Oportunidades* as the main supporting evidence in proposing similar interventions. In particular, the so-called technical cooperation was the instrument that the World Bank and the Inter American Development Bank offered to other countries to facilitate the adoption of CCTs.

III-1.2. The 1999 economic crisis and the introduction of *Familias en Accion* in Colombia

The economic crisis of the second part of the late 1990s reached most of the Latin American countries. As for Colombia, the gross domestic product had not suffered from negative

growth rates since the Colombian government recorded national statistics. An economic crisis started in 1998 with a sharp contraction of the economic activity in 1999, when the economy shrank and unprecedented 4.9 percent. The impacts of this economic crisis were manifested by high unemployment rates, malnutrition of young children and school dropouts. According to an internal official document, the impact of this economic crisis was manifested through unemployment rates over 20 percent, reaching 40 percent in the lowest income quintile of the population. It was calculated that the household income of the lowest income quintile had plummeted 21 percent between 1996 and 2000 (DNP 2001). These households had started to respond to the crisis by withdrawing their children from school and decreasing the consumption of food. This socioeconomic turmoil pressured the government to respond by finding an alternative strategy to buffer the negative impacts on households in extreme poverty.

Back in 2000 the Colombian government, with the international aid from the United States and the European Union, introduced a new security strategy known as the *Plan Colombia*. *The Plan* was aimed at strengthening the institutional capacity and response against Marxist guerrilla groups and against the production of narcotics. In spite of the fact that most of the investment was focused on military supplies and the modernization of national security agencies, policymakers were concerned about the success of the *Plan* without a social component amid an economic recession. Consequently, in year 2000 the *Red de Protección Social* (RPS) (Social Protection Network) was introduced as a complementary social intervention of the overall military strategy. The RPS was composed of three different sub-programmes: 1. a workfare programme that would counteract the high unemployment levels among the poor by building infrastructure; 2. a job training programme for three years that would recruit and train unemployed and disadvantaged youths during the crisis; 3. a CCT programme that finally became the current *Familias en Accion* intervention (Accion Social 2010; DNP 2000).

The inclusion of a CCT in the social component of the *Plan Colombia* did not emerge accidentally. The multilateral banks played an essential role after learning the results from the initial *Oportunidades* experience in Mexico. In fact, the internal project document CO-0247 that details the financial support to the RPS from the Inter-American Development Bank highlights that:

"Programs with conditional subsidy grant mechanisms similar to the one proposed here have been carried out in other countries of the region (Mexico, Honduras and Brazil), and have been evaluated as among the most successful social programs. These evaluations show that such programs have generated significant increases in levels of school attendance, in the use of basic health services and in the consumption of a more balanced and nutritional diet by beneficiary children" (IADB 2000: 38).

The impact evaluation of similar interventions and the interaction of the multilateral banks combined with the response from the government to the economic crisis were determinant in the introduction of the CCTs known as *Familias en Accion* in Colombia.[45]

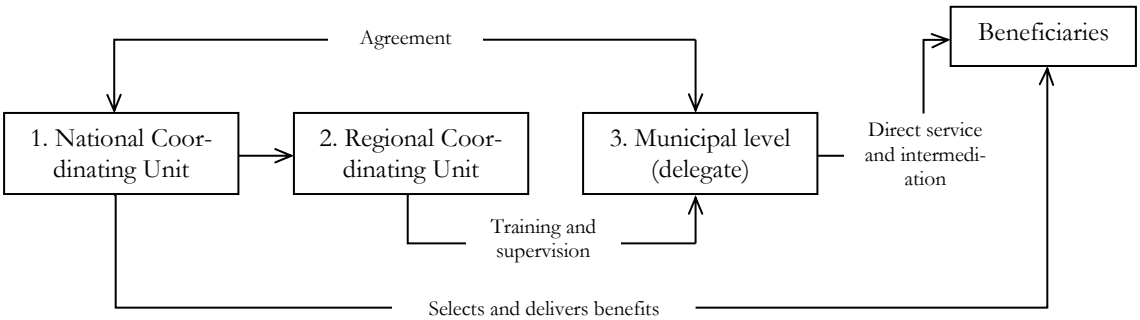
III-2. Design and implementation of *Familias en Accion* 2001-2010

III-2.1. Institutional background

The institutional features of *Familias en Accion* are shaped by the administrative division of the country. Colombia is a decentralized republic divided into 32 provinces called *departamentos* where governors are the administrative head. Each *departamento* has one capital city which hosts most of the main decentralised agencies from the national government. Each *departamento* is divided into municipalities with an administrative structure composed of one municipal council and one mayor.[46] There are 1.119 municipalities according to the 2005 census with a population that ranges from 350 to 7 million inhabitants. Bogota D.C. is the largest city and metropolitan area with nearly 20 percent of the national population. The programme, as an initiative of the central government, is operated indirectly at each municipality by the staff from the local mayor office.

The administration of the programme involves the participation of different actors and decentralized agencies. The National Coordinating Unit (NCU) of *Familias en Accion* is attached directly to a presidential agency (see Figure III-1 below).[47]

FigureIII-1. Administrative setting of *Familias en Accion.*



Source: Author.

The NCU is in charge of managing the programme at the national level. It designs all of the components of the intervention which are detailed in the operation rules. The NCU establishes the amount of money to be delivered, selects and registers the beneficiaries, manages the information system and contacts the banks that finally make the payments to final beneficiaries. The NCU has one delegation at the capital city of each province of the country, called Re-

[45] Sugiyama (2011) provides a wider explanation on how CCTs were adopted by Latin American Countries.
[46] Governors, council members and mayors are democratically elected for a period of four years.
[47] Currently the agency name is *Departamento para la Prosperidad Social (DPS),* former *Acción Social.*

gional Coordinating Unit (RCU). The RCU depends directly from the NCU with a staff that averages 4 employees. This office runs the programme at the regional level and is in charge of disseminating the national guidelines in the municipalities where the beneficiaries finally are. The NCU and the RCU are not intended to hold any direct contact with the beneficiaries but they manage their information and deal with customer service cases with high complexity including legal matters. The lowest decentralisation of *Familias en Accion* emerges from the operation of the programme at the municipal level.

As a prerequisite for the operation of the programme, the NCU signs an agreement with each mayor of each municipality of the country. Through an agreement, the municipal mayor commits to hiring one delegate for the programme operation and to incorporating the costs of the administration of the programme into his office's budget. The mayor must open a customised office for receiving all the beneficiaries and hire a team that supports the municipal delegate. The provision of health and education services must be also guaranteed. Finally, the NCU selects the beneficiaries, delivers the cash benefits and leads the RCU to provide training and support to the municipal delegate on the operation of the programme (see FigureIII-1).

III-2.2. Objectives and instruments

Familias en Accion is shaped by operation rules that specify the procedures that each administrative member must follow to run the programme. It has been slightly modified from its first version in 2001 with adaptations to the different stages that the programme has experienced since it was introduced.[48] The objectives and implementation cycle have remained almost unmodified and most of the changes have emerged from the adoption of new technologies to deliver the cash transfer and the verification of the co-responsibilities. For instance, an initial approach would lead the programme to pay the money with face-to-face tellers, while today most of transfers are made through plastic debit cards and ATMs. The implementation guideline of the programme preserves its general components which have remained unmodified during the period of analysis.

The general objective of the programme according to the implementation guideline is *"Mantener y aumentar la inversión que las familias en extrema pobreza, familias pertenecientes al nivel 1 del Sisben, hacen sobre el capital humano de sus hijos* " (FIP-RAS 2006: 4).[49] This general objective assumes three implicit conditions of the potential beneficiaries: first, it assumes that beneficiary households are suffering from persistent poverty; second, it assumes that children that actually participate in human capital accumulation activities are at risk of dropping out; third, it assumes

[48] Modifications to the rules of the programme must be approved by the IADB and the World Bank.
[49] This can be read in English as follows: *"To maintain and increase the investment that the families in extreme poverty make in the human capital of their children "* (FIP-RAS 2006: 4).

that dropouts are encouraged to return to school or health centres. In fact, this design stipulates the following specific objectives:

> "...a) Reducir la inasistencia y la deserción de los alumnos de educación primaria y secundaria. b) Completar el ingreso de las familias con niños menores de siete años en extrema pobreza, para incrementar el gasto en alimentación. c) Aumentar la atención de salud de los niños menores de siete años. d) Mejorar las practicas de cuidado de niños en aspectos tales como salud, nutrición estimulación temprana y prevención de la violencia intrafamiliar " (FIP-RAS 2006: 4).[50]

The designers of the intervention learnt that achieving these objectives would require understanding the drop-out sources for children belonging to poor households. The design of *Familias en Accion* implicitly recognises that the main reason why children do not attend school is the parental inability to afford the education of their children. On one hand, the value of the cash benefits was established to equalise the observed average education expenditure of eligible households. This did not consider a normative bundle of education-related goods and services, but rather, it was based on the reported value that actual students with similar socioeconomic conditions would spend. On the other, the nutrition transfer would cover the nutrition expenditure on food that would keep infants well nourished according to the local chart of normative calories consumption. In sum, dropout reasons where understood to be addressed by delivering an income transfer that would take to cope with them.

The main instrument employed to achieve the objectives of the programme is, indeed, the cash benefit restricted to the compliance of the co-responsibilities. The transfers are preferably given to the mother or main female care-giver of the children in the household.[51] The design of the intervention includes three different transfers detailed at nominal prices as follows:

- Nutrition cash transfer: this subsidy is intended to increase the consumption of food of children under seven years of age. The subsidy is given bi-monthly to the household regardless the number of children. It can be accumulated with the education cash transfer. In order to receive this transfer, children should attend health services regularly according to the normative child growth and development plan. The value of the nutrition cash transfer was fixed at 20 US$ per month from 2001 to 2005. In 2006 the value was increased to 25 US$.

[50] This can be read in English as follows: *"...a) Reduce the school dropout of students in primary and secondary education; b) Complement the income of families with children under seven years old in extreme poverty for increasing their spending on food; c) Increase the access to health services of children under seven years old; d) Improve the care giving of children in several dimensions such as health, nutrition, early childhood stimulation and prevention of domestic violence"* (FIP-RAS 2006: 4).

[51] Duflo (2003) demonstrates that when transfers are given to female care-givers the results in nutrition are better than when transfers are given to male household members.

- Primary education cash transfer: this transfer is designed to increase and maintain the school attendance of children between seven and 17 years of age, registered between the first and fifth grade. This transfer is paid bi-monthly during the 10 months of the school year. The co-responsibility of this transfer entails the school attendance at least 80 percent of the education calendar. The value of the transfer was 6 US$ per month between 2001 and 2005 and increased to 7.5 US$ thereafter. This transfer is assigned to each child in the household and can be accumulated with other subsidies.
- Secondary education cash transfer: similar to the primary education cash transfer, the secondary education subsidy is designed for children from 7 to 17 years of age attending at least 80 percent of the school calendar. This subsidy is given bi-monthly to students between sixth and eleventh grade. The value of the cash benefit was 12 US current dollars between 2001 and 2005 and increased to 15 US$ thereafter.

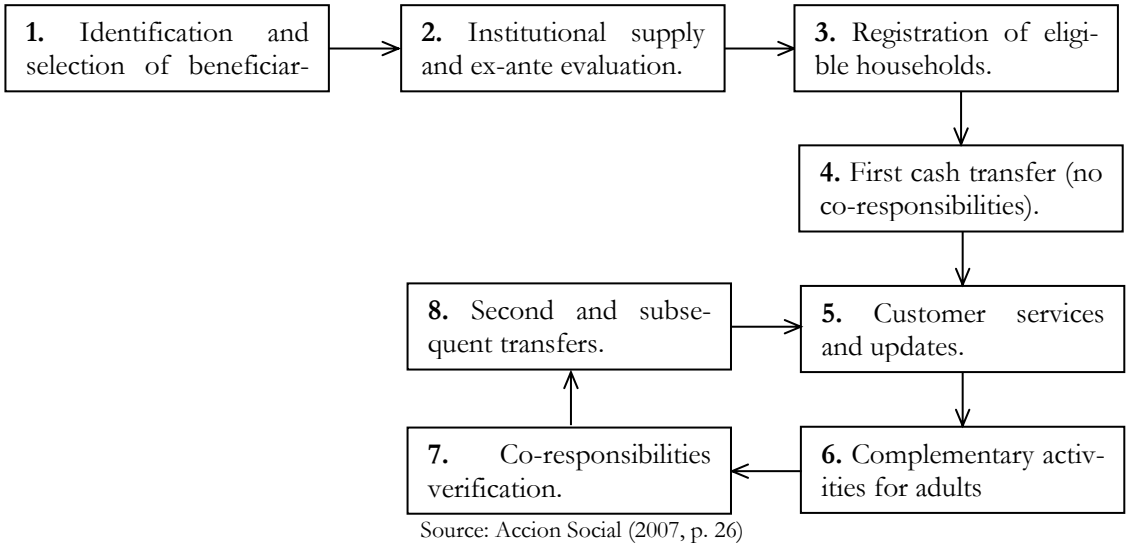
The secondary education and nutrition cash transfers were increased in 2007 for a group of 15 cities where designers learnt that the main dropout source was not the inability of parents to afford the education of their children. Instead, it was noticed that children faced other urban problems that would prevent them to attend school, such as child labour, gangsterism and disinterest in education. The values range from 7.5 to 30 US$ per month per students according to the school grade the child attends (Accion Social 2007). On average, a household could add up a monthly transfer of 50 US$, which corresponds to the 17 percent of total household consumption.

III-2.3. Implementation cycle

The implementation cycle of the programme summarises the steps to be followed in order to complete the transfer of benefits to the final recipients. The cycle is composed by eight specific steps detailed in the *Familias en Accion* operation rules. These steps start from targeting (identification of beneficiaries) through the payments and complementary activities (Accion Social 2007). Figure III-2 illustrates the implementation cycle:

[*Continued on the next page*]

Figure III-2. Implementation cycle of *Familias en Accion*.



Source: Accion Social (2007, p. 26)

Each box of Figure III-2 is detailed in the following sub-sections. Additionally, the current exit criteria are explained.

III-2.3.1. Identification and Selection of beneficiaries

Geographic criteria

The first stage of the implementation cycle of the programme corresponds to the targeting and selection of eligible households. This process entails a geographic component that has changed as the programme has been scaled up to uncovered locations. Given the initial financial constraints the prioritisation of the transfers was focused on selecting the poorest and smallest municipalities of the country. The selection of municipalities is thus the first level of eligibility of beneficiary households. The lowest level of selection entails the targeting of potential household recipients by the utilization of the *Sisben* welfare score.

Starting from the geographic criterion, during the period between 2001 and 2006 the programme selected the municipalities with the following criteria:

- Population below 100 thousand inhabitants according to the last available national census.
- At least one branch of any public or private commercial bank.
- The municipality could not be a province's capital city.
- *Sisben* database up to date.

With these requirements, the programme initially identified around 750 municipalities eligible for the programme. However, between 2001 and 2006 these geographic criteria were modified when a group of 265 out of 300 municipalities without a bank's branch were allowed to partic-

ipate in the programme.[52] Subsequently, in 2007 all these restrictions were removed and any municipality could be included in the intervention. By 2009, due to budget restrictions some specific neighbourhoods in some large capital cities were geographically selected instead of all the eligible population. As previously mentioned, a differential transfer scheme was implemented in selected neighbourhoods in large cities.

Individual criteria

Once the geographic level of selection is completed, the targeting and selection of beneficiaries depends on a household-level welfare score known as *Sisben*. *Sisben* stands for *Sistema de Identificación de Potenciales Beneficiarios de Programas Sociales*.[53] It was put into practice in 1993 after the 1991 Constitution ordered the state to prioritise the social policy to the poorest. The identification of households in poverty introduced a challenge to the government, as the high informality rates dominating the Colombian economy deter the use of single means test methods. Based on observational characteristics, the *Sisben* welfare score is obtained from the implementation of a household survey with 75-80 questions whose content have been changed in three opportunities. An algorithm generates a score that ranges between 0 and 100 denoting 0 the poorest household and 100 the richest. Since the score is calculated for at least 80 percent of the Colombian population in every municipality, this targeting instrument is not only used by *Familias en Accion* but by most non-contributory programmes that incorporate an individual selection criterion (DNP-Mision Social 2003).

Sisben is a proxy means test (Grosh and Baker 1995). Different from other approaches it does not attempts to predict household consumption or income levels. The resulting *Sisben* can be associated to a poverty measure that allows policy makers to rank households according to their characteristics summarised in one single scalar. Those characteristics are rarely related to the general conditions of the economy and they tend to change in response to structural modifications of each household's human, physical and social endowments. In this sense, the *Sisben* is tailored to a structural definition of poverty. According to an official document, the *Sisben*

> "El I-Sisben busca información sobre la capacidad de las familias de generar ingresos en el largo plazo. Responde a un enfoque integral de estándar de vida, cuya medida se hace por una aproximación de test de medios, mediante las variables

[52] This group of municipalities were able to send their beneficiaries to be paid at a bank's branch in closest municipalities.
[53] In English, Potential Beneficiaries Identification System for Social Programmes. See Azevedo, Bouillon, and Irarrazaval (2011) for a detailed regional description of social information systems in Latin America.

mencionadas. No es una medida coyuntural y por lo tanto no capta cambios de liquidez de corto plazo" (DNP-Mision Social 2003: 93).[54]

The design and administration of the *Sisben* relies on the *Departamento Nacional de Planeacion* (DNP) (National Planning Department).[55] This institution centralises the information reported by the municipalities, crosses and merges the data and validates the changes that are generated on the field work. Among other controls, the *Sisben* administrator detects signs of manipulation. It is in charge of providing the programme with a depurated dataset to be employed in the recruitment of new beneficiaries. Despite *Sisben* survey is carried out by face to face visits by enumerators, an eligible household applying for an intervention would not obtain the benefits unless its score is calculated at the municipality level and then sent to the DNP for its validation.[56]

The *Sisben* score algorithm has been modified three times since it was introduced in order to reduce targeting errors and potential manipulation. The first version of the *Sisben* score was employed between 1994 and 2002. During this period the components and formulas for calculating the score were publicly known. Camacho and Conover (2009) evaluated the potential manipulation of the first version of the *Sisben* and identified the sources of the moral hazards and adverse selection derived from the data management. The second version of the *Sisben* was introduced in 2003 with secret components and formulas. Some variables such as ceiling materials and income were ignored while others such as landline telephone, utilities' tariff strata and durable assets were incorporated (DNP-Mision Social 2003). Finally, in 2010 the current version of the *Sisben* was implemented with enhancements in the algorithm for the calculation of the score, inclusion of concepts of vulnerability and free determination of levels or cut-off point by programmes' administrators (Florez, Espinosa, and Sanchez 2008).

The *Sisben* survey is often composed of 74 questions detailing the socioeconomic characteristics of the household. A broad description of the modules is specified as follows:

1. Identification: contains the location of the household, including municipality, sector, address and distinction between rural and urban areas.
2. Dwelling characteristics: it registers the dwelling's construction materials such as roof (not in the second and third versions), walls and floors. It also details the provision of utilities and the location of the water source. Finally, it defines the number of households living in a shared dwelling.

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[54] This can be read in English as follows: *"The I-Sisben seeks for information about the household's capacity to generate income in the long run. Responds to an integral focus of living standard, whose measuring is made by an proxy mean test... it is not a conjunctural measure of income and, hence, do not detect liquidity changes in the short run "* (DNP-Mision Social, 2003, p. 93).
[55] Thus, the agency in charge of *Familias en Accion* does not run this targeting algorithm.
[56] See an assessment by Castaneda (2005)

3. Living conditions: this module records whether the household owns the dwelling or rents it, the number of rooms available for sleeping and the availability and location of toilet. It also specifies the cooking fuel (charcoal, firewood, kerosene, gas or electricity), the availability of landline and the ownership of certain assets (fridge, washing machine, TV, oven and others).
4. Socio-demographic composition of the household: reports the individual characteristics of the members of the household. Identifies the kinship among members starting from the head. For each household member the survey registers the gender, age, marital status, ID number, pregnancy, disabilities, availability of health insurance, school attendance, education level, labour activity in the last month and monthly income.

Between 2001 and 2010 most of the beneficiaries participating in *Familias en Accion* were targeted and selected by the use of the second version of the *Sisben*. The procedure consists of summarising in one scalar a poverty measure containing aggregated information about the quality of the household's dwelling, utilities or public services provided, demographic composition of the household, income and labour activity, human capital and social security (DNP-Mision Social 2003).[57] Household definition is determined by the notion of *all-eat-from-the-same-pot*, regardless the consanguinity of its members. The resulting *Sisben* score was divided by the DNP into six and four levels in urban and rural areas, respectively. The higher the *Sisben* level, the better-off the household. *Familias en Accion* selects the first level of households that are considered as the poorest as that they are identified at the bottom of the *Sisben* score.[58]

For example, a household living in a slum would receive an enumerator from the local planning office. The dwelling will be observed according to its construction materials and the private provision of utilities. Then, each member of the household would be listed and described taking into account his or her gender, age, education, marital status, income, labour activity and others. The enumerator will return the survey to the local planning office, where the information is introduced onto computing software where a provisional score and level is assigned to the household. The local planning office sends the database to the DNP whose administrators make sure that no household member was registered before in other households and that no abrupt changes have been made to someone's characteristics. Finally, the DNP sends the datasets to each programme administrator, including *Familias en Accion*.

[57] The quantitative method to calculate the *Sisben* is known as optimal scaling and categorical principal component analysis (DNP-Mision Social, 2003).
[58] It is calculated that at least 10 million people participate in social programmes by obtaining the *Sisben* score. *Familias en Accion* is the only one selecting the first level of classification, while the rest select levels 1 and 2 (Bottia, Cardona, and Medina 2008).

The programme imports the *Sisben* information onto its own information system and rules out those households without children between 0 and 17 years of age. Since it is possible to find more than one mother and her own group of children in the same household, the next step in this selection process is the identification of particular familiar kinships. Then the system keeps and prioritises the selection of mothers and their respective children to be listed as eligible for the programme. As the mother is the main claimant, *Familias en Accion* would rely on the eligibility criteria of the poorest mothers as representatives of their whole household. Indeed, names and identification numbers of selected mother or care-givers are published in public places prior to the programme registration.

In sum, *Familias en Accion* does not have direct control over its individual targeting and selection. The administrator of the programme receives the information from the DNP and selects the poorest cohort. Mothers from selected households were prioritised to receive the transfers on behalf of their children and family. The first stage of the implementation cycle is finished with the publication of the names of eligible mothers belonging to the poorest households in selected municipalities.

III-2.3.2. Institutional supply and ex-ante evaluation

The operation of the programme is contingent on the provision of health and education services; otherwise the conditionalities cannot be verified. The operation of *Familias en Accion* in a municipality requires an assessment of supply capacity of the health and education services. The administrator of the programme along with the municipal delegate gathers information on the availability of doctors, nurses, teachers, classrooms and some other supplies and facilities that facilitate the appropriate formation of human capital. Given the fact that the programme is justified by the low utilization of these services by the eligible households, the objective of this assessment is to establish if the available capacity will sustain the potential increase in its demand.

The indicators for the health services include the doctor-population ratio, vaccination coverage and the potential number of health checkups for infants. Similarly, the education supply is assessed according to the number of schools, classrooms' area, number of regular students, teacher-student ratio and last year's local dropout rate. If these indicators satisfy the minimum requirement for the operation of the programme, then the registration process can take place.

III-2.3.3. Registration of eligible households

The registration process of eligible households takes place in each municipality for a limited time. The objective in this stage of the implementation cycle is to check the *Sisben* information and to make the eligible mothers aware of her participation in *Familias en Accion*. The munici-

pal delegate and the RCU agree on the dates and duration of the registration according to the number of potential beneficiaries. Some municipalities can afford to assist eligible mothers with a paper-based registration process and some others with internet-based data collection systems. An average of one thousand mothers can be assisted daily for a period not longer than two weeks. Since the programme cannot be accessed on demand, if an eligible mother misses the registration process she will not be able to participate in the programme until a new process is conducted.

Prior to the registration process, the municipal delegate receives the list of selected household mothers for their potential participation. The list is published or disclosed in local schools, churches, hospitals, advertised in radio stations and some other public facilities. The mothers must gather several documents, including a copy of her identification card, birth certificates of their children and school enrolment certificates from those children attending school.[59] Each mother on the registration list must sign a contract in which she commits to complying with the co-responsibilities. Mothers representing their household must dedicate at least one day to the registration process. If listed mothers work or look after their children they must assume the opportunity cost. The registration process may imply queuing over an hour before the serving modules are reached in which mothers can spend. Not all the mothers manage to obtain the registration and must wait until a new enrolment process is organised in the municipality.[60]

III-2.3.4. First cash transfer

The first cash transfer is made within two months after registration. The amount of the cash benefit depends on the documents that mothers hands in at the registration process when the programme determines how many children they have and which of them is currently attending school. On average, each family receives 50 US$ bimonthly.

III-2.3.5. Customer service and information updates

After the first and subsequent payments, the beneficiaries can update their information. If during the registration process the programme made any mistake, this is the stage in which the mothers and municipal delegates must inform the RCU. For example, if a child is enrolled at school, then the mother could hand in its certificate and start receiving the corresponding cash benefit. The programme would accept any changes except the addition of new children or an eventual switch of the registered claimant mother.

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[59] If a particular child is not attending school, she can register him and obtain the registration certificate for receiving the transfers. If a particular mother is not in town, another adult from her household in charge of her children can take her place.

[60] The registration process could take between three and four years to be repeated in the same municipality.

III-2.3.6. Complementary activities for adults

The combination of the co-responsibilities and the cash benefits are not the only components of the programme. The adult members of the household have to attend several meetings where they receive training on self-care and caregiving to their children. Frequently, a doctor, a nutritionist or a nurse accompany these meetings and speak about the complementary health services accessible to them. Women are encouraged to obtain preventive services like papillomavirus tests, mammographies, and some others.[61]

Beneficiary households are organized in groups of 50 members who are led by one leader mother. The leader mother is elected by all the 50 households in a general assembly that is held after the first cash transfer. The leader is trained by the municipal delegate in the implementation of the programme so she can help others on the implementation cycle. Leaders are also the main communicating channel between the municipal delegate and households, through which the information on events and meetings is disseminated within beneficiaries.

III-2.3.7. Verification of co-responsibilities

Co-responsibilities are binding for participants in *Familias en Accion*. The programme implements several modalities of verification depending on the size of the municipality. In essence, the mother will need to visit the schools where her children study and the health centres where the infants are checked and obtain an attendance certificate. Finally, she must hand these documents to the municipal delegate who uploads the certificates onto the information system. Without the verification of co-responsibilities each two months, the family will not obtain the cash benefit.

This stage of the programme demands time and costs to the mother. She must take transportation to the schools and health centres to obtain the corresponding certificates. When a large group of mothers obtain the certificates at the same time, they must wait in large queues that can take one entire day. Therefore, the verification of the co-responsibilities can prevent some families to receive the cash benefit in absence of the out-of-pocket expenses that they should cover.[62]

III-2.3.8. Second payment and second cycle

Once the beneficiary mother completes the first verification of co-responsibilities and the information on her children has been updated, she will be able to receive the second cash benefit. The programme employs several modalities depending on the banking capacities of the

[61] Contreras and Maitra (2013) detect positive effects of *Familias en Accion* on health outcomes for adult members in beneficiary households.

[62] This requirement highly affects the families in the rural areas. According to an internal monitoring report, a mother needs to travel an average of 22 kilometres for verifying the co-responsibilities and spend 5 US$ (Familias en Accion 2002).

municipality. Some payment points are based on the direct transfers into the beneficiary's bank account while some others depend on face-to-face tellers.

The following cycle consists of the verification of co-responsibilities, the updating of the information, customer service and the attendance in complementary adult activities and transfers.

III-2.4. End of the transfers and exit from the programme

Between 2001-2010 *Familias en Accion* has stopped delivering the transfers to some households based on the natural lifecycle of their children. Following the nature of a CCT, the programme also penalises the non-compliance of the conditions. The implementation manual specifies that participants are withdrawn if:

- The beneficiary child reaches 18 years of age.
- The mother does not withdraw the transfer after accumulating two payments.
- The household does not meet the co-responsibilities for two continuous implementation cycles.
- The household provides false information on the eligibility criteria.
- The household migrates to an uncovered municipality where the programme does not operate.
- In 2007 and 2011, the households that had lost their eligibility criteria were dropped from the programme (Villa 2008). This exit criterion was not explicitly clear in the operation rules.

These conditions determine the end of the transfers or exit from the programme. As any SAP of its nature, *Familias en Accion* does not consider the principles of exhausted-effectiveness and non-recurrence of poverty that this thesis addresses. Indeed, a household that is enrolled with a newborn child can be exposed to the intervention over 18 years. Similarly, the programme stops the transfers to non-eligible household (exit from poverty) regardless their likelihood of being eligible in the future. On the other hand, the exit from the programme is also dependent on the penalisation to the household when it is unable to comply with the co-responsibilities. Given the severe poverty that some households suffer from, direct and opportunity costs of verifying the co-responsibilities can lead them unintentionally out of the programme.

III-2.5. Stages of operation of the programme

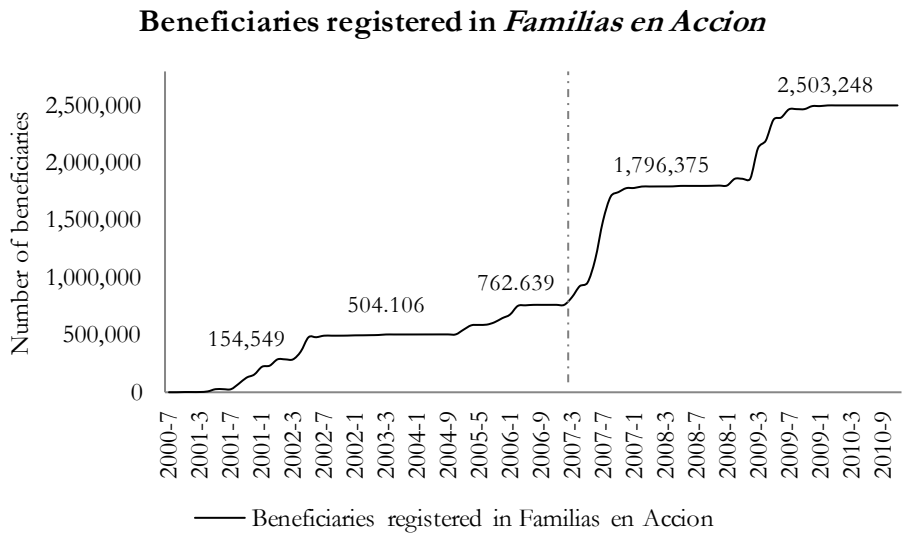
The initial *Familias en Accion* intervention was intended to operate over a three years window, starting in June 2001 through June 2004. A pilot stage had been implemented between December 2000 and April 2001, when the operation rules and information systems where tested

and consolidated. The programme was provided with initial funding to recruit 340 thousand households in three hundred out of 1,119 municipalities. These municipalities were targeted according to the criteria previously explained. The programme aimed at selecting households that had been identified as extreme poor in 1999, when the country faced a sharp decrease in its GDP.

Two main broad stages can be identified in the operation of the programme in the period 2001-2010. These stages would depend on the funding cycle of the programme, which did not rely directly on taxes but on loans from multilateral banks. The initiation of each stage was characterised by a massive registration process, while no further enrolments were made between stages. Thus, new beneficiaries were only admitted in any given municipality unless a new registration process was carried out. No new children were admitted for registered households. Similarly, households falling into poverty would need to wait for the next registration to obtain the transfers from the programme.

The first stage started in 2001 with the introduction of the intervention in response to the economic crisis that hit the country in 1999. This first stage ended in 2006 when the funding cycle of the programme was renewed and a new registration process took place in 2007 with a refined targeting criterion. In its first stage, *Familias en Accion* was funded by the national government through two loans from the Inter-American Development Bank and the World Bank adding up nearly 400 million US$. By the end of 2006 the programme had registered 762 thousand beneficiaries in 847 municipalities.

Figure III-3. Number of beneficiaries (households) in Familias en Accion.



Source: Author with information from *Familias en Accion's* administrative records.

The second stage is defined by a new funding cycle starting in 2007 that combined national taxes and loans from multilateral banks in the amount of 1.5 billion US$. This second stage

was characterised by the implementation of *Familias en Accion* in every municipality including large cities. All the geographic selection criteria were removed and any municipality was eligible for the programme. It incorporated nearly 1.8 million beneficiaries by 2009 and 2.5 million by 2010. The milestone that determined the end of the second stage of implementation was the change of the ruling government and the introduction of a renewed individual targeting instrument.[63] Hence, the two stages of the programme implementation combine funding and targeting elements defined as the periods spanned between 2001-2006 and, secondly, the period 2007-2010.

One feature of the implementation of *Familias en Accion* over these stages has been the mismatch between the eligibility and actual registration. Although the programme identifies eligible households according to the *Sisben* score, not all of them are actually registered in the programme. The administrative records indicate that between 60 and 80 percent of eligible households are incorporated into *Familias en Accion*. Thus between 20 and 40 percent of eligible households would not take up the transfers. Marcelo (2009) conducted a study to assess the reasons why some eligible mothers do not respond to the registration process. He found that a proportion of 45 percent of eligible households that did not participate claimed that they did not obtain any information about the existence of the programme in their community, while the rest alleged lack of interest in the cash transfers. On the other hand, 55 percent of those households that did not take the programme were not found by the study. Since 2001 the programme has accounted for 3.5 million eligible households, but only 2.5 have actually participated by 2010.

III-2.6. Impact evaluations

As part of the programme's funding, the multilateral banks provided *Familias en Accion* with an initial loan conditional on the impact evaluation of the CCT. In spite of the fact that the programme was not designed on a randomised controlled trial setting as Mexico's *Oportunidades*, the evaluation strategy consisted of the selection of 122 treatment and comparison municipalities. Thus, the targeting and selection criteria were not affected by the evaluation strategy. Most of the evaluation reports were based on the implementation of quantitative non-experimental methods funded by a special line of the loan contract (Attanasio, Meghir, and Vera-Hernandez 2004).

[63] The *Sisben* was modified in 2010. The assignment score was made incomparable to previous versions. The DNP stopped setting the mandatory eligibility cut-off points and each programme became responsible setting its own eligibility criterion (Florez, Espinosa, and Sanchez 2008).

The impact evaluation reports taken into account in this section correspond to those commissioned by the administration of the programme.[64] The first one addresses the results of the implementation of the programme in the first stage in 2001-06, while the second is focused on the introduction of *Familias en Accion* into large cities in 2007-10. The institutional origin of these impact evaluations guaranteed that the field work performed by the evaluators and the adoption of recommendations were potentially internalised by the administration of the programme. In fact, each stage of implementation of the programme was supported by the results of an impact evaluation.

III-2.6.1. Impact evaluation in the first stage of implementation

The first impact evaluation was done between 2001 and 2006. The selection of the municipalities was made by the programme and notified to the evaluators. Given that *Familias en Accion* was not introduced in all the municipalities of the countries, the evaluation strategy consisted of identifying a group of comparison municipalities. In this sense, 122 municipalities participated in the evaluation, divided between 57 treated and 65 untreated.[65] For the evaluation's sake, the municipalities were divided between town centres and scattered rural areas. Using matching techniques, the villages and their rural areas were compared by conducting a baseline survey and two follow-ups with 11,462 households and 20,868 children.[66]

In response to the lack of initial randomization, two main non-experimental methods were considered. The availability of a panel data allowed the combination of *propensity score matching* and *difference in difference* treatment effect estimators.[67]

The results of the impact evaluation were revealing in terms of human capital accumulation and household consumption, especially in rural areas. According to the final report by IFS-Econometría-SEI (2006) school attendance increased by 5.1 and 7.2 percentage points in urban and rural areas for children between 12-17 years of age, respectively. The programme reduced the number of repeated school years by 0.12 for children between 14-17 years old. As for labour markets, child labour was almost eradicated by a reduction of 5.5 percentage points in rural areas while the number of weekly worked hours by adults remained unaffected. Although the transfer was found to correspond to 20 percent of household income, there were no significant impacts on household incomes while consumption was only increased by 5 per-

[64] There are a relevant number of working papers that evaluate the impact of *Familias en Accion* on several outcomes. See for example Attanasio et al. (2010, 2009, 2005a, 2005b), Forde et al. (2011) and Nuñez (2011)
[65] A group of untreated municipalities became treated over the evaluation period.
[66] These matching techniques consisted mainly of propensity score matching. The municipalities were paired according their propensity score (probability of being treated by the programme). Then, the differences in the outcomes between treated and comparison municipalities were attributed to the programme.
[67] See a methodological introduction by Gertler et al., (2010)

centage points in rural areas. Similarly, food consumption increased 15 percent in rural areas.[68] Thus, the programme reduced food poverty in rural areas by 12.6 percent while a multidimensional living condition index was unmodified.[69]

In 2012 Econometría-SEI (2012) was commissioned to do a long-term evaluation of the first stage of implementation of *Familias en Accion* after 10 years of operation. They used the same evaluation sample from the baseline for treated and untreated groups collected in 2002. Their findings confirmed those in the first impact assessment in rural areas. For example, it was observed that beneficiary children were 1.3cm taller at 9 years of age. However, they were 5.6 percentage points more likely to be overweight.[70] Parents were more aware about the importance of a good nutrition of their children emphasising on being "filled-up and fat" rather than "well nourished." Findings on education showed that children between 7-11 years of age were 1.3 percentage points less likely to do any kind of paid or unpaid work. Similarly, youths between 18-26 years of age were 6.4 percent more likely to complete the high school education but, conversely, 4 percentage points more likely to repeat a school year due to low academic performance. Female youths between 18-28 years of age that had benefitted from the programme were 2.5 percentage points more likely to obtain a formal job while their number of children was affected in one less child.

The long term evaluation done by Econometría-SEI (2012) provides a qualitative approach relevant to the results to be presented in next sections. Some parents participating in focus groups manifested their interest in helping their children break the intergenerational transmission of poverty. Their effort seems to be insufficient in terms of the human capital formation. Particularly, a household's head declares that "*Para mí es muy importante que los niños estudien, no quiero que mis hijos se queden sin educación, si mi esposo hubiera estudiado hoy sería una persona importante, un docente y yo también sería una persona importante. Por eso quiero que mis hijos vayan al colegio. Mi hijo grande no quiso ir a la escuela, no le gusta, siendo inteligente. No quiere estudiar, prefirió trabajar con el padre en las labores del campo...*" (Econometría-SEI 2012: 91).[71] Some other parents are emphatic on the limitations their children face to complete their school. Rural households emphasize that high or secondary schools are limited available and only cover until ninth grade (11th grade is the last one). On the other hand, they complain about the limitations of local labour markets and the supply of undergraduate or technical education. Another household's head declares

[68] Among foods, the impact was centred in the increase in the intake of proteins and cereals.
[69] The multidimensional living condition index was referred as the Unsatisfied Basic Needs method. (Battiston et al. 2009) provide some conceptual ideas on this index and compare this index among Latin American countries.
[70] In the terms of the previous chapter, the fact that children were found more likely of being overweight is an example of a symptom of *over-dose* of the treatment.
[71] This can be read in English as follows: *"It's very important for the children to study, I don't want my children be low educated... I want my children attend school. My oldest child was reluctant to attend school, he doesn't like it. He doesn't like to study, he'd rather work with his father on agricultural matters... "* (Econometría-SEI 2012: 91).

that "*Muchos muchachos desertan porque dicen: - de qué me sirve terminar el bachillerato y después qué me pongo hacer*" (Econometría-SEI 2012: 93).[72] This issue with the households' expectations on what their children will do once they complete school is influenced by the poor performance of local labour markets. In addition to the underemployment of parents, the households often refer to other children or youths that have finished school, invest in higher human capital and end up working at low qualified activities. For example, "*Mi hijo salió aburrido del bachillerato y no quiere seguir estudiando, tiene 17 años y no sabe qué hacer...*" (Econometría-SEI 2012: 113).[73]

III-2.6.2. Impact evaluation in the second stage of implementation

The second stage of implementation in 2007-2010 was shaped by the introduction of the programme in large cities. The administrators were interested in learning about the behaviour of the effectiveness of *Familias en Accion* in large urban cities where the transfers were redefined. In fact, the level of cash benefits were different especially for children in secondary education to whom the transfers were intended to prevent and response to child labour. The programme had evaluation experience in small towns while its performance in new covered areas in large cities was uncertain. Thus, despite the programme was still operating in small towns or municipalities, the evaluation of this stage of implementation focused on the effects in large cities.

As part of the impact evaluation, a baseline survey was carried out in 2007 prior to the introduction of the programme in large cities. A follow-up survey was conducted in 2011. In this setting, treated and untreated groups were defined in the selected cities as the programme did not cover all the eligible neighbours. The evaluation methodology relied on quasi-experiment data by obtaining difference in difference and regression discontinuity estimates. Nearly ten thousand households were surveyed with a panel structure of treatment and comparison groups. Between the baseline period and the follow-up the non-random attrition rate was 15 percent.

In spite of the fact that the effects of the programme on human capital formation had been predominantly higher in rural areas, the evaluation of this stage showed that the average years of education of beneficiary children increased by 0.15. However, the programme did not have any impact on school attendance, which is explained by the existing high levels of school enrolment at the baseline. Health status of the beneficiary children improved. The programme mitigated the likelihood of illness, especially from respiratory infections (5.8 percent less). The programme also increased the consumption of better quality food. For instance, cheese consumption increased by 20 percentage points and vegetables by 18 percentage points. In total,

[72] This can be read in English as follows: *"...so many children drop out of school because they think: why should I complete my studies if I will have nothing to do afterwards?"* (Econometría-SEI 2012: 93).
[73] This can be read in English as follows: *" My son graduated very disappointed from school and he doesn't want to study any longer, he is 17 and doesn't know what to do... "* (Econometría-SEI 2012: 113).

monthly per-capita food consumption increased by 18 US$, which was higher than the observed results in small towns and rural areas. In fact, the food poverty headcount rate decreased in 9 percent. Therefore, the impacts of *Familias en Accion* on human capital formation and poverty were also significant in large cities.

In summary, *Familias en Accion* is a programme with a broad evidence of its impact on several human capital indicators, including health, nutrition, education and school registration and attendance. The long term evaluation manifested that the programme was not adequate to meet the expectations of children once they complete school. In fact, they are better equipped with higher levels of education but at the same time they were unable to put their skills into practice on the local labour markets. These impact evaluations were set up in a static framework, while the next session will attempt to throw light on the effects of the programme at different levels of exposure.

III-3. Conclusions

This chapter has examined the introduction of CCTs in Colombia. In the light of the economic crisis that hit the country in 1999, the government responded by adopting the Mexican cash transfer approach. Multilateral banks played an important role by facilitating the adoption the Mexican *Oportunidades* programme with the name of *Familias en Accion*. The results of the impact evaluation of *Oportunidades* also provided the evidence that supported its implementation in Colombia. After a pilot stage between December 2000 and April 2001, the programme scaled up *Familias en Accion* prioritising small villages. By 2010 all the municipalities of the country were covered by the programme.

It was shown that the programme consists of an operation cycle that entails the targeting and selection of beneficiaries. The main targeting tool for the identification of households in extreme poverty was the *Sisben*. The *Sisben*, administered by the DNP, provides a welfare score from 0 to 100 indicating an ordering scale from the poorest to the wealthiest. Once the households in extreme poverty were enrolled in the programme they would received an average transfer of 50 US$. The implementation of the programme over its implementation stages reached 2.5 million families, although 3.5 million had been identified as eligible.

Impact evaluations have demonstrated the positive effects of *Familias en Accion* on children's human capital outcomes. Child labour was eradicated by the programme in rural areas, while young children manifested higher growth scores as a consequence of a better nutrition status. In the long run the programme caused overweight in beneficiary children, while the labour prospects of graduate children were limited by the poor dynamics of the local economy. Final-

ly, the evaluation of the implementation of the programme in large cities showed that the programme can generate positive effects on poverty and higher quality food consumption.

Given that current impact evaluations have been done under a static setting, the next chapter will examine the continuous effects of *Familias en Accion* taking into account the length of exposure as the treatment variable.

CHAPTER IV: CONTINUOUS EFFECTS ESTIMATION OF THE LENGTH OF EXPOSURE TO *FAMILIAS EN ACCION*

Human Development Conditional Cash Transfers (CCTs) have been successful in helping households in poverty achieve a higher investment in children's human capital in developing countries (Fiszbein and Schady 2009). As it was presented in the last chapter for *Familias en Accion*, CCTs have been evaluated in a static framework, considering the impact as constant over time. One of the most unexplored fields in the implementation of CCTs is the potential dynamic of their effectiveness as the length of exposure varies. Understanding how the effectiveness of CCTs is shaped by the participation of beneficiaries over time could lead to the generation of evidence-based exposure rules.

Despite the theoretical model presented in the previous chapter predicts how the effectiveness of the programme varies, this chapter does not seek for testing such predictions. The proposed quantitative methodology along with a rich dataset composed of the administrative records of the programme provide an empirical evidence that demonstrate how a CCT affects the outcomes of interest over time (i.e. the number of years of education represented by the $1 - l_c^{cct}$ argument in the function $h(1 - l_c^{cct})$). The dataset consist of the pre- and post-programme targeting survey, the *Sisben*, which contains more than 60 million observations in a two-round setting. The unprecedented use of this dataset provides an outstanding consistency to the results which are not affected by sampling errors.

To date, recent research on CCTs has tended to focus on whether these interventions accomplish their objectives or not, rather than understanding the extent to which the length of exposure can generate intended or unintended effects. For this reason, the aim of this chapter is to evaluate the response of the outcomes of *Familias en Accion* to different length of exposure levels. By employing the non-experimental effectiveness evaluation methodology known as *Generalised Propensity Score* (GPS) (Hirano and Imbens 2004; Imbens and Wooldridge 2009), this chapter will be able to provide evidence of reliable quantitative estimates from secondary data and administrative records. In a conventional impact evaluation based on binary treatment settings (treated and control groups) the identification strategy consists of achieving unbiased results. The main concern in the latter is that selection in the participation process might confound the results in absence of a random assignment of the length of duration. On the other hand, the main concern in the estimation of the GPS is how the lack of randomness in the assignment of the length of the exposure can lead to biased estimates. In fact, the GPS can estimate the intervention's effects considering the treatment or exposure as continuous accounting for the lack of randomness in the assignment of length of exposure to each benefi-

ciary household. Thus, the assessment of the programme by considering the response of the intended unintended outcomes to the length of exposure will contribute to the understanding of how the effectiveness varies.

This chapter have been organised in the following way: section IV-1 explains the quantitative methodology for the estimation of the continuous treatment effects with the GPS. Similarly, section IV-2 describes the secondary and administrative data used in the estimation of the equations proposed in the quantitative methodology; section IV-3 presents the results while section IV-4 briefly discusses their implications. Finally, section IV-5 presents the conclusions of this chapter.

IV-1. Methodology: the Generalised Propensity Score

The impact evaluations that have detected the effects of *Familias en Accion* on the human capital formation of children and household dynamics are based on the conventional binary difference in the outcomes for treated and comparison groups. These evaluations also have assumed the impact of the programme as constant over time with no considerations on its potential variation in response to different levels of exposure. The fact that evaluations consider the effects as constant over time reveals a broad gap in the assessment of these types of interventions as result of the recognition of potential cycle of the effects. For example, it is not clear whether the increase of 5.1 percentage points in school attendance observed in the initial impact evaluation will remain constant for different spells of participations. The impact of the intervention can be increasing, constant or even decreasing over time (Behrman and King 2008). Therefore, this section presents the methodology for the estimation of continuous marginal treatment effects, considering a time-varying impact of the intervention.

There are several underlying challenges that must be taken into account in estimating the continuous treatment effects when, as in this case, the length of exposure to the intervention is regarded as the continuous treatment. The binary comparison between treated and untreated individuals is not suitable, as this analysis is not intended to look at the counter-factual effects on the outcomes in absence of the programme. Instead, it is focused on the continuous effects on the outcomes at different lengths of exposure for treated individuals. If the length of exposure was assigned randomly one could compare the outcomes of a certain variable by merely differentiating the results from household or individuals at different lengths of duration. When randomization is not feasible, the estimation of the continuous treatment effects may be driven by the endogeneity that could arise between the length of exposure and the selected outcomes. The main source of endogeneity is the selection bias in the permanence of each household in the programme and the administrative criteria selecting the municipalities where the programme operates. For example, a longer exposure could lead to a higher human

capital accumulation and vice-versa. So far, there is no evidence on a social assistance programme or controlled trial with a random assignment regime of its length of duration. In this case, the possible treatment effects will be confounded by the potential endogeneity between the length of duration and outcomes. Households with higher levels of child human capital will be able to participate longer, as the compliance of the co-responsibilities implies direct and opportunity costs that the poorest households are unable to afford. The administrative selection also plays an important role in the length of exposure. The national coverage of the programme has been expanded gradually taking into account the characteristics of the municipalities where it has been introduced (see Chapter III for details). The characteristics determining the selection of municipalities evidently are not random and must be considered. Indeed, the main challenge of the proposed methodology is, in fact, the mitigation of the potential confoundedness in the estimation of the effects of the programme by considering the treatment as continuous.

The analogy with medical trials can be used to illustrate the continuous treatment effects and its basic concepts in this context. Consider a new therapeutic treatment for a particular disease. A control and treated group can help to demonstrate whether the therapy is effective or not. The researcher would also attempt to test the effects of the length of exposure and obtain a dose-response indicator. This complementary exercise will determine the span that the medicine requires to achieve its complete effectiveness. As the researcher is interested in a positive supply of medicine, a control group with a placebo treatment is unnecessary. Participation selection bias or the way patients are chosen for the medical trial is not part of the question that the researcher wants to answer. The researcher could randomly assign the same dose over a different length of exposure to several voluntary patients. The randomisation will eliminate any potential bias generating the possible endogeneity between outcomes and the length of exposure (e.g. the sickest patient will want to participate longer than the healthiest). In this ideal case the differences in the outcomes among patients at different exposure levels will denote the response to the dose of the new therapeutic treatment. If randomization is not possible, the researcher will need to mitigate the endogeneity between the outcomes and the length of exposure. Given the availability of observable characteristics from participants, a non-experimental method will help the analysis to be completed towards the estimation of a reliable dose-response indicator.

A significant number of econometric methods have been developed to address the lack of randomness in the assignment of continuous treatments and dose-response analysis. In most recent studies, several alternatives have been used for the estimation of continuous treatment effects based on parametric and nonparametric estimators. Behrman, Cheng, and Todd (2004)

assess the effects of public nurseries in Bolivia on children's nutritional status at different lengths of exposure. They calculate a semi-parametric dose-response function by differentiating the estimated effects for children at different length of duration matched with non-participant children. On the other, they suggest estimations based on data on participants, clarifying that:

> "The advantage of this approach over the previous one is that it does not require assumptions on the process governing selection in the program and allows for the possibility into the program is based on unobservable characteristics." (Behrman, Cheng, and Todd 2004: 113).

Florens et al. (2008) suggest the estimation of continuous treatment effects with non-parametric instrumental variable approach. However, this method of analysis has a number of limitations. Despite the latter approach can mitigate the biases generated by a non-random assignment of a continuous treatment, it does not facilitate the analysis because it does not lead to the construction of a dose-response function. Instead, it focuses on the estimated coefficient of the treatment variable instrumented with excluded variables. In contrast, Imai and Dyk (2004) develop a feasible parametric approach based on the generalisation of the binary-based propensity score as detailed by Rosenbaum and Rubin (1983). They illustrate their point by referring to the effects of smoking on health status. In fact, they state that:

> "The lack of experimental data led many researchers to use propensity scores. Because this method is confined to a binary treatment, the focus has been on the comparison of smokers and nonsmokers without distinguishing among smokers based on how much they smoke" (K. Imai and Dyk 2004: 857).

Despite their contribution to the analysis, the proposed generalisation of the propensity score by Imai and Dyk (2004) does not demonstrate rigorously the mitigation of the potential endogeneity between the continuous treatments and outcomes. One major drawback of their approach is that they do not formulate the specific framework under which the identification strategy achieves the unconfoundedness between the outcomes and the treatment variable. Flores et al. (2011) propose a semi-parametric approach following Hirano and Imbens (2004) and Imbens and Wooldridge (2009) by specifying a similar generalisation of the propensity score. The semi-parametric approach provides a dose-response analysis with kernel estimators tested with an example based on the length of exposure of job seekers to a job training programme in United States (known as the Job Corps). Zhao, Dyk, and Imai (2013) analyse the method proposed by Flores et al. (2011) and consider that it *"can exhibit undesirable properties"* (Zhao, Dyk, and Imai 2013: 3) due to the smoothing algorithm in the proposed non-linear

technique.[74] In summary, the above group of detailed methods could provide a feasible alternative to estimate the continuous treatment effects of the length of exposure of *Familias en Accion*. As this chapter does not contribute to the development of a particular method, the criterion for the employment of one of them is based on its degree of acceptance and validation among empirical researchers.[75]

Among the feasible methods for the estimation of continuous treatment effects, here it is considered the parametric procedure introduced by Imbens (2000), Hirano and Imbens (2004) (HI henceforth) and Imbens and Wooldridge (2009) that generalises the conventional binary propensity score treatment effect analysis initially developed by Rosenbaum and Rubin (1983). Despite the availability of some other developments on the generalization of binary treatment effects, the HI has been widely used and tested.[76]

The GPS has a number of attractive features. The main assumption of the parametric estimation of the continuous treatments effects proposed by HI is that the assignment of the intervention is random conditional on observational data. Specifically,

> "Following Rosenbaum and Rubin (1983) and most of the other literature on propensity score analysis, we make an unconfoundedness or ignorability assumption, that adjusting for differences in a set of covariates removes all biases in comparisons by treatment status." (Hirano and Imbens 2004: 1).

HI demonstrate that a generalization of the binary treatment, which they call *Generalized Propensity Score* (GPS), has the same properties of the binary treatment propensity score. The potential confoundedness or endogeneity derived from the dependence of the outcomes on the continuous treatment assignment is controlled by the availability of observed pre-treatment covariates. The subsequent randomness given the control for observational data is commonly known as Conditional Independence Assumption (CIA).

The GPS facilitates the analysis when observational data are available. Controlling for a significant number of covariates can be complex as the quantity of variables increases. Obtaining a

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[74] Lee (2014) also proposes a non-parametric approach. However, it lacks robustness when the bandwidth varies. Similarly, Bia, Flores, and Mattei (2011) demonstrate that the non-parametric regressions in this setting are sensitive to the specification of the model.

[75] According to the service scholar.google.com (visited in October 2013) the citation of these methods by journal articles, books and working papers are: Imai and Dyk (2004) 319 citations; Behrman, Cheng, and Todd (2004) 224 citations; Florens et al. (2008) 96 citations; Flores et al. (2011) 27 citations; Imbens (2000) 801 citations; Hirano and Imbens (2004) 235 citations and Imbens and Wooldridge (2009) 1,084 citations.

[76] Applications of the HI method, including the continuous treatment as length of exposure, are addressed by Bia and Mattei (2008) with loans and grants in the financial sector, Kluve et al. (012) and Choe, Flores-Lagunes, and Lee (2011) with the effects of the duration of job training programmes on earnings, Heinrich, Hoddinott, and Samson (2012) with the length of exposure and Aguero, Carter, and Woolard (2006) with a nutritional benefit of the South Africa's Child Support Grant. Teixeira (2010) with the effects of the value of the benefits of Brazil's Bolsa Familia on labour supply.

single scalar, the propensity score, can simplify the analysis and accomplish the CIA (Rosenbaum and Rubin 1983). In fact, the GPS developed by HI is a scalar that allows the estimation of continuous treatment effects controlling for any number of covariates.

Important considerations need to be taken into account in employing HI methodology. The first one is that it relies on the mitigation of the endogeneity between the continuous treatments employing observable pre-treatment covariates. This fact can ignore the existence of unobservable factors that can drive the results under certain circumstances, especially on the administrative side. The second and more importantly, HI method suggests a parametric specification of the dose-response function by forcing the shape of the distribution of the estimated effects, which are considered normally distributed. As it can be noticed below, the implications of these two considerations are coped by analysing endogeneity in the continuous variable and providing a flexible functional form of the parametric specification.

IV-1.1. Formalization of the HI continuous treatment effects estimation

The framework developed by HI assumes the existence of random sample units denoted by $i = 1, \dots, N$ and a potential outcome, $Y_i(t)$ for $t \in \tau$, which is known as the unit-level dose-response function. In a binary treatment effect framework $\tau = \{0,1\}$, however in the continuous case the treatment effect the treatment variable, τ, is deemed to vary in the interval $[t_0, t_1]$. HI focus on the average continuous treatment effect from the average dose-response function specified by $\mu(t) = E[Y_i(t)]$. The dose-response function would be confounded by a potential endogeneity between Y_i and τ unless the control for observable covariates for each unit i, X_i.

HI simplify the notation by dropping the i and they assume that T is a continuously distributed variable. $Y(T)$ is then a well defined random variable and suitably measurable. The assumption of independence between Y and T is based on the weak unconfoundedness because for each level of treatment the following conditional independence holds:

$$Y(t) \perp T \mid X \quad \textit{for all } t \in \tau \tag{IV.1}$$

The CIA leads to the definition of the GPS:

$$r(t, x) = f_{T|X}(t|x) \tag{IV.2}$$

Where $r(t, x)$ is defined as the conditional density of the treatment given the covariates. For the observed units, the GPS is then defined as $R = r(T, X)$.

Similar to the binary propensity score, the continuous treatment preserves the balancing properties of the covariates given the GPS for any level of treatment. That is:

$$X \perp 1\{T = t\} \mid r(t, X) \tag{IV.3}$$

When equation IV.3 holds, the balancing score property is achieved by the GPS. As HI point out that *"In combination with unconfoundedness this implies that assignment to treatment is unconfounded given the generalized propensity score"* (Hirano and Imbens 2004: 2). In this case, the balancing property is also analysed on the common support region as suggested by Flores et al. (2011). The balancing test is constrained to the common support region, which is obtained by calculating quintiles of the continuous treatment variable, T, and identifying the median of the GPS at each quintile. The common support helps the analysis obtain a better internal validity, as it rules out those households with the highest and lowest GPS over an overlapping region among quintiles. Borrowing from the notation by Flores et al. (2011), the quintiles of T are denoted by $Q_i = \{1, 2, 3, 4, 5\}$ and the value of the GPS at the median of the treatment by $\hat{R}_i^q$, such that for each quintile, *q*, the common support region is given by:

$$CS_q = \left\{i: \hat{R}_i^q \in \left[max\left\{min_{\{j:Q_j=q\}}\hat{R}_j^q, min_{\{j:Q_j\neq q\}}\hat{R}_j^q\right\}, min\left\{max_{\{j:Q_j=q\}}\hat{R}_j^q, max_{\{j:Q_j\neq q\}}\hat{R}_j^q\right\}\right]\right\} \tag{IV.4}$$

IV -1.1.1. Estimation

The estimation of the average continuous treatment effects implies the estimation and calculation of the GPS and the individual dose-response function. This process consists of four basic steps. The first one is the regression of the observable covariates on the treatment variable, T_i,. The second is obtaining the GPS (the R function) with the predictions of the previous regression. The third one is the estimation of the individual dose-response function by regressing the outcome variable on the treatment variable and the GPS. The last one, is the calculation of the average dose-response function for a given treatment level interval.

HI use a flexible parametric approach and define the distribution of the treatment given the covariates as a normal-distributed function:

$$T_i|X_i \sim N(\beta_0 + \beta_1' X_i, \sigma^2) \tag{IV.5}$$

The GPS is then calculated once the parameters β_0, β_1 and σ^2 in equation IV.5 are estimated. HI suggest a simple normal model as an explicit functional form for equation IV.2:

$$\hat{R}_i = \frac{1}{\sqrt{2\pi\hat{\sigma}^2}} exp\left(-\frac{1}{2\hat{\sigma}^2}\left(T_i - \hat{\beta}_0 - \hat{\beta}_1' X_i\right)^2\right) \tag{IV.6}$$

The next step is the estimation of the conditional expectation of the outcome, Y_i, given the treatment variable and the GPS. Since the regression analysis can force the functional form of the treatment effect function, a cubic approximation is specified to facilitate a flexible parameterisation (linear or quadratic approaches are also feasible):

$$E[Y_i|T_i, R_i] = \alpha_0 + \alpha_1 \cdot T_i + \alpha_2 \cdot T_i^2 + \alpha_3 \cdot T_i^3 + \alpha_4 \cdot R_i + \alpha_5 \cdot R_i^2 + \alpha_6 \cdot R_i^3 + \alpha_7 \cdot T_i \cdot R_i \quad \text{(IV.7)}$$

Finally, at a given treatment level, the estimates of equation IV.7 are averaged to obtain the dose-response function:

$$\widehat{E[Y(t)]} = \frac{1}{N}\sum_{i=1}^{N}\big(\hat{\alpha}_0 + \hat{\alpha}_1 \cdot t + \hat{\alpha}_2 \cdot t^2 + \hat{\alpha}_3 \cdot t^3 + \hat{\alpha}_4 \cdot \hat{r}(t, X_i) + \hat{\alpha}_5 \cdot \hat{r}(t, X_i)^2 + \hat{\alpha}_6 \cdot \hat{r}(t, X_i)^3 + \hat{\alpha}_6 \cdot t \cdot \hat{r}(t, X_i)\big) \quad \text{(III.8)}$$

Finally, equation IV.8 is essential for the inference of the continuous treatment effect. Since the treatment variable is contained in the R_i function, the coefficients that form T_i in equation IV.8 cannot be interpreted as the continuous marginal effect of the treatment. According to the level of treatment of specific interest, the slope of equation IV.8 is evaluated to obtain the unconfounded marginal effects.

IV -2. Data

The estimation of equations IV.5, IV.6, IV.7 and IV.8 is made by employing the *Sisben* data. As previously explained in chapter III, the *Sisben* is used as the main individual targeting tool by the programme, as participation is conditional on the availability of the socioeconomic score for every single household. The *Sisben* survey is carried out before the programme is introduced in a municipality when potential beneficiaries seldom are aware about the possible eligibility to *Familias en Accion*. The main advantage of using the *Sisben* data is the census coverage for lowest income quintiles of the country.

The *Sisben* data used in this context is composed of two rounds. The first one consists of the pre-programme classification of each eligible household for the different registration waves detailed in a previous section. This isolates any potential contamination of observable covariates required by the estimation of the GPS. The pre-programme data were collected during the first and second stage of implementation of the programme between 2001 and 2010. Between 2010 and 2011 the *Sisben* data were recertified by a new survey with a national coverage. The outcomes to be considered for the continuous treatment are generated for the second round of the *Sisben* survey used for the recertification of the socioeconomic conditions of eligible and ineligible households in 2010-2011. Thus, the pre-programme covariates denoted by

the X_i vector in equation IV.4 in the estimation methodology are obtained from the pre-programme *Sisben* eligibility survey while the outcomes, Y_i, are obtained by the general second round after different spans of participation for every household were completed.

The treatment variable, T_i, is obtained from administrative records and the composition of the household given the pre-programme characteristics. The programme's information system contains the initial registration date of every beneficiary and the current status that allows the calculation of the length of duration. To avoid additional endogeneity between different lengths of exposure and the selected outcomes, the estimations are focused on current beneficiaries. Differences between the intended and the actual length of duration may contaminate the analysis due to voluntary or involuntary dropout over the participation period. Hence, the treatment variable is generated from the administrative trace of current beneficiaries, ruling out dropouts and retired households.[77]

The initial *Sisben* data contains pre-programme information for 32,247,627 people, corresponding to nearly 72 percent of the Colombian population. After cleaning the dataset and excluding ineligible households, 15,955,265 people were identified as eligible for *Familias en Accion*, representing around 3 million households. The pre-programme dataset was merged with the second round containing post-programme information. Mothers or fathers registered as main claimants of the benefits from the programme on behalf of the household were tracked across municipalities. Given that the *Sisben* survey between 2009 and 2010 was focused exclusively on low and middle income households, the second round registers 28,489,569 people. After merging pre-programme and post-programme *Sisben* databases the attrition rate was 18.2 percent, mainly due to migration or death of the claimant mother. Table IV.1 below compares selected pre-programme variables for attrited and unattrited households (for full set of variables see Table IV-A1.1 in the Appendix of this chapter).

Table IV.1. Comparison between attrited and unattrited households (selected variables).

Pre-programme Variables (proportion)	Attrited	Unattrited	Difference
Household level			
Electricity	0.839	0.856	0.016***
			(0.001)
Type of dwelling:			
Room in a house	0.133	0.101	-0.032***
			(0.001)
House or apartment (flat)	0.850	0.886	0.035***
			(0.001)
Wall construction material:			
Zinc, cardboard, plastics	0.018	0.015	-0.003***

[77] Deserter households are those who leave the programme voluntarily while retired those to whom the administrator has stopped the transfers (see detail in previous chapter).

			(0.000)
Raw wood	0.197	0.163	-0.034***
			(0.001)
Bricks	0.521	0.507	-0.013***
			(0.001)
Floor construction material:			
Sand, earth	0.341	0.352	0.011***
			(0.001)
Concrete	0.497	0.513	0.015***
			(0.001)
Number of rooms [a]	2.284	2.417	0.133***
			(0.002)
Households in the dwelling	1.254	1.172	-0.081***
			(0.001)
Household members [a]	4.715	5.633	0.917***
			(0.005)
Mean household age [a]	38.96	41.850	2.885***
			(0.027)
Household with children under 6yo	0.637	0.691	0.053***
			(0.001)
Ownership of the dwelling	0.452	0.453	0.000***
			(0.00)
Assets:			
TV	0.360	0.377	0.021***
			(0.001)
Cooking fuel:			
Gas in cylinder	0.286	0.284	-0.001***
			(0.001)
Gas from distribution network	0.152	0.145	-0.006***
			(0.001)
Type of illumination:			
Candle	0.105	0.102	-0.002***
			(0.001)
Electricity	0.831	0.850	0.019***
			(0.001)
Potential monthly cash transfer (US$) [a]	27.30	26.97	-0.330***
			(0.041)
Head of the household			
Male	0.670	0.743	0.072***
			(0.001)
Age [a]	38.96	41.850	2.885***
			(0.027)
Years of education [a]	4.247	3.833	-0.414***
			(0.006)
Employed	0.749	0.757	0.008***
			(0.001)
Employed with health benefits	0.032	0.030	-0.001***

			(0.000)
Macro-level variables			
Local population [a]	246,690	238,152	-8538***
			(1,001)
Party of incumbent at enrolment			
Independent	0.365	0.341	-0.024***
			(0.000)
No elections / No info	0.150	0.136	-0.014***
			(0.000)
Officialist or coalition party	0.243	0.267	0.023***
			(0.000)
Real provincial GDP per capita (US$) [a]	3,285	3,449	163.0***
			(42.92)
Share of agriculture in provincial GDP	0.141	0.139	-0.023***
			(0.001)
Provincial employment rate	0.529	0.525	-0.038***
			(0.004)
Number of observations	712,732	928,819	1,641,551

Source: *Familias en Accion* Information System (2000-2010); Departamento Administrativo Nacional de Estadisticas (DANE) (2000-2010); Departamento Nacional de Pleaneacion (DNP) (2000-2010). See Table IV-A1.1 for full set of varaibles.
Notes: (1) Differences are calculated by linear regression. (2) Standard errors of the differences in parenthesis. (3) * Significant at 10%; ** Significant at 5%; *** Significant at 1%. (4) [a] This variables are not in proportional terms. (5) US$ values are calculated by current exchange rates.

Attrited households tend to show slightly poorer living conditions and have younger members. Most of the differences in these characteristics between both groups are close to zero but they are significant at 1 percent. The significance of the difference is influenced by the size of the sample, which drives almost zero coefficients to show some level of significance given the asymptotic property of the t-test. Attrition could raise problems in the interpretation of the results for the entire population that can pose an econometric challenge. Nonetheless, as the rules of the programme indicate that beneficiary and eligible households must have updated Sisben information, the results relevant for the operation of the programme here are valid for unattrited households. As the main focus here is on the effects associated with the implementation of Familias en Accion , the population of interest consists of households that can be found at any stage of the Sisben survey, not the population at large. Therefore, the significant difference in the covariates between attrited and unattrited households, are no enough by themselves to suggest that the attrition will drive the conclusions of this empirical analysis. Indeed, only those households that count on a Sisben score in the follow up are relevant for the programme's operation.

The eligible households with a complete set of pre and post programme information were finally merged with the administrative information on actual participants. Since each participat-

ing household has its own registration record and *Sisben* internal identification number, no attrition was found in this step. Retired, suspended or dropped out households were ruled out. Finally, a database containing 1,641,551 households and 7,933,935 people was consolidated with the complete *Sisben* and administrative information on current participants by June 2011.

IV -2.1. Data description

In this section the variables taken into consideration for the estimation of the continuous treatment effects are detailed. To distinguish between the two possible types of locations covered by the *Sisben* survey, the presentation divides the description of the variables into those households living in rural and urban areas. Additionally, the variables are grouped by their role in the estimation of the equations specified above.

IV -2.1.1. Pre-programme variables

As the HI methodology requires, the first group of variables to be described are those observable characteristics that control for the potential endogeneity between the outcomes and the length of exposure. These variables are obtained from the *Sisben* survey that is carried out prior to the introduction of *Familias en Accion* at the municipality level. Given that the eligibility to the programme considers the household as a whole, no individual variables are included in this part of the analysis, except those from the head of the household. The pre-programme variables are assumed not to be affected by the programme in order to achieve the CIA.

Table IV.2 below describes the pre-programme variables considered for the estimation of equation IV.5 and the calculation of equation IV.6. These variables were selected as they are deemed to explain the length of exposure to *Familias en Accion* in the period 2000-2010, in the sense that they contain household-level and macro-level variables. In particular, variables determining the initial geographic coverage of the first stage of the programme are considered. There are three categories that were taken into account. The first one groups the variables at the household level, which indicate the main assets, public infrastructure and demographic traits that denote the living conditions of its members. Moser (2008) looks into the influence of these characteristics (especially assets) on the household socioeconomic performance. Attanasio et al. (2004) also examine the relevance of some of these characteristics in the household welfare tendency. As seen before, household information is originated by the pre-programme *Sisben* survey but additional covariates are originated by other sources. Most of variables in this category denote the physical conditions of the households as well as its composition in terms of number of children, presence of members with disabilities and the potential monthly cash transfer. The second category of pre-programme covariates corresponds to the individual characteristics of the head of the household, recognised as the main breadwinner or whose decision power is determinant, and his/her spouse, including their age, edu-

cation and employment status. These individual variables are considered to be important for the programme length of participation as predominately either the head or his/her spouse receives the cash transfers directly from the programme. The third category of variables is included in order to control for the condition of the economy and political environment that might determine the length of exposure to the programme at the provincial or municipal level (Besley and Coate 2003). As previously mentioned, the programme was phased in slowly among the municipalities of the country according to their demographic and institutional characteristics. Some of these macro-level variables include the size of local population which was the main variable considered for the introduction of the programme at certain municipalities. Political characteristics such as the ruling party at the time of the programme's introduction as well as the number of votes where included as indication of any possible political influence in the adoption of the programme in those municipalities belonging to the same party of the ruling national government. Finally, since *Familias en Accion* was created in response to an economic crisis, it is assumed that it was the national government's interest to cover the most depressed regions. Thus, the economic characteristics that take account for the real GDP per capita, local budget as indicator of business tax revenues were included. The status of the labour markets (employment and unemployment rates) is also considered.

The observable covariates manifest the poverty level of the beneficiaries according to their living conditions (see Table IV.2 below). It is also evident the sharp differences between rural and urban areas where utilities such as sewer, garbage collection or running water evidence relevant disparities. These households are identified to live in poor quality material dwellings with earth floor and a high rate of members per bedrooms. Similarly, households were found to prefer more televisions than fridges. In the same way the number of children and the household composition was used to calculate the total monthly transfer received from the programme if they actually participated in the baseline. Thus, the potential cash transfer from the programme is also included in this group of variables, averaging similar monthly values for households in rural and urban areas (27.16 US$).

The individual characteristics of the head of the household have strong relationship with male-related features. Indeed, 72.18 percent of the households are headed by males, predominantly in rural areas. Urban heads are more educated but fewer are employed, while the average spouse is significantly younger and non-employed.

The macro-level variables are referred to the year or month when the registration in the programme took place. These variables were obtained from the *Departamento Administrativo*

Nacional de Estadisticas (DANE) (National Statistic Department),[78] the DNP and the Colombian electoral organization agency (*Registraduria*).[79] This group of variable is important because they were considered by the administrator of *Familias en Accion* in the geographic selection process. Starting from the population size, it was found that scattered rural zones have significantly lower inhabitants than urban areas. The second sub-group of variables include the political party of ruling mayors at the enrolment as well as their share of votes. Besides the real GDP per capita, it was considered the share of the GDP corresponding to the agricultural sector. The local or municipal budget is taken into account as an indicator of the economic activity and institutional strength as well as the provincial employment and unemployment rates.

Table IV.2. Averages of pre-programme variables (standard errors in brackets).

Pre-programme Variables (proportion)	Rural	Urban	Overall
Household level			
Electricity	0.707	0.969	0.856
	[0.455]	[0.173]	[0.351]
Sewer	0.067	0.591	0.366
	[0.249]	[0.492]	[0.482]
Garbage collection	0.081	0.739	0.456
	[0.273]	[0.439]	[0.498]
Running water	0.337	0.824	0.615
	[0.473]	[0.381]	[0.487]
Without toilet	0.495	0.125	0.284
	[0.500]	[0.331]	[0.451]
Type of dwelling:			
Room in a house	0.067	0.105	0.088
	[0.249]	[0.306]	[0.284]
House or apartment (flat)	0.916	0.885	0.898
	[0.278]	[0.319]	[0.302]
Other	0.018	0.010	0.013
	[0.132]	[0.100]	[0.115]
Wall construction material:			
No walls	0.001	0.000	0.001
	[0.031]	[0.016]	[0.024]
Zinc, cardboard, plastics	0.013	0.016	0.015
	[0.115]	[0.124]	[0.120]
Low quality vegetables	0.055	0.027	0.039
	[0.229]	[0.163]	[0.194]
Raw wood	0.223	0.118	0.163
	[0.416]	[0.323]	[0.370]
Polished wood	0.279	0.095	0.174
	[0.448]	[0.294]	[0.379]
Resistant material	0.165	0.052	0.101
	[0.371]	[0.223]	[0.301]
Bricks	0.264	0.691	0.508

[78] Available at http://www.dane.gov.co
[79] Available at http://www.registraduria.gov.co

	[0.441]	[0.462]	[0.500]
Floor construction material:			
Sand, earth	0.541	0.211	0.353
	[0.498]	[0.408]	[0.478]
Raw wood	0.101	0.048	0.071
	[0.301]	[0.215]	[0.257]
Concrete	0.340	0.644	0.513
	[0.474]	[0.479]	[0.500]
Tile	0.018	0.095	0.062
	[0.133]	[0.293]	[0.241]
Carpet	0.000	0.001	0.001
	[0.019]	[0.034]	[0.028]
Number of rooms [a]	2.473	2.551	2.517
	[1.296]	[1.321]	[1.311]
Number of bedrooms [a]	1.744	1.794	1.773
	[0.831]	[0.855]	[0.845]
Households in the dwelling	1.100	1.187	1.149
	[0.408]	[0.604]	[0.531]
Household members [a]	6.396	6.439	6.421
	[2.718]	[2.949]	[2.852]
Mean household age [a]	21.462	22.338	21.962
	[8.256]	[7.972]	[8.107]
Household with pregnant woman	0.079	0.084	0.082
	[0.269]	[0.277]	[0.274]
Household with disabled member	0.086	0.081	0.083
	[0.281]	[0.273]	[0.276]
Average age of children [a]	7.388	7.491	7.491
	[3.745]	[3.763]	[3.755]
Age of the youngest child [a]	4.379	4.704	4.564
	[6.241]	[6.355]	[6.308]
Household with children under 6yo	0.710	0.693	0.701
	[0.454]	[0.461]	[0.458]
Household's children attend school	0.687	0.755	0.726
	[0.464]	[0.430]	[0.446]
Ownership of the dwelling	0.340	0.644	0.513
	[0.474]	[0.479]	[0.500]
Assets:			
Fridge	0.137	0.387	0.280
	[0.344]	[0.487]	[0.449]
TV	0.509	0.783	0.664
	[0.499]	[0.392]	[0.463]
Cooking fuel:			
Household does not cook	0.004	0.009	0.007
	[0.060]	[0.094]	[0.081]
Firewood, charcoal.	0.840	0.194	0.474
	[0.367]	[0.396]	[0.499]
Mineral coal	0.011	0.006	0.009

	[0.106]	[0.080]	[0.092]
Kerosene, oil, gasoline	0.005	0.033	0.021
	[0.068]	[0.178]	[0.142]
Gas in cylinder	0.111	0.414	0.282
	[0.314]	[0.493]	[0.450]
Gas from distribution network	0.017	0.251	0.149
	[0.129]	[0.433]	[0.356]
Electricity	0.013	0.093	0.058
	[0.114]	[0.291]	[0.234]
Type of illumination:			
Candle	0.191	0.029	0.100
	[0.393]	[0.169]	[0.300]
Kerosene, oil, gasoline	0.093	0.006	0.044
	[0.290]	[0.077]	[0.204]
Electricity	0.712	0.964	0.855
	[0.453]	[0.186]	[0.353]
Solar energy, bio-energy	0.004	0.001	0.002
	[0.063]	[0.023]	[0.045]
Maximum monthly cash transfer (US$) [a]	27.16	27.15	27.16
	[21.14]	[21.83]	[21.54]
Head of the household			
Male	0.793	0.667	0.722
	[0.405]	[0.471]	[0.448]
Age [a]	43.30	42.45	42.82
	[15.23]	[14.55]	[14.86]
Years of education [a]	2.822	4.220	3.613
	[2.540]	[3.268]	[3.054]
Married or cohabitant	0.790	0.710	0.745
	[0.407]	[0.454]	[0.436]
Employed	0.772	0.701	0.732
	[0.419]	[0.458]	[0.443]
Employed with health benefits	0.016	0.040	0.030
	[0.127]	[0.196]	[0.170]
Spouse's age [a]	30.22	27.08	28.44
	[19.46]	[20.47]	[20.09]
Spouse's years of education [a]	2.535	3.220	2.922
	[2.637]	[3.426]	[3.127]
Employed spouse	0.045	0.122	0.089
	[0.207]	[0.328]	[0.284]
Macro-level variables			
Local population [a]	63,367	370,145	236,948
	[152,893]	[636,088]	[512,059]
Party of incumbent at enrolment			
Ethnic minority	0.0042	0.0475	0.0289
	[0.065]	[0.213]	[0.167]
Independent	0.2936	0.3687	0.3364
	[0.455]	[0.482]	[0.472]

No elections / No info	0.1568	0.119	0.1352
	[0.364]	[0.324]	[0.342]
Officialist or coalition party	0.2909	0.2483	0.2666
	[0.454]	[0.432]	[0.442]
Opposition party	0.2545	0.2165	0.2328
	[0.436]	[0.412]	[0.423]
Votes obtained by ruling party	0.413	0.393	0.402
	[0.210]	[0.179]	[0.193]
Real provincial GDP per capita (US$) [a]	3,440	3,721	3,599
	[1,713]	[1,758]	[1,744]
Share of agriculture in provincial GDP	0.139	0.116	0.126
	[0.053]	[0.058]	[0.057]
Local public per capita budget (US$) [a]	51.18	73.67	63.90
	[47.50]	[66.49]	[60.04]
Provincial employment rate	0.527	0.514	0.519
	[0.042]	[0.038]	[0.040]
Provincial unemployment rate	0.119	0.121	0.120
	[0.026]	[0.028]	[0.027]
Number of observations [households]	712,732	928,819	1,641,551

Source: *Familias en Accion* Information System (2000-2010); Departamento Administrativo Nacional de Estadisticas (DANE) (2000-2010; Departamento Nacional de Pleaneacion (DNP) (2000-2010).
Notes: (1) Standard deviations in parenthesis. (2) [a] This variables are not in proportional terms. (3) US$ values are calculated by current exchange rates.

IV -2.1.2. Continuous treatment and outcome variables

The second group of variables to be described and required by HI are those that emerge from a post-programme *Sisben* database (see Table IV.3).

On one hand, the continuous treatment variable is presented in relative terms as the elapsed proportion of maximum length of exposure, which is obtained from the administrative records. These administrative records track each household from the registration until the last activity of the operational cycle. On the other, the selected outcomes are specified according to the objectives of this analysis and are the intended effects of the design of *Familias en Accion*. Some other outcomes related to the unintended effects for adults are also considered by this analysis.

Recall that the previous chapter mentioned that the operation of the programme at each municipality was the main factor determining the duration of beneficiaries in the programme. The table below shows the number of municipalities that were registered in the programme for the first time over the period of analysis. It is evident that an important number of municipalities started the registration in *Familias en Accion* in 2001 - 2002:

Table IV.3. Municipalities enrolled in the programme

Year/Month	Number of municipalities

2000m7	1
2000m10	1
2000m12	24
2001m1	2
2001m3	19
2001m4	84
2001m5	155
2001m9	155
2001m10	83
2001m11	103
2001m12	36
2002m1	31
2002m2	1
2002m3	1
2002m5	82
2002m7	1
2003m2	5
2003m3	5
2005m1	34
2005m3	28
2005m5	8
2005m7	20
2005m9	48
2005m11	27
2006m1	7
2006m3	129
2006m5	3
2007m3	2
2007m4	3
2007m6	2
2007m7	2
2007m8	1

Source: Administrative data from Familias en Accion

The continuous treatment variable of the analysis is detailed in this section. Familias en Accion recruits households with children at different ages. The enrolment age and the school grade of the youngest child determine the maximum length of exposure of the whole household to the programme insofar as the household remains in extreme poverty and comply with the co-responsibilities. It is an explicit assumption of the programme that the length of exposure of beneficiaries to the CCTs facilitates school completion. Not taking this into account could result in ignoring potential behavioural responses from beneficiary households who expect particular lengths of participation associated with the participation in the programme. Furthermore, every child enrolled at different ages faces a right censorship at age 17 which is also the normative age for school graduation over 11 years of education. This condition de-

termines the intended exposure to the CCTs. The rules of the programme would not allow beneficiaries older than 18 years of age to receive the cash transfers even if they have not finished the conventional school cycle. The age differentials at enrolment could complicate the comparison of, for example, a child enrolled at 14 years old with an observed and potential exposure of 3 years with another one enrolled at 7 years of age with the same length of participation but a potential exposure of 10 years. Thus, the treatment is not only the observed length of duration but also the intention of the programme that leads to the formation of the participation horizon.

The potential complications that emerge from the age differentials are tackled by calculating the elapsed proportion of maximum length of exposure of the household to the programme. For example, if a child is enrolled in the programme at 13 years old and his household has been participating in the programme for two years, then the proportion of the elapsed proportion of maximum length of exposure is 0.5. This is similar to a child enrolled at 7 years of age and an observed participation length of five years. The proportion of the elapsed proportion of maximum length of exposure allows the comparability of children at different ages and school grade at enrolment by avoiding right censorship and reference to specific time units. Hence, for each household *i* the continuous treatment variable (parameter T_i in equation IV.4) is defined as:

$$T_i = \frac{elapsed\ years\ of\ participation_i}{min(18-age\ of\ youngest\ child\ in\ the\ household_i, 11-school\ grade)} \quad \text{(IV.8)}$$

Table IV.4 below shows the average continuous treatment variable in rural and urban areas. As it can be noticed, rural households are prone to participate in the programme for a higher proportion of than urban households. Overall, households average a proportion of 0.36 of elapsed proportion of maximum length participation, which indicates that on average they still have most of the intended participation length to be completed

[*Continued on the next page*]

Table IV.4. Averages of continuous treatment and outcome variables (standard errors in brackets)

Treatment and outcome Variables	Rural	Urban	Overall
Continuous treatment variable:			
Elapsed proportion of maximum length of exposure	0.388	0.354	0.368
	(0.187)	(0.187)	(0.188)
Current children:			
Children's years of education	4.222	4.709	4.490
	(2.773)	(2.954)	(2.884)
Children's years of education (enrolled at 7yo)*	4.222	4.125	4.169
	(2.201)	(2.102)	(2.148)
Children's school registration (proportion)	0.861	0.895	0.880
	(0.346)	(0.306)	(0.325)
Children's school registration (enrolled at 7yo - proportion)	0.898	0.939	0.921
	(0.303)	(0.239)	(0.270)
Current adults:			
Completed school (currently 18yo - proportion)	0.20	0.32	0.27
	(0.400)	(0.467)	(0.445)
Adult school registration (enrolled between 7 - 17yo - proportion)***	0.225	0.280	0.256
	(0.418)	(0.449)	(0.436)
Labour participation (enrolled between 7 - 17yo - proportion)***	0.371	0.346	0.357
	(0.483)	(0.476)	(0.479)
Households:			
Earning capacity indicator	6.195	6.721	6.496
	(2.515)	(2.555)	(2.552)
Eligible (proportion)	0.666	0.435	0.535
	(0.472)	(0.496)	(0.499)
Number of observations (households)	712,732	928,819	1,641,551

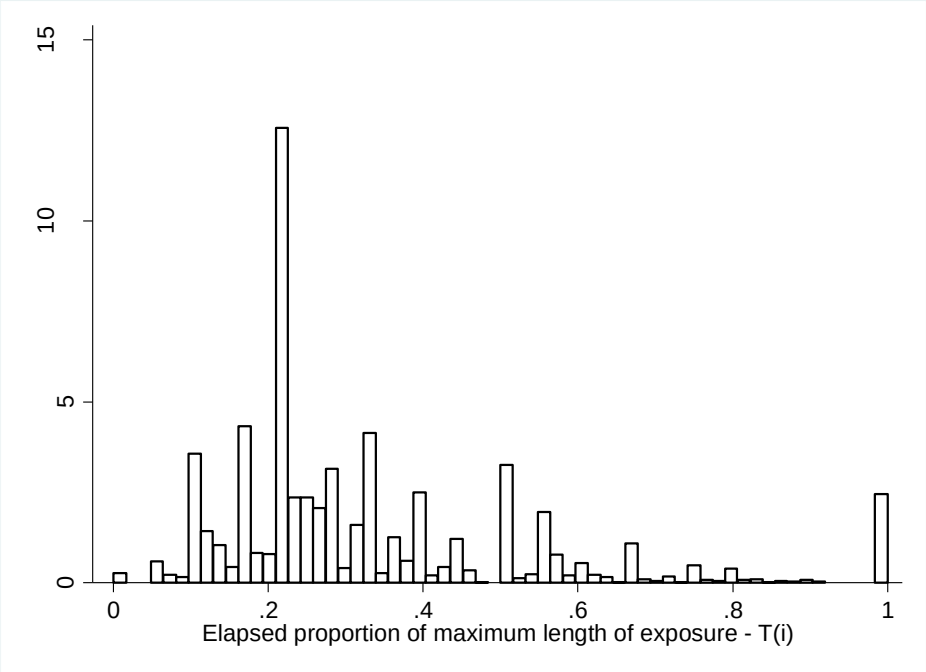
Number of observations (children 7 - 17yo)	892,578	1,084,335	1,976,913
Number of observations (children enrolled at 7yo)	84,187	102,131	186,318
Number of observations (adults enrolled at < 18yo)	1,562,338	2,225,907	3,788,245
Number of observations (adults enrolled between 7 - 17yo)	232,002	298,800	530,802

Source: *Familias en Accion* Information System (2000-2010); Departamento Administrativo Nacional de Estadisticas (DANE) (2000-2010); Departamento Nacional de Pleaneacion (DNP) (2000-2010).
Notes: (1) * Refers to children that were enrolled into the programme at seven years old; ** Proportion of adults enrolled at 18 years old and above; *** Proportion of adults that were children when their households were exposed to the programme.

[*Continued on the next page*]

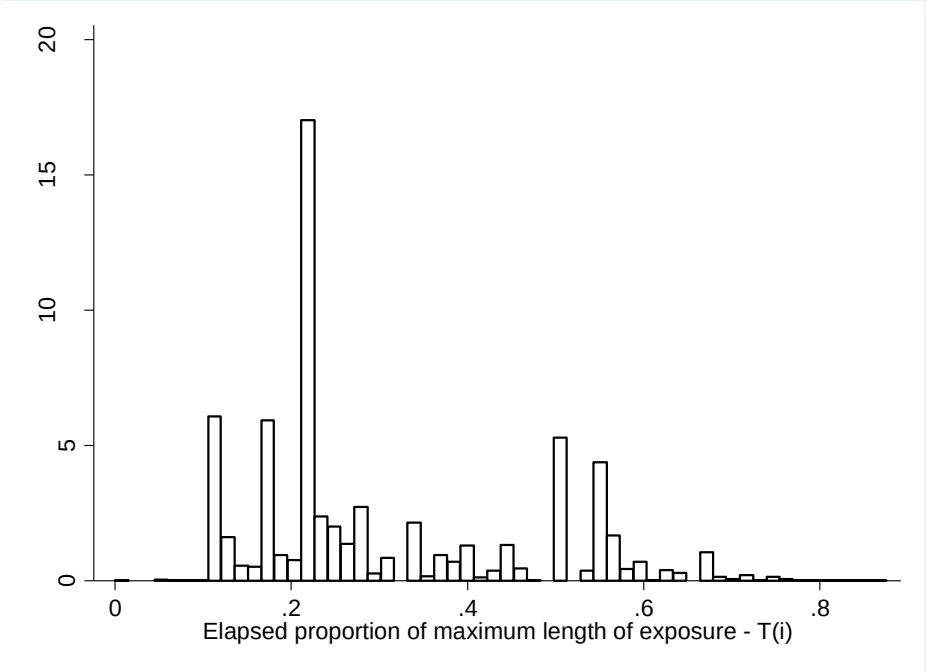
Figure IV-1 and IV.2 below show the histograms of the treatment variable for the whole sample and the sample on the common support (derived from equation IV.4), respectively. They reveal the different ages and consequent maximum length of exposure of participating households. The sharpest difference is evident for those households with a proportion of elapsed maximum participation of 0.23. Given that the estimations are centred on the common support region, it is evident that it leads to a trimming of the extremes where those households averaging values close to 0 and 1 are ruled out.

Figure IV-1. Histogram of the continuous variable (whole sample).



Source: *Sisben* survey 2000-2010.

Figure IV-2. Histogram of the continuous variable (on common support).



Source: *Sisben* survey 2000-2010.

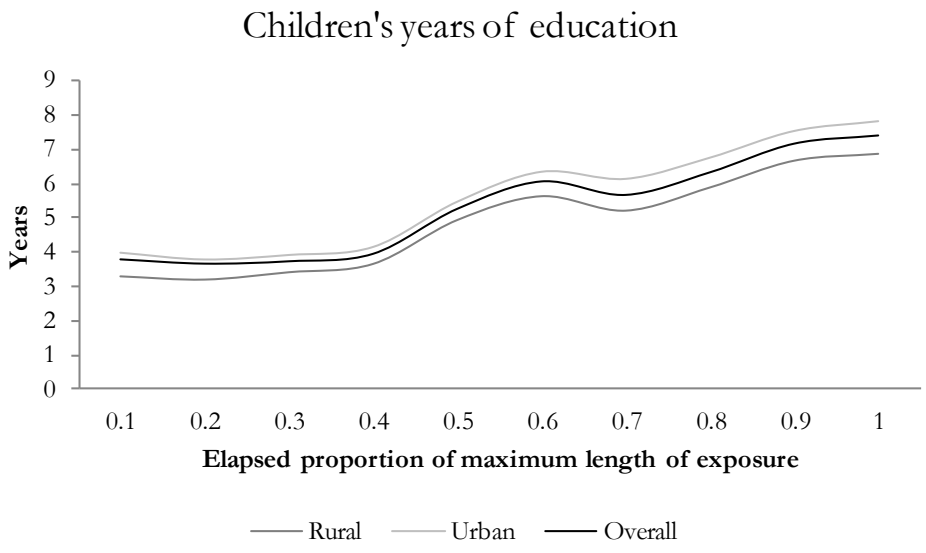
Now the variable description focuses on the outcome variables. The first group refers to the human capital formation of children, which is the main interest of the programme in its objective of breaking the intergenerational transmission of poverty. *Sisben* data does not contain information on the nutritional status of eligible children and only collects information on school registration and regular attendance. As Table IV.4 details, children's years of education averages 4.49. Disaggregating by areas, urban children have attained more education years than their rural peers, averaging 4.70 and 4.22 years of education, respectively.

This analysis also takes into consideration the case of those children that were enrolled in the programme at 7 years of age. Children enrolled at 7 years of age allow the assessment of the whole schooling trajectory of each child under the influence of *Familias en Accion*, especially because the right censorship of the treatment variables is homogeneous for all of them. Indeed, children starting the programme at 7 years offer an opportunity to obtain the continuous treatment effects by ruling out those children with short length of exposure due to a late enrolment. Children enrolled in the programme at 7 years old add up 212,374 observations and average 4.17 years of education (with a higher achievement in rural areas).

The behaviour of the years of education over the elapsed proportion of maximum length of exposure is showed in Figure IV-3. Apparently, there is not a response of the years of education to the length of exposure between the proportion 0 and 0.4. Indeed, an average of 4 years of education is clearly evident for all the children until the proportion achieves 0.4 of the maximum length. It finally rises to 7.37 years of education for children with a complete exposure to the programme, disaggregated between 7.82 and 6.84 years in urban and rural areas, respectively. The descriptive difference between being the least exposed and the fully exposed is about 3.3 years of education.

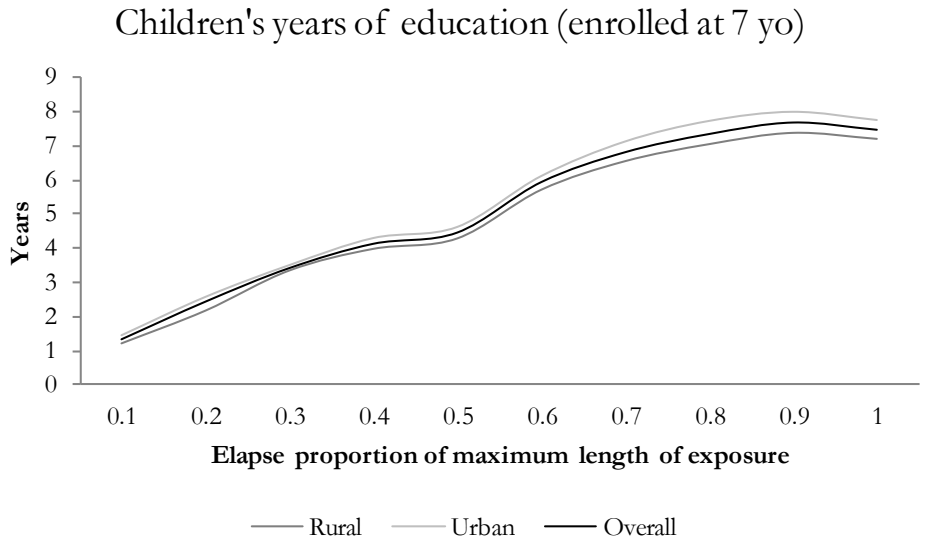
[*Continued on the next page*]

Figure IV-3. Children's years of education enrolled at any age.



Source: *Sisben* survey 2000-2010.

Figure IV-4. Children's years of education enrolled at 7yo.

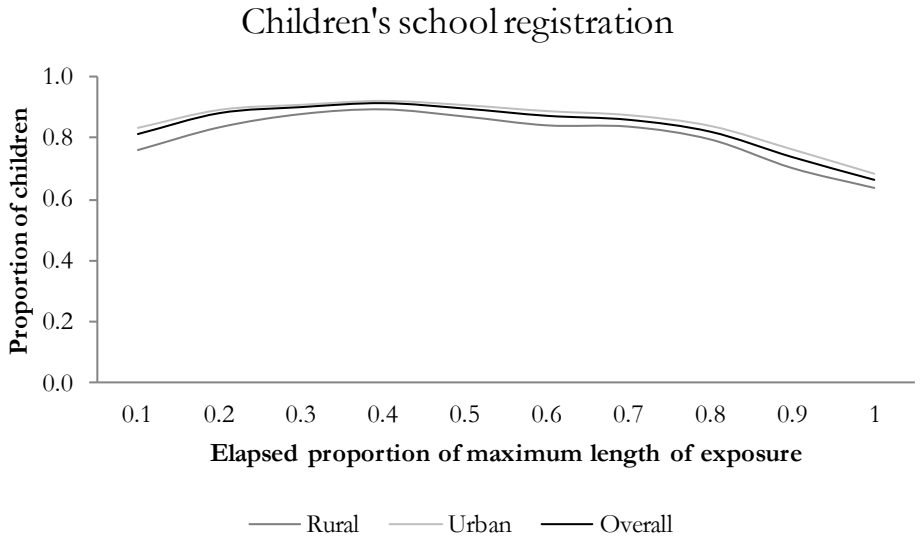


Source: *Sisben* survey 2000-2010.

Figure IV-4. Children's years of education enrolled at 7yo. above shows the average years of education of the children that were enrolled in the programme at 7 years of age as the elapsed proportion of maximum length of exposure ranges between 0.1 and 1. The trend and differences in urban and rural areas does not vary sharply over the participation period. As expected, the years of education start equally for all the groups in both areas, where children achieve 7.73 and 7.21 years when they are fully exposed to *Familias en Accion* in urban and rural areas, respectively. Despite the trajectory of this variable over the exposure it is highly influenced by the children's age, the overall average of years of education attained by them average 7.45 when the proportion of exposure achieves around 1.

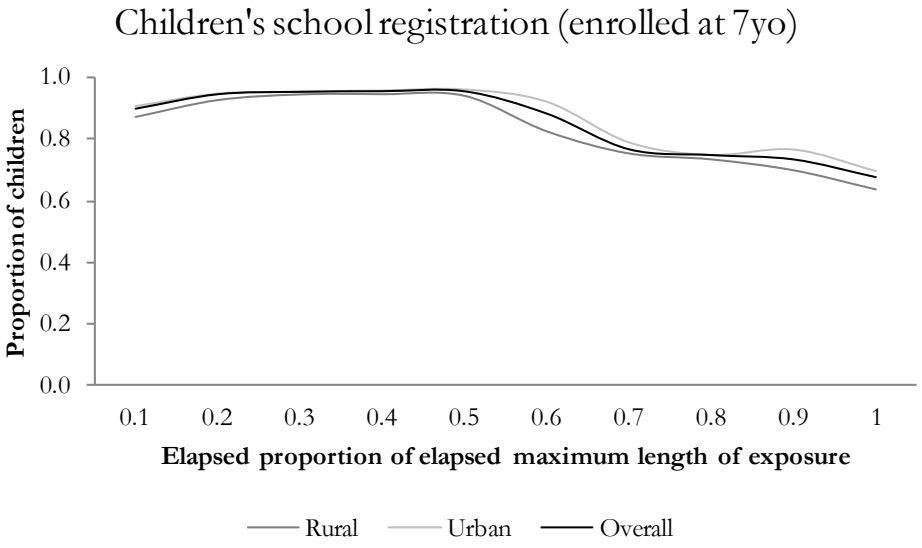
School registration is the second outcome to be analysed over the proportion of the length of exposure to the programme. *Sisben* survey records the activity of the children in the last month. The latter includes if they dedicated the most of their time in school activities which imply registration. Similar to the outcome of years of education, the school registration is assessed for all the children and those between 7-17 years of age that were enrolled in *Familias en Accion* at 7 years old. According to the post-programme data, the school registration is 89.5 and 86.1 percent of children in urban and rural areas, respectively. The observed trajectory shows that school registration tends to decline sharply after 0.5 of the length of potential exposure to the programme. Figure IV-5 shows that school registration rates can reach levels between 60-70 percent at the end of the exposure:

Figure IV-5. Children's school registration at any age.



Sisben survey 2000-2010.

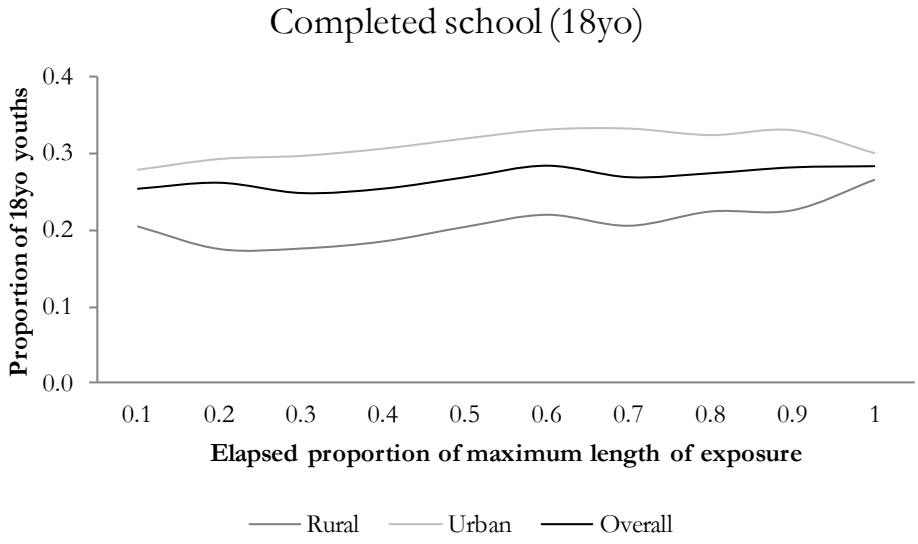
Figure IV-6. Children's school registration (enrolled at 7yo)



Sisben survey 2000-2010.

The description of the outcome variables turns now to the description of complementary adult-related outcome variables. The first variable to be analysed for adults regards their human capital formation when they were intended to be participating in *Familias en Accion*. One milestone sought by the objectives of the programme is that children complete their school cycle before adulthood (18 years of age). Indeed, the normative age at which children graduate from school is 17. This is the end of the human capital accumulation proposed by *Familias en Accion*, as no additional support is given after this age. It is observed that the completion rate for 18 years old youths averages about 27 percent, with 20 and 32 percent for rural and urban areas, respectively. As Figure IV-7 shows, the trend of the completion rate seems to be positive but still flat as long as the elapsed proportion of maximum length of exposure increases.

Figure IV-7. Completed school (currently 18yo).



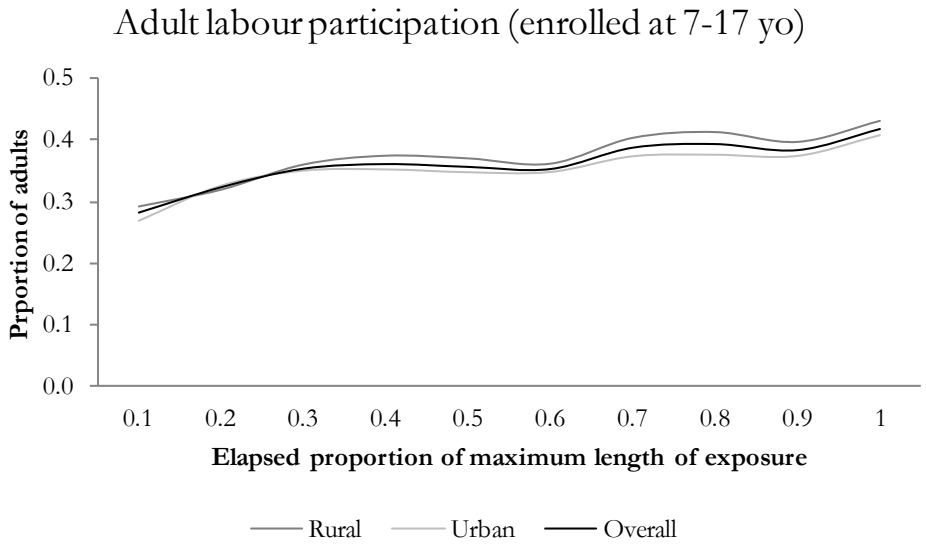
Sisben survey 2000-2010.

Similar to the school registration, the *Sisben* survey records the activity of all household members in the last month of reference. In fact, the labour activity or inactivity is recorded for all adult members. The labour participation is defined here as those adults that declared to be working or searching for a job in the last month.[80] The labour participation of current adults that were enrolled in the programme when children is also addressed. This group of people is important to understand whether the exposure to the CCTs affects the labour behaviour of former students. This outcome is important, as the objectives of the programme are also interested in learning about the labour market performance of previous participants who are considered to hold higher levels of human capital. Their labour participation is currently lower than that of adults enrolled at 18 years old and older, as only 35.7

[80] This variable does not fit the ILO (1985) standards for labour statistics but provides a broad idea of the labour behaviour of adult members.

percent of them are employed or unemployed. For this cohort, the labour participation in rural areas is mostly higher than urban areas (see Figure IV-8).

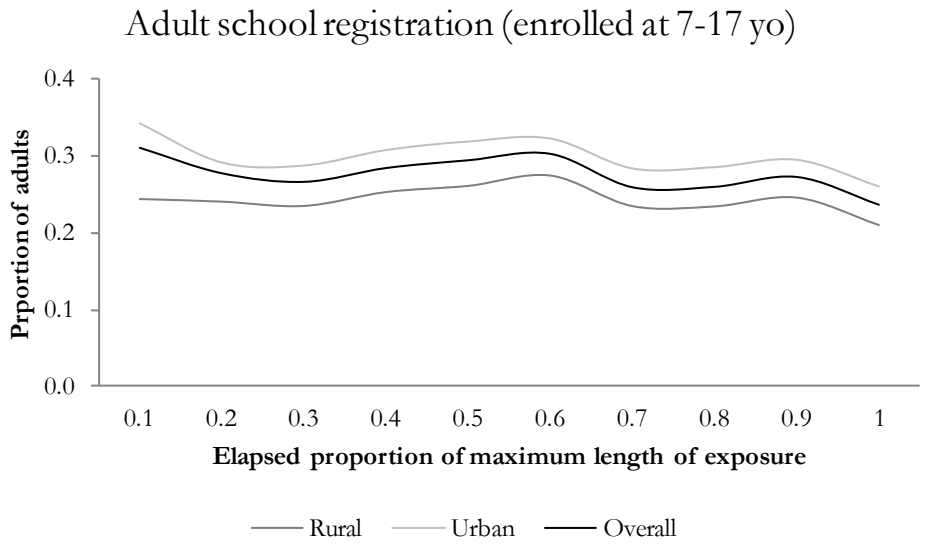
Figure IV-8. Adult participation (enrolled between 7-17 years of age).



Sisben survey 2000-2010.

Finally, it is important to assess whether current adults that were exposed to the programme when children continued studying after school age. This outcome is relevant since the labour participation of current adults is significantly lower than the rest. Despite the fact that *Familias en Accion* does not support a higher level of education beyond school, the longer length of exposure may lead the beneficiaries to continue their human capital investment at their own expense. According to the post-programme data 25.6 percent of these adults attend an educational institution with a higher incidence in urban areas (see Table IV.4)

Figure IV-9. Adult school registration (enrolled between 7-17 years of age).



Sisben survey 2000-2010.

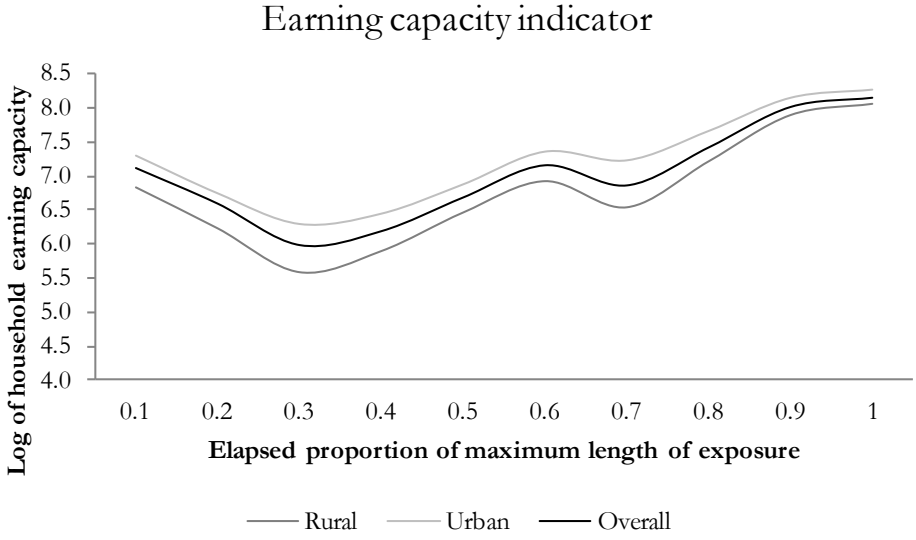
Figure IV-9 above shows the school registration rate of current adults that were exposed to the programme when children (commonly in tertiary education). In this descriptive approach, the elapsed proportion of maximum length of exposure does not drive the school enrolment of previous participants. However, it tends to behave negatively when children are fully exposed to the programme. This reflects how the age is driving this outcome as the most exposed to the programme can participate longer in tertiary education. The registration rate is accounted here after the normative school age ends, when the education registration is considerably high. The adult school registration fluctuates between 20 and 30 percent over a relative flat shape as Figure IV.9 illustrates.

Now the attention is turned to household-level outcomes. The next outcome variable to be analysed is the household earning capacity. Since the *Sisben* survey is not designed to generate income or labour information, we impute the potential salaried earnings for adults between 18-65 years old following Garfinkel and Haveman (1977) and Haveman and Bershadker (1998). A log-salaried earnings equation is estimated using data from the *Encuesta Nacional de Calidad de Vida* (National Survey of Living Standards, in English) carried out by the *Departamento Administracion Nacional de Estadisticas* (*DANE*) (National Statistics Department) in 2010 after accounting for the selection bias following Heckman (1979). Wage workers (formal and informal) are taken into consideration here, as the earning capacity indicator denotes the labour earnings that an individual would obtain if his or her human capital was fully employed as result of a market transaction, which is only possible on a subordinated job (Haveman and Bershadker 1998). The estimated coefficients are then used for imputing the potential log-salaried earnings of adults belonging to the households in the *Sisben* survey. The predicted log-salaried earnings are then added up for each household in per-capita terms, whose resulting variable is considered as an earning capacity indicator (appendix IV-A.2 provides the details on this estimation).

The earning capacity indicator seems to be positively related to the continuous treatment only after the elapsed proportion of maximum length of exposure is higher than 0.3 (see figure below). The shape of the line is similar for both areas and the overall indicator. Figure IV.10 below shows that the longer exposure to the cash transfers is related with a higher earning capacity. Despite this description can be confounded by the lack of randomness in the assignment of the length of exposure, the increasing earning capacity indicator obtained its shape from effects of the programme on children's human capital. These effects

are translated into a higher earning capacity once they become adults and potentially participate in the labour markets.[81]

Figure IV-10. Earning capacity indicator.

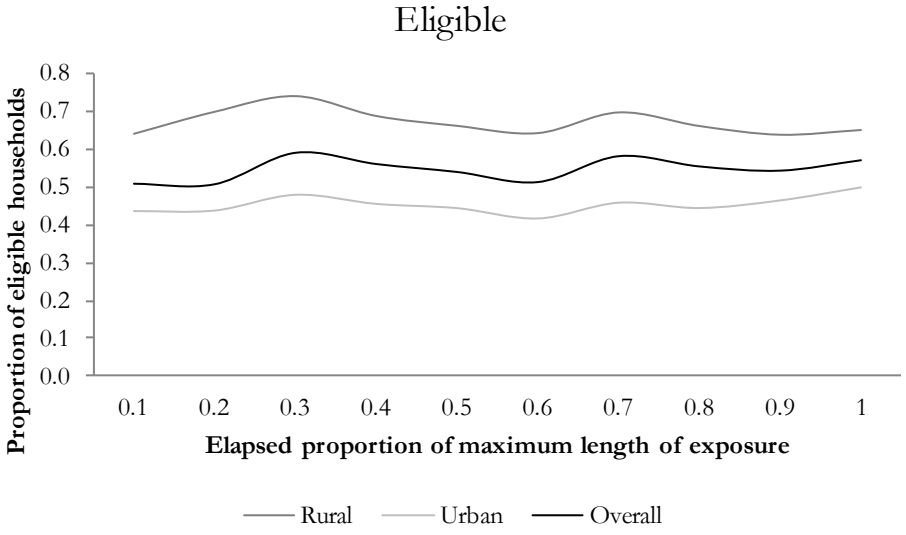


Source: *Sisben* survey 2000-2010 and DANE 2010.

Finally, another important variable relevant to the programme's objectives is assessed. After households end their participation in the programme, they are expected to be ineligible to participate as the categorical criteria are not met, in the sense that there are no more children. As abovementioned, eligibility is determined by the *Sisben* score and the cut-off thresholds that the programme establishes prior to the household participation. Figure IV.11 below illustrates the proportion of eligible households over the elapsed proportion of maximum length of exposure. Eligible households remain almost stable over the participation in the programme, starting and ending around 0.5. The differences between urban and rural areas are considerable, especially because rural households remain highly eligible when they complete their maximum length of participation.

Figure IV-11. Probability of being eligible

[81] Next section will present the results accounting for the lack of randomness in the assignment of the treatment variable.



Source: *Sisben* survey 2000-2010.

In summary, the analysis of the trend of the selected outcomes over the elapsed proportion of length of exposure is divided into three groups composed by children, adults and households. The treatment variable (the dose) is defined as the proportion of the maximum length of duration completed by the household. Children's years of education behave as expected as the exposure to the programme increases. The description contemplates the years of education attained by children enrolled in the programme at seven years of age, which allows the analysis of the trajectory of participating children over the exposure. For the latter cohort, children accumulate up to 7.2 years of education when the household is fully exposed to the programme. Labour participation of current adults who have been exposed to the programme when children also shows a positive trend, starting from a proportion of 0.29 and ending at 0.43. Focusing on the household as a whole, the earning capacity indicator tends to improve when the proportion of maximum length of exposure is higher than 0.3. Finally, the eligibility of the household shows stability over the exposure to the programme, averaging a proportion of 0.5 on average for participating households. The description of the three groups of outcomes turns in the following section into a dose-response analysis controlling for pre-programme characteristics and the proposed GPS analysis.

IV -3. Results

This section shows the results of the estimation of the dose-response and treatment effect functions as specified by HI in equations IV.5, IV.6, IV.7 and IV.8. The results are detailed in three stages that entail the calculation of the GPS, the balancing test of the conditional independence and the calculation of the dose-response functions for each selected outcome.

IV -3.1. GPS estimation

As specified by equation IV.5, the calculation of the GPS requires the estimation of the conditional expectation of the continuous treatment given the pre-programme covariates. This is achieved by running a linear regression of the elapsed proportion of maximum length of exposure on the household characteristics shown in Table IV.2.

Most of the covariates or household characteristics are significant in the analysis. Table IV.5 below presents the regression of the conditional expectation of the treatment variables given the pre-programme covariates (Table IV.A3.1 in the appendix IV-A1 shows the full set of covariates). The results are revealing if one observes the significant variables driving the bias reduction of the elapsed proportion of maximum length of exposure as they show discriminatory power in the prediction of households with short or long exposure to the programme.[82] The significant variables show that households with poorer living conditions among the programme's beneficiaries apparently obtain lower exposure to the cash transfers. On the other hand, the macro-level variables reveal that political variables do not discriminate between longer or shorter exposures.

Table IV.5. Regression of the conditional expectation of the continuous treatment given the covariates (significant coefficients only)

Dependent variable: Elapsed proportion of maximum length of exposure	Coefficient
Household level	
Urban = 1	0.007***
	(0.001)
Running water	-0.001**
	(0.000)
Type of toilet	
Connected to sewer	-0.006***
	(0.001)
Type of dwelling:	
House or apartment (flat)	0.006***
	(0.001)
Wall construction material:	
Low quality vegetables	0.010*
	(0.006)
Raw wood	0.010*
	(0.006)
Floor construction material:	
Raw wood	-0.004***
	(0.001)
Concrete	-0.003***
	(0.000)

[82] Non-significant variables do not contribute at all to the comparison of households at different levels of exposure, as they reveal a non-discriminatory power for households with more or less treatment dose.

Tile	-0.008***
	(0.001)
Households in the dwelling	-0.011***
	(0.000)
Household members	-0.003***
	(0.000)
Household with pregnant woman	-0.037***
	(0.001)
Household with disabled member	0.007***
	(0.001)
Average age of children	0.004***
	(0.000)
Age of the youngest child	0.000***
	(0.000)
Household with children under 6yo	-0.11***
	(0.001)
Household's children attend school	0.087***
	(0.000)
Ownership of the dwelling	
Own, on mortgage	0.007***
	(0.001)
Own, completely paid	0.008***
	(0.000)
Other	0.001***
	(0.000)
Assets	
TV	0.000**
	(0.000)
Cooking fuel:	
Household does not cook	0.014***
	(0.002)
Firewood, charcoal.	0.012***
	(0.003)
Mineral coal	0.014***
	(0.002)
Kerosene, oil, gasoline	0.012***
	(0.002)
Gas in cylinder	0.011***
	(0.002)
Gas from distribution network	0.013***
	(0.002)
Type of illumination:	
Kerosene, oil, gasoline	-0.002**
	(0.001)
Solar energy, bio-energy	0.007**
	(0.004)
Maximum monthly cash transfer (US$)	0.000***
	(0.000)
Head of the household	

Male	-0.004***
	(0.001)
Age	0.000***
	(0.000)
Years of education	-0.000***
	(0.000)
Married or cohabitant	-0.001*
	(0.001)
Employed	0.005***
	(0.000)
Employed with health benefits	-0.007***
	(0.001)
Spouse's age	0.000***
	(0.000)
Employed spouse	0.002***
	(0.001)
Macro-level variables	
Local population	-0.000*
	(0.000)
Party of incumbent at enrolment	
Real provincial GDP per capita (US$)	-0.000***
	(0.000)
Provincial employment rate	0.000**
	(0.000)
Provincial unemployment rate	0.001***
	(0.000)
Year of baseline survey	
2009	-0.105**
	(0.052)
2010	-0.174***
	(0.029)
Number of observations	1,635,725
R-square	0.237

Source: Familias en Accion Information System (2000-2010); Departamento Administrativo Nacional de Estadisticas (DANE) (2000-2010); Departamento Nacional de Pleaneacion (DNP) (2000-2010).
Notes: (1) The linear regression includes the municipal-level fixed effects (2) Clustered Standard errors (at the municipality level) in parenthesis. (3) * Significant at 10%; ** Significant at 5%; *** Significant at 1%.

The calculation of the GPS entails the prediction of the residuals of the linear regression of the elapsed proportion of maximum length of exposure on the covariates. In fact, equation IV.6 shows the arithmetic transformation of the residuals into a new variable containing the GPS. The GPS is then introduced as a control variable in the estimation of the dose-response function.

IV -3.2. Balancing test

One of the assumptions made by the estimation of the continuous treatment effects is the conditional independence between the outcomes and the treatment variable given the GPS (known as CIA). After the estimation of the elapsed proportion of maximum length of exposure given the covariates, it is feasible to compare the relation between the continuous treatment and the covariates controlling for the GPS. Regression analysis with bootstrapped standard errors is used for making this comparison, following the suggestions by Imai and Dyk (2004).

Table IV.5 below presents the results of an exercise that regresses each of the covariates on the treatment variable for selected covariates (Table IV-A2.1 in the Appendix shows the full set of variables). Each cell corresponds to a linear regression of each covariate on the continuous treatment variable and the continuous treatment controlling for the GPS. The last column corresponds to the same estimations on the common support region. The coefficients in the first column (continuous treatment) would be significant if the covariate is endogenous to the continuous treatment. The second and third columns of coefficients (continuous treatment with GPS) would be non-significant if the GPS complies with equation IV.3.

Table IV.6. Balancing test of pre-programme covariates (selected pre-programme covariates)

Pre-programme variable	Continuous treatment	Continuous treatment with GPS	Continuous treatment with GPS on common support
Household level			
Sewer	-0.003***	-0.002	-0.089
	(0.000)	(0.005)	(0.054)
Garbage collection	-0.00***	-0.004	-0.001
	(0.000)	(0.005)	(0.036)
Running water	-0.099***	-0.134	-0.056
	(0.026)	(0.104)	(0.099)
Without toilet	0.095***	0.064	0.049
	(0.024)	(0.050)	(0.068)
Type of dwelling:			
Room in a house	-0.044***	-0.018**	-0.064
	(0.007)	(0.009)	(0.082)
House or apartment (flat)	0.045***	0.015	0.060
	(0.008)	(0.011)	(0.072)
Wall construction material:			
No walls	-0.000*	0.000	-0.001
	(0.000)	(0.000)	(0.001)
Polished wood	0.074***	0.057	0.018
	(0.015)	(0.040)	(0.028)
Resistant material	0.078***	0.109	0.092
	(0.011)	(0.211)	(0.020)

Pre-programme variable	Continuous treatment	Continuous treatment with GPS	Continuous treatment with GPS on common support
Bricks	-0.145***	-0.121	-0.123
	(0.030)	(0.141)	(0.194)
Floor construction material:			
Sand, earth	0.111***	0.117	0.130
	(0.022)	(0.091)	(0.204)
Concrete	-0.086***	-0.063	-0.027
	(0.019)	(0.045)	(0.044)
Tile	-0.033***	-0.035	-0.026
	(0.008)	(0.021)	(0.022)
Number of rooms	0.117***	-0.011	-0.062
	(0.030)	(0.047)	(0.110)
Number of bedrooms	0.101***	-0.072***	-0.060
	(0.020)	(0.031)	(0.066)
Households in the dwelling	-0.032***	-0.031	-0.014
	(0.008)	(0.022)	(0.014)
Household members	-0.149***	-0.058	-0.127
	(0.068)	(0.095)	(0.241)
Mean household age	4.613***	-2.555***	4.350
	(0.192)	(0.284)	(3.048)
Household with pregnant woman	-0.115***	-0.106	-0.124
	(0.003)	(0.084)	(0.092)
Household with disabled member	0.034***	0.014	0.012
	(0.003)	(0.010)	(0.019)
Average age of children	0.001***	0.000	0.000
	(0.000)	(0.000)	(0.000)
Age of the youngest child	0.002***	0.001	0.000
	(0.000)	(0.010)	(0.000)
Household with children under 6yo	-0.502***	0.040***	-0.021
	(0.011)	(0.018)	(0.026)
Household's children attend school	0.396***	0.376	0.260
	(0.013)	(0.280)	(0.300)
Ownership of the dwelling	0.147***	0.042	0.048
	(0.013)	(0.039)	(0.051)
Assets:			
Fridge	-0.053***	-0.020	-0.218
	(0.022)	(0.029)	(0.023)
TV	-0.060***	-0.014	-0.023
	(0.023)	(0.032)	(0.036)
Cooking fuel:			
Household does not cook	-0.005***	-0.006	-0.008
	(0.001)	(0.008)	(0.015)
Firewood, charcoal.	0.226***	0.247***	0.173
	(0.034)	(0.046)	(0.114)
Kerosene, oil, gasoline	-0.007***	-0.006	-0.008
	(0.002)	(0.003)	(0.013)
Gas in cylinder	-0.047***	0.003	0.003

Pre-programme variable	Continuous treatment	Continuous treatment with GPS	Continuous treatment with GPS on common support
	(0.021)	(0.028)	(0.038)
Gas from distribution network	-0.109***	-0.195	-0.185
	(0.038)	(0.255)	(0.498)
Electricity	-0.059***	-0.045	-0.035
	(0.028)	(0.030)	(0.039)
Type of illumination:			
Candle	0.017**	0.008	0.007
	(0.010)	(0.012)	(0.042)
Electricity	-0.061***	-0.024*	-0.013*
	(0.018)	(0.014)	(0.011)
Maximum monthly cash transfer (US$)	9.933***	8.835***	7.456
	(0.227)	(3.472)	(5.978)
Head of the household			
Male	0.043***	0.015	0.022
	(0.009)	(0.010)	(0.345)
Age	6.836***	-0.337	-0.313
	(0.245)	(0.391)	(0.790)
Years of education	-0.953***	-0.461	-0.671
	(0.119)	(0.365)	(0.988)
Married or cohabitant	0.035***	0.085	0.081
	(0.007)	(0.076)	(0.075)
Employed	0.028***	0.067	0.065
	(0.006)	(0.073)	(0.083)
Employed with health benefits	-0.010***	-0.009***	-0.517
	(0.003)	(0.004)	(0.679)
Spouse's age	6.439***	2.745	3.685
	(0.269)	(1.990)	(4.684)
Spouse's years of education	-0.557***	0.120	0.138
	(0.093)	(0.121)	(0.144)
Employed spouse	-0.022***	-0.009	-0.009
	(0.009)	(0.006)	(0.010)
Macro-level variables			
Local population	-344,423***	-399,650***	-399,650*
	(116,017)	(137,256)	(247,653)
Party of incumbent at enrolment			
No elections / No info	0.063***	0.038***	0.009
	(0.021)	(0.016)	(0.043)
Real provincial GDP per capita (US$)	-188.8**	-132.5	-132.5
	(87.760)	(111.5)	(144.9)
Share of agriculture in provincial GDP	2.560***	2.629	2.334
	(0.705)	(1.996)	(2.145)
Local public per capita budget (US$)	-22.68***	-13.05	-11.54
	(8.190)	(7.871)	(8.654)
Provincial employment rate	1.634***	2.742	1.544
	(0.435)	(2.575)	(2.154)

Pre-programme variable	Continuous treatment	Continuous treatment with GPS	Continuous treatment with GPS on common support

Source: Familias en Accion Information System (2000-2010); Departamento Administrativo Nacional de Estadisticas (DANE) (2000-2010); Departamento Nacional de Pleaneacion (DNP) (2000-2010).
Notes: (1) Estimations by linear regression. (2) GPS coefficients omitted. (3) Bootstrapped standard errors. (4) * Significant at 10%; ** Significant at 5%; *** Significant at 1%.

The bootstrapped standard errors define whether there is a bias reduction with GPS and the common support. The most striking result to emerge from this balancing test is that the GPS is able to reduce the bias generated by the endogeneity between the continuous treatment and the pre-programme covariates, especially on the common support. As shown in the referred table, most of the coefficients associated to the 65 covariates were significant at some low significant level. On the other, the column of coefficients controlling for the GPS shows a bias reduction as they are not significant. In fact, when the GPS is introduced into the regression analysis the low significance levels vanish for most of the covariates. This balancing test on the common support demonstrates the potential capacity of the GPS for complying with equation IV.1, which states that the outcomes are orthogonal to the treatment given the GPS. Given the robust bias reduction offered on the common support, the dose-response functions are estimated on this region.

IV -3.3. Dose-response analysis: effects of the exposure to *Familias en Accion*.

The order of the presentation of the estimation results of the dose-response functions (equation IV.7 and equation IV.8) is led by the previous description of the selected outcomes. The main focus is based on the primary objectives of the programme that entail the human capital of children during their schooling age (years of education and school registration). The analysis is also focused on the results for the youths whose households have been exposed to the programme when they were children. The latter includes results for adults and households that are detailed as part of the unintended outcomes.

Table IV.7 below provides the results on the estimation of equation IV.7. With a cubic specification, the continuous outcomes were estimated by linear regression while the binary outcomes were estimated by a binomial Probit regression. As it can be seen, the continuous treatment variable obtained significant coefficients, except for two outcomes: school completion by 18 years old youths and the labour participation of current adults that were exposed to the programme when children. Estimated coefficients are used to predict the dose-response function shown in equation IV.8. Following Bia and Mattei (2008), the focus of analysis is the graphical presentation of the predicted estimates for the dose-response function along with the bootstrapped confidence intervals at 95% with 200 replications.

Table IV.7. Dose-response estimation for outcome variables

Dependent variable / Outcome	Treatment	Treatment^2	Treatment^3	GPS	GPS^2	GPS^3	Treatment*GPS	R-square
Current children:								
Children's years of education	-0.876***	0.215	1.677***	.005	-0.105	0.041**	0.642***	0.60
	(0.184)	(0.532)	(0.461)	(0.119)	(0.087)	(0.020)	(0.030)	
Children's years of education (enrolled at 7yo)	7.764***	-23.15***	21.89***	-1.819***	1.296***	-0.298	0.992***	0.51
	(0.707)	(2.221)	(2.072)	(0.553)	(0.393)	(0.089)	(0.131)	
Children's school registration*	0.728***	-1.330**	1.677***	0.334***	-0.286***	0.078***	0.286***	0.10
	(0.172)	(0.528)	(0.422)	(0.108)	(0.080)	(0.019)	(0.028)	
Children's school registration (enrolled at 7yo)*	11.36***	-21.81***	15.54***	0.076	0.013	0.003	-0.056*	0.18
	(0.616)	(1.759)	(1.520)	(0.120)	(0.035)	(0.092)	(0.036)	
Current adults:								
Completed school (currently 18yo)*	-2.034	6.701	-5.051	0.367	-0.293	0.093	-0.203**	0.01
	(3.537)	(6.561)	(7.331)	(0.327)	(0.246)	(0.058)	(0.084)	
Adult school registration (enrolled between 7 - 17yo)*	1.722***	-2.798***	2.053***	0.037	-0.139	0.054*	0.203	0.08
	(0.320)	(0.882)	(0.721)	(0.177)	(0.132)	(0.031)	(0.045)	
Labour participation (enrolled between 7 - 17yo)*	0.734	-1.934	2.623	0.078	0.056	-0.029	-0.099**	0.12
	(0.609)	(1.841)	(3.680)	(0.164)	(0.123)	(0.029)	(0.042)	
Labour participation (enrolled at > 18yo)*	-0.126	3.435***	-3.728***	0.244***	-0.063	0.014	-0.409	0.26
	(0.108)	(0.326)	(0.292)	(0.070)	(0.053)	(0.012)	(0.019)	
Households:								
Earning capacity indicator	-1.947***	-15.66***	21.30***	-4.277***	1.828***	-0.347***	3.471***	0.22
	(0.247)	(0.730)	(0.642)	(0.159)	(0.119)	(0.028)	(0.041)	
Eligible	4.885***	-11.50***	7.982***	0.401***	-0.169**	0.002	-0.132	0.15
	(0.139)	(0.410)	(0.361)	(0.089)	(0.067)	(0.016)	(0.023)	

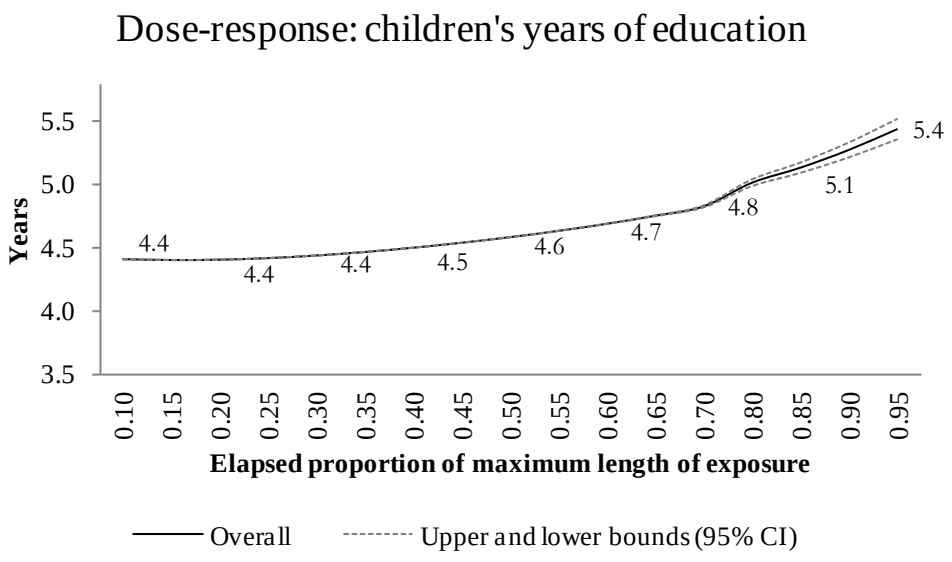
Source: Familias en Accion Information System (2000-2010); Departamento Administrativo Nacional de Estadisticas (DANE) (2000-2010); Departamento Nacional de Pleaneacion (DNP) (2000-2010).
Notes: (1) Coefficients are estimated by linear regression and binomial Probit (indicated by *) controlling for age and gender. (2) Estimations on the common support. (3) Bootstrapped standard errors with 300 repetitions. (4) * Significant at 10%; ** Significant at 5%; *** Significant at 1%.

As robustness check, the dose-response function is estimated with another specification. This is done by considering a quadratic parametric shape of the regression functional form. If the significance of the coefficients is different from the estimated cubic form, then the results could be compromised by the specification of the dose-response function. Table IV-A5.1 in the appendix shows the estimations of the quadratic specification of the dose-response function. These results suggest that the significance and sign of the estimated coefficients are not sensitive to the specification of the functional form, which corroborates the robustness of the suggested dose-response function.

IV -3.3.1. Current children

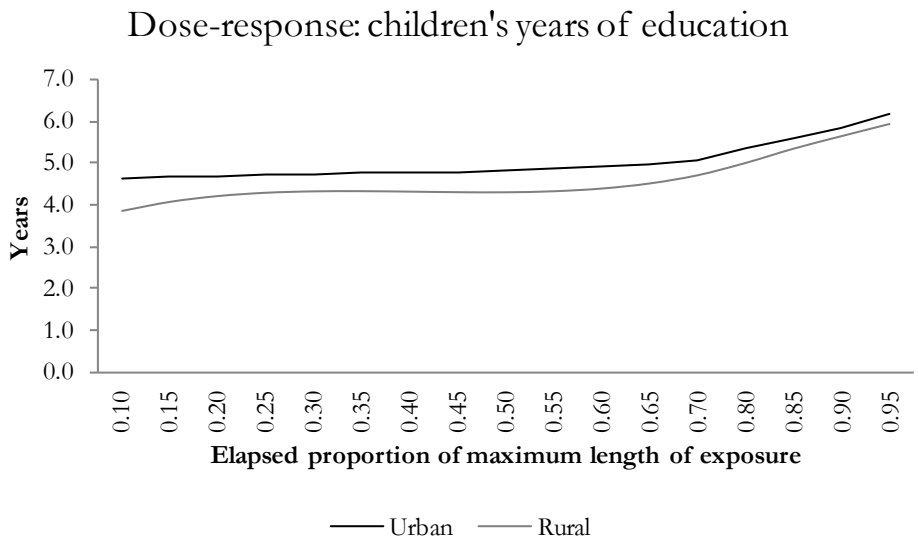
As shown in Figure IV-12 below, the number of years of education responds positively to the elapsed proportion of maximum length of exposure. The dose-response function reveals that children participating in *Familias en Accion* can obtain between 4.4 and 5.4 years of education. Apparently, the difference of 1 year of education that separates on average the least from the most exposed to the CCTs is considerably high. However, the accumulation of years of education is notably slow between the elapsed proportion of 0.1 and 0.70 where children accumulate 0.4 years, while 0.6 years are accumulated after an elapsed proportion of 0.75. The differences between rural and urban areas were expected given the initial observed levels of year of education in the sense that urban children perform better than their rural peers. On average, urban children accumulate a difference of 1.5 years of education given a proportion of exposure to the programme from 0.1 to nearly 1. Meanwhile, rural children experience an accumulation of 2.1 from 3.8 years of education at an elapsed exposure of 0.1 to 5.9 at an exposure close to 1.

Figure IV-12. Estimated dose-response function of "years of education (children 7-17 years old)."



Source: *Sisben* survey 2000-2010.

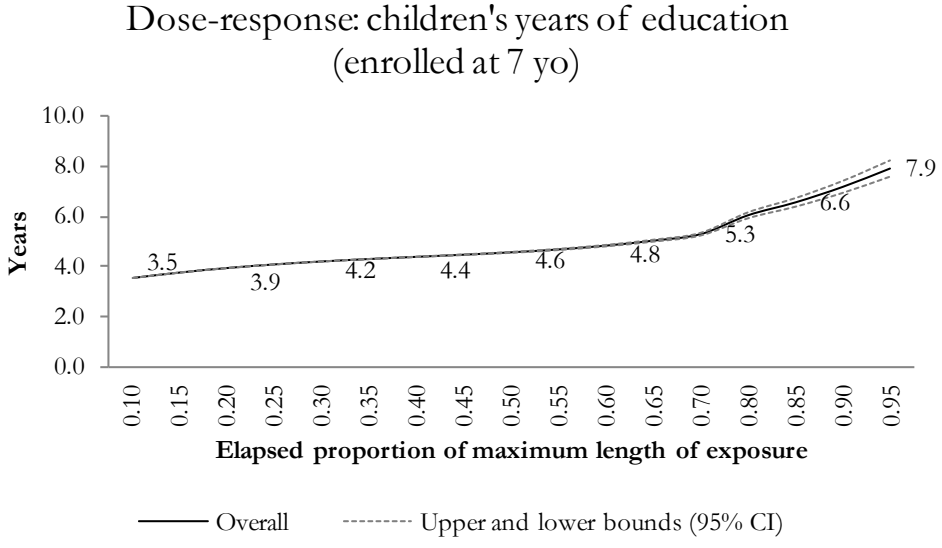
Figure IV-13. Estimated dose-response function of "years of education (children 7-17 years old)" - Urban and rural.



Source: *Sisben* survey 2000-2010.

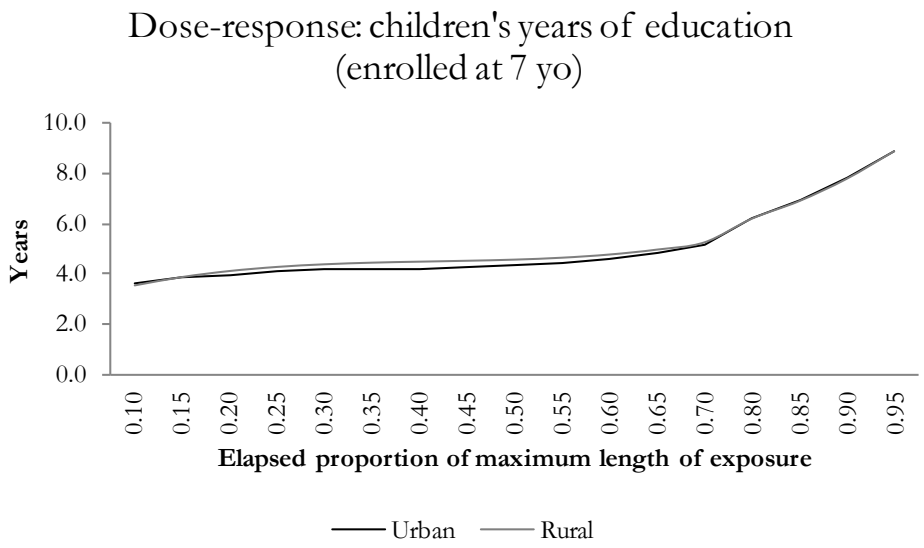
The effects of the exposure to the programme on the years of education are shown in Figure IV-14 below for children enrolled in the programme at 7 years of age. Recall that the description of this outcome without adjustment of the GPS suggested an increasing pattern. Participating 7 years old children can obtain an average from 3.5 to 7.9 years of education in the observed period according to the dose-response function. This implies that a full participation in the programme makes a marginal increasing difference of 4.4 years of education, especially when the elapsed proportion of maximum length of exposure is greater than 0.65. Apparently, there are no differences between urban and rural areas, which implies that if children initiate school at the same time as the programme participation, then these geographic differences tend to decline.

Figure IV-14. Estimated dose-response function of "years of education (enrolled at 7 years old)."



Source: *Sisben* survey 2000-2010.

Figure IV-15. Estimated dose-response function of "years of education (enrolled at 7 years old)." - Urban and rural.

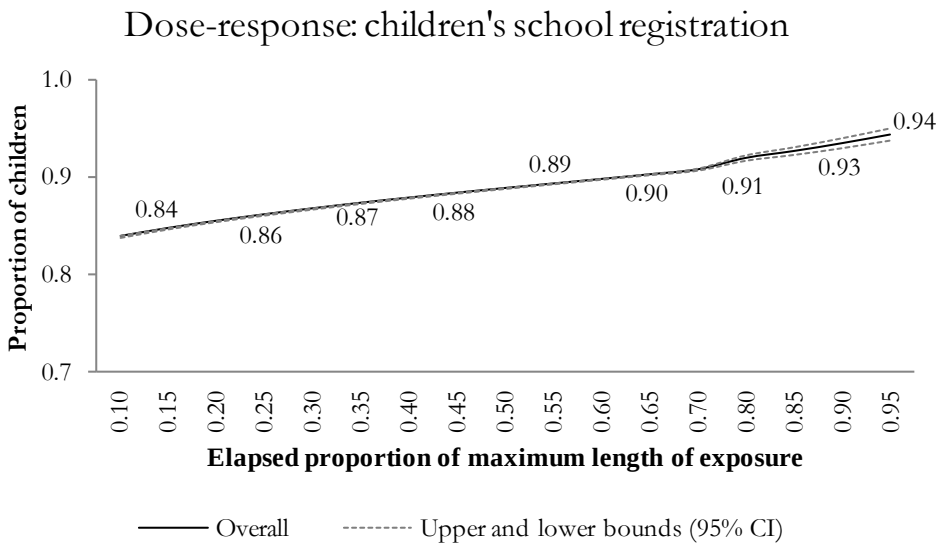


Source: *Sisben* survey 2000-2010.

The next result to be analysed is school registration of current children. Figure IV-16 below shows the evolution of the probability of being registered at school for children between 7-17 years of age. Recall that in the description of this outcome variable in the previous section is was shown that a longer exposure does not translate in to higher school registration. Instead, when this outcome variable is adjusted by the GPS the response of this outcome to the exposure is consistent with the accumulation of years of education, with a positive slope and an increasing marginal rate when the elapsed proportion is greater than 0.7. School registration in fact starts from a probability of 0.84 and reaches 0.94 when the elapsed proportion of exposure is nearly 1. In other words, almost all children are expected to be registered at school when fully exposed to the programme. If they are exposed only to a proportion of 0.1, children are expected to obtain atheschool registration with 10 percentage points lower probability. The geographic differences evidence that urban children experience a higher probability of registration than rural children, especially when they are fully exposed to the programme, when the difference with an elapsed proportion of 0.1 can reach 12 percentage points (see Figure IV.17 below).

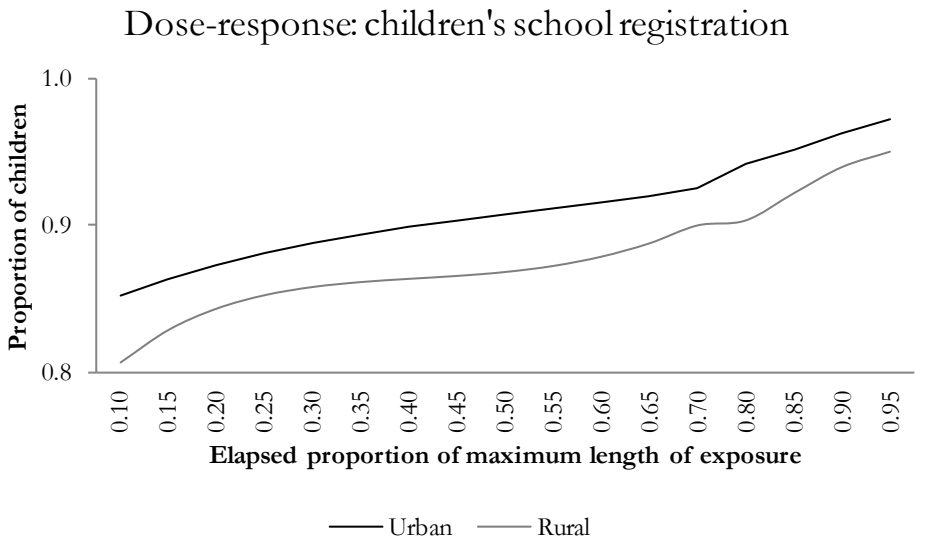
[*Continued on the next page*]

Figure IV-16. Estimated dose-response function of "children's school registration."



Source: *Sisben* survey 2000-2010.
Note: Probability estimates.

Figure IV-17. Estimated dose-response function of "children's school registration." - Urban and rural.

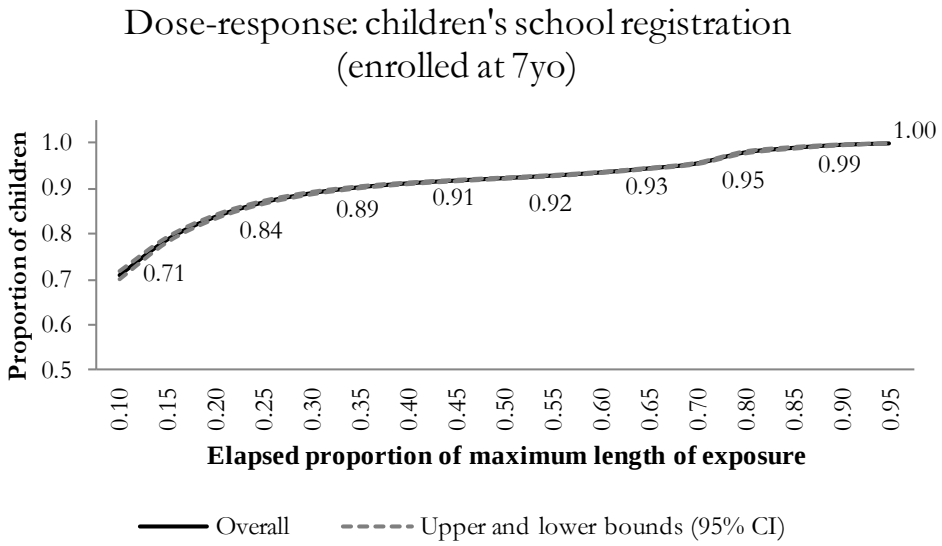


Source: *Sisben* survey 2000-2010.
Note: Probability estimates

The results of the probability of being registered at school for children that were enrolled at 7 years old are similar to the rest of the children (see Figures IV.18 and IV.19 below). In this case, the probability of being registered as response to the continuous exposure reaches 1 when children are fully exposed. In fact, the difference in receiving none or full exposure is 29 percentage points, starting in 71 percent and reaching 100. Recall that the single description of this variable in the previous section showed a decreasing trend over the exposure. However, the slope of the dose-response function, adjusted by the GPS, is notably increasing, reporting a difference in the probability of being registered at school of 20 percentage points between an elapsed proportion of the length of exposure changes from 0.1 to 0.45. The results between areas are striking. Despite the initial estimated probabilities of

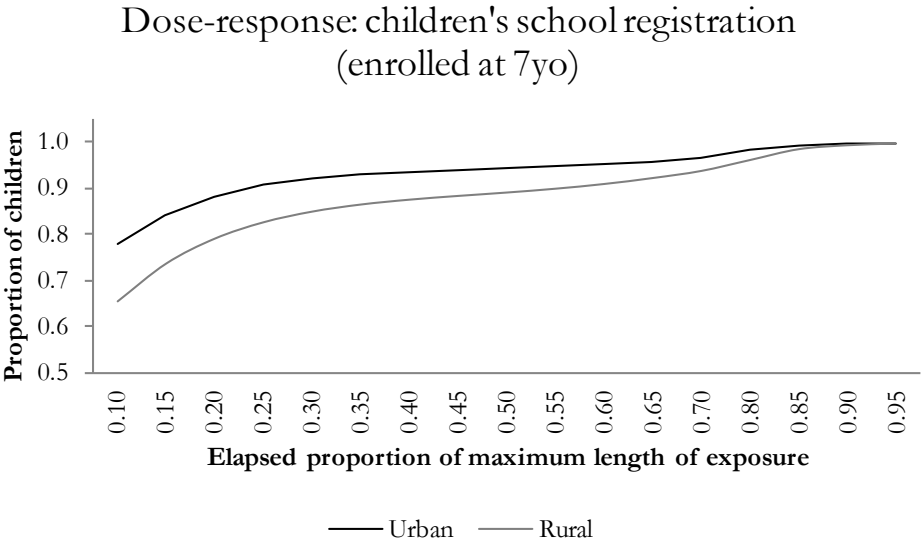
being registered at school are 77 and 65 percent for urban and rural children, respectively, a full exposure to the programme equalizes both figures. The gains for rural children are much higher, making a difference of 34 percentage points from being exposed at a proportion of 0.1 to nearly 1.

Figure IV-18. Estimated dose-response function of "children's school registration (enrolled at 7 years old)."



Source: *Sisben* survey 2000-2010.
Note: Probability estimates.

Figure IV-19. Estimated dose-response function of "children's school registration (enrolled at 7 y. o.)." - Urban and rural.



Source: *Sisben* survey 2000-2010.
Note: Probability estimates.

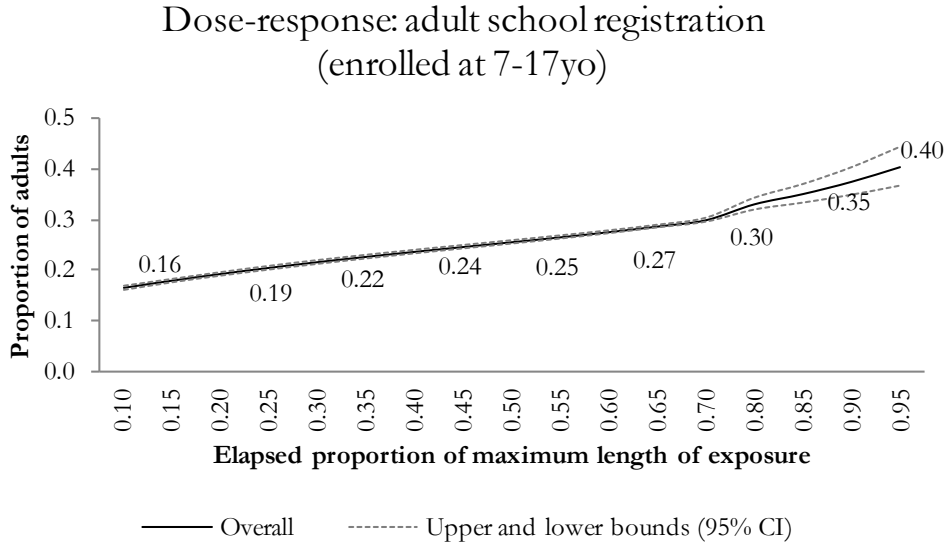
IV -3.3.2. Current adults

The analysis turns now to the adult members of the households exposed to *Familias en Accion*. First, as it can be observed in Table IV.7 the response of youths once they finish their participation in the programme is revealing. Some outcomes did not obtain significant coefficients in the treatment variable. Indeed, the exposure apparently does not have any ex-

planatory power on the completion of school when the youths are 18 years old. A similar result is observed for the labour participation of adults exposed to the programme when children, whose coefficients for the treatment are not significant. On the other hand, the programme seems to have some effect on the school registration of youths whose households were exposed to the programme when they were children. In other words, once the children become adults their previous exposure to the CCTs leads them to continue accumulating more education, instead of participating on the labour markets.

Figure IV.20 below shows the response of young adults whose households were exposed to the programme when they were children. The probability of being attending school or a higher degree of education ranges between 0.16 and 0.4 with an increasing pattern after a proportion of exposure greater than 0.7. The higher the exposure to the programme, the higher the likelihood of school continuation. The sharpest difference is evident between a proportion of exposure between 0.7 and nearly 1. This marginal effect of the exposure on the probability is higher for rural adults for this outcome, with a difference of 37 percentage points between the exposures of 0.1 to nearly 1. Looking at urban and rural areas, when adults with some exposure when children are fully exposed to the programme the differences between urban and rural adults is irrelevant.

Figure IV-20. Estimated dose-response function of "adult school registration (enrolled between 7 - 17 years old)."



Source: *Sisben* survey 2000-2010.
Note: Probability estimates.

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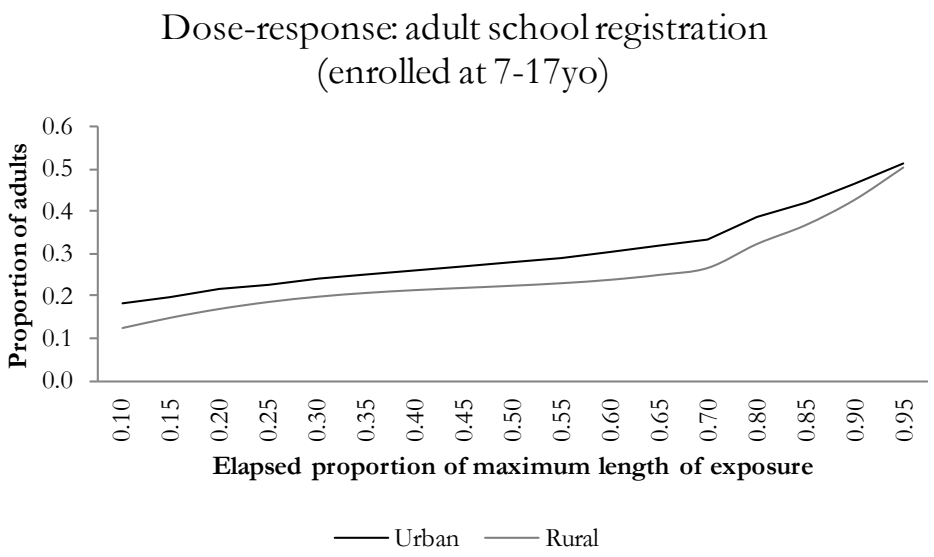
Figure IV-21. Estimated dose-response function of "adult school registration (enrolled between 7-17 y. o.)" - Urban and rural

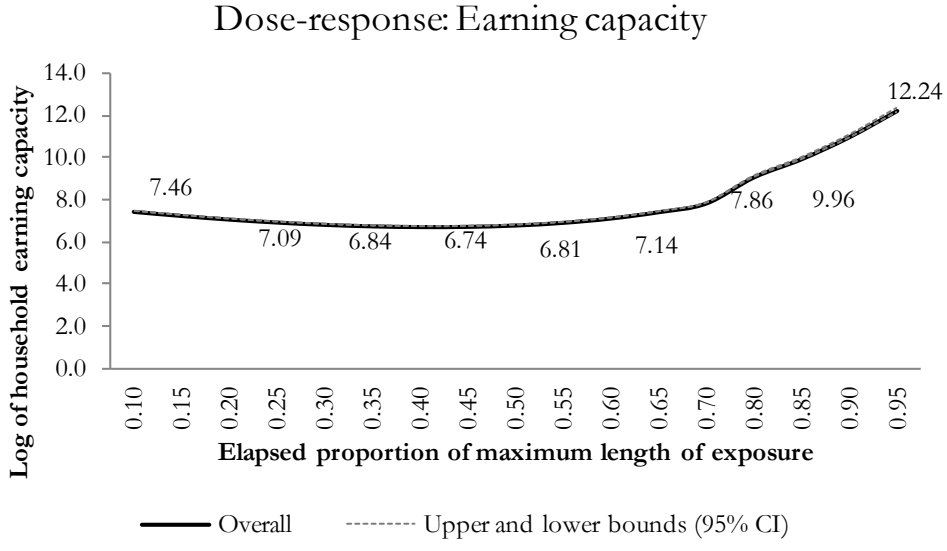


Source: *Sisben* survey 2000-2010.
Note: Probability estimates.

IV -3.3.3. Households

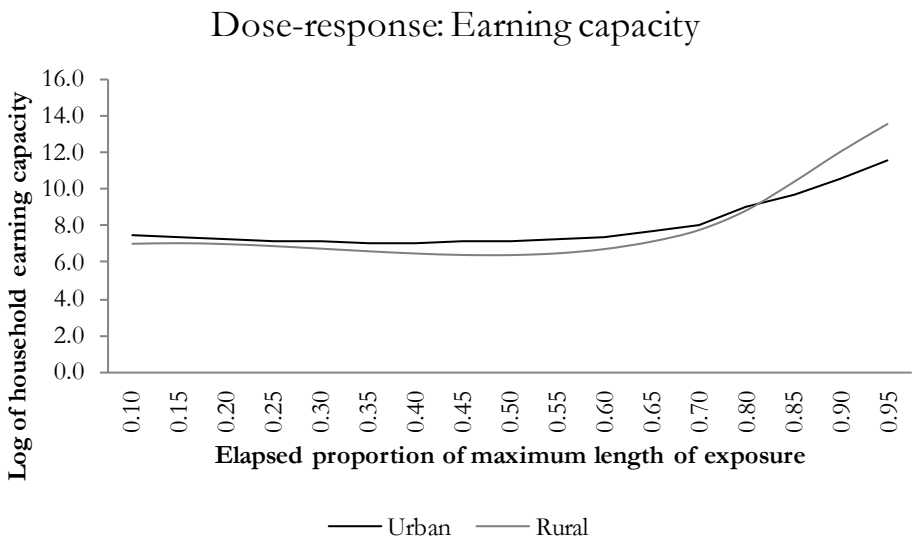
The first household level indicator in this analysis has to do with the estimated earning capacity. Figure IV.22 below shows the response of the exposure to the programme to this indicator, which reveals a decreasing marginal effect between the initial proportion of exposure and a minimum response at a proportion of 0.45. The response is increasing and reaches a maximum when households are fully exposed to the programme. The earning capacity seems to show a higher marginal effect for rural households (see Figure IV.23), especially after an exposure of 0.70 where these households demonstrate a higher marginal response than urban households.

Figure IV-22. Estimated dose-response function of "earning capacity indicator."



Source: *Sisben* survey 2000-2010.

Figure IV-23. Estimated dose-response function of "earning capacity indicator." - Urban and rural.



Source: *Sisben* survey 2000-2010.

The second outcome at the household level to be analysed is the probability of being eligible. This outcome is important because households are expected to overcome the eligibility threshold once they end their participation in the programme. Figure IV.24 below shows that the probability of being eligible is consistent with the previous earning capacity response to the dose or treatment. Eligibility reaches a maximum when the elapsed proportion of the length of exposure reaches 0.35 and then shows a decreasing marginal effect of the exposure. It becomes stable when the proportion of exposure is greater than 0.65. Nonetheless, the 95% confidence intervals after a proportion of exposure of 0.70 demonstrate a mixed result, where the final probability of being eligible ranges between 0.51 and 0.55. On the other hand, while the probability of being eligible in rural households shows a stable response over the exposure and has a similar shape as the overall figure, what is interesting in urban areas is that the marginal effect of the exposure is slightly negative with a decrease of 7.4 percentage points from the initial proportion of exposure to nearly 1. This in fact contrasts with the figure of earning capacity indicator, which showed a stronger response for rural households.

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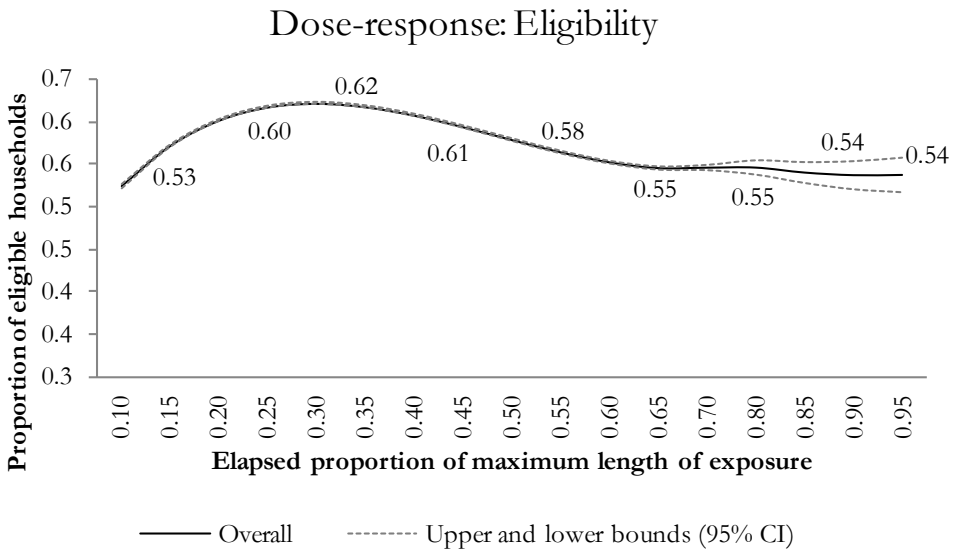
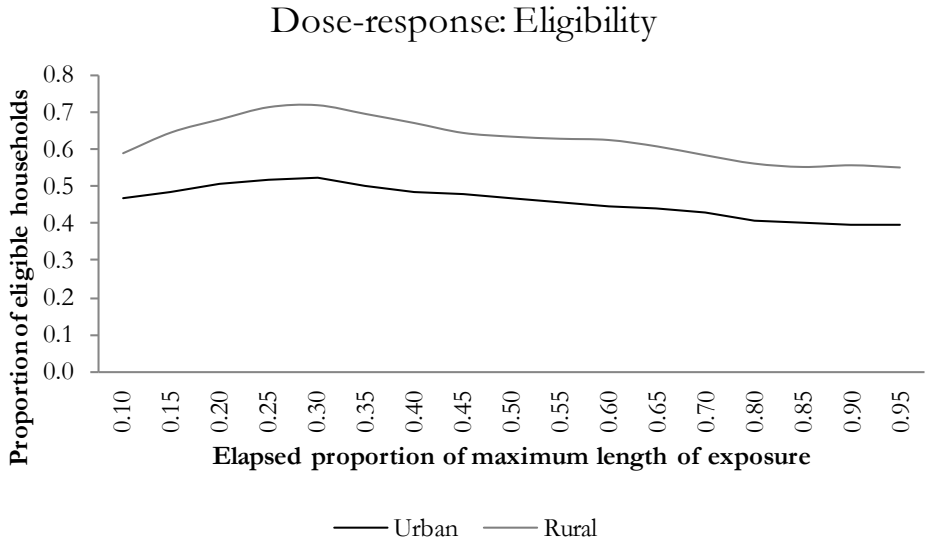
Figure IV-24. Estimated dose-response function of "probability of being eligible."



Source: *Sisben* survey 2000-2010.
Note: Probability estimates.

Figure IV-25. Estimated dose-response function of "probability of being eligible." - Urban and rural.



Source: *Sisben* survey 2000-2010.
Note: Probability estimates.

IV -4. Linking these results with previous findings

The modified version of the BR model in Chapter III showed that poor families would under-invest in their children due to liquidity restrictions and the imperfections of the credit markets. The interaction of the programme would generate higher human capital accumulation levels. In this chapter one input of human capital, time devoted to schooling, was empirically analysed. The estimations of the dose-response and the treatment effect functions allowed the understanding of the sensitiveness of the effect of the CCTs to the length of exposure. Starting from the assessment of the outcomes for participating children, the results showed that the outcomes behave as expected: the higher the exposure to the programme, the higher the accumulation of years of education. However, the outcomes related

to adult household members reveal that the intervention could generate negative marginal effects in labour force participation and eligibility to the programme.

The years of education and school registration respond positively to the elapsed proportion of maximum length of exposure. This means that, according to these findings, the programme could benefit the children until they complete the full intended exposure. The unexpected outcome emerges when children stop their participation once they turn 18 years old. Surprisingly, the completion of school apparently did not respond to any exposure for 18 years old youths whose households were exposed to the programme when younger. In contrast with the previous impact evaluations, this fact demonstrates that the programme increases the likelihood of school completion. However, it seems that this effect is not sensitive to the length of exposure. Similarly, labour force participation of youths who were exposed to the CCTs when children did not respond to any level of length of exposure. One possible explanation to the question on why they do not participate on labour markets is that they are encouraged to continue studying after they turn 18. The fact that youths are prone to study when they experience a higher exposure can prevent parents to believe that they are overinvesting in their children's human capital. The latter is confirmed by the findings that demonstrate that an adult school registration responses to a longer proportion of exposure. The reviewed qualitative evaluation supports this finding on youth labour supply and adult school registration, since parents believed that children do not have further opportunities after school graduation and seek for continue studying. In summary, children accumulate human capital but some of them stay economically inactive short after they become adults.

The results on child and youth human capital formation are also positively related to the estimated earning capacity indicator. As the children are able to accumulate more years of education the whole household enhances its capacity to generate income if its members were fully employed in the labour markets. This contrasts to the probability of the household of being eligible, which remains unaltered over the maximum length of exposure. This relation seems to be more relevant in urban areas, where households are less likely to remain eligible for the cash transfers when fully exposed to the programme.

The variation in the programme's effectiveness underlines the fact that the exposure to the intervention could generate different intended and unintended results at different lengths. It could be part of the programme's design to value the extent to which these dynamics can be used for the creation of exposure rules according to the desired results. Similarly, the understanding of the response of a single intervention could lead to the introduction of

complementary programmes that would mitigate the unintended effects at different stages of the initial strategy.

IV -5. Conclusions

In this chapter the aim was to find evidence on the varying effectiveness of social assistance programmes through the exploration of CCTs in Colombia. Known as *Familias en Accion*, the programme has been in operation since 2001 with almost 3 million beneficiaries and 6 million children. The previous evaluations of the programme have been done on a static basis, which considers that the effects of the intervention on specific indicators are unaltered over time. The evidence that emerges from the estimations in this chapter is essential to understand how the effectiveness of the programme can change as households participate at different lengths of exposure.

This chapter has evidenced the response of a group of selected outcomes to the length of the exposure. Since the programme does not apply a random rule in the assignment of the length of duration of the benefits, the outcomes could be endogenous to the estimated effectiveness. After exploring a rich database from the targeting and administrative systems of the programme, the proposed methodology consisted of comparing households at different lengths of exposure controlling for potential endogeneity. The estimation of the GPS and the dose-response functions were based on the idea that observable characteristics prior to the enrolment can mitigate the bias among households with different lengths of exposure. With several tests and robustness checks the reliability of the results leads the analysis to an unbiased evidence of the effectiveness over the length of exposure.

One of the most significant findings to emerge from this study is that the programme is successful in the accumulation of more years of education of participating children. On average, this outcome showed a difference of one year of education from the least to the most exposed household to the programme. Additionally, those children enrolled in *Familias en Accion* when they were 7 years of age, attain even more years of education, especially in the urban areas. The latter is confirmed by a nearly 100 percent probability of school attendance when children are fully exposed to the CCTs. Nonetheless, adult members of participating households were complementarily assessed with mixed results. Current adults who were fully exposed to the programme when children were more likely to be registered at a tertiary education institution, with no relevant differences between urban and rural areas. On the other hand, adult labour participation seems unaffected by the programme until the elapsed proportion of length of exposure reaches 0.8. At the end of the participation length the probabilities of being employed or searching for a job drop from 0.55 to 0.40. This finding does not seem to be consistent when looking into overall urban and rural are-

as, however, apparently it is explained by the cohort of males and females with an age over 25 years old. It was also shown that at the household level the estimated earning capacity estimator responses positively to the exposure of the programme, in particular when the elapsed proportion is greater than 0.70 (surprisingly, the earning capacity is higher in rural areas when the household is fully exposed). Similarly, the probability of being eligible remains unaltered if a household with short exposure is compared to one with complete exposure. These results imply that, in general, the programme can perform as intended with reference to the human capital formation of children, but another complementary strategy is required for adults when they are about to end their participation.

These findings suggest several courses of action for the implementation of social assistance programmes. It is imperative that programme designers set up exposure strategies when the intended or unintended outcomes yield undesired effects. For instance, the lower probability of labour participation to some extent triggers the response from the programme in order to set an exit condition from the programme. This exit condition does not imply the end of the benefits but rather the introduction of the household to active labour market policies that reinforce the main transfers. It is beyond the scope of this research to define such policies. This research will serve as a base for future studies for complementary interventions when programmes are prone to generate unintended effects at some point of participation. Comparing it to a medical therapy, when the side effects of a given intervention emerge, some other treatments will be needed to mitigate its side effects.

Finally, a number of important limitations need to be considered. First, the lack of randomness in the assignment of the length of the exposure evidences the development of a dose-response estimation method accounting for just observable characteristics. There are unobservable variables that were not taken into consideration. And second, the proposed generalised propensity score is based on assumptions that were made flexible in this chapter (e.g. the parametric form of the dose-response functions and the estimations through linear regression). Further research in this field should be focused on addressing these limitations.

Appendix IV -A1. Comparison between attrited and unattrited households in the pre-programme condition

The following table contains the differences in the pre-programme characteristics between attrited and unattrited households in the post-programme survey. Given the number of observations, the differences that are close to zero obtain low standard errors and significant inference. Unattrited households turned out to be larger and to have older but less educated heads, live in smaller towns and occupy slightly better dwellings.

Table IV-A1.2. Comparison between attrited and unattrited households.

Pre-programme Variables (proportion)	Attrited	Unattrited	Difference
Household level			
Electricity	0.839	0.856	0.016***
			(0.001)
Sewer	0.355	0.367	0.011***
			(0.001)
Garbage collection	0.452	0.456	0.004***
			(0.001)
Running water	0.581	0.612	0.030***
			(0.001)
Without toilet	0.309	0.286	-0.023***
			(0.001)
Type of dwelling:			
Room in a house	0.133	0.101	-0.032***
			(0.001)
House or apartment (flat)	0.850	0.886	0.035***
			(0.001)
Other	0.017	0.014	-0.003092
			(0.000)
Wall construction material:			
No walls	0.001	0.001	-0.000***
			(0.000)
Zinc, cardboard, plastics	0.018	0.015	-0.003***
			(0.000)
Low quality vegetables	0.045	0.039	-0.005***
			(0.000)
Raw wood	0.197	0.163	-0.034***
			(0.001)
Polished wood	0.153	0.173	0.019***
			(0.001)
Resistant material	0.066	0.102	0.036***
			(0.001)
Bricks	0.521	0.507	-0.013***
			(0.001)
Floor construction material:			
Sand, earth	0.341	0.352	0.011***
			(0.001)
Raw wood	0.094	0.072	-0.021***

			(0.001)
Concrete	0.497	0.513	0.015***
			(0.001)
Tile	0.068	0.063	-0.004***
			(0.000)
Carpet	0.001	0.001	-0.000***
			(0.000)
Number of rooms [a]	2.284	2.417	0.133***
			(0.002)
Number of bedrooms [a]	1.555	1.681	0.126***
			(0.002)
Households in the dwelling	1.254	1.172	-0.081***
			(0.001)
Household members [a]	4.715	5.633	0.917***
			(0.005)
Mean household age [a]	38.96	41.850	2.885***
			(0.027)
Household with pregnant woman	0.067	0.075	0.008***
			(0.001)
Household with disabled member	0.054	0.075	0.020***
			(0.000)
Household with children under 6yo	0.637	0.691	0.053***
			(0.001)
Household's children attend school	0.672	0.723	0.050***
			(0.001)
Ownership of the dwelling	0.452	0.453	0.000***
			(0.00)
Assets:			
Fridge	0.238	0.271	0.033***
			(0.001)
TV	0.36	0.377	0.021***
			(0.001)
Cooking fuel:			
Household does not cook	0.018	0.008	-0.009***
			(0.000)
Firewood, charcoal.	0.434	0.473	0.038***
			(0.001)
Mineral coal	0.008	0.008	0.000***
			(0.000)
Kerosene, oil, gasoline	0.029	0.021	-0.008***
			(0.000)
Gas in cylinder	0.286	0.284	-0.001***
			(0.001)
Gas from distribution network	0.152	0.145	-0.006***
			(0.001)
Electricity	0.073	0.061	-0.012***
			(0.000)
Type of illumination:			

Candle	0.105	0.102	-0.002***
			(0.001)
Kerosene, oil, gasoline	0.062	0.046	-0.016***
			(0.000)
Electricity	0.831	0.850	0.019***
			(0.001)
Solar energy, bio-energy	0.002	0.002	-0.000*
			(0.000)
Potential monthly cash transfer (US$) [a]	27.30	26.97	-0.330***
			(0.041)
Head of the household			
Male	0.670	0.743	0.072***
			(0.001)
Age [a]	38.96	41.850	2.885***
			(0.027)
Years of education [a]	4.247	3.833	-0.414***
			(0.006)
Married or cohabitant	0.665	0.766	0.100***
			(0.001)
Employed	0.749	0.757	0.008***
			(0.001)
Employed with health benefits	0.032	0.030	-0.001***
			(0.000)
Spouse's age [a]	21.67	27.866	6.196***
			(0.037)
Spouse's years of education [a]	2.809	3.116	0.306***
			(0.006)
Employed spouse	0.083	0.088	0.004***
			(0.001)
Macro-level variables			
Local population [a]	246,690	238,152	-8538***
			(1,001)
Party of incumbent at enrolment			
Ethnic minority	0.012	0.025	0.012***
			(0.000)
Independent	0.365	0.341	-0.024***
			(0.000)
No elections / No info	0.150	0.136	-0.014***
			(0.000)
Officialist or coalition party	0.243	0.267	0.023***
			(0.000)
Opposition party	0.229	0.231	0.002***
			(0.000)
Votes obtained by ruling party	0.388	0.402	1.390***
			(0.017)
Real provincial GDP per capita (US$) [a]	3,285	3,449	163.0***
			(42.92)

Share of agriculture in provincial GDP	0.141	0.139	-0.023***
			(0.001)
Local public per capita budget (US$) [a]	27.88	32.98	0.050***
			(0.004)
Provincial employment rate	0.529	0.525	-0.038***
			(0.004)
Provincial unemployment rate	0.113	0.117	0.039***
			(0.006)
Number of observations	712,732	928,819	1,641,551

Source: *Familias en Accion* Information System (2000-2010); Departamento Administrativo Nacional de Estadisticas (DANE) (2000-2010); Departamento Nacional de Pleaneacion (DNP) (2000-2010).
Notes: (1) Differences are calculated by linear regression. (2) Standard errors of the differences in parenthesis. (3) * Significant at 10%; ** Significant at 5%; *** Significant at 1%. (4) [a] This variables are not in proportional terms. (5) US$ values are calculated by current exchange rates.

Appendix IV -A2. Estimation of earning capacity

The *Sisben* survey fails to provide reliable information on the income, consumption and detailed labour information. As an alternative, Garfinkel and Haveman (1977) and Haveman and Bershadker (1998) are followed to generate an earning capacity indicator using the data from the *Encuesta Nacional de Calidad de Vida* (National Survey of Living Standards, in English) carried out in 2010. The estimated coefficients for the individual salaried labour earnings are used to predict the household income generated by its adult members in the *Sisben* survey.

As Garfinkel and Haveman (1977) point out, the earning capacity is designed to measure the ability of the household to generate income if its physical and human capital were fully employed as a result of a labour market transaction. They propose the estimation of a typical *Mincer's equation* (Mincer 1974) for full-time adult wage workers. Haveman and Bershadker (1998) suggest the exclusion of students and self-employed workers. Finally, the predicted individual income is added up for each household as the indicator of earning capacity.

The estimation of log-salaried earnings starts form the selection of, in fact, salaried adult workers from the *Encuesta Nacional de Calidad de Vida*. Since the selection of wage workers implies the non-randomness (or selection bias) of the resulting sub-sample, the first stage of the estimation requires the specification of a selection model following Heckman (1979). The core of this selection model is the estimation of a Probit model of being a wage worker for adult household members. This stage includes individual and household characteristics that are commonly informed in the *Sisben* and national sampling surveys. The following table presents the result of the Probit model for the selection of wage workers:

Table III.A2.1. Probit estimated for being a wage worker.

Probit estimates for being a wage worker (older than 18yo)	
Head of the household = 1	0.697***
	(0.021)
Married or cohabitant = 1	-0.003
	(0.020)
Attends school =1	-0.208***
	(0.035)
Number of household members	0.000
	(0.001)
Household employment rate	2.030***
	(0.044)
Household with children under 6yo	0.232***
	(3.000)
Urban household = 1	0.076***
	(0.023)

Probit estimates for being a wage worker (older than 18yo)	
Assets	
Fridge = 1	0.036
	(0.026)
TV = 1	-0.129***
	(0.034)
Cable TV = 1	-0.070**
	(0.023)
Water heater = 1	-0.00978
	(0.031)
Microwave = 1	-0.01539
	(0.033)
Air conditioner = 1	-0.017762
	(0.063)
Personal computer = 1	-0.242***
	(0.028)
Stereo system = 1	-0.088***
	(0.022)
Motorcycle = 1	-0.185***
	(0.026)
Car = 1	-0.018827
	(0.035)
Constant	-0.160**
	(0.076)
Number of observations	34,371
Number of expanded observations	9,809,928
R-square	0.15

Source: Encuesta Nacional de Calidad de Vida (National Survey of Living Conditions) (2010); Departamento Administrativo Nacional de Estadisticas (DANE).
Notes: (1) Probit estimates with robust standard errors. (2) Expanded observations denote the use of sampling weights. (3)* Significant at 10%; ** Significant at 5%; *** Significant at 1%.

The results of the estimation of the Probit model are then employed in the prediction of the estimates. Subsequently, this allows the calculation of what Heckman (1979, 156) calls as the *inverse of Mill's ratio*.

The second stage implies the estimation of the log-salaried earning including the *inverse of Mill's ratio* into the Mincer (1974) equation. Since the goal of this estimation is the prediction of the labour earnings, the potential endogeneity that emerges between the dependent and independent variables is ignored. Following Haveman and Bershadker (1998) the equation includes human capital variables, gender and regional location. The estimation results are detailed in the following table:

[*Continued on the next page*]

Table III.A2.2. Linear regression for the estimation of the earning capacity indicator

Linear regression estimates - Log of adult labour earnings (wage workers)	
Age	0.079***
	(0.010)
Age^2	-0.00***
	(0.000)
Years of education	0.123***
	(0.004)
Male = 1	0.275***
	(0.037)
Regional location	
Oriental	0.167***
	(0.065)
Central	0.143**
	(0.064)
Pacifica	-0.092
	(0.064)
Bogota	0.350***
	(0.064)
Antioquia	0.107
	(0.083)
Valle del Cauca	0.254***
	(0.063)
San Andres y Providencia	0.324***
	(0.064)
Orinoquia - Amazonia	0.106
	(0.078)
Inverse of Mill's ratio	-0.518***
	(0.078)
Constant	10.75***
	(0.212)
Number of observations	7,636
Number of expanded observations	7,639,780
R-square	0.28

Source: Encuesta Nacional de Calidad de Vida (National Survey of Living Standards) (2010); Departamento Administrativo Nacional de Estadisticas (DANE).
Notes: (1) Linear regression estimates with robust standard errors. (2) Expanded observations denote the use of sampling weights. (3)* Significant at 10%; ** Significant at 5%; *** Significant at 1%.

The estimated coefficients are then used in the prediction of the household earning capacity with the *Sisben* survey in per-capita terms. The resulting prediction, the earning capacity indicator, contains information of the potential earnings that each household would obtain if its human capital endowment were fully employed on the labour market.

Appendix IV -A3. Estimation of the conditional expectation of the treatment given the pre-programme covariates

The following table presents the estimations of equation IV.4. This is the first stage in obtaining the GPS:

Table IV.A3.1. Regression of the conditional expectation of the continuous treatment given the covariates

Dependent variable: Elapsed proportion of maximum length of exposure	Coefficient
Household level	
Urban = 1	0.007***
	(0.001)
Electricity	0.002
	(0.001)
Sewer	-0.000
	(0.001)
Garbage collection	-0.000
	(0.001)
Running water	-0.001**
	(0.000)
Type of toilet	
Latrine	-0.000
	(0.001)
Unconnected to sewer	-0.000
	(0.001)
Connected to septic well	-0.000
	(0.001)
Connected to sewer	-0.006***
	(0.001)
Type of dwelling:	
House or apartment (flat)	0.006***
	(0.001)
Other	0.001
	(0.002)
Wall construction material:	
No walls	0.007
	(0.006)
Zinc, cardboard, plastics	0.008
	(0.006)
Low quality vegetables	0.010*
	(0.006)
Raw wood	0.010*
	(0.006)
Polished wood	0.006
	(0.006)
Resistant material	0.007
	(0.006)
Floor construction material:	
Raw wood	-0.004***

	(0.001)
Concrete	-0.003***
	(0.000)
Tile	-0.008***
	(0.001)
Carpet	-0.002
	(0.005)
Number of rooms	-0.000
	(0.000)
Number of bedrooms	-0.000
	(0.000)
Households in the dwelling	-0.011***
	(0.000)
Household members	-0.003***
	(0.000)
Mean household age	-0.000
	(0.000)
Household with pregnant woman	-0.037***
	(0.001)
Household with disabled member	0.007***
	(0.001)
Average age of children	0.004***
	(0.000)
Age of the youngest child	0.000***
	(0.000)
Household with children under 6yo	-0.11***
	(0.001)
Household's children attend school	0.087***
	(0.000)
Ownership of the dwelling	
Own, on mortgage	0.007***
	(0.001)
Own, completely paid	0.008***
	(0.000)
Other	0.001***
	(0.000)
Assets	
Fridge	-0.000
	(0.000)
TV	0.000**
	(0.000)
Cooking fuel:	
Household does not cook	0.014***
	(0.002)
Firewood, charcoal.	0.012***
	(0.003)
Mineral coal	0.014***
	(0.002)
Kerosene, oil, gasoline	0.012***

	(0.002)
Gas in cylinder	0.011***
	(0.002)
Gas from distribution network	0.013***
	(0.002)
Type of illumination:	
Kerosene, oil, gasoline	-0.002**
	(0.001)
Electricity	0.001
	(0.001)
Solar energy, bio-energy	0.007**
	(0.004)
Maximum monthly cash transfer (US$)	0.000***
	(0.000)
Head of the household	
Male	-0.004***
	(0.001)
Age	0.000***
	(0.000)
Years of education	-0.000***
	(0.000)
Married or cohabitant	-0.001*
	(0.001)
Employed	0.005***
	(0.000)
Employed with health benefits	-0.007***
	(0.001)
Spouse's age	0.000***
	(0.000)
Spouse's years of education	0.000
	(0.000)
Employed spouse	0.002***
	(0.001)
Macro-level variables	
Local population	-0.000*
	(0.000)
Party of incumbent at enrolment	
Independent	0.056
	(0.039)
No elections / No info	0.029
	(0.058)
Officialist or coalition party	0.048
	(0.038)
Opposition party	0.026
	(0.037)
Votes obtained by ruling party	0.000
	(0.001)
Real provincial GDP per capita (US$)	-0.000***
	(0.000)

Share of agriculture in provincial GDP	0.000
	(0.000)
Local public per capita budget (US$)	0.000
	(0.000)
Provincial employment rate	0.000**
	(0.000)
Provincial unemployment rate	0.001***
	(0.000)
Year of baseline survey	
2002	-0.012
	(0.028)
2003	-0.031
	(0.028)
2004	-0.037
	(0.028)
2005	-0.043
	(0.028)
2006	-0.044
	(0.028)
2007	-0.030
	(0.031)
2008	-0.061
	(0.034)
2009	-0.105**
	(0.052)
2010	-0.174***
	(0.029)
Number of observations	1,635,725
R-square	0.237

Source: Familias en Accion Information System (2000-2010); Departamento Administrativo Nacional de Estadisticas (DANE) (2000-2010); Departamento Nacional de Pleaneacion (DNP) (2000-2010).

Notes: (1) The linear regression includes the municipal-level fixed effects (2) Clustered Standard errors (at the municipality level) in parenthesis. (3) * Significant at 10%; ** Significant at 5%; *** Significant at 1%.

Appendix IV -A4. Balancing test of pre-programme covariates

The table below shows the results of the balancing test.

Table IV.A4.1. Balancing test of pre-programme covariates

Pre-programme variable	Continuous treatment	Continuous treatment with GPS	Continuous treatment with GPS on common support
Household level			
Electricity	-0.059	-0.025	-0.012
	(0.017)	(0.019)	(0.029)
Sewer	-0.003***	-0.002	-0.089
	(0.000)	(0.005)	(0.054)
Garbage collection	-0.00***	-0.004	-0.001
	(0.000)	(0.005)	(0.036)
Running water	-0.099***	-0.134	-0.056
	(0.026)	(0.104)	(0.099)
Without toilet	0.095***	0.064	0.049
	(0.024)	(0.050)	(0.068)
Type of dwelling:			
Room in a house	-0.044***	-0.018**	-0.064
	(0.007)	(0.009)	(0.082)
House or apartment (flat)	0.045***	0.015	0.060
	(0.008)	(0.011)	(0.072)
Other	-0.001	0.003	0.002
	(0.002)	(0.003)	(0.011)
Wall construction material:			
No walls	-0.000*	0.000	-0.001
	(0.000)	(0.000)	(0.001)
Zinc, cardboard, plastics	-0.001	0.001	0.000
	(0.002)	(0.002)	(0.001)
Low quality vegetables	-0.001	0.008	0.001
	(0.004)	(0.006)	(0.001)
Raw wood	-0.005	0.034**	0.006
	(0.013)	(0.019)	(0.003)
Polished wood	0.074***	0.057	0.018
	(0.015)	(0.040)	(0.028)
Resistant material	0.078***	0.109	0.092
	(0.011)	(0.211)	(0.020)
Bricks	-0.145***	-0.121	-0.123
	(0.030)	(0.141)	(0.194)
Floor construction material:			
Sand, earth	0.111***	0.117	0.130
	(0.022)	(0.091)	(0.204)
Raw wood	0.008	0.052	0.048
	(0.007)	(0.012)	(0.052)
Concrete	-0.086***	-0.063	-0.027
	(0.019)	(0.045)	(0.044)
Tile	-0.033***	-0.035	-0.026

Pre-programme variable	Continuous treatment	Continuous treatment with GPS	Continuous treatment with GPS on common support
	(0.008)	(0.021)	(0.022)
Carpet	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)
Number of rooms	0.117***	-0.011	-0.062
	(0.030)	(0.047)	(0.110)
Number of bedrooms	0.101***	-0.072***	-0.060
	(0.020)	(0.031)	(0.066)
Households in the dwelling	-0.032***	-0.031	-0.014
	(0.008)	(0.022)	(0.014)
Household members	-0.149***	-0.058	-0.127
	(0.068)	(0.095)	(0.241)
Mean household age	4.613***	-2.555***	4.350
	(0.192)	(0.284)	(3.048)
Household with pregnant woman	-0.115***	-0.106	-0.124
	(0.003)	(0.084)	(0.092)
Household with disabled member	0.034***	0.014	0.012
	(0.003)	(0.010)	(0.019)
Average age of children	0.001***	0.000	0.000
	(0.000)	(0.000)	(0.000)
Age of the youngest child	0.002***	0.001	0.000
	(0.000)	(0.010)	(0.000)
Household with children under 6yo	-0.502***	0.040***	-0.021
	(0.011)	(0.018)	(0.026)
Household's children attend school	0.396***	0.376	0.260
	(0.013)	(0.280)	(0.300)
Ownership of the dwelling	0.147***	0.042	0.048
	(0.013)	(0.039)	(0.051)
Assets:			
Fridge	-0.053***	-0.020	-0.218
	(0.022)	(0.029)	(0.023)
TV	-0.060***	-0.014	-0.023
	(0.023)	(0.032)	(0.036)
Cooking fuel:			
Household does not cook	-0.005***	-0.006	-0.008
	(0.001)	(0.008)	(0.015)
Firewood, charcoal.	0.226***	0.247***	0.173
	(0.034)	(0.046)	(0.114)
Mineral coal	0.002	0.003	0.003
	(0.001)	(0.002)	(0.002)
Kerosene, oil, gasoline	-0.007***	-0.006	-0.008
	(0.002)	(0.003)	(0.013)
Gas in cylinder	-0.047***	0.003	0.003
	(0.021)	(0.028)	(0.038)
Gas from distribution network	-0.109***	-0.195	-0.185
	(0.038)	(0.255)	(0.498)
Electricity	-0.059***	-0.045	-0.035

Pre-programme variable	Continuous treatment	Continuous treatment with GPS	Continuous treatment with GPS on common support
	(0.028)	(0.030)	(0.039)
Type of illumination:			
Candle	0.017**	0.008	0.007
	(0.010)	(0.012)	(0.042)
Kerosene, oil, gasoline	0.007	0.012	0.023
	(0.005)	(0.087)	(0.078)
Electricity	-0.061***	-0.024*	-0.013*
	(0.018)	(0.014)	(0.011)
Solar energy, bio-energy	0.001	0.000	0.000
	(0.000)	(0.000)	(0.000)
Maximum monthly cash transfer (US$)	9.933***	8.835***	7.456
	(0.227)	(3.472)	(5.978)
Head of the household			
Male	0.043***	0.015	0.022
	(0.009)	(0.010)	(0.345)
Age	6.836***	-0.337	-0.313
	(0.245)	(0.391)	(0.790)
Years of education	-0.953***	-0.461	-0.671
	(0.119)	(0.365)	(0.988)
Married or cohabitant	0.035***	0.085	0.081
	(0.007)	(0.076)	(0.075)
Employed	0.028***	0.067	0.065
	(0.006)	(0.073)	(0.083)
Employed with health benefits	-0.010***	-0.009***	-0.517
	(0.003)	(0.004)	(0.679)
Spouse's age	6.439***	2.745	3.685
	(0.269)	(1.990)	(4.684)
Spouse's years of education	-0.557***	0.120	0.138
	(0.093)	(0.121)	(0.144)
Employed spouse	-0.022***	-0.009	-0.009
	(0.009)	(0.006)	(0.010)
Macro-level variables			
Local population	-344,423***	-399,650***	-399,650*
	(116,017)	(137,256)	(247,653)
Party of incumbent at enrolment			
Ethnic minority	-0.031	-0.024	-0.010
	(0.030)	(0.025)	(0.033)
Independent	-0.054	-0.084	-0.087
	(0.356)	(0.071)	(0.074)
No elections / No info	0.063***	0.038***	0.009
	(0.021)	(0.016)	(0.043)
Officialist or coalition party	0.003	-0.003	-0.002
	(0.054)	(0.072)	(0.054)
Opposition party	0.044	0.048	0.039
	(0.028)	(0.039)	(0.030)
Votes obtained by ruling party	1.116	0.821	0.643

Pre-programme variable	Continuous treatment	Continuous treatment with GPS	Continuous treatment with GPS on common support
	(1.021)	(1.317)	(0.943)
Real provincial GDP per capita (US$)	-188.8**	-132.5	-132.5
	(87.760)	(111.5)	(144.9)
Share of agriculture in provincial GDP	2.560***	2.629	2.334
	(0.705)	(1.996)	(2.145)
Local public per capita budget (US$)	-22.68***	-13.05	-11.54
	(8.190)	(7.871)	(8.654)
Provincial employment rate	1.634***	2.742	1.544
	(0.435)	(2.575)	(2.154)
Provincial unemployment rate	0.105	0.122	0.139
	(0.175)	(0.242)	(0.449)

Source: Familias en Accion Information System (2000-2010); Departamento Administrativo Nacional de Estadisticas (DANE) (2000-2010); Departamento Nacional de Pleaneacion (DNP) (2000-2010).
Notes: (1) Estimations by linear regression. (2) GPS coefficients omitted. (3) Clustered Standard errors (at the municipality level) in parenthesis. (4) * Significant at 10%; ** Significant at 5%; *** Significant at 1%.

Appendix IV -A5. Robustness check on the specification of the dose-response estimation

Table IV.A6.1. Dose-response estimation for outcome variables (robustness check)

Dependent variable / Outcome	Treatment	Treatment²	GPS	GPS²	Treatment*GPS	R-square
Children's years of education	-1.442***	2.107	0.226	-0.078	0.596***	0.60
	(0.097)	(3.105)	(0.328)	(0.095)	(0.027)	
Children's years of education (enrolled at 7yo)	3.202***	-0.686**	-0.191*	0.115***	0.110***	0.47
	(0.329)	(0.324)	(0.111)	(0.032)	(0.007)	
Children's school registration*	0.152*	-0.349***	0.096***	-0.050***	0.242***	0.10
	(0.090)	(0.098)	(0.030)	(0.009)	(0.025)	
Children's school registration (enrolled at 7yo)*	6.114***	-3.793	0.129	0.061*	-0.564***	0.18
	(0.365)	(4.759)	(0.127)	(0.036)	(0.094)	
Completed school (currently 18yo)*	-2.084	6.887	0.139	-0.098***	-0.204**	0.01
	(5.536)	(5.557)	(0.087)	(0.027)	(0.081)	
Adult school registration (enrolled between 7 - 17yo)*	0.493***	-3.754***	0.341	-0.174	1.489	0.07
	(0.120)	(0.127)	(0.049)	(1.123)	(0.075)	
Labour participation (enrolled between 7 - 17yo)*	-0.126	0.271*	0.255***	-0.062	-0.178***	0.12
	(0.108)	(0.155)	(0.046)	(0.054)	(0.037)	
Labour participation (enrolled at > 18yo)*	-1.026	0.651***	0.161***	-0.012**	-0.297***	0.26
	(1.060)	(0.066)	(0.018)	(0.006)	(0.016)	
Earning capacity indicator	-46.54***	-35.45***	-1.280***	1.232***	4.086***	0.21
	(0.962)	(1.065)	(0.298)	(0.093)	(0.263)	
Eligible	2.300***	-2.609***	0.403***	-0.136**	-0.368***	0.00
	(0.075)	(0.083)	(0.023)	(0.007)	(0.020)	

Source: Familias en Accion Information System (2000-2010); Departamento Administrativo Nacional de Estadisticas (DANE) (2000-2010); Departamento Nacional de Pleaneacion (DNP) (2000-2010). Notes: (1) Coefficients are estimated by linear regression and binomial Probit (indicated by *) controlling for age and gender. (2) Estimations on the common support. (3) Bootstrapped standard errors with 300 repetitions. (4) * Significant at 10%; ** Significant at 5%; *** Significant at 1%.

CHAPTER V: THE IMPLICATIONS OF POVERTY DYNAMICS FOR SOCIAL ASSISTANCE PROGRAMMES: THE NON-RECURRENCE OF POVERTY IN *FAMILIAS EN ACCION*

Within antipoverty strategies, governments in developing countries have increasingly implemented targeted Social Assistance Programmes (SAPs). In the particular case of human development conditional cash transfer programmes (CCTs) in Latin America, it is estimated that about 100 million people access to the benefits from such interventions with outstanding effects on poverty reduction (Stampini and Tornarolli 2012). These programmes have developed targeting and eligibility criteria based on household poverty status. Millions of participants in targeted SAPs have been identified and selected by employing means or proxy means tests that determine, along with other categorical criteria, the eligibility for the transfers. The success of targeted SAPs in reducing poverty is associated to how accurately targeting tools identify households or individuals in poverty (Kanbur and Stern 1987). In the framework of the implementation of some SAPs, like the one analysed in this chapter, targeting methods and some poverty measures share similar characteristics. While a poverty measure attempts to identify who faces certain level of income or assets deficits, targeting methods such as means and proxy means tests aim to identify who is in poverty or in extreme poverty in the context of a policy response.[83] One characteristic that targeting tools share with some poverty measures is that they provide a static snapshot of the household status. Even so, similar to poverty status, eligibility status may change once participation starts as households can find a way out of poverty or above the eligibility threshold according to the targeting method. A particular response from a SAP could be dropping non-poor or ineligible participants to prevent inclusion errors. Recalling the previous chapters, SAPs aimed at increasing children's human capital can generate positive marginal effects for a significant period of time. One aspect that cannot be ignored is that eligibility for the transfers is subject to changes over the participation period. Such change may occur before the effectiveness of the programme has been exhausted. Non-poor or ineligible participants can still benefit from the transfers if they face a high probability of becoming poor back again. Therefore, the non-poverty or ineligibility status is not necessarily exit conditions by its own.

Poverty is dominated by a static property that eligibility for targeted SAPs takes over. Means or proxy means tests offer a snapshot at enrolment that is subject to changes over

[83] The difference in this sense is that poverty is a fact, whereas eligibility for a targeted intervention is part of a policy response. For instance, similar to a poverty headcount measure, targeting defines eligibility by employing cut-off points or eligibility thresholds that attempt to imitate poverty lines. They can also obey to budgetary restrictions when a universal transfer scheme is not financially feasible.

time. In the long or medium term, households may experience several poverty and non-poverty spells that can, in theory, lead to changes in their eligible and ineligible status. For example, in Mexico, Brazil and Colombia, the exposure of some beneficiaries to CCTs have been longer than ten years, period over which eligibility status of beneficiary households has changed (Accion Social 2010; Barrientos 2013b; Behrman et al. 2008). The shift in the household status is conventionally known as poverty dynamics or, in the context of the implementation of targeted SAPs, eligibility dynamics. To some extent, households may benefit from some poverty alleviation that might lead them to experience ineligibility for transfer programmes. The policy response when this happens is still uncertain, as the design of most interventions barely contemplates this scenario (see Table I-1). There is little consensus on how antipoverty interventions should incorporate poverty dynamics into their design settings, especially when, in recent years, long lasting effectiveness has been evidenced and millions of households around the world have escaped poverty (Addison, Hulme, and Kanbur 2009; Chen and Ravallion 2010). Given the success of some developing countries in reducing poverty in the last decade due to antipoverty policies or inclusive growth (Barrientos 2013c), it is becoming increasingly difficult to ignore the importance of poverty or eligibility dynamics of beneficiary households as an exit condition from targeted SAPs.

To date, there has been modest agreement on how poverty dynamics affects the implementation of SAPs. In practice, non-poor or ineligible households participating in SAPs are expected to leave the programme on suspicion of inclusion errors. In developing countries, some targeted programmes have adopted the idea of *programme graduation*, which consists of detecting beneficiary households no longer eligible for the transfers as they are found not in poverty as measured by means or proxy means tests.[84] For instance, CCT programmes in Latin America have implemented the exclusion of non-poor ineligible beneficiaries. They do not employ a gradual withdrawal or phase out scheme as some earned income tax credits schemes do in some OECD countries (Blundell 2006),[85] instead, the benefits are stopped abruptly when the household's welfare increases above the eligibility threshold.

Similar to poverty status, eligibility status in SAP participation can vary over time and households may experience several shifts from being eligible for being ineligible and vice

[84] See for example an analysis of ineligible households made by González-Flores, Heracleous, and Winters (2012) on the Mexico's *Oportunidades* programme. In particular, when households are found ineligible the administrator delivers either a differentiated benefit or definitely stops the transfers. The authors examined the upward mobility of current participants in order to determine which households characteristics make them be classified as ineligible.

[85] OECD countries have implemented activation policies based on welfare to work programmes that aim to accelerate or maintain non-eligibility of benefit recipients (providing job search support and mean tested tax credits) (OECD 1999)

versa. An underlying issue in the implementation of targeted SAPs is that the socioeconomic condition of ineligible or non-poor households may behave differently when they are dropped from the intervention. In a general fashion, Bossert, Chakravarty, and D'Ambrosio (2012) have studied the implications of previous poverty (or eligibility) experience and how it can affect future prospects, in the sense that a current non-poor household that has been in poverty in the past is not necessarily a poverty leaver. Dropping a household from a transfer programme because of the fact that it is temporarily ineligible ignores its risk of becoming eligible back again in the future. For example, in 2007 nearly 60 thousand households were excluded from *Familias en Accion* as they were found ineligible according to the targeting or entry method (Villa 2008). Another evaluation of their socioeconomic condition in 2010 revealed that 42.3 percent of them were currently observed to be in extreme poverty (and consequently eligible again) according to the programme's proxy means test. In other words, these households had not left extreme poverty permanently. A suspected inclusion error turned into an exclusion error in a matter of three years even though the programme was still effectives as shown in the previous chapter. Only a proportion of 57.7 percent of ineligible beneficiaries were identified at low risk of facing extreme poverty recurrence.

The fact that participating beneficiaries in SAPs are affected by poverty dynamics motivates the concern addressed by this chapter. Poverty or eligibility dynamics can play an important role in defining the conditions under which participants can leave the antipoverty intervention when it is still effective. The non-recurrence principle that dominates the concern of this chapter states that an exit condition is suggested if ineligible participants face low risk of becoming eligible due to its eligibility dynamics. This principle is relevant insofar as other categorical eligibility criteria are met (e.g. households still have children, members in old ages, pregnant woman, etc.) and the programme is still effective according to the exhausted-effectiveness principle. As shown in chapters III and IV, human capital formation of children participating in CCT programmes is subject to the socioeconomic characteristics of transfer recipients. These characteristics can be recurrent to some ineligible participants. The non-recurrence of poverty provides an important element to the comprehension of the exit conditions from targeted SAPs. Understanding poverty or eligibility dynamics in this sense can lead a SAP to anticipate whether ineligible beneficiaries could become eligible back again and screen out those at low risk accounting for their previous participation experience.

In spite of the fact that we can obtain a valid framework of analysis from the poverty dynamics literature, additional considerations must not be ignored. Specific to the eligibility

dynamics, the existing literature highlights that households or individuals with previous participation or eligibility in SAPs are more likely to participate in the future (Andrén 2007). Among other factors, stopping the transfers when participants are ineligible can make households more likely to become eligible back again, which affects eligibility dynamics due to behavioural responses to ineligibility. One explanation is what Sen (1995) calls "incentive distortion" in which households can change their behaviour in order to keep their eligibility status.[86] For instance, Li et al. (2014) find that the probability of suffering from food insecurity increases significantly before households benefit from the Food Stamps programme in the United States. [87] When participation ends, households start experiencing food insecurity once again. Jenkins and Cappellari (2008) and Hansen et al. (2014) encompass these ideas referring to the "state dependence" in the context of social assistance participation in the United Kingdom and Canada, respectively, identifying that current household's eligibility status may be dependent on previous eligibility experience. The discussion on the exit conditions from SAPs should not be limited by the single eligibility transition of current beneficiaries without a prospective consideration of their welfare status.

The main idea behind the empirical analysis of this chapter is to look into current eligibility probabilities of former ineligible participants by focusing on a poverty dynamics framework. The interest of this chapter is not in the detailed policies that drive households above and below the eligibility thresholds. Likewise, the focus here is not on the shocks that drive households into poverty or eligibility as they are considered in general terms. Instead, as SAPs attempt to identify and deliver transfers to households in poverty, the focus here is the assessments of the likelihood that current ineligible beneficiaries become eligible accounting for previous programme participation experience. As the non-recurrence of poverty principle states, an exit condition with a non-recurrence of poverty in targeted SAPs is then possible insofar as ineligible participating households show low probabilities of being eligible. As a consequence, they are considered poverty or eligibility leavers. Ineligible participants facing high probabilities of being poor or eligible can still benefit from effective interventions.

The contribution of this chapter to current literature is twofold. First, the implications of eligibility dynamics for the implementation of SAPs are examined through a detailed review of existing approaches relevant to the analysis. Changes in the eligibility status of ineligible beneficiaries may occur after they are dropped from a given SAP, resulting in their reincor-

[86] Kanbur, Keen, and Tuomala (1994) explore the implications of labour incentives to programme eligibility.
[87] The Food Stamp is now known as the Supplemental Nutrition Assistance Programme (SNAP).

poration due to the recurrence of some degree of poverty defined by targeting tools in the short or medium run. An exit condition is only feasible for ineligible beneficiaries complying with the non-recurrence of poverty principle once their poverty trend is assessed. Second, an empirical approach to the estimation the household's probability of being eligible for the *Familias en Accion* programme is made, such that a targeted SAP design could incorporate exit conditions strategies that acknowledge the eligibility dynamics. A rich data are explored as done in the previous chapter. It includes millions of administrative records and a household survey with no sampling errors. To the best of the author's knowledge, this is the first graduation approach of this type focused on eligibility dynamics of transfer programmes receipt in developing countries.

Several empirical approaches can be applied to the study of eligibility dynamics derived from a poverty dynamics framework. Traditionally, poverty dynamics have been studied over the estimation of vulnerability to poverty, expected utility or uninsured risk. Disagreements dominate the debate on which method is sufficiently robust to address the number of assumptions on which they are based (Hoddinott and Quisumbing 2008). The estimation of vulnerability to poverty pays strong attention to the covariant and idiosyncratic shocks that push households or individuals below the poverty threshold. Very little interest has been given to the previous experience of poverty in the context of programme participation. Alternatively, in this chapter poverty and eligibility dynamics are assessed by the observation of poverty or eligibility transitions of current and potential beneficiaries of Colombia's *Familias en Accion* programme. Using a two round panel dataset with over 6.7 million households, special attention is paid to those households that were identified as ineligible in the baseline period and are currently eligible. A multivariate Markovian normal probability model is estimated by simulation following Cappellari and Jenkins (2004) and Jenkins (2011). Different from the estimation of vulnerability, the study of poverty or eligibility transitions takes into account observed and unobserved heterogeneity that could contaminate the analysis. Similarly, it accounts for behavioural changes towards eligibility, commonly referred as the state dependence, through which current eligibility status may depend on previous eligibility experience. The model also incorporates a mitigation of the potential bias resulting from non-random attrited households within panels.

The outline of this chapter is presented as follows. The first section will raise the importance of the assessment of the implications of poverty dynamics in the implementation SAPs. The second section presents evidence on the challenges that CCTs face in terms of poverty dynamics. The third section presents the previous experience of eligibility transition in the *Familias en Accion* programme. The fourth section spells out the empirical meth-

odology for the estimation of the transition probabilities; the fifth section will detail the data and results of the estimation. Finally, the sixth section presents the conclusions of this study.

V-1. Understanding poverty dynamics and the non-recurrence of poverty principle in SAPs

The understanding of eligibility dynamics and their implication for the implementation of SAPs are relevant to the main research question of this chapter. Poverty dynamics, as the referent to eligibility dynamics, in this context are considered as the change in the eligibility status of participants in SAPs, switching from eligible or ineligible (and vice versa) over a period over which the intervention is still effective. The socioeconomic trajectory of a given household could be shaped by periods of poverty and non-poverty or, for SAPs, eligibility and ineligibility. Targeted SAPs identify their beneficiaries by employing means and proxy means tested targeting methods with well-defined eligibility thresholds. Targeted SAPs may face the possible ineligibility of some participants at some extent of exposure to the intervention. Programme's administrators may stop the transfers to those households or individuals that were enrolled as eligible but have turned ineligible in response to suspected targeting inclusion errors. This is because targeting methods that attempt to identify households in poverty (or extreme poverty) are mostly static, while socioeconomic conditions vary over time (Baulch and Hoddinott 2000). Eligibility dynamics have strong implications for the operation of SAPs, especially when they implement targeting methods that determine programme eligibility.

The relation between poverty and eligibility dynamics is straightforward. The poverty status of a given household determines eligibility to antipoverty programmes. Their relation becomes relevant when SAPs target with means tests or proxy means tests that attempt to identify households or individuals in poverty. Being in poverty is a necessary but an insufficient condition to become eligible. The latter is because programmes can make targeting errors, identifying as poor someone who really is not in poverty (Barrientos 2013a, chap. 6). First, eligibility and poverty dynamics can follow a similar trend when means or proxy means tests are designed to identify households or individuals in poverty, extreme poverty or multidimensional poverty. When targeting errors are constant over time, poverty and eligibility dynamics can follow a similar trend. In absence of targeting errors, poverty and eligibility dynamics are exactly the same. For instance, Brazil's *Bolsa Familia* identifies eligible beneficiaries by generating a registry of beneficiaries below a means tested targeting threshold known as *Cadastro Unico*. The eligibility threshold in *Bolsa Familia* is defined by the national food poverty line (S. Soares, Ribas, and Soares 2008). Mexico's *Oportunidades* pro-

gramme employs a proxy means test that predicts household income. The eligibility threshold in *Oportunidades* is also defined by the national food poverty line (Villa and Nino-Zarazua 2014). Second, when eligibility is determined by means or proxy means tests with selection thresholds that obey to other criterion or budgetary restrictions, eligibility dynamics can still show similar patterns as a standard poverty dynamic analysis. For instance, Ecuador's *Bono de Desarrollo Humano* employs a proxy means test (known as *Selben*) whose eligibility threshold was initially defined by the affordable coverage allowed by the fiscal capacity of the national government (Schady and Araujo 2006). The commonality between poverty and eligibility dynamics emerges from the fact that both consider a minimum threshold and are referred to a change in the socioeconomic status of households or individuals over time.

Hulme and Shepherd (2003), in their conceptualisation of chronic poverty,[88] provide suitable conceptualization of poverty dynamics. This can provide a framework of analysis in which eligibility dynamics may be understood as a factor that can affect the performance of a targeted SAP. In the categorisation of households, there are two aggregate groups broadly considered chronic poor and transient poor (Davis (2009) also provides a similar approach based on life experiences in Bangladesh).[89] Two different sub-groups can be identified within the chronic poor, namely, always poor and usually poor. Always poor households or individuals experience persistent poverty without being classified as non-poor over their lifecycle. Usually poor households or individuals fluctuate sporadically under and above the poverty line. Improvements tend to occur gradually, while declines tend to occur abruptly. Usually poor suffer from chronic poverty and could be ineligible for SAPs for a short period over their life course (known also saw-tooth trajectory). Similarly, transient poor are those who escape poverty but can fall below the poverty line or eligibility thresholds. Transient poor can be divided into churning poor and occasionally poor. Churning poor are those whose classification between poor and non-poor fluctuates below and above the poverty line with a seasonal pattern, especially in rural areas where households are able to work at temporary crops.[90] Occasionally poor are located most of the time above the pov-

[88] Hulme (2003: 399) defines chronic poor as "*those individuals and households who experience poverty for extended periods of time or their lives*." Despite there is a field of the chronic poverty that regards its measurement (Bossert, Chakravarty, and d' Ambrosio 2010), the intention here is to borrow the concept on the dynamics of the socioeconomic classification of the households. Baulch and Hoddinott (2000) provide a similar approach to poverty dynamics. Davis (2006) provides a graphical classification based on a qualitative analysis from interviews in Bangladesh.

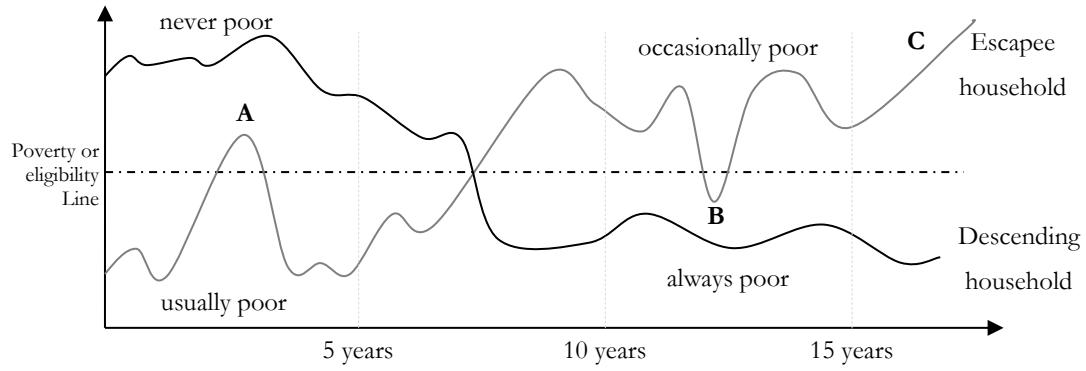
[89] This discrimination is widely characterised by Jalan and Ravallion (2000) who regard transient poverty as the varying component of consumption that can be mitigated by insurances or income stabilisation schemes. Similarly, they define chronic poverty as the non-transient component that remains once consumption is smoothed. They consider that chronic poverty can be mitigated with long-term investments in human and physical capital.

[90] See for example a seasonal approach by Dercon and Krishnan (2000).

erty or eligibility threshold but can experience a poverty period at least once in the long-term.

Figure V.1 below is borrowed from Hulme and Shepherd (2003) to illustrate poverty and eligibility dynamics and their implications to the implementation of SAPs. The vertical axis is divided by the poverty or eligibility threshold defining households or individuals between poor and non-poor, or eligible and non-eligible for SAPs. The horizontal axis represents the time line with a hypothetical dashed milestone for each five years, period over which a SAP is considered to be effective as defined by the exhausted effectiveness principle. As regards poverty or eligibility dynamics, the dark line indicates the welfare level of a descending household, initially classified as never poor that falls below the threshold later on. This line could be self-declared income or the predicted income or score from a proxy means test. The descending household could have experienced a negative shock that pushed it below the threshold, as it was vulnerable to poverty (and consequently to eligibility) at a critical point.[91] Sources of such shocks remain general in this analysis but further attention is later given on previous eligibility experience. Contrarily, the grey line shows the poverty trend of an escapee household that was usually poor, experiencing non poverty at point A. The escapee household becomes occasionally poor as it experiences transient poverty at point B. Finally, the escapee household consolidates its classification by being non-poor in the long-term after point C.

Figure V-1. Escaping and descending households.



Source: Hulme and Shepherd (2003, 406)

Central to this analysis, SAPs often deal with usually and occasionally poor households that experience eligibility and non-eligibility spells. Exit conditions could vary for each group of households as they are dependent on when the welfare status is assessed (Calvo and Dercon 2009). If a usually poor household is enrolled when eligible for the intervention, ad-

[91] Baulch (2011) tries to answer why a household or an individual falls into chronic poverty. Among the causes he identifies the lack of resilience to negative shocks (idiosyncratic or covariant), especially when the affected household or individual is endowed with low levels of physical, natural, human, financial or social capital.

ministrators could be tempted to stop the transfers at point A of Figure V-1 as they ignore the risk of the household of becoming eligible later on. A suspected inclusion error at point A turns into an exclusion error when the household falls back into poverty. If the programme can determine whether the household is experiencing chronic or transient poverty according to its targeting criteria, the transfers might not be stopped at point A and the household can benefit effectively from the transfers. For instance, additional human capital formation of children generated by a CCT might not be disrupted at point A. Contrary, if a household joins the SAP at point B, the programme can stop delivering the transfers at point C, where the risk of falling below the poverty or eligibility threshold is significantly low and the household could be dropped from the intervention. In point C the principle of non-recurrence is met and exit condition is feasible at this point. The assessment of the household and the determination of its classification and transition probabilities can provide SAPs with accurate exit strategies.

The non-recurrence of poverty principle is relevant here in the sense that, insofar the intervention if still effective, ineligible households or individuals are suggested to leave the programme if they are actually poverty leavers over an expected time window. This idea is only feasible when the exhausted effectiveness principle has been previously analysed. The latter sets the maximum length of exposure of beneficiaries to the intervention, while the non-recurrence of poverty principle sets a minimum length of exposure in the specific case when households or individuals are in transient poverty. The understanding of poverty dynamics and its implications for the generation of exit conditions are then relevant to suggest when non-poor or ineligible participants are suitable to be dropped by a social transfers programme. As current literature focus on an efficient performance of the targeting tool in terms of inclusion and exclusion errors in including or excluding programme participants (Grosh 1994; Sabates-Wheeler, Hurrell, and Devereux 2014; Cornia and Stewart 1993), here the effectiveness of the intervention defines whether it is convenient to end household or individual participation when they are ineligible but persistently poor.

V-2. Implications for SAPs in the practice

Different SAPs implement different responses to the eligibility dynamics of their participants. Barrientos (2013) provides a classification of SAPs observing at the characteristics of their design and implementation in developing countries. First, pure income transfers are adopted by programmes aimed at delivering income subsidies to households or individuals in poverty. Pure income transfers often obtain the form of social pensions, where participants' intended exit is determined by the end of their natural lifecycle. Second, SAPs are grouped within income transfers combined with assets accumulation. The latter include the

human development conditional cash transfer programmes (CCTs) whose intended exit rule is determined by the completion of children's health and education cycles. Finally, poverty reduction programmes set a specific social welfare target to be achieved by participating households. An example of these is the former *Chile Solidario* strategy, whose intended exit condition was the single achievement of a social minimum of different poverty dimensions. This last group of SAPs explicitly targets the reduction of poverty helping households find a way out of the eligibility threshold, while the first two groups deliver transfer as participants are still eligible. A commonality among them is their response when participants are identified as ineligible due to an improvement in their welfare level. Ineligibility triggers the suspension of the benefits. Despite participants do not complete the intended cycle (death of the pensioner or children's school graduation), in most cases ineligible participants are also considered as poverty leavers.

Pure income transfers and transfers with assets accumulation are strongly dependent on the categorical criteria that determine programme eligibility along with the poverty status. Thus the exposure to this kind of programmes is determined by specific household characteristics (e.g. age of children, age of members in old ages, pregnancy, etc.). Eligibility dynamics have stronger implications for these kind of transfers insofar as households keep the categorical eligibility criteria as shown previously in Figure I.1. Contrarily, integrated poverty reduction programmes are also subject to this analysis, as their objectives entail driving households consistently out of poverty. How sensitive are transfer programmes to poverty and eligibility dynamics is determined by the targeting methods.

Eligibility to SAPs in developing countries is frequently determined by targeting and selection methods. As high informality rates in developing countries prevents the programmes corroborating the household income, most of targeting methods are reliant on the employment of proxy means tests (PMT) (Grosh and Baker 1995). With the exception of Brazil's *Bolsa Familia* and Argentina's *Asignacion Universal por Hijo*, all CCT programmes in Latin America employ some type of PMT.[92] PMTs rely on the imputation of household welfare levels. They consist of indexes that summarise observed household characteristics. The eligibility threshold commonly attempts to minimise inclusion or exclusion errors in reference to income or consumption poverty lines. Some of the observed household characteristics (house physical elements) are more time-varying than others (household composition, age, labour market outcomes). Therefore, by using PMTs most SAPs have identified selection thresholds under which households are considered poor or, in other words, eligi-

[92] In Latin-American countries these proxy means tests have taken the names of Sisben in Colombia, RUB in Honduras and El Salvador, Selben in Ecuador, SISFOH in Peru or *Ficha de Proteccion* Social in Chile.

ble. Unlike standard poverty measures or means tested transfers, eligibility dynamics of proxy- means tested SAPs are strongly dependent on the components of the predicted income.

One serious limitation of the PMT as an accurate proxy of household poverty status is, in fact, one of its strengths. PMTs have the advantage of relying on observational data to construct a household welfare index, instead of on direct income or consumption levels. The observable characteristics are essential when other sources of verification are unavailable. Time-invariant components of PMTs shape the view of the implications of eligibility dynamics for the implementation of SAPs. Changes in welfare scores could reflect lagged changes in the household income or consumption that they try to predict. Thus, eligibility would need more time to reflect a constant income or consumption flow over time. For example, the experience of Mexico's *Oportunidades* has demonstrated that the exposure to these interventions could reach periods over 15 years. The programme relies on a PMT that predicts household income based on time-varying and time-invariant characteristics, such that eligibility is determined by a predicted income below the food poverty line (SEDESOL 2013). González-Flores, Heracleous, and Winters (2012) provide evidence indicating that the PMT employed by *Oportunidades* reflects low eligibility dynamics in spite of the fact that poverty could shift in a volatile manner.

The influence of poverty or eligibility dynamics in the implementation of SAPs is dependent on how regular the eligibility or poverty status of beneficiaries is tracked. PMTs are costly and institutionally demanding. Despite the analysis of the implications of eligibility dynamics for social assistance can be facilitated by rigorous administrative records in high income countries, developing countries still fail to capture an updated track of the socioeconomic conditions of households in poverty or at risk of becoming poor. Actually, SAPs in developing countries evaluate the eligibility of their beneficiaries at enrolment. Unlike developed countries, households are re-evaluated without a regular basis. Such is the case of *Oportunidades*, in which beneficiaries are intended to participate in the programme for three years, period after which the intention of the programme is to determine whether participating households are still eligible. If it turns out that a given household is no longer eligible, then it is routed onto an exit pathway known as *Esquema Diferenciado de Apoyos* (SEDESOL 2005). There is little evidence that *Oportunidades* has followed rigorously this rule, given the high costs of surveying five million households that receive the income subsidies from the programme. To date, in most SAPs the graduation strategies that should be implemented when a household becomes ineligible are still vague and unclear.

Some examples illustrate how programmes deal with the expected change in the eligibility criteria in SAPs due to eligibility dynamics in Latin America. The most illustrative case is provided by the poverty reduction programme *Chile Solidario* between 2002 and 2011. The programme employed a proxy means test survey known as *Ficha de Proteccion Social*. In its *Puente* (Bridge) component participating households were required to meet a minimum socioeconomic level in a matter of 24 months. Households would receive personalised support from a social worker that regularly would identify and keep track of their main living condition deficits. The insight of such assistant was that, under the identification of potential demand of basic services (housing, schooling, health, etc.), the social worker would match or "bridge" beneficiaries with the publicly-funded supply of social services. After the completion of the two years period each household is considered "graduated," as they are deemed to be above the poverty or eligibility threshold. The intended duration of the *Puente* component is proposed to deliver enough socioeconomic strength to households in extreme poverty that would lead them to preserve their graduated status.

Once the first cohort of beneficiaries completed the *Puente* stage of *Chile Solidario* the formerly Ministry of Development and Planning (known as MIDEPLAN, today Ministry of Social Development) conducted a follow-up evaluation. The report offers a particular view of what SAPs face when the intended length of exposure is finished with graduated households (MIDEPLAN 2009). From those households that had started the participation between 2002 and 2004, only 30 percent had met the whole set of minimum living condition standards that the strategy proposed to deliver in two years. Given that only a small proportion of the beneficiaries could be considered as a graduated, the rest were treated as "pending conditions" with unclear rules on how to proceed. The dimensions of the strategy that were more likely to fail were those related to housing, labour markets and income.[93] The persistence of extreme poverty in two thirds of the beneficiaries made it necessary to extend the programme, as it was unable to affect eligibility dynamics towards an escapee trend of its beneficiaries.

Another important element to stand out from the report by MIDEPLAN (2009) illustrates how eligibility dynamics play an important role in SAPs. Despite some households whose minimum living condition standards had been accomplished, they dropped back again at some point of the participation period. In other words, as usually poor, they escaped and went back into eligibility at different lengths of exposure. As an integrated antipoverty intervention, the support of the programme was not strong enough to maintain those house-

[93] One of the minimum conditions in the dimension of income was that the households' earning would surpass the food poverty line. However, 76.7 percent of them did not meet this condition after two years of participation (MIDEPLAN, 2009, p. 59).

holds out of the eligibility threshold or on an escapee trend. More precisely, although the minimum living conditions of habitability, labour markets and income had been met, at the final assessment the households were missing them. *Chile Solidario* had the intention to deliver the elements to beneficiary households for escaping extreme poverty, but the misunderstanding on how these dynamics affect the aims and objectives of the general strategy did not allow the generation of a sustainable exit condition.

In 2007 Colombia's CCT, *Familias en Accion,* started a massive scaling up process which entailed the recertification of the eligibility status of existing beneficiary households. The programme crossed its administrative information with new survey data several years after enrolment. As it was shown in Chapter II, the operation rules of the programme do not set a regular frequency of recertification. The majority of initial eligibility information had been generated in 2000-04, while this assessment was done between four and seven years later. After crossing several sources of information, the programme found 7 percent of the participating households classified ineligible. The administrators of the programme assumed that transferring subsidies in cash to ineligible households would be considered as a targeting inclusion error. Only eligible households could remain receiving the transfer income support according to the operation rules. At the end, the programme made the decision of stopping the transfers to those households that were ineligible. In this case the same eligibility criteria were used as an exit condition.

The example of *Familias en Accion* is important in the sense that it illustrates the main concern of the empirical strategy of this chapter. Eligibility dynamics do not affect programmes exclusively when participants are actively receiving the transfers but also when they are forced to leave for not being eligible. Ineligible ex-participant households might improve their wellbeing status or become eligible back again in the future following a usually poor trend. Despite it is impossible to accurately predict future welfare levels, one could identify common characteristics that determine whether an ex-participant considered as non-poor could fall under the eligibility threshold. In fact, Villa (2008) attempted to provide a characterisation of poverty dynamics by calculating the expected consumption level in the future according to a certain threshold (i.e. poverty line) following Chaudhuri, Jalan, and Suryahadi (2002). Villa (2008) used this characterisation to predict how likely it was for ex-participants in *Familias en Accion* to keep expending on the normative nutrition and education of their children in the future. The analysis concluded that 68 percent of the ineligible ex-participants had a high probability of not being able to keep investing in their children's human capital. In the face of the fact that the programme dropped all the ineligible

households, these ex-post estimations demonstrated that they were not meeting the principle of non-recurrence of poverty.

In contrast, some developed countries have introduced activation strategies that aim to accelerate the graduation process of welfare (or social assistance) beneficiaries, consolidating eligibility dynamics towards driving them towards exit. These policies have taken the shape of welfare-to-work strategies, in which individual recipients are considered ineligible when they find a new job and earn wages above a defined threshold (Pascual and Magnusson 2007).[94] In recent years, the response of the majority of Anglo-Saxon countries to the job activation of SAPs recipients has been the provision of meant-tested earned income tax credits when unemployed workers find a job at low wages (Adler 2004). The tax-credit is reduced gradually until it phases out completely. As other kind of transfers in developing countries, this type of activation policy is also affected by the eligibility dynamics that currently are not incorporated into the design.

Relevant to this analysis, Cappellari and Jenkins (2008) provide an empirical example on the implications of eligibility dynamics and the participation of individuals or households in SAPs in the United Kingdom in the period 1995-2005. They centre their approach on the determinants of the annual transitions of individuals in and out of pure income welfare benefits (Income Support, Job Seekers Allowance, Housing Benefit and Council Tax Benefit). Despite the observed exit rate (understood as individuals becoming ineligible) of beneficiaries participating in welfare programmes is roughly 37 percent, another relevant proportion, 32 percent, became eligible for the benefits. Some of the actual recipients had been identified as eligible in recent poverty episodes and participation records.

The frequency under which individuals or households switch their eligibility status depends on the time-varying property of targeting method. The experience in countries like the United Kingdom shows that an individual may be found to be in churning poverty, with a continuous switch between eligibility and ineligibility year in year out. This phenomenon is more likely when the targeting tool is based on individual income earnings, which might obey to cyclical behaviour of the economy. On the other hand, recall that SAPs in developing countries tend to rely on proxy means tests, composed indexes that integrate a diversity of dimensions that denote several household characteristics. Some of these dimensions are less likely to change over time (gender composition, geographic location, number of members of the household, among others). Changes in the eligibility status of households in this context are driven by those time-varying characteristics. As previously mentioned and de-

[94] High informality rates in developing countries inhibit the implementation of similar strategies within SAPs.

tailed in Table I.1, the recertification frequency in CCTs in Latin America is still unclear in the majority of interventions.

To sum up, eligibility dynamics can affect SAPs because they implement targeting methods incorporating static over time-varying components. The identification of the type of poverty trend that households are experiencing is essential to define exit conditions under the principle of non-recurrence of poverty. Usually poor households can be wrongly identified as escapees when they experience a non-poverty period. This may drive effective programmes to stop the transfers without assessing their risk of becoming eligible back again in the future. The assessment of such transition leads to the characterization of the poverty or eligibility transitions of current ineligible participants. Low probabilities of becoming eligible for the transfers could trigger an exit condition for current ineligible participants: only if they are face low probabilities of falling into poverty or eligibility (they are not chronic or usually poor), then they can stay receiving the transfers unless some other intervention provides further support to the overall antipoverty strategy. The following sections focus on the estimation of such probabilities, while the definition complementary interventions are beyond of the scope of this study.

V-3. *Familias en Accion* and graduation conditions related to eligibility dynamics

Familias en Accion was introduced in Colombia in 2001 with well-defined entry criteria (see Chapter II for details). Given the country's negative economic growth in 1999 that triggered a deep economic crisis, the national government responded by adopting the Mexican human development CCT known as *Oportunidades*. The previous existence of its targeting tool, the *Sisben*, facilitated the rapid registration of beneficiaries as well as the response to the crisis on households in extreme poverty. The *Sisben* is a proxy means test adopted by the country in 1993 with a continuous updating process and a proposed revision of beneficiaries each four years.[95]

There are not explicit duration or exit rules within the programme's operation rules. *Familias en Accion* intended length of duration is expected to meet the natural lifecycle of the beneficiary children. The length of exposure is determined by the age of the youngest child in the household. Different from integrated poverty reduction programmes, *Familias en Accion* delivers income transfers in cash while participants experience poverty, instead of explicitly

[95] Once the programme obtained the existing *Sisben* information of eligible households, its administrators start the advertisement of the registration process. Mothers of eligible households were prioritised as cash recipients, in absence of them, fathers or grandparents were in the second place. The eligible mothers would be invited to the registration windows to sign a document which would compromise them to comply with the co-responsibilities. The registration process could last maximum one week in a selected municipality, after this event no further registration opportunities are given to eligible but unregistered households. Thus, between 60 and 80 percent of eligible households take up the transfers in each municipality.

facilitate poverty reduction in the short or medium run. It does not include an adult income generation strategy or complementary active labour market programme. The programme is ended for a given household if the youngest of its children either completes all school grades or turns 18 years of age. In the period 2001-2010 the operation rules would not recognise poverty dynamics as a source of eligibility and exit from the programme. In fact, the implementation rules would not specify how to proceed in the case that a beneficiary becomes ineligible.

Although one of the specific objectives of the programme is to alleviate poverty in the long run when children become adults and participate in the labour markets, another gap in the participation rules is that poverty and eligibility status are not measured regularly. As the identification of targeting is not conducted by the programme, the administrators relied on the general update of the *Sisben* score which can occur every five years. In the period 2001-2009, ineligible participants were arbitrarily dropped from the programme even if their children were far from graduating from school. Similarly, in each municipality the programme promotes the formation of a recertification committee whose role is to certify that beneficiary households provide reliable and valid information and is experiencing extreme poverty.[96] Although certification committees can recommend the withdrawal of a beneficiary for not being entitled to receive the cash transfers, there is little evidence or documentation supporting that such committees have worked properly. As it happens in most SAPs in developing countries, the response of *Familias en Accion* when a participating household becomes ineligible is still unclear and unspecified in its operation rules.

V-3.1 Changes in the *Sisben* score and implication for eligibility transitions in 2010

As detailed in Chapter II, the welfare score generated by *Sisben* ranges between 0 and 100, being 0 the poorest household and 100 the wealthiest. The algorithm used for the generation of the score is not of public domain. Until 2009, the score was initially divided into six and four groups (or levels) in urban and rural areas, respectively, with ascending cut-off points. The programme defined the targeting of eligible households with a welfare score in the first level of *Sisben* located in selected municipalities. Selected households were expected to be below the national food poverty line. Approximately 75 percent of the Colombian population is covered by the survey, while 50 percent of the households would be classified within the first two levels of the *Sisben*. By 2010 a new algorithm generating the *Sisben* score was introduced with different cut-off points for the programme eligibility that currently vary between large cities and the rest of urban and rural areas. This change in the *Sisben* al-

[96] Alatas et al. (2012) find problems with this type of community targeting as the members of the community do not share the same poverty criteria with the administrator of the programme.

gorithm was made due to a precautionary response to the potential manipulation from households participating in social transfer programmes. Table V.1 below shows the cut-off points of the *Sisben* score by 2006 and 2010. The most significant differentiation of the two versions was the introduction of the distinction of main cities from the rest of urban and rural areas in the *Sisben* score in 2010.

Table V.1 Eligibility cut-off points

	Area	Eligible	Ineligible
Sisben (in 2006)	Urban	0 - 11.00	> 11.00
	Rural	0 - 17.50	> 17.50
	Area	Eligible	Ineligible
Sisben (in 2010)	Main cities or urban areas	0 - 30.56	> 30.56
	Rest of urban areas	0 - 30.20	> 30.20
	Rural	0 - 29.03	> 29.03

Source: DNP-*Sisben* 2007-2010.

The fact that the algorithm of the *Sisben* score was changed in 2010 can clearly affect the eligibility transitions analysis. In 2006, the score would be obtained by the construction of a single index from several dimensions whose weights were calculated with categorical principal component analysis (Castaño 2002). In 2010, the algorithm was modified with the addition of health and vulnerability dimensions (see Table V.2 below). Within the health dimension, variables measuring household members with disabilities and adolescents with children were considered. As for vulnerability, the new index incorporates local child mortality rate, local homicide rate and the local coverage rate of education and health services. Unlike the previous version, the current *Sisben* score is calculated with the employment of fuzzy sets and fuzzy logic algorithms (Florez, Espinosa, and Sanchez 2008).

Table V.2. Comparison of *Sisben* scores methodologies.

Characteristic	*Sisben* in 2006	*Sisben* in 2010
Score range	0 - 100	0 - 100
Determination of eligibility thresholds	Centralised by the National Planning Department.	Determined by each programme with assistance of National Planning Department.
Measure type	Measure of living standards that orders households according to their assets endowment.	Measure with stronger emphasis on Sen's functionings and capabilities approach. Ordering obeys to an axiomatic setting.
Calculation approach	Principal Component Analysis with continuous and categorical variables. Categorical variables are quantified by the method of optimal scaling. Aggregation results from the first principal component that summarises the variance of included variables.	Fuzzy sets and fuzzy logic approach with the arbitrary generation of membership functions. Each variable is assessed according to its possibility (not probability) function. Aggregation results from the sum of the different dimensions.

Geographic disaggregation	Urban and rural.	Main cities, urban and rural
Common variables	Physical characteristics of the dwelling, provision of utilities, fuel used to cook, endowment of assets, education lagged of children, overcrowding.	
Uncommon variables	Strata of utilities' tariff, number of toilets, availability of shower, having phone landline, education of the head and spouse, proportion of working household members.	Members with disabilities, adolescents with children, proportion of illiterate households, proportion of working children, number of household members, local child mortality rate, local homicide rate, health and education coverage.

Source: Author based on information from Florez, Espinosa, and Sanchez (2008)

The *Sisben* welfare score in 2010 involves the detection of the cut-off points specified in Table V.1 according to the programme's objectives. An internal document by DPS (2013) indicates that five dimensions were taken into account to establish the eligibility thresholds for *Familias en Accion*. In this sense, the cut-off points resulted from the analysis of the household deprivation in the dimensions of education, food security, and employment and housing endowments. The thresholds in cities, rest of urban areas and rural areas were derived from the level of the *Sisben* score that minimises the inclusion and exclusion errors (according to the deprivations related to the objective of supporting the human capital formation of children in extreme poor households). Different from the eligibility criterion in 2006, current eligible households were intended to be more sensitive to the intervention.

The new *Sisben* setting affects the eligibility transition in addition to household poverty dynamics. DPS (2013) predicts that 43.1, 57.9 and 77.6 percent of eligible households on the basis of the previous methodology would remain eligible with the new *Sisben* score in the main cities, other urban areas and rural areas, respectively. Similarly, a percentage of 29.9, 14.3 and 11.9 ineligible of current eligible households were not eligible with the previous methodology. Thus, the analysis of the eligibility transition of eligible and ineligible households includes the two components of administrative and idiosyncratic drivers.

In consequence of the two versions of the *Sisben* score (in 2006 and 2010), the analysis of the eligibility transitions contemplates both settings. The inclusion of the *Sisben* score in 2010 leads to the examination of current eligibility status of households accounting for their previous eligibility experience. The latter provides inferences on how the administrative and idiosyncratic changes affected the predicted current eligibility. On the other hand, the inclusion of the *Sisben* score in 2006 will allow for an assessment of current eligibility status isolating the administrative changes introduced in 2010. The methodology of the *Sisben* in 2006 is replicated with the data in 2010 to obtain the eligibility status with the same criterion, leading to the analysis of the idiosyncratic characteristics of the households

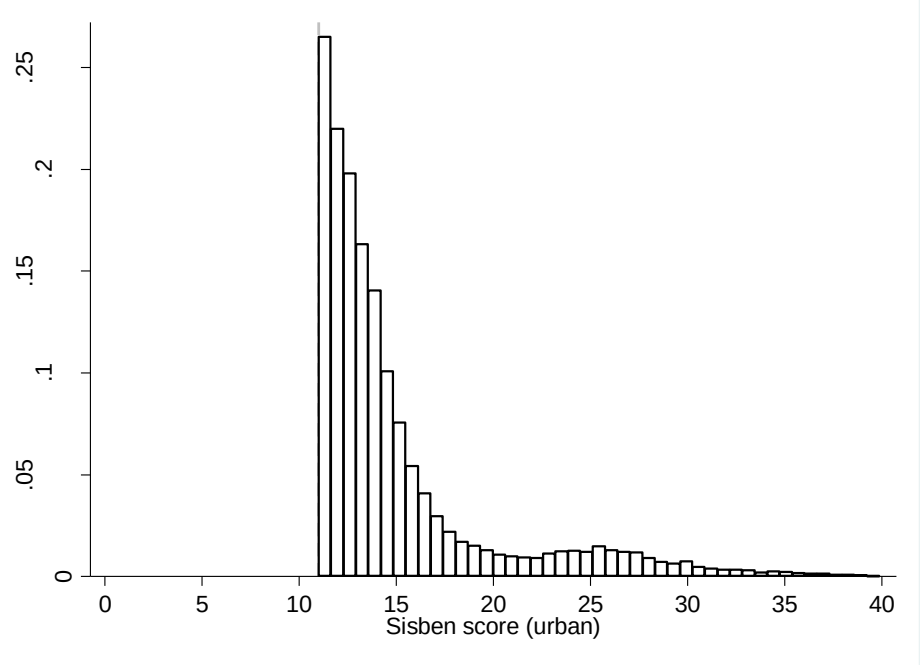
that contributed to the transition. The inferences over both methodologies are reported in next sections.

V-3.1. Registration process in 2007 and transition of dropped households

In 2007 *Familias en Accion* conducted a massive registration process that implied the recertification of the eligibility status of beneficiaries in the previous year. This effort was made over the idea of registering 1.5 million households with 3 million children. From nearly 640 thousand households participating in the programme by 2006, 64 thousand were found to be ineligible (60 percent in urban areas). Ineligible households were dropped from the programme in 2007 without any complementary intervention. They were considered "graduated" from the programme.

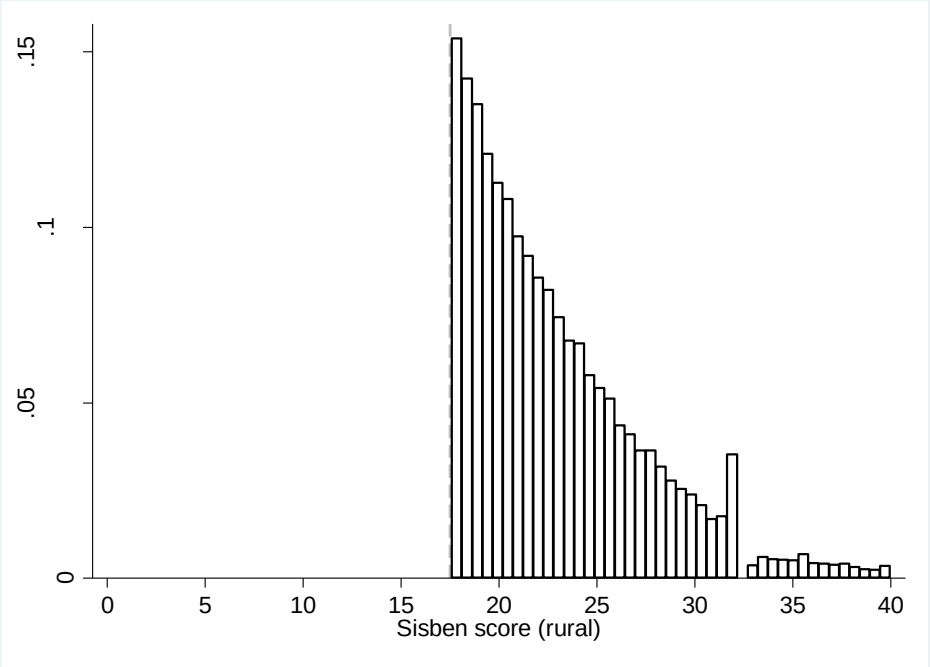
Figures V.2 and V.3 below present the histograms of the *Sisben* score in 2006 for those 64 thousand households in urban and rural areas that were removed from the programme in 2007. As they are ineligible for staying in the programme, the score is greater than the eligibility threshold. It can be seen in the histograms that a large density accumulation of households are close to the threshold, especially in urban areas.

Figure V-2: Histogram of the *Sisben* score for beneficiaries dropped in 2007 (urban)



Source: DNP-*Sisben* survey 2006.

Figure V-3: Histogram of the *Sisben* score for beneficiaries dropped in 2007 (rural)



Source: DNP-*Sisben* survey 2006.

Turning now to the current eligibility status of these households in 2010, the *Sisben* survey was carried out again for current and potential beneficiaries. The DNP commissioned the recertification of most of the households in the *Sisben* data. The recertification process in each municipality would take no longer than three months. As for participating households in *Familias en Accion*, an important proportion of households considered as "graduated" in 2007 were clearly at risk of becoming eligible a couple of years later. Recall that Villa (2008) had estimated that an important number of ineligible participants were facing high risk of becoming poor in the future.

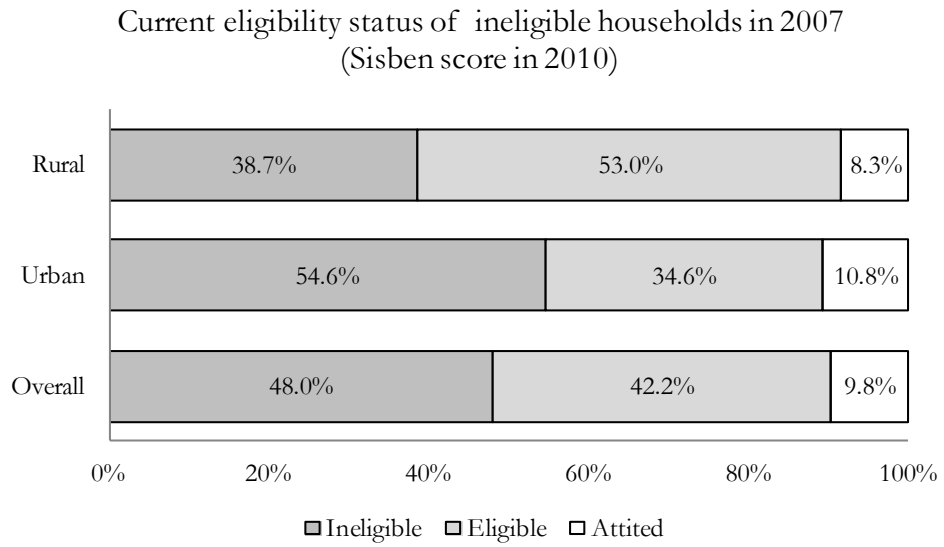
[Continued *on the next page*]

Figure V-4 and Figure V-5 below show the results of the recertification of the current eligibility of dropped households in 2007 with the *Sisben* methodology in 2010 and 2006. Overall, it is observed that 42.2 percent of ineligible households were found to be eligible back again in a matter of few years due to idiosyncratic/covariant/administrative shocks or state dependence patterns.[97] In contrast, 60.5 percent of dropped and ineligible households remained ineligible in 2010 according to the same 2006 *Sisben* score methodology, while a 30 percent became eligible. Thus, the risk for ineligible households resulted in a real change in the socioeconomic condition of these households that are now classified as eligible:

[97] This descriptive exercise is unable to determine what leads the households to fall back into eligibility.

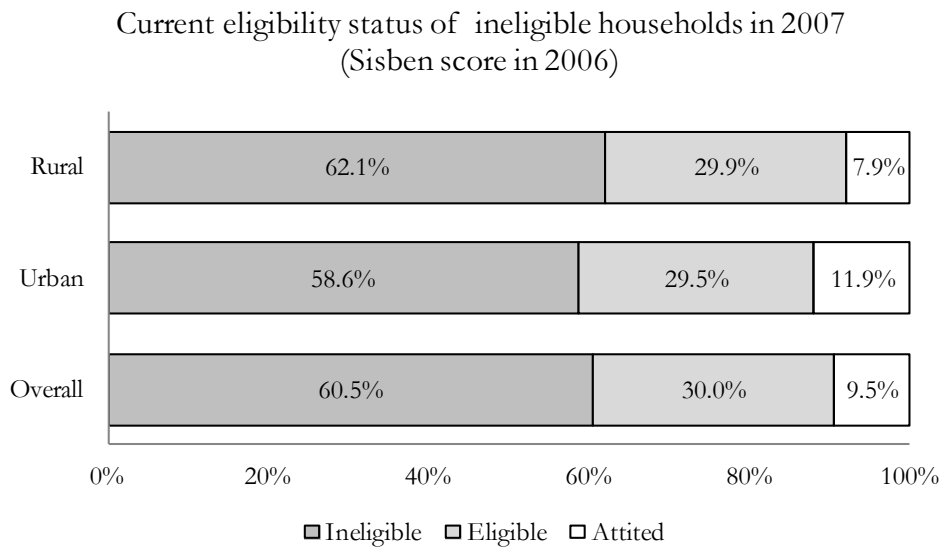
[*Continued on the next page*]

Figure V-4. Current eligibility status of ineligible households in 2007 (*Sisben* score in 2010)



Source: DNP-*Sisben* survey 2006 and 2010

Figure V-5. Current eligibility status of ineligible households in 2007 (*Sisben* score in 2006)



Source: DNP-*Sisben* survey 2006 and 2010

What is interesting of these Figures is that eligibility dynamics were ignored by the programme in spite of the act that it was still effective. Programme administrators considered ineligible households as poverty leavers in fear of an inclusion error of 10 percent. This inclusion error turned later into an exclusion error that the programme did not considered, even though dropped households would comply with the categorical selection criteria. If the programme anticipated this eligibility transition, these households would be still obtaining the income benefits that, according to Chapter IV, were still effective.

As administrative or some other sources could have affected the eligibility status of these households, next section will refer to the methodology to predict the probability of being eligible under current and old classification.

V-4. Empirical methodology: accounting for heterogeneity and state dependence

An important number of facts must be taken into consideration in the selection of a reliable estimation method for poverty or eligibility transition dynamics. First, one must account for unit-level heterogeneity, which refers to characteristics that may drive a household to switch from poor to non-poor status or vice versa. These characteristics can be observed (e.g. low human capital levels) or unobserved (e.g. unmeasured cognitive abilities). Second, state dependence, the extent to which previous poverty or programme eligibility experience can determine future poverty or eligibility, must be considered, in the context that there could be a reinforcement mechanism that may cause poverty or eligibility to persist (Azariadis and Stachurski 2005). In other words:

> "A household may experience extended poverty because of either transitory shocks that induce a general slowdown in economic activities, or persistent unobserved characteristics that are disadvantageous for escaping poverty, or the tendency of poverty to propagate itself due to a number of behavioral responses induced by the past history of poverty, commonly referred to as true state dependence of poverty persistence or "scarring effect" in the literature of poverty dynamics where past poverty results in depreciation of human and physical capital stock, that may potentially spark a poverty spiral. Thus, empirical models of poverty dynamics need to control for effects of unobserved heterogeneity and transitory shocks to obtain the measure of true state dependence." (Bigsten and Shimeles 2008: 1563).

A reliable statistical method should, in principle, account for these issues not only in the context of poverty dynamics, but rather in the context of eligibility dynamics.

V-4.1. Conventional poverty dynamics estimation that can be applied to eligibility dynamics analysis

Modelling poverty dynamics have been shaped predominantly by the emergence of methods that estimate vulnerability to poverty. The method employed in this chapter, the Markovian model, is not listed as conventional vulnerability estimation but it does share some of the aims in the elaboration of a vulnerability measure. It departs from the idea that poverty status is a snapshot that illustrates a static condition of a given individual or household. Vulnerability is a dynamic concept that captures better the ins and outs of poverty, in which a negative event (the transition from non-poor to poverty) prevails in the analysis

(Moser 1998). The variety of methods has driven the estimation of poverty and consequent eligibility dynamics to a lack of consensus on which econometric model offers accurate results in estimating vulnerability (Baulch 2011). In general terms, the main idea of the estimation process is the prediction of the change in the poverty status of a given household or individual over time.

Naude, Santos-Paulino, and McGillivray (2009) and Zhang and Wan (2009) have agreed that the estimation of vulnerability should comply with certain properties. It should correspond to the *ex ante* prediction of the poverty status in period $t + 1$ from a current poverty status in t. Vulnerability should then be forward looking in the context of household or individual welfare. The poverty threshold must also indicate a minimum welfare level under which individuals face some extent of deprivation, such as poverty lines or minimum of calories intake. The estimation of a vulnerability measure must also be specific on the causes of the risk that push households or individuals down the poverty line. In this sense, it must be specific in the sense that hazardous events should be identified. These hazardous events could be environmental, socioeconomic, physical or political. Some other authors have emphasised on idiosyncratic or covariant hazards (Harttgen and Günther 2007), which also include macroeconomic events (Briguglio et al. 2009). Another property that the literature on vulnerability considers important is that the estimation must be forward-looking and dependent on a fixed time horizon. The majority of authors treat the forward-looking property as a general term defining vulnerability as a underlying risk that might be realised in the "future" (Hoddinott and Quisumbing 2008; Ligon and Schechter 2004), without detailing the specific term after which such realisation will take place.

Calvo and Dercon (2007) and Foster, Dutta, and Mishra (2010) provide an axiomatic framework for the generation of a vulnerability measure. In particular, a vulnerability measure should consider the likelihood of future poverty spells and the severity or depth of the poverty episode (the distance from the poverty line). A complete set of axioms is not yet agreed by contributing authors. Some commonalities indicate that a vulnerability measure must comply with a focus and symmetry axioms, indicating that it must refer to a negative shock pushing households into poverty. This negative shock cannot be compensated with a probability of being out of poverty. A vulnerability measure should also be always sensitive to the risk that emerges from hazardous events, which implies that a higher risk translates into higher vulnerability.

Several empirical approaches have been proposed without a definitive consensus on how vulnerability should be quantified. The estimation of vulnerability as expected poverty (the

likelihood that non-poor households or individuals fall into poverty in the future) has been developed beyond the scope of an axiomatic framework. Instead, it has been dominated by the implicit properties and availability of information on income and consumption, as they are the main argument in welfare or utility functions (Dercon and Krishnan 2000).[98] In practice, the available methodologies, which are described by Hoddinott and Quisumbing (2008), focus on the prediction of the probability of falling below a certain consumption or income level with panel data. In this sense, a poverty and vulnerability thresholds are required to estimate future poverty status and identify which units of analysis face high risk. Given that consumption or income levels are allowed to vary over time and not necessarily across households or individuals, the discussion on the use of panel or cross sectional data remains controversial (Chaudhuri, Jalan, and Suryahadi 2002).

Similar to the estimation methods, there is a lack of consensus on how the vulnerability threshold must be defined. Pritchett, Suryahadi, and Sumarto (2000), Zhang and Wan (2009) and Dang and Lanjouw (2014) suggest absolute, and still arbitrary, thresholds. The most popular threshold sets a 50 percent probability threshold and a second one equalising the poverty headcount of the country (e.g. if the poverty headcount is 40 percent, the vulnerability threshold would be 40 percent probability as well). A relative vulnerability threshold could emerge from the average population average of the probability of being poor.

Ligon and Schechter (2003) propose vulnerability estimations based on the expected utility in food consumption of households by decomposing total vulnerability into that generated by aggregate risk, idiosyncratic risk and unexpected risk (or measurement error). Using a panel dataset from Hungary, they found that having higher education levels, being male and owning an animal were related with lower vulnerability to covariant shocks. Contrarily, households with pensioners and employed members were factors related with lower vulnerability to idiosyncratic shocks. Günther and Harttgen (2009) also reach similar conclusions by estimating vulnerability to poverty in Madagascar, where they identify that aggregate shocks hit more severely households in rural areas while idiosyncratic shocks hit more severely households in urban areas. In the same way, Gaiha and Imai (2004) estimate the vulnerability to poverty of rural farmers in India by employing a dynamic panel model following Arellano and Bond (1991). The focus of this analysis is based on the prediction of household income and the assessment of whether it falls below several poverty lines. The hazardous event is defined by an eventual crop shock in a semi-arid region. Given their

[98] Carter and Barrett (2006) offer a dynamic point of view by proposing an asset based welfare measure.

estimations, their simulations show that the proportion of transient and persistent poor households changes with a negative small shock over a period longer than three years.

Some other authors analyse the effects of policy responses on household vulnerability levels. In this sense, Imai, Gaiha, and Kang (2010) estimate the vulnerability to poverty of Vietnamese households and suggest the implementation of SAPs to reduce risk. Amin, Rai, and Topa (2003) analyse the incidence of micro-credit on vulnerable households in Bangladesh, by implying that loans are able to reduce risk and by looking into the risk-sharing framework proposed by Townsend (1994). They identify that micro-credit fails to reach the most vulnerable individuals. Jha, Imai, and Gaiha (2008) estimate the treatment effects of public works and food subsidy programmes on vulnerability to poverty in rural India. Their propensity score matching estimations suggest that a public works intervention is less effective in addressing vulnerability to poverty than the food subsidy intervention. In the same line, Imai, Wang, and Kang (2010) look into the effects of the abolition of the rural tax scheme in China and found a negative impact on vulnerability to poverty of rural households.

V-4.2. Markovian models

V-4.2.1. Accounting for state dependence and heterogeneity

In spite of the fact that vulnerability measures and estimations methods have made an important contribution to the understanding of poverty dynamics, they ignore important observed and unobserved elements emerging from the implementation of antipoverty interventions or SAPs. They have studied the causes of vulnerability to poverty given idiosyncratic or covariant shocks. These considerations in the analysis of vulnerability to poverty have a number of limitations when looking into the context of programme participation. This idea is based on Heckman (1991), in the sense that other type of behavioural changes must be considered when an individual experiences poverty or eligibility and participates in a SAP. First, and as an econometric concern, observed and unobserved heterogeneity need to be taken into account as some vulnerability estimation methods actually attempt to do. Heterogeneity, as an initial endowment, is integrated into the analysis because it can determine poverty status. In the same line, conventional vulnerability estimations centre their analysis on household and individual heterogeneity to which they refer as idiosyncratic characteristics. In spite of the fact that heterogeneity seems not to be as important as state dependence (Heckman and Borjas 1980), it must not be ignored. Heckman and Borjas (1980) in reference to unemployment (eligibility and participation in this case):

> "If these unmeasured variables are correlated over time and are not properly controlled, previous unemployment may appear to be a determinant of future unemployment solely because it is a proxy variable for temporally correlated unobservables. Improper treatment of unmeasured variables gives rise to a conditional relationship between future and past unemployment due solely to uncontrolled heterogeneity" (Heckman and Borjas 1980: 247)

Accounting of observed heterogeneity or household characteristics is straightforward when survey data are available. In fact, the study of the drivers of poverty and vulnerability have been widely reported (Dasgupta and Stern 2004). However, any econometric method for the prediction of the probability of being poor should also account for unobserved heterogeneity, such as those characteristics that are not reported in household surveys.

Second, as an theoretical concern, the analysis should also consider the state dependence of being poor or eligible to a SAP, which may be affected by previous eligibility and programme participation, while it can pose new elements in the transition from non-poverty into poverty. State dependence emerges mainly because the eligibility and participation experience can affect observed and unobserved heterogeneity and, hence, determine future eligibility or participation. For instance, current poverty status and household composition could be influenced by previous poverty experience. The distinction between heterogeneity and state dependence is important because:

> "If true state dependence is relatively more important than heterogeneity, an effective policy could focus on preventing people from becoming poor, since, once poor, they are likely to remain so no matter what their initial characteristics were. On the other hand, if heterogeneity explains the persistence in poverty, it is important to focus on changing the characteristics that keep the individual at a high risk of being poor" (Nilsson 2012: 2).

State dependence in the context of participation in SAPs is another factor that must be kept in mind when looking into poverty dynamics in addition to hazardous events. Some authors have studied this additional factor contributing to the persistence of poverty in developed countries. They have paid particular attention to labour market outcomes from programme participation (Biewen 2009), such as the former Assistance to Families with Dependent Children (AFDC) in United States, the Income Support in Australia or the welfare system reform (Hartz IV) in Germany (Königs 2014; Levine and Zimmerman 2014).[99]

[99] Welfare state-dependency has been referred as an "addiction" by Plant (1984).

State dependence could be critical not only in the experience of poverty but also in terms of eligibility or participation in SAPs. In Heckman (1981)'s words, *"...past experience has a genuine behavioural effect in the sense that an otherwise identical individual who did not experience the event would behave differently in the future than an individual who experience the event"* (Heckman 1981: 91). Related to labour markets, Heckman (1991) concludes that previous employment status can determine current employment decisions. Analogously, households with previous participation in a transfer programme like a CCT may thus present higher probabilities of being poor or eligible. A single vulnerability measure, as any described above, would not be able to capture these higher probabilities. Households that have claimed the transfers in the past could present higher probabilities of claiming them in the future than other households that have never claimed the transfers. For instance, Hansen et al. (2014) found that in some Canadian states the probability of recurrence of welfare programme participation could reach up to 90 percent, in contrast with individuals who have never participated.

Given these elements, the next section presents the econometric approach accounting for heterogeneity and state dependence.

V-4.2.2. The econometric approach

Besides vulnerability estimation approaches, the second group of methods attempts to understand poverty as the binary transition that entails the identification of the probability that a household in poverty becomes non-poor or ineligible. The characteristics of the available data need to be taken into account when discussing the advantages of these econometric approaches. The *Sisben* survey used in this study is able to reveal eligibility status but not reliable income or consumption levels.[100] For the purpose of this chapter, the modelling of poverty dynamics is based on a Markovian model of eligibility transitions.

The *Sisben* survey, as an input for a proxy means test, fails to provide detailed information on income and consumption. Given the characteristics of the available data, the methodological approach of this chapter is based on a Markovian eligibility transitions modelling which is broadly studied and recent methodologically developed in the context of poverty transitions and social assistance receipt by Jenkins (2011), Cappellari and Jenkins (2004) and Cappellari and Jenkins (2002). An early introduction of the Markovian model was made for the analysis of labour earnings by McCall (1971) and for the analysis of the AFDC intervention by (Boskin and Nold 1975). The application of the transition model in

[100] An alternative use of the *Sisben* score or an asset based poverty measure for the estimation of vulnerability to poverty, as suggested by Carter and Barrett (2006), is still lacking empirical and theoretical consensus as these poverty measures do not fit into a permanent consumption hypothesis.

this chapter is made in an eligibility transition framework in the *Familias en Accion* programme.

There are two different methods that can drive the estimation eligibility transition. The first one, ignored in this chapter, entails the analysis of the length of duration of poverty with longitudinal data. It implies the estimation of hazard regression models that consider the poverty duration spells as a dependent variable, in an attempt to predict how long a particular household or individual will remain eligible for a SAP. Hazard regression models involve stronger assumptions, since there is no certainty on when poverty starts and when it ends in the existing data. The second method, the focus of this section, deals with the binary eligibility status of a given household in two different periods. This second method relies on Markovian models that estimate de probability of being eligible for a SAP in the current period (t) given the state dependence of being eligible in a previous one ($t-1$) and the retention rate in an unbalance panel. Markovian models are practical when considering a short panel dataset, as it only demands the pair of t and $t-1$. This method does not require to learn when the eligibility status did start in the past because it assumes that current status is dependent on previous eligibility experience (Stevens 2012). Despite being a non-linear model with computationally demanding iterations, Cappellari and Jenkins (2003) and Cappellari and Jenkins (2006) provide a software component to carry out the estimations of Markovian models in this context.

The alternative estimation of hazard regression models partially suits the available data. It is not the main interest of this chapter to understand the length of eligibility spells of beneficiary households. Instead, this chapter aims to predict the transition probabilities with particular focus on ineligible participating households (hazard regression models do not respond to this concern). Moreover, according to Jenkins (2011) Markovian models may prevail over hazard regression models in several ways. The first one is that its specification can account for non-random attrition, which is modelled simultaneously with eligibility transitions. The second is that the left-censorship of the first round of a panel-structured dataset is internalized by the model. The main reason is that current eligibility status could depend on the previous round of the panel but not on those in the past. This attractive property of the Markovian model implies that no baseline data are needed prior to the programme participation of beneficiaries in *Familias en Accion*, as only previous observable characteristics are assumed to predict the probability of being eligible in the next round. While hazard regressions models are based on the prediction of duration of eligible spells, Markovian models are expressed in terms of simultaneous probability (Probit or Logit) estimations.

If one assesses the probability that a given household falls into eligibility or remains in it, then the analysis could be oriented towards an estimation of a single Probit model. In that case, the observable covariates in the period $t-1$ could be used as predictor of the eligibility status at t. This assumes that conditions in $t-1$ can predict the eligibility status in t. One potential problem in the interpretation of a single Probit model is the possible unobserved heterogeneity that could arise even from attrited and retained households when such attrition is non-random. Another problem emerges from the potential dependency of the eligibility status in period t on the eligibility status in $t-1$. In particular, when looking into the eligibility to SAPs, the socioeconomic classification of a given household can depend on its previous eligibility experience, as mentioned by Cappellari and Jenkins (2008). A single Probit estimate could be a naïve approach to the modelling of eligibility transitions. Non-random attrition and state dependence can confound the single Probit results, in the sense that they can confound the estimations and generate biased coefficients. The Markovian model is specified in a multiple equations system in which the unobserved heterogeneity along with the state dependence are simultaneously modelled to obtain reliable probability estimates in the current period.

There are four simultaneous components in the modelling of the transition analysis that are taken into consideration. The first one is the estimation of the eligibility status in the period $t-1$, which will control for the state dependency of the eligibility status at t. The second one is the modelling of the probability that a household observed in period $t-1$ is retained in period t. The latter also controls for unobserved heterogeneity that could drive the results. The third one is the estimation of the eligibility status in period t, providing the main input of analysis controlling for additional unobserved heterogeneity. Finally, the correlations of the estimations errors of the first three components are observed in the assessment of how the state dependence and unobserved heterogeneity may affect the estimations of the transitions in the current period. All of these components depend on the availability of observable covariates in period $t-1$.

Formally, based on Jenkins (2011, 334-341) it is considered that for $i = 1, \dots, N$ households the propensity of being eligible for a SAP in period $t-1$ is given by:

$$p^*_{it-1} = \beta' X_{it-1} + u_{it-1} \text{ with } u_{it-1} = \mu_i + \delta_{it-1} \qquad \text{(V.1)}$$

In this equation, β' is a vector of parameters, X_{it-1} represents a vector of explanatory variables or covariates at the baseline which are obtained from the *Sisben* survey in a 2006 cohort. μ_i is a specific individual or household effect an orthogonal to δ_{it-1} a white noise

error. u_{it-1} is considered to be random and normally distributed with expected value of 0 and variance equals 1. Eligibility status is defined when the propensity of being eligible is greater than a given value (e.g. zero). Thus, if $p^*_{it-1} > 0$ then the variable $P_{it-1} = 1$ indicates a household to be observed eligible for a *Familias en Accion*.

Additionally, it is assumed that a household whose eligibility status is observed in $t-1$ is also observed in period t. Hence, consider r^*_{it} the propensity of retention of those households observed in both periods, whose relation with observed covariates is given as follows:

$$r^*_{it} = \psi' W_{it-1} + v_{it} \text{ with } v_{it} = \eta_i + \xi_{it} \quad \text{(V.2)}$$

Where ψ' and W_{it-1} are columns of observed covariates in $t-1$, similar to those in equation V.1. η_i is a specific effect and ξ_{it} a white noise. v_{it} is normally distributed with an expected value of 1 and a variance of 0. Similar to the previous case, a household is observed to be retained when $r^*_{it} > 0$ with $R_{it} = 1$.

A third component of the model is the estimation of the eligibility status in the current period that results from the eligibility transition. This equation is essential as it provides the main input of analysis of the transition probabilities. The propensity to eligibility is determined by:

$$p^*_{it} = [(P_{it-1})\gamma'_1 + (1 - P_{it-1})\gamma'_2]z_{it-1} + \varepsilon_{it} \text{ with } \varepsilon_{it} = \tau_i + \zeta_{it} \quad \text{(V.3)}$$

Where γ'_1, γ'_2 and z_{it-1} are vectors of parameters and baseline covariates, τ_i is an household specific effect and ζ_{it} a white noise normally distributed. Similar to the eligibility status in the baseline period, if $p^*_{it} > 0$ then the household is observed eligible for a SAP, this is, $P_{it} = 1$ if in only if $R_{it} = 1$.

Finally, the model of eligibility transitions analyses the correlations between the three residuals specified above in the components of the model. This specification analysis contributes to the validation of the simultaneous estimation of the different propensities to eligibility. In fact, u_{it-1}, v_{it} and ε_{it} are considered to have a trivariate standard normal distribution. Therefore, the correlations are defined as follows:

$$\rho_1 \equiv corr(u_{it-1}, v_{it}) = cov(\mu_i, \eta_i) \quad \text{(V.4)}$$

$$\rho_2 \equiv corr(u_{it-1}, \varepsilon_{it}) = cov(\mu_i, \tau_i) \quad \text{(V.5)}$$

$$\rho_3 \equiv corr(v_{it-1}, \varepsilon_{it}) = cov(\eta_i, \tau_i) \quad \text{(V.6)}$$

The interpretation of equations V.4, V.5, and V.6 is straightforward. ρ_1 indicates the relation between initial eligibility status and the retention of the household in the survey. When $\rho_1 > 0$ the more likely a household to be observed eligible in period $t-1$, the lower the propensity of being attrited in period t. ρ_2 shows the extent of the relation between the unobserved individual factors that determine eligibility in the baseline period, $t-1$, and the eligibility transition. If $\rho_2 > 0$ then the higher propensity of the household to be observed eligible in $t-1$ makes it more likely to remain eligible in period t (it validates the conditional probability of being eligible in t given the eligibility status in $t-1$). ρ_3 shows the correlation between the unobserved individual effects in the propensity of retention with those determining current eligibility status. Similar to the previous inference, if $\rho_3 > 0$ then the propensity of the household to be observed in both periods will positively drive the propensity of the household to be observed (or become observable) eligible compare to households with higher probabilities of being attrited. Finally, the validation of the model emerges from the statistical significance of the correlations. If $\rho_1 = \rho_3 = 0$ then the retention of the households is not relevant and the attrition can be considered as exogenous. If $\rho_1 = \rho_2 = 0$ the eligibility status in the current period, t, is not endogenous to the eligibility status in the baseline period, $t-1$. The last validation emerges when testing that $\rho_1 = \rho_2 = \rho_3 = 0$, which indicates that the three equations are mutually exogenous and there is no need to estimate them simultaneously. In other words, the latter implies that a Probit model would be sufficient.

The focus of the estimation turns now on the predicted eligibility probabilities. A particular interest is given to the *entry rate*, this is, the probability of being eligible for a SAP in t, given that the household is eligible in $t-1$. The predicted entry rate is defined as:

$$e_{it} = Pr(P_{it} = 1 | P_{it-1} = 0) = \frac{\phi_2(\gamma_1' z_{it-1}, -\beta' X_{it-1}, \rho_2)}{\phi_2(-\beta' X_{it-1})} \quad \text{(V.7)}$$

and an *exit rate* defined as:

$$x_{it} = Pr(P_{it} = 0 | P_{it-1} = 1) = 1 - \frac{\phi_2(\gamma_1' z_{it-1}, -\beta' X_{it-1}, \rho_2)}{\phi_2(-\beta' X_{it-1})} \quad \text{(V.8)}$$

Based on these entry and exit rates, Jenkins (2011) defines the expected length of duration of eligibility and ineligibility spells. This can help the *Familias en Accion* determine (i) an expected length of duration of programme participation insofar as beneficiaries are eligible and (ii) an expected duration of an ineligibility spell insofar as the programme is still effective. In this case it is defined the expected eligibility and ineligibility duration as $1/e_{it}$ and

$1/x_{it}$, respectively, which are adjusted according to the elapsed period between the survey date in $t-1$ and t.

The relevance of the entry rate for the implementation of a SAP is the main focus of this chapter. Non-eligible households can be considered ready to leave the intervention as they do not comply with the eligibility criterion in the period $t-1$, irrespectively to its particular entry likelihood in period *t*. The estimations results of this chapter will focus particularly on this prediction.

IV-4.2.3 Estimation

The estimation of the parameters in previous equations requires the definition of the Partial Likelihood Estimator. This is given for each household with eligibility status by the following log-likelihood equation:

$$\log L_i = P_{it-1}R_{it}log[\phi_3(k_i\gamma_1' z_{1t-1}, m_i\psi' w_{it-1}, q_i\beta' X_{it-1}; k_i m_i \rho_3, k_i q_i \rho_2; m_i q_i \rho_i)] + (1-P_{it-1})R_{it}log[\phi_3(k_i\gamma_2 z_{it-1}, m_i\psi' w_{it-1}, q_i\beta' X_{it-1}; k_i m_i \rho_3, k_i q_i \rho_2; m_i q_i \rho_2)] + (1-R_{it})log[\phi_2(m_i\psi' w_{it-1}, q_i\beta' X_{it-1}; m_i q_i \rho_i)] \quad (V.9)$$

Where $k_i \equiv 2P_{it-1}, m_i \equiv 2R_{it-1}, q_i \equiv 2P_{it-1}-1$

Equation V.8 requires the availability of covariates in period $t-1$ and the pooled socioeconomic information for each household in period t. Given the non-linearity of the log-likelihood and the potential complications that may arise from the trivariate normal distribution function, ϕ_3, Lorenzo Cappellari and Jenkins (2004) propose the estimation of the parameters by simulation following Gourieroux and Monfort (1996) with certain number of replications or draws. In this case, the Markovian model of eligibility transitions is estimated by simulating the number of draws after which the coefficients and standard errors remain stable.

IV-5. Data and results

In order to assess the eligibility transitions, a two rounds survey is taken into consideration. In its first round, the data consist of the *Sisben* census survey that contains the cohort of households employed in the 2007 registration process when some eligible beneficiaries were dropped from the programme. It is estimated that about two thirds of the Colombian population, predominantly at the bottom of the income distribution, is covered by the survey (Misión Social 2003). The baseline contains information for 3,897,892 eligible and 2,878,858 ineligible households, adding up 6,776,750 observations. The second round of the survey was carried out in 2010 with a similar *Sisben* survey with a total attrition rate of

17.2 percent. The two rounds were merged into a single Stata file to estimate the eligibility transitions probabilities.

Turning now to the description of the eligibility transition matrix from the baseline to the current period, it is evident the important proportion of households that became eligible after being considered ineligible in a previous socioeconomic evaluation. This fact raises implications for the implementation of SAPs, as some of ineligible participants were excluded from the interventions but shortly they became eligible; they were not escapees, but usually poor or usually eligible. Table V.3 below shows that according to the *Sisben* score in 2010, overall, 27.6 percent of ineligible households in the baseline became ineligible three years later (looking at the proportion with attrited sample the proportion is 22.3 percent of the households). This proportion is more relevant in rural areas, where almost a half of the households, 47.5 percent, became eligible (40.4 percent with the attrite sample). Looking at the *Sisben* score with the methodology in 2006, the transitions without the administrative changes in the eligibility threshold indicate that, overall, in the unattrited sample 17 percent of ineligible households became ineligible for the transfers (a lower proportion than in the *Sisben* 2010 score classification). A relevant difference between *Sisben* score versions is notable for rural households, where 54 percent of them in the baseline became ineligible, while a lower proportion (23.6 percent) of ineligibles became eligible. If a SAP stops its transfers to ineligible households it may be necessary to restore it benefits in the future to an important proportion of usually eligible households.

[*Continued on the next page*]

Table V.3. Eligibility transition matrix

		Eligibility at *t* (*Sisben* score in 2010)			Eligibility at *t* (*Sisben* score in 2006)		
Eligibility at *t-1* *(overall)*	*Sample with unattrited sample*	Ineligible	Eligible	Missing	Ineligible	Eligible	Missing
	Ineligible	72.4%	27.6%		83.1%	16.9%	
	Eligible	41.9%	58.1%		48.3%	51.7%	
	All	54.5%	45.5%		63.0%	37.0%	
	Sample with attrited sample						
	Ineligible	58.6%	22.3%	19.1%	67.7%	13.7%	18.6%
	Eligible	35.2%	48.9%	15.9%	42.5%	45.6%	11.9%
	All	45.2%	37.6%	17.2%	53.6%	31.5%	14.9%
Eligibility at *t-1* *(urban)*	*Sample with unattrited sample*	Ineligible	Eligible	Missing	Ineligible	Eligible	Missing
	Ineligible	76.9%	23.1%		84.5%	15.5%	
	Eligible	47.0%	53.0%		46.6%	53.4%	
	All	59.9%	40.1%		63.3%	36.7%	
	Sample with attrited sample						
	Ineligible	61.6%	18.5%	19.9%	69.7%	12.7%	17.6%
	Eligible	39.5%	44.6%	15.8%	39.6%	45.5%	14.9%
	All	49.3%	33.0%	17.7%	53.1%	30.8%	16.1%
Eligibility at *t-1* *(rural)*	*Sample with unattrited sample*	Ineligible	Eligible	Missing	Ineligible	Eligible	Missing
	Ineligible	52.5%	47.5%		76.4%	23.6%	
	Eligible	25.2%	74.8%		54.0%	46.0%	
	All	35.0%	65.0%		62.0%	38.0%	
	Sample with attrited sample						
	Ineligible	44.6%	40.4%	15.0%	66.0%	20.4%	13.6%
	Eligible	21.2%	62.9%	15.9%	46.6%	39.7%	13.7%
	All	29.5%	54.9%	15.6%	53.5%	32.8%	13.7%

Source: DNP-*Sisben* 2007-2010 with administrative records from *Familias en Accion*.

Table V.3 above revealed that the implementation of SAPs requires reliable tools to anticipate the transition of ineligible beneficiaries. The transitions of ineligible households are now assessed in order to provide predictions of the probabilities given the abovementioned estimation strategy. This strategy follows the optimisation of equation V.9 whose results supply the parameters for the prediction of exit and, more importantly, entry rates. By obtaining the entry rates, it is possible to generate exit rules for ineligible beneficiary households.

The estimation of the parameters requires a set of observable covariates at the baseline. In this sense, Appendix V-A.1 presents the selected observable covariates to be considered, resulting mainly from the data mining of the *Sisben* survey and some other sources at subnational levels. Given the differential eligibility score, averages from rural and urban areas are presented separately. A first group of variables denote the physical conditions of the households (including assets ownership) as well as general demographic characteristics. These variables are assumed to be more rigid over time in comparison with age or number of household members, while they can be positively related with an ascending transition. It can be observed that ineligible households are, by far, living in better conditions compared to eligible households (with wider differences in rural areas). The second group of variables illustrates the characteristics of the head of the households, predominantly male (with lower proportion in urban areas), and older in ineligible households in overall terms. Household conditions are expected to present mixed effects on eligibility transitions. Household composition such as number of adults, age of children and spouse's education can decrease or increase the odds of current eligibility according to how the *Sisben* score absorbs them. Heads are also low educated in rural eligible households, and tend to obtain higher labour benefits in urban ineligible households. The third group of covariates are deemed to influence eligibility transitions from the municipality and regional levels. These covariates are generally defined by local population, the economic activity (labour markets, GDP and economic sectors) and the political conditions that may drive the institutional setting at the municipal level. Employment and unemployment levels can decrease or increase the odds of being eligible, respective. While political factors can account for the implementation of some other policies that can be shaped by the political affiliation and preferences of the ruling mayor (some of them can be pro-poor or not) or unobserved corruption (Williams et al. 2009). On the other hand, political factors can be a source of manipulation of the *Sisben* score that can benefit the incumbent in electoral terms (Camacho and Conover 2009).

V-5.1. Estimation results

The first set of results is obtained after equation V.9 is estimated by simulation employing the econometric model developed by Cappellari and Jenkins (2006). The simulation was conducted in Stata 13.1 with 283 draws.[101] These estimations were carried out separately in rural and urban areas and for the *Sisben*'s score methodology in 2006 and 2010. The latter would also work as a robustness check of the model, identifying common significant covariates between areas. As we are interested in current eligibility as a result of eligibility transitions, only the estimated coefficients of this category are presented below in Table V.5.

The first element to observe in the results is the analysis of the interrelation between unobservables driving state dependence, attrition and current eligibility status. Starting from the correlations, Table V.4 below shows that all of them obtained significant coefficients, implying that non-random attrition and state dependence are not negligible. The correlation between unobservables and the initial eligibility status, ρ_1, is low but statistically significant in rural and urban areas, which suggests that eligible households at the baseline are more likely to remain in the *Sisben* dataset. The second correlation (ρ_2), between unobservable characteristics and the eligibility transition, also yielded a significant t-statistic, indicating that eligible households in the baseline are prone to remain eligible in the current period, t. Finally, the third correlation of the model illustrates the association between unobservables driving household retention within *Sisben* data and current eligibility status. ρ_3 shows the highest correlation coefficient in urban and rural areas and *Sisben* methodologies with a strong significant level. The latter indicates that those households with higher probabilities to remain in the *Sisben* data are more likely to be classified eligible for the intervention in contrast to attrited households.

Table V.4. Correlations and test of hypotheses (*Sisben* score in 2010 and 2006)

With Sisben score in 2010	Rural		Urban	
Correlations between unobservables	*Estimate*	*t-statistic*	*Estimate*	*t-statistic*
Base-year eligibility status and retention (ρ_1)	0.044	2.36	0.050	5.55
Base-year eligibility status and conditional current eligibility status (ρ_2)	0.073	5.66	0.047	6.24
Retention and conditional current eligibility status (ρ_3)	0.958	304.32	0.980	101.06
Tests of hypotheses	*Test statistic*	*p-value*	*Test statistic*	*p-value*
Exogeneity of initial conditions, $\rho_1 = \rho_2 = 0$	2.36	0.018	5.54	0.000
Exogeneity of sample retention, $\rho_1 = \rho_3 = 0$	5.64	0.000	6.23	0.000

[101] Given the number of observations, the simulation and maximum likelihood optimization took over 500 hours with a desktop computer equipped with 32GB of RAM, a 500GB solid state and an Intel Core i7 processor.

Joint exogeneity, $\rho_1 = \rho_2 = \rho_3 = 0$	11153.90	0.000	23249.20	0.000
With Sisben score in 2006	Rural		Urban	
Correlations between unobservables	*Estimate*	*t-statistic*	*Estimate*	*t-statistic*
Base-year eligibility status and retention (ρ_1)	0.032	2.07	0.020	3.31
Base-year eligibility status and conditional current eligibility status (ρ_2)	0.034	2.28	0.287	6.74
Retention and conditional current eligibility status (ρ_3)	0.990	42.03	0.863	16.18
Tests of hypotheses	*Test statistic*	*p-value*	*Test statistic*	*p-value*
Exogeneity of initial conditions, $\rho_1 = \rho_2 = 0$	2.07	0.038	2.90	0.000
Exogeneity of sample retention, $\rho_1 = \rho_3 = 0$	2.28	0.022	7.12	0.000
Joint exogeneity, $\rho_1 = \rho_2 = \rho_3 = 0$	20477.20	0.000	56863.40	0.000

Source: DNP-*Sisben* 2007-2010 with administrative records from *Familias en Accion*. Based on Jenkins (2011, chap. 11).

The specification of the model is assessed with the hypotheses testing shown in the lower part of Table V.4 for each *Sisben* methodology (2010 and 2006). This hypotheses testing can be considered as a specification check. All the tests of exogeneity obtained negligible test statistics in rural and urban area with a confidence level of 95%, indicating that the model is correctly specified in terms of accounting for unobserved heterogeneity, state dependence and attrition. For example, if $\rho_1 = \rho_3 = 0$ had obtained a non-significant t-statistic, then the attrition might have been considered as random. If $\rho_1 = \rho_2 = 0$ was significant, then the state dependence hypothesis might have been neglected. Finally, if $\rho_1 = \rho_2 = \rho_3 = 0$ was statistically accepted, then the model might have been reduced to a single univariate Probit model. Hence, the test of hypotheses over the specification of the model in this case has confirmed to be statistically appropriate.

Turning now to the coefficients of the model shown in Table V.5 below, the results obtained from the estimation of the current eligibility status (persistence or entry into the eligibility threshold) with the *Sisben* scores in 2010 and 2006, suggest that the covariates that generate a positive impact on current eligibility are those highly sensitive over time. Covariates denoting physical characteristics are significant in rural and urban areas with a negative sign, in specific landline telephone and garbage collection with *Sisben* score in 2006. Most of these physical covariates are mostly dependable on their public provision, though. Some of the characteristics of the dwellings are commonly significant between both *Sisben* methods, fact that leads to infer that the administrative changes in 2010 were not crucial for these covariates. It can be seen that some covariates in the group of household composition produce positive impacts. Interestingly, the number of households in one single dwelling, the number of household members, the presence of a pregnant woman and a disabled member increase the probability of being currently eligible.

Table V.5. Transitions' probability estimates (significant coefficients only).

	Sisben score in 2010		*Sisben* score in 2006	
Dep. variable: currently eligible = 1	Rural	Urban	Rural	Urban
<u>*Household level*</u>				
Electricity		0.086**		
		(0.039)		
Sewer		-0.104***	0.175**	
		(0.021)	(0.075)	
Landline telephone	-0.267***	-0.106***	-0.411***	-0.170***
	(0.069)	(0.014)	(0.100)	(0.028)
Garbage collection		-0.151***		
		(0.018)		
Running water	-0.069***	-0.114***	-0.293***	
	(0.020)	(0.027)	(0.029)	
Toilet				
Latrine	-0.210***		-0.120***	
	(0.032)		(0.035)	
Unconnected to sewer	-0.226***		-0.175***	0.108**
	(0.025)		(0.031)	(0.049)
Connected to cesspit	-0.208***		-0.116***	0.138**
	(0.019)		(0.025)	(0.056)
Connected to sewer	-0.264***	-0.123**	-0.180**	
	(0.079)	(0.059)	(0.077)	
Type of dwelling:				
House or apartment (flat)		0.029*	0.119***	0.109***
		(0.016)	(0.034)	(0.020)
Wall construction material:				
Raw wood		0.302*		
		(0.168)		
Floor construction material:				
Raw wood	-0.064**	-0.090**	-0.062*	-0.173***
	(0.025)	(0.043)	(0.034)	(0.053)
Concrete	-0.134***	-0.115***	-0.116***	-0.125***
	(0.019)	(0.022)	(0.023)	(0.025)
Tile	-0.286***	-0.219***	-0.360***	-0.438***
	(0.044)	(0.026)	(0.055)	(0.032)
Carpet		-0.068**		-0.511***
		(0.029)		(0.063)
Number of rooms [a]		-0.014**		-0.012**
		(0.006)		(0.005)
Number of bedrooms [a]	-0.023*	0.025**		
	(0.012)	(0.014)		
Households in the dwelling	0.060***	0.090***	0.066***	0.044***
	(0.021)	(0.008)	(0.024)	(0.011)
Household members [a]	0.102***	0.102***	0.037***	0.040***
	(0.005)	(0.006)	(0.004)	(0.004)
Mean household age [a]			-0.003**	-0.008***
			(0.002)	(0.001)

Household with pregnant woman	0.137***	0.140***	0.060**	0.034**
	(0.027)	(0.014)	(0.026)	(0.016)
Household with disabled member	0.150***	0.185***	0.055**	0.057***
	(0.025)	(0.017)	(0.026)	(0.014)
Average age of children [a]	-0.029***	-0.018***		
	(0.002)	(0.002)		
Age of the youngest child [a]	-0.036***	-0.033***	-0.047***	-.048***
	(0.008)	(0.013)	(0.010)	(0.013)
Household with children under 6yo	0.047**	0.022**		
	(0.021)	(0.010)		
Household's children attend school	0.039***	0.064***		0.058**
	(0.015)	(0.021)		(0.024)
Ownership of the dwelling	-0.095***	-0.055**	-0.103***	-0.236***
	(0.014)	(0.024)	(0.016)	(0.018)
Assets:				
Fridge	-0.139***	-0.109***	-0.187***	-0.068***
	(0.021)	(0.010)	(0.024)	(0.015)
Washing machine		-0.138***		-0.161***
		(0.017)		(0.024)
Oven	-0.356**		-0.350**	
	(0.169)		(0.156)	
TV	-0.069***	-0.088***	-0.079***	-0.061***
	(0.018)	(0.009)	(0.022)	(0.013)
Cable TV			0.289***	
			(0.111)	
Cooking fuel:				
Firewood, charcoal.		0.345***	0.272**	0.176***
		(0.048)	(0.131)	(0.051)
Kerosene, oil, gasoline		0.180***		0.147***
		(0.045)		(0.050)
Gas in cylinder		0.091***		0.068*
		(0.035)		(0.041)
Electricity		0.088**	0.408**	0.163***
		(0.043)	(0.159)	(0.058)
Type of illumination:				
Kerosene, oil, gasoline				-0.144**
				(0.066)
Electricity		0.103**		
		(0.042)		
Head of the household				
Age [a]	0.004***	-0.005***	0.002***	-0.004***
	(0.00)	(0.00)	(0.00)	(0.00)
Years of education [a]	-0.035***	-0.041***	-0.034***	-0.039***
	(0.003)	(0.003)	(0.003)	(0.003)
Married or cohabitant	-0.070**	-0.121**		
	(0.035)	(0.062)		
Employed		-0.041*	0.065***	

		(0.021)	(0.025)	
Employed with health benefits	-0.213***	-0.105***	-0.363***	-0.300***
	(0.040)	(0.013)	(0.055)	(0.016)
Spouse's age [a]		0.003*	0.002***	
		(0.001)	(0.001)	
Spouse's years of education [a]	-0.037***	-0.028***	-0.033***	-0.025***
	(0.003)	(0.002)	(0.003)	(0.002)
Employed spouse		0.030**		
		(0.013)		
Macro-level covariates				
Local population [a]			0.000**	
			(0.000)	
Party of incumbent at enrolment				
Independent			0.489***	0.390***
			(0.150)	(0.120)
No elections / No info	0.407**		0.634***	
	(0.165)		(0.184)	
Officialist or coalition party			0.453***	0.354***
			(0.148)	(0.115)
Opposition party			0.401***	0.316***
			(0.150)	(0.116)
Votes obtained by ruling party (%)	0.421***		0.352**	
	(0.105)		(0.162)	
Real provincial GDP per capita (US$) [a]			0.000**	0.000**
			(0.000)	(0.000)
Share of agriculture in provincial GDP		58.68*		
		(35.493)		
Local public per capita budget (US$) [a]			0.000**	0.000**
			(0.000)	(0.000)
Provincial employment rate	0.014**		0.017**	0.014**
	(0.006)		(0.007)	(0.006)
Provincial unemployment rate	0.028***	-0.012**	0.019**	-0.015*
	(0.008)	(0.006)	(0.009)	(0.009)
Number of observations (households)	1,423,822	5,352,928	1,423,822	5,352,928

Source: Departamento Administrativo Nacional de Estadisticas (DANE); Departamento Nacional de Pleaneacion (DNP). See full table in the Appendix.

Notes: (1) Robust standard error at the municipality level in parenthesis. (2) Estimations from a multivariate Probit model by simulation with 283 draws (3) Estimations controlled by provincial and year of household survey fixed effects. (4) Outputs for the baseline and retention estimations are not reported.

From the table above it is worth noting that children in the household also play an important role. The older the children, the lower the estimated probability with *Sisben* score in 2010 but not in 2006. Contrarily, children under six years of age, school attendance and ownership of the dwelling generate a positive impact in this sense; however, they are irrelevant with *Sisben* score in 2006. The ownership the dwelling and other mobile assets has a negative impact, such as having a fridge or a television. Characteristics of the head of the

household (and some of his/her spouse) obtained mixed results. Age resulted positive in rural areas and negative in urban areas; as expected, the years of education of the head and his/her spouse generate a negative impact on the eligibility, while being employed with health benefits (an indicator of receiving benefit from social security) is strongly negatively related. From the macro-level covariates the estimation apparently did not yield robust results as the significance levels are different in rural and urban areas. Nonetheless, some political conditions are positively related in rural areas with the *Sisben* score in 2010 but consistently significant with *Sisben* score in 2006. Finally, unemployment level resulted in opposite signs in both areas, but employment rate with the *Sisben* score in 2006 resulted consistently positively related with being eligible.

In sum, the characteristics driving current eligibility of households yielded the expected signs. Essentially, those time-varying covariates were more robustly significant between areas and *Sisben* score methods.

V-5.2. Predicted entry rates

The coefficients from the estimation of current eligibility are used to predict the entry rates. These rates can be presented separately for all status combinations (eligible or ineligible). The predictions are particularly focused on ineligible households in $t-1$ that are likely to be currently eligible. The description of the results is presented graphically and then by a summary table. The Figures V-6 and V-7 below show the predicted probabilities of being currently eligible according to the *Sisben* score in 2010 and 2006. Given the relevance of the current *Sisben* version, the comparison of the results is better fitted for the *Sisben* score in 2010 as the new method could lead to updated policy discussion as previous *Sisben* algorithm is obsolete. Despite the Sisben score in 2010 has three different cut-off points, an indicative dashed line has been placed around the common thresholds. Similarly, solids lines on the graphs indicate the 0.5 predicted entry rate threshold, below which an average household is considered to have low probabilities of being eligible. A sensitiveness analysis of this threshold is presented later on.

Starting from urban areas, the entry rates of the population respond on a descending rate to the *Sisben* score in 2010. What is interesting from these results is that the eligibility threshold indicates that urban households face, on average, an entry rate of 0.57 (0.63) in urban (rural) areas. This implies that a change in the eligibility status from ineligible to eligible is expected to occur in 58 (55) months in urban (rural) areas, while a change from eligible to ineligible is expected to occur in 78 (94) months. As these spells were calculated at

the average entry rate, Table V.5 below presents the expected entry and exit spells at different entry rates.

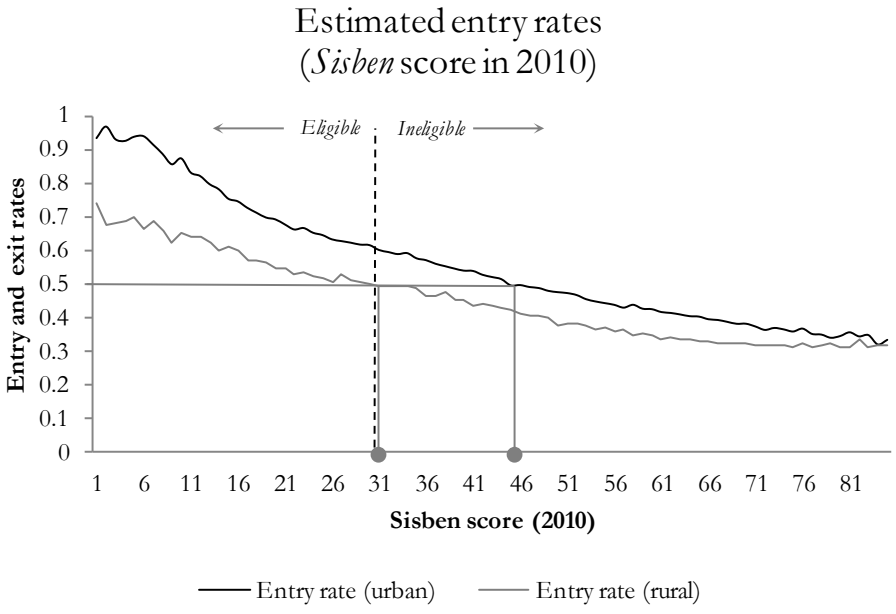
Table V.6. Expected entry and exit spells (months).

Entry rate:	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
Urban (months)									
Expected entry	336	168	112	84	67	56	48	42	37
Expected exit	37	42	48	56	67	84	112	168	336
Rural (months)									
Entry duration	348	174	116	87	70	58	50	44	39
Exit duration	39	44	50	58	70	87	116	174	348

Source: DNP-*Sisben* 2007-2010 with administrative records from *Familias en Accion.*

In a similar analysis, Figure V-6 and Figure V-7 below present the predicted probabilities of being currently eligible (entry rate) with the *Sisben* score in 2010 for urban and rural areas (exit rates are the complementary probabilities according to equation V.8). An average ineligible household with entry rates just below current eligibility threshold has a high probability of being eligible. Households in rural areas show a lower average of predicted entry rates according to these estimates. A previous description of the changes in the *Sisben* algorithm showed that the eligibility status of rural households was slightly affected by these administrative changes. Thus, average rural entry rates show lower levels than the urban estimates. Another implication of the results in rural areas indicates that the eligibility threshold is close to the 0.5 entry level. Ineligible rural households above the eligibility threshold have low average probability of being eligible.

Figure V-6. Estimated entry rates (*Sisben* score in 2010)

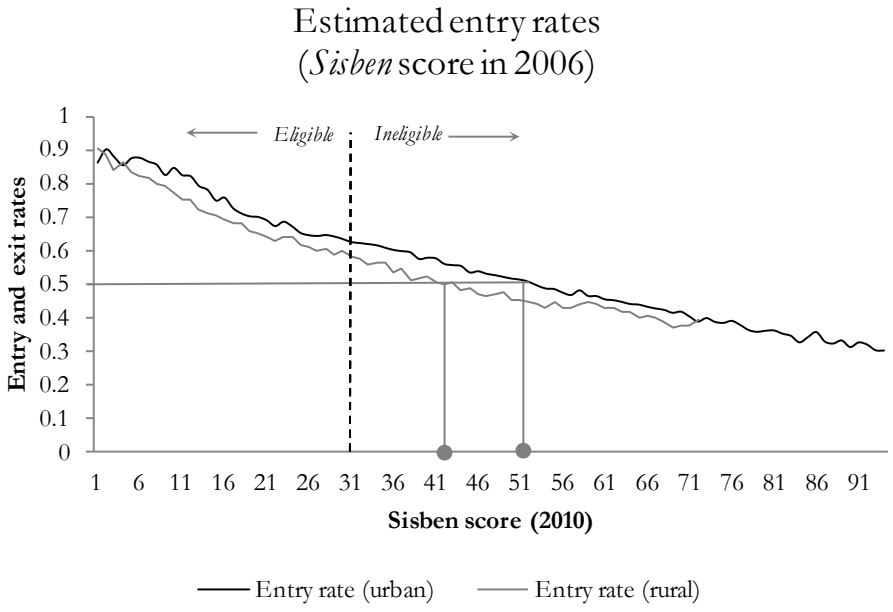


Source: *Sisben* 2006 – 2010.

In line with the entry rate prediction in urban areas, a *Sisben* score in 2010 of 45 will guarantee an entry rate below the 0.5 threshold, implying that an average household faces low probabilities of being eligible. In other words, if the programme administrators wanted to set an exit line considering the state dependence from previous eligibility, then a *Sisben* score of 45 in urban areas would be the one consistent with the principle of non-recurrence of poverty. It does not mean that participating households will not have an "incentive distortion" with an exit line. Instead, it means that the entry rates with respect to the eligibility line will be lower to the extent that ineligible households are less likely to fall into eligibility even if they have previous eligibility experience. A similar inference is applicable in rural areas, in spite of the fact that current eligibility threshold is close to the one indicating a low entry rate.[102]

Conversely, Figure V-7 below shows the entry and the complementing exit rates for the predictions with the *Sisben* score method in 2006 in urban and rural areas. This is important to isolate the administrative changes that were introduced into the new measurement of households' eligibility levels. Unlike current *Sisben* score (in 2010), the predicted entry rates in rural areas are lower than in urban areas over similar levels. At a *Sisben* score in 2010 of 43 and 51 the average entry rates are lower than 0.5 in urban and rural areas, respectively. As the *Sisben* score in 2006 is currently obsolete in the light of the decision making, entry and exit rates are consistent to those resulted from the predicted values with the *Sisben* score in 2010.

Figure V-7. Estimated entry rates (*Sisben* score in 2010)



Source: *Sisben* 2006 – 2010.

[102] The eligibility threshold is 29.03 and the low entry rate line is 31.

A second complementary analysis obtained from the predicted entry rates consists of setting the probabilities greater than 0.5 to learn the proportions of households above and below this threshold with an interval of 0.1. Table V.7 below presents the results of this exercise. Looking at urban (urban) areas, 49.2 (56.5) percent of current ineligible households are highly likely to become eligible. An important group, current ineligible households dropped in 2007, present a 42.3 (43.9) percent incidence with higher probabilities of becoming eligible. This latter group is of relevance in the graduation strategy, as their transition dynamics place them at risk of being eligible back again.

Table V.7. Estimated entry rates (percentage of the sample)

Sisben score in 2010	Ineligible sample	Ineligible dropped in 2007
Urban		
Entry rate > 0.4	47.2%	41.1%
Entry rate > 0.5	39.2%	32.3%
Entry rate > 0.6	30.0%	23.2%
Rural		
Entry rate > 0.4	51.6%	41.2%
Entry rate > 0.5	46.5%	33.9%
Entry rate > 0.6	40.8%	26.9%
Sisben score in 2006	Ineligible sample	Ineligible dropped in 2007
Urban		
Entry rate > 0.4	42.0%	36.4%
Entry rate > 0.5	29.6%	21.6%
Entry rate > 0.6	28.5%	13.5%
Rural		
Entry rate > 0.4	43.8%	36.8%
Entry rate > 0.5	45.3%	28.5%
Entry rate > 0.6	37.0%	21.5%

Source: DNP-*Sisben* 2007-2010 with administrative records from *Familias en Accion.*

Similar inference can be made with the *Sisben* score in 2006 in urban areas (see lower part of Table V.7 above). In rural areas the entry rates are significantly different and follow the urban trend. This confirms that the administrative changes in the *Sisben* score in 2010 were more relevant in the adjustment of rural eligibility classification. Indeed, 31.6 percent current ineligible households (dropped in 2007) are predicted to present high probabilities of being eligible in urban areas, the lowest proportion among the different compared groups.

These findings are relevant to setting a sustainable exit rules. A SAP running over a long period would experience ins and outs of beneficiaries in a matter of years. Under the consistent objective to increase children's human capita in the context of CCTs, ineligible households could be graduated if they are less likely to become eligible after they leave the intervention, as they are identified to be on an escapee trend. For *Familias en Accion* esti-

mates, current classification of ineligible households indicates that 62.4 and 90.7 percent of them are subject to be graduated in urban and rural areas, respectively. On the other hand, 36.7 and 9.3 percent of urban and rural ineligible households, respectively, may experience the initial deficits in their socioeconomic indicators that made them eligible in $t-1$.

V.6. Conclusions

Within the different components that orbit around the implementation of SAPs, this chapter has raised a relevant question over the implications of poverty dynamics (or eligibility dynamics) for suggesting exit conditions when interventions are still effective. As recent research on this field has lacked theoretical and empirical foundations, a practical response in CCT programmes has been the withdrawal of beneficiaries who have resulted ineligible in the recertification of their eligibility status. This response is problematic because it ignores the implication of poverty dynamics, to the extent that some of ineligible households may come fall back into eligibility. In terms of children's human capital formation, some ineligible participants may still benefit from the transfers. The odds of eligibility are essential to be assessed and evaluated under these settings. Households with low likelihood of being eligible could exit from SAPs, while others with high odds can remain in the programme. An illustration was provided by the implementation of Colombian human development conditional cash transfer programme, *Familias en Accion*. In 2007 the programme dropped 60,000 ineligible beneficiary households even when the programme was still effective, as shown in Chapter IV. Half of dropped households were found to be currently eligible.

Based on these facts, a Markovian transition model was employed to predict the household probabilities of being currently eligible. Several vulnerability estimation methodologies were reviewed, but in the context of the implementation of SAPs, two basic elements were considered. First, observed and unobserved heterogeneity was taken into consideration by identifying households characteristics form the *Sisben* survey. Second, state dependence, the extent to which previous eligibility status experience can predict current eligibility status, was considered as the central element of analysis. The Markovian transition model was estimated accounting for state dependence, observed and unobserved heterogeneity and non-random attrition. Given the complexity of this method, the iterations were made by simulation.

A rich dataset has been used in the prediction of transition probabilities. Administrative records and the household survey that is carried out to define programme eligibility added up to 6.7 million observations over two rounds. The Markovian model revealed consistent

results according to the specification tests of hypothesis. The estimations in urban and rural areas served to identify mutually significant variables and to check the robustness of the estimates. Changes in the eligibility score algorithm were sorted by running similar estimations with current and previous methods. The size of the dataset and its characteristics helped finding reliable estimates without sampling errors.

Several important findings were obtained from the data and the estimation exercises. First, this chapter has shown that 22.3 and 13.7 percent of previous eligible households are currently eligible under current and former eligibility score algorithms, respectively. As expected, rural households experience higher entry transition rates. A second major finding was that different household characteristics drive the transition of households, in particular time-varying covariates. For instance, the number of households in the dwelling, number of household members, households with a pregnant woman and age of the head of the household were the most important covariates associated with a positive impact on current eligibility. Third, if a 0.5 probability threshold is considered, the predicted probabilities have shown that 39.2.4 (29.6) and 46.5 (45.3) percent of ineligible households present low probabilities of becoming eligible in urban and rural areas, respectively, using current (previous) eligibility algorithm. These proportions of households are less likely to repeat the eligibility or poverty status. On average, a change in the eligibility status is expected to occur in 58 and 55 months in urban and rural areas, respectively, if we focus in current *Sisben* method.

In the light of these results, the evidence from this chapter suggests that poverty dynamics should be taken into consideration when defining the exit conditions from SAPs when they are effective over time. These exit conditions do not solely imply a shift in the eligibility status from eligible to ineligible when poverty or eligibility is transient. This chapter does not offer answers on the interventions that can help participants to find a way out of eligibility, it highlights the relevant condition that any SAP should consider before determining the exit conditions of its beneficiaries under a non-recurrence of poverty setting. The reasons that drive households out of poverty or eligibility (i.e. economic growth, effectiveness of the intervention, positive shocks) remain general. This contribution is aligned with the idea that poverty or eligibility dynamics have strong influence in defining programme exit conditions, in the sense that exit is suggested when the probability of becoming eligible is relatively low for ineligible participants. An important consequence of the findings is that eligibility dynamics provide an important element in the evaluation of the conditions the beneficiaries should achieve in order to leave social assistance. Exit strategies as an addi-

tional feature of SAPs must ensure that non-poor or ineligible recipients are on an exit trend out of poverty or eligibility.

Several policy priorities should therefore be taken into account in the design of SAPs. Under current settings, social transfers providers in developing countries could tend to believe that the goals of their policies are accomplished when recipients' welfare rises above the eligibility thresholds. However, the evidence from this chapter demonstrates that further responses should be considered, especially because eligibility transitions indicate that some households are persistently eligible for SAPs. Some developed countries have opted to provide tax credits to welfare leavers that require additional spending. However, maintaining ineligible households receiving social transfers in developing countries could imply additional fiscal efforts that some may not expect to make. It is important to understand to which extent the SAPs are effective and allow transient poor to benefit from such effectiveness.

The major achievement here was the study of the implications of eligibility dynamics to SAP exit settings. However, the empirical findings in this chapter are subject to some limitations. Despite the richness of the data, the unavailability of long term panel datasets would enhance the quality of the results, incorporating long term exposure and better state dependence assessment of the participation in SAPs over subsequent rounds. Similarly, the change in the eligibility algorithm of *Familias en Accion* programme between 2006 and 2010 prevented a complete analysis of eligibility transitions under current eligibility settings. The methodological disclosure restriction on the new algorithm contributed to this limitation as it prevented the calculation of the *Sisben* score for both rounds of the survey. Finally, an issue that was not addressed in this study was whether the empirical findings from human capital conditional cash transfer programmes can be validated in other type of interventions within the SAPs set. Further research should address the implications of eligibility dynamics for other kind of interventions.

As a final point, this research has thrown up one key question in need of further investigation. The approach of programme exit of ineligible recipients from SAPs requires the articulation of complementary interventions that complement current strategies. In particular, for those ineligible recipients whose predicted transition probabilities of being eligible are considerably high. The study of such interventions is relevant to the current consolidation of social transfer in developing programmes. Similarly, the econometric approach considered in this chapter could be complemented with the conventional estimations of vulnerability to poverty or eligibility. However, given our considerations on the available data, the

unobserved heterogeneity, the state dependence and attrition are still more consistent over the strong assumptions that the estimation of vulnerability to poverty or eligibility imply.

Appendix V-A.1. Descriptive statistics

Table V.A.1. Descriptive statistics.

	Rural		Urban		Overall	
Covariates	Eligible	Ineligi-ble	Eligible	Ineligible	Eligible	Ineligible
Household level						
Electricity	0.541	0.908	0.939	0.999	0.845	0.983
	[0.498]	[0.289]	[0.240]	[0.031]	[0.361]	[0.129]
Sewer	0.006	0.052	0.453	0.885	0.348	0.738
	[0.076]	[0.222]	[0.498]	[0.319]	[0.476]	[0.440]
Landline telephone	0.001	0.029	0.169	0.558	0.130	0.465
	[0.027]	[0.167]	[0.375]	[0.497]	[0.336]	[0.499]
Garbage collection	0.007	0.054	0.606	0.938	0.465	0.782
	[0.085]	[0.225]	[0.489]	[0.241]	[0.499]	[0.413]
Running water	0.183	0.467	0.640	0.940	0.533	0.856
	[0.386]	[0.499]	[0.480]	[0.238]	[0.499]	[0.351]
Toilet						
Latrine	0.080	0.062	0.038	0.007	0.048	0.016
	[0.271]	[0.242]	[0.191]	[0.081]	[0.213]	[0.127]
Unconnected to sewer	0.090	0.277	0.043	0.019	0.054	0.065
	[0.287]	[0.447]	[0.204]	[0.138]	[0.227]	[0.246]
Connected to cesspit	0.201	0.538	0.252	0.066	0.240	0.150
	[0.401]	[0.499]	[0.434]	[0.249]	[0.427]	[0.357]
Connected to sewer	0.005	0.047	0.516	0.898	0.396	0.748
	[0.071]	[0.213]	[0.500]	[0.303]	[0.489]	[0.434]
Type of dwelling:						
House or apartment (flat)	0.886	0.909	0.796	0.905	0.817	0.906
	[0.318]	[0.287]	[0.403]	[0.293]	[0.387]	[0.292]
Room in a house	0.029	0.003	0.011	0.000	0.015	0.001
	[0.169]	[0.052]	[0.102]	[0.022]	[0.121]	[0.029]
Other	0.000	0.000	0.000	0.000	0.000	0.000
	[0.001]	[0.000]	[0.001]	[0.001]	[0.001]	[0.001]
Wall construction material:						
Zinc, cardboard, plastics	0.019	0.002	0.015	0.001	0.016	0.002
	[0.135]	[0.043]	[0.123]	[0.038]	[0.126]	[0.039]
Low quality vegetables	0.065	0.011	0.027	0.003	0.036	0.005
	[0.247]	[0.104]	[0.162]	[0.057]	[0.186]	[0.068]
Raw wood	0.297	0.096	0.199	0.016	0.222	0.030
	[0.457]	[0.294]	[0.399]	[0.126]	[0.416]	[0.171]
Polished wood	0.269	0.184	0.102	0.032	0.142	0.059
	[0.443]	[0.388]	[0.303]	[0.175]	[0.349]	[0.235]
Resistant material	0.211	0.197	0.046	0.061	0.084	0.085
	[0.408]	[0.397]	[0.209]	[0.240]	[0.278]	[0.279]
Bricks	0.137	0.511	0.610	0.886	0.499	0.820
	[0.344]	[0.500]	[0.488]	[0.318]	[0.500]	[0.384]
Floor construction material:						
Raw wood	0.148	0.119	0.064	0.030	0.083	0.046
	[0.355]	[0.324]	[0.244]	[0.170]	[0.276]	[0.209]

	Rural		Urban		Overall	
Concrete	0.243	0.654	0.527	0.533	0.460	0.555
	[0.429]	[0.476]	[0.499]	[0.499]	[0.498]	[0.497]
Tile	0.007	0.072	0.115	0.407	0.090	0.348
	[0.084]	[0.259]	[0.319]	[0.491]	[0.286]	[0.476]
Carpet	0.000	0.001	0.009	0.011	0.007	0.009
	[0.014]	[0.028]	[0.093]	[0.105]	[0.081]	[0.096]
Number of rooms [a]	2.215	2.655	2.253	2.835	2.244	2.804
	[1.238]	[1.472]	[1.260]	[1.462]	[1.255]	[1.465]
Number of bedrooms [a]	1.536	1.785	1.618	1.925	1.599	1.900
	[0.748]	[0.860]	[0.758]	[0.892]	[0.757]	[0.888]
Households in the dwelling	1.068	1.095	1.135	1.184	1.119	1.169
	[0.334]	[0.373]	[0.607]	[0.621]	[0.555]	[0.586]
Household members [a]	4.374	3.949	4.249	3.922	4.278	3.927
	[2.598]	[2.126]	[2.525]	[2.038]	[2.543]	[2.054]
Mean household age [a]	30.878	31.835	26.492	31.209	27.523	31.319
	[17.807]	[17.160]	[16.145]	[15.396]	[16.655]	[15.725]
Household with pregnant woman	0.053	0.045	0.054	0.038	0.054	0.039
	[0.224]	[0.208]	[0.226]	[0.191]	[0.225]	[0.194]
Household with disabled member	0.091	0.075	0.067	0.066	0.073	0.068
	[0.288]	[0.264]	[0.250]	[0.248]	[0.260]	[0.251]
Average age of children [a]	7.707	7.642	7.413	8.238	7.477	8.137
	[4.332]	[4.507]	[4.367]	[4.456]	[4.361]	[4.471]
Age of the youngest child [a]	0.034	0.030	0.109	0.018	0.092	0.020
	[0.719]	[0.680]	[0.720]	[0.525]	[0.721]	[0.556]
Household with children under 6yo	0.474	0.427	0.529	0.400	0.516	0.405
	[0.499]	[0.495]	[0.499]	[0.490]	[0.500]	[0.491]
Household's children attend school	0.437	0.452	0.598	0.562	0.560	0.543
	[0.496]	[0.498]	[0.490]	[0.496]	[0.496]	[0.498]
Ownership of the dwelling	0.589	0.506	0.508	0.446	0.527	0.457
	[0.492]	[0.500]	[0.500]	[0.497]	[0.499]	[0.498]
Assets:						
Fridge	0.048	0.296	0.284	0.641	0.229	0.580
	[0.214]	[0.456]	[0.451]	[0.480]	[0.420]	[0.494]
Washing machine	0.001	0.006	0.020	0.108	0.016	0.090
	[0.029]	[0.078]	[0.141]	[0.310]	[0.124]	[0.286]
Oven	0.000	0.004	0.009	0.047	0.007	0.039
	[0.019]	[0.060]	[0.093]	[0.211]	[0.082]	[0.194]
TV	0.092	0.353	0.408	0.743	0.334	0.674
	[0.289]	[0.478]	[0.491]	[0.437]	[0.472]	[0.469]
Cable TV	0.001	0.007	0.056	0.196	0.043	0.162
	[0.023]	[0.085]	[0.229]	[0.397]	[0.202]	[0.369]
Cooking fuel:						
Firewood, charcoal.	0.950	0.727	0.314	0.034	0.463	0.156
	[0.219]	[0.446]	[0.464]	[0.180]	[0.499]	[0.363]
Mineral coal	0.013	0.031	0.005	0.005	0.007	0.009
	[0.112]	[0.173]	[0.072]	[0.068]	[0.083]	[0.096]

	Rural		Urban		Overall	
Kerosene, oil, gasoline	0.003	0.008	0.031	0.013	0.024	0.012
	[0.054]	[0.088]	[0.173]	[0.113]	[0.154]	[0.109]
Gas in cylinder	0.017	0.186	0.340	0.435	0.264	0.391
	[0.128]	[0.390]	[0.474]	[0.496]	[0.441]	[0.488]
Gas from distribution network	0.000	0.004	0.200	0.402	0.153	0.332
	[0.020]	[0.066]	[0.400]	[0.490]	[0.360]	[0.471]
Electricity	0.002	0.020	0.071	0.082	0.055	0.071
	[0.046]	[0.140]	[0.257]	[0.275]	[0.228]	[0.257]
Type of illumination:						
Kerosene, oil, gasoline	0.134	0.016	0.020	0.001	0.047	0.004
	[0.341]	[0.124]	[0.139]	[0.037]	[0.211]	[0.062]
Electricity	0.537	0.905	0.933	0.996	0.840	0.980
	[0.499]	[0.293]	[0.249]	[0.065]	[0.366]	[0.140]
Solar energy, bio-energy	0.006	0.004	0.001	0.001	0.002	0.001
	[0.080]	[0.065]	[0.033]	[0.023]	[0.048]	[0.034]
Head of the household						
Male	0.797	0.799	0.620	0.642	0.662	0.670
	[0.402]	[0.401]	[0.485]	[0.479]	[0.473]	[0.470]
Age [a]	45.96	44.74	40.10	44.99	41.47	44.94
	[16.99]	[17.25]	[18.97]	[15.35]	[18.69]	[15.70]
Years of education [a]	2.362	3.697	3.971	6.161	3.593	5.727
	[2.150]	[2.807]	[3.409]	[3.677]	[3.231]	[3.662]
Married or cohabitant	0.659	0.693	0.576	0.600	0.595	0.617
	[0.474]	[0.461]	[0.494]	[0.490]	[0.491]	[0.486]
Employed	0.754	0.751	0.650	0.679	0.674	0.692
	[0.431]	[0.432]	[0.477]	[0.467]	[0.469]	[0.462]
Employed with health benefits	0.007	0.070	0.049	0.344	0.039	0.296
	[0.081]	[0.255]	[0.217]	[0.475]	[0.194]	[0.456]
Spouse's age [a]	24.83	26.16	21.15	22.78	22.01	23.38
	[0.429]	[21.898]	[21.647]	[22.086]	[21.867]	[22.091]
Spouse's years of education [a]	0.007	2.894	2.500	3.863	2.321	3.692
	[0.084]	[3.044]	[3.311]	[4.254]	[3.104]	[4.084]
Employed spouse	0.000	0.034	0.092	0.136	0.076	0.118
	[0.014]	[0.182]	[0.289]	[0.343]	[0.265]	[0.323]
Macro-level covariates						
Local population [a]	44,454 [137,535]	54,976 [231,007]	906,291 [1,947,897]	1,559,630 [2,467,299]	703,697 [1,743,666]	1,294,365 [2,313,552]
Party of incumbent at enrolment						
Independent	0.277	0.277	0.385	0.280	0.360	0.279
	[0.447]	[0.447]	[0.487]	[0.449]	[0.480]	[0.449]
No elections / No info	0.175	0.141	0.108	0.091	0.124	0.100
	[0.380]	[0.348]	[0.310]	[0.288]	[0.329]	[0.300]
Officialist or coalition party	0.299	0.340	0.204	0.218	0.226	0.240
	[0.458]	[0.474]	[0.403]	[0.413]	[0.418]	[0.427]
Opposition party	0.245	0.235	0.276	0.340	0.269	0.322
	[0.430]	[0.424]	[0.447]	[0.474]	[0.443]	[0.467]

	Rural		Urban		Overall	
Votes obtained by ruling party (%)	0.409	0.415	0.388	0.399	0.393	0.402
	[0.219]	[0.199]	[0.172]	[0.157]	[0.185]	[0.165]
Real provincial GDP per capita (US$) [a]	4,259	4,771	4,744	5,604	4,630	5,457
	[2,796]	[2,667]	[2,904]	[3,118]	[2,886]	[3,060]
Share of agriculture in provincial GDP	0.138	0.131	0.105	0.090	0.113	0.097
	[0.505]	0.054	[0.061]	[0.065]	[0.061]	[0.065]
Local public per capita budget (US$) [a]	4,847	9,607	19,522	22,593	16,072	20,304
	[42,523]	[83,925]	[41,349]	[50,856]	[40,141]	[30,516]
Provincial employment rate	53.61	53.37	52.40	53.18	52.68	53.21
	[3.979]	[3.586]	[3.932]	[3.684]	[3.977]	[3.668]
Provincial unemployment rate	12.34	13.28	12.27	13.31	12.28	13.30
	[2.698]	[2.652]	[2.758]	[2.697]	[2.744]	[2.689]
Number of observations (households)	916,289	507,533	2,981,603	2,371,325	3,897,892	2,878,858

Source: Departamento Administrativo Nacional de Estadisticas (DANE); Departamento Nacional de Pleaneacion (DNP). Notes: [1] Standard deviations in brackets. [2] [a] This variables are not in proportional terms. [3] US$ values are calculated by current exchange rates.

Appendix V-A.2. Estimation results

Table V.A.2. Transitions' probability estimates.

	Sisben score in 2010		*Sisben* score in 2006	
Dep. variable: currently eligible = 1	Rural	Urban	Rural	Urban
Household level				
Electricity	-0.037	0.086**	0.004	0.080
	(0.046)	(0.039)	(0.050)	(0.052)
Sewer	-0.028	-0.104***	0.175**	0.016
	(0.083)	(0.021)	(0.075)	(0.056)
Landline telephone	-0.267***	-0.106***	-0.411***	-0.170***
	(0.069)	(0.014)	(0.100)	(0.028)
Garbage collection	-0.011	-0.151***	-0.053	-0.031
	(0.055)	(0.018)	(0.058)	(0.027)
Running water	-0.069***	-0.114***	-0.293***	0.014
	(0.020)	(0.027)	(0.029)	(0.030)
Toilet				
Latrine	-0.210***	-0.038	-0.120***	0.057
	(0.032)	(0.046)	(0.035)	(0.046)
Unconnected to sewer	-0.226***	-0.045	-0.175***	0.108**
	(0.025)	(0.050)	(0.031)	(0.049)
Connected to cesspit	-0.208***	-0.026	-0.116***	0.138**
	(0.019)	(0.063)	(0.025)	(0.056)
Connected to sewer	-0.264***	-0.123**	-0.180**	-0.058
	(0.079)	(0.059)	(0.077)	(0.069)
Type of dwelling:				
House or apartment (flat)	0.016	0.029*	0.119***	0.109***
	(0.026)	(0.016)	(0.034)	(0.020)
Room in a house	-0.125	-0.049	-0.007	-0.093
	(0.087)	(0.061)	(0.080)	(0.070)
Wall construction material:				
Zinc, cardboard, plastics	-0.028	0.014	0.051	-0.299
	(0.203)	(0.156)	(0.212)	(0.236)
Low quality vegetables	-0.060	0.057	0.048	-0.276
	(0.200)	(0.160)	(0.211)	(0.221)
Raw wood	0.016	0.302*	0.067	-0.107
	(0.197)	(0.168)	(0.209)	(0.226)
Polished wood	-0.057	0.024	0.105	-0.327
	(0.198)	(0.156)	(0.211)	(0.228)
Resistant material	-0.018	-0.050	0.176	-0.255
	(0.200)	(0.161)	(0.215)	(0.225)
Bricks	-0.113	-0.051	-0.033	-0.322
	(0.200)	(0.158)	(0.212)	(0.225)
Floor construction material:				
Raw wood	-0.064**	-0.090**	-0.062*	-0.173***
	(0.025)	(0.043)	(0.034)	(0.053)
Concrete	-0.134***	-0.115***	-0.116***	-0.125***
	(0.019)	(0.022)	(0.023)	(0.025)
Tile	-0.286***	-0.219***	-0.360***	-0.438***

	(0.044)	(0.026)	(0.055)	(0.032)
Carpet	0.062	-0.068**	-0.160	-0.511***
	(0.313)	(0.029)	(0.399)	(0.063)
Number of rooms [a]	0.008	-0.014**	-0.004	-0.012**
	(0.007)	(0.006)	(0.008)	(0.005)
Number of bedrooms [a]	-0.023*	0.025**	-0.013	-0.016
	(0.012)	(0.014)	(0.013)	(0.012)
Households in the dwelling	0.060***	0.090***	0.066***	0.044***
	(0.021)	(0.008)	(0.024)	(0.011)
Household members [a]	0.102***	0.102***	0.037***	0.040***
	(0.005)	(0.006)	(0.004)	(0.004)
Mean household age [a]	0.000	-0.002	-0.003**	-0.008***
	(0.002)	(0.002)	(0.002)	(0.001)
Household with pregnant woman	0.137***	0.140***	0.060**	0.034**
	(0.027)	(0.014)	(0.026)	(0.016)
Household with disabled member	0.150***	0.185***	0.055**	0.057***
	(0.025)	(0.017)	(0.026)	(0.014)
Average age of children [a]	-0.029***	-0.018***	0.000	-0.003
	(0.002)	(0.002)	(0.002)	(0.003)
Age of the youngest child [a]	-0.036***	-0.033***	-0.047***	-.048***
	(0.008)	(0.013)	(0.010)	(0.013)
Household with children under 6yo	0.047**	0.022**	-0.008	0.007
	(0.021)	(0.010)	(0.021)	(0.013)
Household's children attend school	0.039***	0.064***	0.009	0.058**
	(0.015)	(0.021)	(0.016)	(0.024)
Ownership of the dwelling	-0.095***	-0.055**	-0.103***	-0.236***
	(0.014)	(0.024)	(0.016)	(0.018)
Assets:				
Fridge	-0.139***	-0.109***	-0.187***	-0.068***
	(0.021)	(0.010)	(0.024)	(0.015)
Washing machine	0.106	-0.138***	0.025	-0.161***
	(0.109)	(0.017)	(0.107)	(0.024)
Oven	-0.356**	-0.001	-0.350**	-0.029
	(0.169)	(0.019)	(0.156)	(0.026)
TV	-0.069***	-0.088***	-0.079***	-0.061***
	(0.018)	(0.009)	(0.022)	(0.013)
Cable TV	0.030	0.025	0.289***	-0.010
	(0.134)	(0.020)	(0.111)	(0.038)
Cooking fuel:				
Firewood, charcoal.	0.105	0.345***	0.272**	0.176***
	(0.148)	(0.048)	(0.131)	(0.051)
Mineral coal	-0.005	0.047	0.102	0.126
	(0.157)	(0.072)	(0.161)	(0.083)
Kerosene, oil, gasoline	-0.005	0.180***	0.165	0.147***
	(0.175)	(0.045)	(0.174)	(0.050)
Gas in cylinder	0.004	0.091***	0.088	0.068*
	(0.150)	(0.035)	(0.132)	(0.041)

Gas from distribution network	0.170	0.010	0.303	-0.005
	(0.228)	(0.036)	(0.230)	(0.046)
Electricity	0.005	0.088**	0.408**	0.163***
	(0.156)	(0.043)	(0.159)	(0.058)
Type of illumination:				
Kerosene, oil, gasoline	0.005	0.002	-0.020	-0.144**
	(0.039)	(0.050)	(0.045)	(0.066)
Electricity	-0.013	0.103**	-0.051	0.074
	(0.047)	(0.042)	0.050	(0.050)
Solar energy, bio-energy	-0.045	0.043	0.092	-0.001
	(0.085)	(0.102)	(0.080)	(0.141)
Head of the household				
Male	-0.015	-0.002	-0.020	-0.012
	(0.028)	(0.012)	(0.029)	(0.016)
Age [a]	0.004***	-0.005***	0.002***	-0.004***
	(0.00)	(0.00)	(0.00)	(0.00)
Years of education [a]	-0.035***	-0.041***	-0.034***	-0.039***
	(0.003)	(0.003)	(0.003)	(0.003)
Married or cohabitant	-0.070**	-0.121**	0.0182	-0.030
	(0.035)	(0.062)	(0.037)	(0.054)
Employed	0.025	-0.041*	0.065***	0.008
	(0.022)	(0.021)	(0.025)	(0.020)
Employed with health benefits	-0.213***	-0.105***	-0.363***	-0.300***
	(0.040)	(0.013)	(0.055)	(0.016)
Spouse's age [a]	0.00	0.003*	0.002***	0.005
	(0.001)	(0.001)	(0.001)	(0.001)
Spouse's years of education [a]	-0.037***	-0.028***	-0.033***	-0.025***
	(0.003)	(0.002)	(0.003)	(0.002)
Employed spouse	0.054	0.030**	-0.009	0.014
	(0.038)	(0.013)	(0.036)	(0.016)
Macro-level covariates				
Local population [a]	0.000	0.000	0.000**	0.000
	(0.000)	(0.004)	(0.000)	(0.000)
Party of incumbent at enrolment				
Independent	0.200	-0.050	0.489***	0.390***
	(0.151)	(0.103)	(0.150)	(0.120)
No elections / No info	0.407**	0.032	0.634***	0.220
	(0.165)	(0.146)	(0.184)	(0.171)
Officialist or coalition party	0.191	-0.177	0.453***	0.354***
	(0.150)	(0.111)	(0.148)	(0.115)
Opposition party	0.162	-0.154	0.401***	0.316***
	(0.150)	(0.103)	(0.150)	(0.116)
Votes obtained by ruling party (%)	0.421***	0.207	0.352**	-0.125
	(0.105)	(0.160)	(0.162)	(0.186)
Real provincial GDP per capita (US$) [a]	0.000	0.000	0.000**	0.000**
	(0.000)	(0.000)	(0.000)	(0.000)
Share of agriculture in provincial GDP	-	58.68*	-	-

	-	(35.493)	-	-
Local public per capita budget (US$) [a]	0.000	-0.012	0.000**	0.000**
	(0.000)	(0.245)	(0.000)	(0.000)
Provincial employment rate	0.014**	-0.003	0.017**	0.014**
	(0.006)	(0.005)	(0.007)	(0.006)
Provincial unemployment rate	0.028***	-0.012**	0.019**	-0.015*
	(0.008)	(0.006)	(0.009)	(0.009)
Number of observations (households)	1,423,822	5,352,928	1,423,822	5,352,928

Source: Departamento Administrativo Nacional de Estadisticas (DANE); Departamento Nacional de Pleaneacion (DNP). Notes: [1] Robust standard error at the municipality level in parenthesis. [2] Estimations from a multivariate Probit model by simulation with 250 draws [3] Estimations controlled by provincial and year of household survey fixed effects. [4] Outputs for the baseline and retention estimations are not reported.

CHAPTER VI: GENERAL CONCLUSIONS

This thesis has investigated the exit conditions of beneficiaries in social assistance programmes (SAPs). Within social protection, SAPs are defined as tax-financed transfers in response to conditions of poverty and vulnerability. The literature has referred to them as a programme because they are part of a broad antipoverty strategy within social protection along with active labour markets policies and social insurance schemes. A particular focus has been given to human development conditional cash transfer programmes (known as CCTs) which have led the implementation of antipoverty strategies with a particular regional preference in Latin America. CCTs are perhaps the most evaluated SAP, as recent impact evaluations have highlighted the relevance of these programmes in the human capital formation of children and the rearrangement of household resources. Recent evidence has documented the impacts of CCTs on a variety of intended and unintended dimensions. Impact evaluations have contributed to the diffusion of CCTs in Latin America and some other regions. They have reported strong attributable impacts on the human capital of children and the alleviation of household poverty in the short run. Impact evaluations have also shown positive effects of CCTs on several dimensions not necessarily related to their main objectives, such as test scores, cognitive achievements, and women empowerment.

The effects of the CCTs on child human capital are related to the characteristics of the population that receives the benefits from the transfers. Similar to the majority of SAPs, CCTs are aimed at selecting households in poverty or extreme poverty with cohabitating children. Young children are required to follow a health and nutrition programme, while schooling-age children are required to attend school on a regular basis. Poor households are identified with targeting methods with several commonalties across Latin America, by employing proxy means tests. These targeting methods determine the entry of households in poverty into the programme.

Targeting and entry to the interventions is a first feature in the implementation of SAPs. Benefits are given in cash or in-kind in a conditional or unconditional setting. Conditionalities on the transfers obey to a paternalistic point of view in the assignment of transfers. The income transfer in cash is expected to be invested in child human capital by beneficiary parents, who are supposed to prioritise other kind of goods and services. When a household is exposed to the intervention the exit conditions in CCTs are often contingent on the age of the younger child in the household. Some programmes like Mexico's *Oportunidades* have operated since 1997 with households exposed to the cash transfers for 15 years since they were enrolled in the programme with infants. Beneficiaries stay in the programme insofar as they comply with the categorical selection. Very few programmes in Lat-

in America establish a fixed duration of participation. Moreover, those programmes with a maximum duration of participation do not justify the foundations of the intended length of exposure. Indeed, very little attention has been paid to the exit conditions of the beneficiaries from SAPs.

The main aim of this thesis was to make a contribution to the knowledge in the implementation of SAPs by bridging the research gap on the exit conditions of beneficiaries. Two basic principles are relevant to this analysis. The first principle, the exhausted effectiveness raises the concern of the time-varying shape of the impact of the programme. Current impact evaluations have been framed within a static setting in which the main question of research is whether the programme works or not. This first principle answered a different question. It focuses on the extent to which the effect of the programme is positive and non-negative. Several factors, such as administrative and household conditions, might shape the variation of the effectiveness of a transfer over time among persistent poor beneficiaries. Programme participation should be stopped or modified if its effectiveness reaches an exhaustion level (zero or negative effects). The second principle, the non-recurrence of poverty deals with the implications of poverty dynamics for the implementation of SAPs. As targeting methods identify households in poverty, such status may change once participation starts and the beneficiary experiences transient poverty. The conventional approach in the majority of programmes is to drop those beneficiaries that are found ineligible in a recertification process. Programmes' administrators may consider that transferring income in cash to ineligible households may be defined as an inclusion error of the targeting process. This approach misunderstands the characteristics of the transient poverty of the household. If poverty is not persistent the household can benefit from the transfer for a short period of time depending on how frequent the recertification process takes place. The non-recurrence of poverty principle is oriented towards the identification of transient poor and permanent non-poor households when the intervention is still effective. Exit of the programme is reliable only if the beneficiary household is at low risk of experiencing eligibility.

The empirical focus of this thesis was based on the implementation of the human development conditional cash transfer programme, *Familias en Accion*, from Colombia. *Familias en Accion* was established in 2000 as a response to an acute economic crisis that led households in poverty to decrease their investment in their children's human capital. The instrument that the programme uses in the targeting process consists of a household survey that covers the three lowest quintiles of the country's population. Known as *Sisben*, the survey is composed of several rounds which provided the main dataset for the empirical analysis of

this thesis. Usually, other empirical studies analysing this type of interventions rely on household surveys with limited groups of analysis and sampling errors components. The tens of millions of observations in the *Sisben* survey allowed for the implementation of econometric models without the conventional concerns on the power and significance of the estimated results. To the best of the of the author's knowledge, this is the first empirical approach in the analysis of a social assistance programme in which these rich data is employed.

VI-1. Summary of findings

This thesis has examined how the exit conditions can be conceptualised from the point of view of two dominating principles. The exhausted effectiveness was the focus of a relevant part of this analysis. In particular, the explanations of the sources of a time-varying effectiveness in social assistance programmes covered one theoretical and one empirical chapter. In contrast, the non-recurrence of poverty principle was covered by one chapter, which reveals that poverty dynamics has been studied more broadly than the effectiveness dynamics emerging from the implementation of social assistance programmes. In fact, this thesis has oriented it major contribution to knowledge towards bridging the gaps arising from lack of interest in the exit conditions of beneficiaries from SAPs in developing countries.

Chapter II presented a theoretical model that explains the economics of the length of exposure to a conditional cash transfer programme as a representative case study of antipoverty interventions. In fact, this chapter has gone some way towards enhancing our understanding of how resource allocation within households is affected by programme participation in a two-period framework. The Baland and Robinson (2000) model was modified by allowing the interaction of the programme in the budget constraint of a typical household. The decision making about the proportion of the children's time to be devoted to work or study was considered, in a first approach, as efficient in a competitive framework. However, the outcomes of the model would change when the credit markets failed to provide loans to poor households. The intervention from the cash transfer programme was essential to buffer the effects of poverty and credit market imperfection, while keeping children apart from child labour. As a consequence the parental decision making was reoriented towards the investment in children's human capital by rearranging their disposable resources.

The main findings from Chapter II are highlighted as follows:

- **Three types of SAPs can be identified according to their length of duration.** A first type is associated with the duration of the programme's funding cycle. A

second type sets a benchmark to be achieved by the intervention (especially in integrated poverty reduction programmes). However, this thesis is based on the implementation of SAPs that set an achievement of specific targets. The length of exposure of a given programme is dependent on the completion of an education degree or the ending of a natural life-course cycle, such as childhood in nutrition and education interventions and old age in social pensions. Some antipovery programmes in Latin America have been in operation for more than 15 years, while several generations of children have benefitted from the CCTs in the region.

- **The effects of the SAPs can vary over the participation period.** Despite the study of the dynamic effectiveness is generic to any context, two different types of outcomes are relevant in the definition of the effectiveness cycle over time. First, stock outcomes (i.e. years of education) are subject to the analysis of non-negative marginal continuous effects. Second, flow outcomes (i.e. school attendance) are subject to the analysis of any marginal continuous effect. The exhaustion of the marginal effect occurs when it becomes zero. In any case, it has been previously shown that the effects of SAPs on children-related outcomes are time-varying, in the sense that they follow a cycle which starts at enrolment and ends when the effects reach a steady state. The characterization of the time-varying property of the effects of SAPs provides some ideas about the sources of such phenomenon. Administrative factors can contribute to the variation of the effects of a particular programme. On the other hand, the time dependency of the effectiveness of the intervention can be determinant when considering the characteristics of the recipients. For instance, the benefits from a nutritional programme will be different if the recipient is a newborn baby or a young child.
- **The Baland and Robinson (2000) model offered a suitable framework to the theoretical analysis of Chapter II.** Several dynamic approaches were reviewed to identify an economic approach to the implementation of a CCT in a human capital investment model. The core of the BR model was the parental decision making on the amount of available time that a child would allocate either to education or work. If households are poor with no bequeathing capacity and unable to save for old age, the model results in an inefficient proportion of time devoted to child labour. The latter occurs because poor parents are unable to internalise the forgone income that would result if they sent their children to school.
- **A conditional cash transfer to poor households can be a second best solution to the BR model.** Poor households who participate in a CCT intervention are required to ensure the human capital accumulation of their children. The total trans-

fer is specified in function of the cash, other services and the time children devote to school attendance. The transfer is sensitive to the proportion of time that children attend school. To the extent that the solution of the problem responds positively, but marginally decreasing, to the length of exposure. The second best solution to the model consists of the role of the transfer in helping the beneficiary household cope with the low saving capacity in a first period. This is only possible when the transfer compensates the forgone income generated by the absence of child labour.

- **Programme's average effect on human capital can fall to zero as the length of exposure varies.** Given the characteristics of the cash transfer and human capital accumulation functions, it was shown that the human capital accumulation can reach similar levels to those levels in absence of the programme. In fact, the effect of the programme, defined as the difference in the human capital accumulated by a beneficiary child and its counterfactual, can be positive, reach a maximum level and become zero. The effectiveness of the programme can become negative when the length of exposure drives the outcomes of the model to be below the counterfactual level. An exit condition is then possible when the programme has exhausted its effectiveness, as a longer length of exposure would generate negative or 'overdose' effects.

Chapter III presented the features of the *Familias en Accion* programme in Colombia. This emblematic conditional cash transfer has been evaluated with outstanding effects on children's nutrition and education outcomes. *Familias en Accion* offered a suitable empirical framework of analysis because it beneficiaries have been enrolled over the last 14 years. In fact, the programme has provided a rich dataset on which the rest of this thesis obtained the pillars for its econometric models. Another feature of this programme is its generic design, in the sense that is delivers cash transfers under an administrative setting that involved several components commonly incorporated in other interventions. These components included the verification of co-responsibilities and complementary activities for adults. *Familias en Accion* started in December 2000 in two municipalities and 2,000 beneficiaries. Today it accounts for nearly 3 million beneficiaries in 1,100 municipalities (including large cities and metropolitan areas).

The main findings from Chapter III are highlighted as follows:

- **Conditional cash transfers programmes emerged in Latin America within a transition from in-kind to cash transfers.** The reforms to the provision of social

protection programmes in Latin America in the 1990s were implemented in response to the large proportion of the population who remained uncovered by social security schemes. The economic crisis that hit the region by the end of the decade led the overhauling of the process through which subsidies were transferred. For instance, in Mexico an evaluation to the subsidies to the corn tortilla revealed that an important amount of resources were leaking towards the non-poor population. The redistributive capacity of the social assistance was compromised by the Mexican strategy of giving in-kind transfers with limited targeting-to-the-poor components. *Progresa* (know today as *Oportunidades*) was created under an evaluation framework which demonstrated important effects on health and education outcomes.

- ***Familias en Accion* was introduced in Colombia as a response to the 1999 economic crisis.** *Familias en Accion* is a social assistance programme that has become a flagship intervention in Colombia. It was created in 2000 with the objective of alleviating poverty and increasing the investment in children's human capital. It delivers two broad groups of transfers. The nutrition transfers are aimed at increasing the food consumption of households conditional on the health check-ups for young children. The school transfers are aimed at increasing the number of year of education of children conditional on regular school attendance over the school calendar. The programme selects its beneficiaries by employing the *Sisben* score. The *Sisben* is a proxy means test that generates an assignment score from which the programme selects households under the lowest cut-off points in urban and rural areas.
- **Similar to most SAPs, the design of *Familias en Accion* does not specify a fixed length of exposure while exit conditions ignore poverty or eligibility dynamics**. Previous research on the effects of *Familias en Accion* has not analysed the consequences of a continuous length of exposure. A newborn child can be exposed to the programme for 18 years until he or she ends school. In fact, the exit conditions of the programme entail only the not compliment with the categorical eligibility criteria and with the conditionalities on which the transfers depend. Non-poor households are dropped from the programme as they are considered a targeting inclusion error.

Chapter IV starts the empirical approach of this thesis by analysing the length of exposure of beneficiary households to the *Familias en Accion* programme. In spite of the fact that several econometric methods were suitable to obtain reliable results, this chapter was based on the Hirano and Imbens (2004) model for the estimation of continuous treatment effects.

The *Sisben* survey and the administrative records from the programme were used as a main input in the econometric analysis. A rich working dataset was composed of more than 60 million observations in two rounds that entailed baseline (pre-programme condition) and a follow-up (post-programme condition) data. The amount and quality of the data that was employed in this chapter facilitated the attainment of reliable results without sampling errors. The selected outcomes were those related with the human capital formation of children. Instead of testing the predictions of the theoretical model developed in Chapter II, this empirical approach is focused on finding evidence on the varying effectiveness of the transfer over the length of exposure.

The main findings and contributions to the current literature from Chapter IV are highlighted as follows:

- **The generalised propensity score allowed for an unbiased comparison of households at different length of exposure to the programme.** The single comparison of households at different length of exposure levels would have led to obtain biased estimates of the marginal treatment effects of the length of exposure to the programme. In particular, households that are able to stay in the programme for longer would show better human capital outcomes. The GPS was an alternative that leads to the unbiased estimation of a dose-response function relating the human capital outcomes with the length of exposure to the programme. It takes into account observable covariates in order to achieve an unconfounded estimation of the continuous effects of the programme looking at participating households. The estimations on a common support of analysis and a balancing test demonstrated reliable continuous treatment effects.
- **Children's years of education and school registration responded positively to the length of exposure to *Familias en Accion*.** On average, the number of years of education at the beginning of the participation in the programme was found to be 4.4, while at the end of the participation it reached 5.4. In other words, when children are fully exposed to the programme they can accumulate one additional year of education, with a higher attainment in urban areas. When the sample was restricted to children enrolled in the programme at 7 years of age, the results showed that the least and the most exposed the programme can complete 3.5 and 7.9 years of education, respectively, with a difference of 4.4 years. This is, a difference of 4.4 year of education for children participating in the programme from the beginning of their school cycle. The school registration outcome responded similarly to the length of exposure. In spite of the fact that the description of the school

registration outcome showed a declining trend at the end of the programme participation, this outcome showed an increasing trend when it was adjusted by the GPS. School registration can be 10 percentage points higher on average when children are fully exposed to the programme. If the sample is restricted to children enrolled at 7 years of age the difference is 29 percentage points. Indeed, the predictions indicate that full exposure to the programme leads to a 100 percent of school registration of children in this cohort.

- **Adults that were exposed to *Familias en Accion* when children were registered in a tertiary level of education.** The programme demonstrated long-lasting human capital formation effects. The registration in a tertiary level of education of adult responded significant and positively to the length of exposure to the programme when they were children. The difference between the least to the most exposed to the least exposed to the programme was 24 percentage points, starting from 16 percent and ending at 40 percent of enrolled adults.
- **The earning capacity responded positively to the length of exposure of the household, while the eligibility status remained almost unchanged.** The estimations results showed that the dose of the programme causes a positive effect on the earning capacity of the household. This response is a consequence of the increases in the children's human capital, which is translated into higher earning capacity when they become adults. In contrast, the difference in the probability of being eligible is inexistent between the least and the most exposed to the programme. However, a medium length of exposure is related to a higher positive response of such probability, indicating that the relation is non-linear between the beginning and the end of the participation in the programme.
- ***Familias en Accion* did not generate marginal continuous treatment effects on labour participation of adults that were exposed to the programme when children.** Despite the programme generated positive continuous treatment effects on children's human capita, these outcomes did not translate into a higher labour participation. This fact matches the previous qualitative evaluation in which the beneficiaries suggested that labour opportunities after graduation from school were scarce and limited. Thus, they were encouraged to enrol in a tertiary education level.
- **Overall, the marginal effectiveness of the programme's effectiveness on education does not become zero over the actual length of exposure.** The estimations of the continuous treatment effects do not show that the programme generates negative effects at any point of the length of exposure. Despite the BR model would predict an overdose effect on human capital accumulation, these empirical

findings obey only to one of the inputs of such human capital. In fact, these findings show that the human capital function could attain negative marginal levels in response to higher years of education and higher levels of school registration. *Familias en Accion* could deliver transfers to households in extreme poverty until children complete their school cycle.

Chapter V addresses the second principle that determines the exit conditions covered by this thesis. The non-recurrence of poverty is regarded as as an essential principle when considering a household as leaver from an effective antipoverty intervention. Programmes select households or individuals identified as being in poverty or eligible for the intervention. As some households or individuals face transient poverty, when participation starts beneficiaries may leave poverty or eligibility which may drive to their exclusion at some length of exposure. The length of exposure associated with a change in the poverty or eligibility status of the beneficiaries may be shorter than the one established as the maximum length of exposure defined by the exhausted effectiveness. The non-recurrence principle of exit conditions from SAPs indicates that households or individuals are able to leave an antipoverty programme only if they experience low likelihood of becoming poor or eligible, insofar as the programme has not exhausted its effectiveness. The *Sisben* survey was also used in this chapter by replicating the eligibility criterion from the *Familias en Accion* programme. A Markovian model was employed in this chapter to identify households considered as leavers from poverty or eligibility and, hence, able to leave *Familias en Accion*.

The main findings and contributions to the current literature from Chapter V are highlighted as follows:

- **The study of poverty dynamics in the context of implementation of SAPs is essential to the understanding of the non-recurrence of poverty principle.** Occasionally and usually poor individuals or households experience transient poverty. They can be selected and enrolled into an antipoverty programme when experiencing poverty, as targeting methods provide a static snapshot of the socioeconomic conditions. The poverty or eligibility status may change, bringing households out of poverty in a temporary manner. If the programme is still effective, only escapee households are able to leave the programme. Escapee households will face low probabilities of falling into poverty when they are dropped from the intervention, while usually poor households must be retained as they are likely to experience poverty again.

- **The implications of poverty dynamics for the implementation of SAPs are dependent on how often the socioeconomic conditions of the beneficiaries are monitored.** In developed countries the means tests used for the selection of beneficiaries for social assistance rely on the availability of information of formal earnings. High informality rates in developing countries prevent the implementation of SAPs to track household's income. Programmes thus employ proxy means tests from which they identify poor or eligible households. Proxy means tests are contingent on the availability of household surveys and demand high transaction costs. The frequency under which the socioeconomic conditions are monitored is guaranteed at enrolment, but subsequent monitoring is not made on a constant basis.
- ***Familias en Accion* is a conventional SAP programme that drops non-poor or ineligible beneficiaries.** Similar to other CCT programmes in Latin America, *Familias en Accion* drops participants that are found with a *Sisben* score below the extreme poverty or eligibility threshold. In 2007 the programme dropped 60 thousand households, from which 30 percent were eligible again three years later. In other words, 70 percent of ineligible households were escapees in the period of analysis, while the rest were not able to leave the programme as they could be classified as usually poor beneficiaries. Similar decisions are made by other SAPs in Latin America that have evidenced a similar effectiveness as the one reported from the *Familias en Accion* programme.
- **The estimations of a Markovian model allowed the calculation of entry rates of ineligible households.** The Markovian model revealed that, according to current *Sisben* version, 39.2 and 46.5 percent of ineligible households experience high probabilities of being eligible in urban and rural areas, respectively. These estimations indicate that the programme would be able to exclude approximately 50 percent of ineligible households under the non-recurrence of poverty principle, in the sense that they can be considered to be on an escapee trend. Under these parameters it is possible to identify a *Sisben* score threshold after which the entry rate is relatively low.

VI-2. Implications from these findings

The findings from this thesis have several implications for the understanding of the exit conditions of beneficiaries from social assistance programmes. In a broad sense, the evidence suggests that, to date, very few social assistance programmes have been designed with clear exit conditions of beneficiaries. Households in poverty are enrolled in the an-

tipoverty programmes with the expectation that they will go up the ladder out of poverty either by providing income or means to afford better livelihoods. Households in poverty have been able to participate in antipoverty programmes under a binary decision making that shifts from being in poverty and not in poverty or vice versa. Cut-off points or thresholds over income earnings or proxy means tests scores obey often to a social minimum that is considered acceptable within a given society. The findings from this thesis imply that interventions aimed at helping households or individual meet such social minima may perform differently when poverty is persistent or transient. Thus, when poverty is persistent the first principle of exit from SAPs, the exhausted effectiveness, suggests that beneficiaries must leave the programme or be switched to another intervention when they can be better off without the transfers. This principle identifies the length of exposure over which the effectiveness of a given SAP is non-zero or non-negative. Once the length of exposure is defined, a second principle, the non-recurrence of poverty, comes into the analysis. If a given SAP is still effective and a beneficiary leaves poverty, this principle suggests that an exit condition must consider that an individual or household will not fall again into poverty in the medium run. The combination of the principles of exhausted effectiveness and non-recurrence of poverty determine the exit conditions of beneficiaries participating in a SAP with a binary selection setting.

The exhausted effectiveness principle adds to the growing body of literature on the implementation of antipoverty programmes in several ways. First, it acknowledges that social assistance interventions designed to reduce poverty may not generate a long-lasting result. It has raised the question on how the effectiveness of a given intervention should be assessed in order to determine the length of exposure. This implies that given the generic methodological approach that was made in this thesis in theoretical and empirical fields, any SAP can follow this principle in the creation of exit conditions of its beneficiaries. However, this thesis has made a strong emphasis on programmes aimed at increasing children's human capital as shown in the alteration of the Baland and Robinson (2000) model. The latter predicts that, to some extent, children could be better off without the programme in terms of human capital accumulation. Second, the findings in the development of the exhausted effectiveness principle support the idea that, in the particular case of child human capital investment, SAPs with certain characteristics can deliver transfers until the beneficiaries complete the full proposed exposure, that is, until the beneficiaries lack the categorical selection criteria due to the achievement of a life course milestone (e.g. becoming adult). Third, the results here indicate that the exhausted effectiveness principle is feasible in the implementation of a SAP if the administrators are highly committed with the

evaluation and evidence generation on the results of the programmes. The effectiveness of a particular programme is only possible if primary data are generated by a rigorous evaluation component.

The non-recurrence of poverty principle also makes an important contribution to the literature dominating the discussion of the implementation of SAPs in developing countries. First, it raises the concern of the implications of transient poverty for the implementation of social assistance programmes. This principle reaches real relevance when programmes response to poverty measured as the deficit of a social minimum which may be defined arbitrarily. The poverty or eligibility thresholds lead to a binary selection of beneficiaries that sets a welfare level under which households participate in the programme or above which beneficiaries are dropped. The non-recurrence of poverty principle suggests that the programme should not end when beneficiaries leave poverty. Instead, it implies that programme participation must consider that the exit conditions include the evaluation of the poverty dynamics of the average participant to determine that an individual or household is certainly a poverty leaver in the long run. Second, the non-recurrence of poverty principle is dependent on the frequency under which the socioeconomic conditions of the beneficiaries are assessed. This principle suggests the programme implementation needs to incorporate a recertification process that matched the expected change in the poverty or eligibility status of the participants.

Taken together, the findings from this thesis indicate, on one hand, that a length of exposure of beneficiaries to SAPs can be established from the point of view of their effectiveness. On the other, they also indicate that over such length of exposure some households may leave poverty or eligibility. These two facts are the main elements of the exit conditions from social assistance that this thesis has proposed. They have opened a new field of research on the components that are identified within the implementation of SAPs in developing countries. A general implication of this thesis is the possibility that certain SAPs (such as pure income transfers, income transfer with asset accumulation and integrated antipoverty strategies) are subject to the application of the two exit principles that were analysed here. In particular, the application of the two principles is possible when SAPs are designed with components that entail a targeting method with a binary selection of beneficiaries, along with a regular delivery of income transfers. Next section discusses the policy implications of these findings.

VI-3. Policy implications

The findings of this thesis have a number of important implications for future practice. The fact that SAPs need to be conceived under an idea of a maximum length of exposure has strong repercussions for the design of such interventions when poverty is persistent. Incorporating the findings of the exhausted effectiveness principle can accelerate the innovation in the design of new kind of interventions in cases where households are stubbornly in poverty. For instance, Mexico's *Oportunidades* CCT programme was conceived as an innovation in how income transfers were delivered, from in-kind to cash transfers interventions. However, since the dissemination of CCTs across Latin America very few interventions have been introduced in spite of the fact that households remain in poverty. It is known that a significant number of factors (or poverty traps) can make poverty to persist in the long run. The key objective in the implementation of SAPs is to provide the tools to the beneficiary households in order that they find their own way out of poverty by escaping the poverty traps. In some cases the effects from SAPs are not sufficient to achieve their objectives. If a maximum duration is incorporated into the implementation of SAPs, the exhausted effectiveness principle implies that more innovative interventions are needed to put into practice. The latter is in response to the fact that households will still be classified below the poverty or eligibility threshold when the length of exposure and the effectiveness are exhausted.

The exhausted effectiveness principle also implies that there is definite need for more monitoring and evaluation in the implementation of SAPs. Impact evaluations so far have reported which interventions actually work in the aim of reducing poverty. Banerjee, and Duflo (2011) have studied several interventions within what they consider an evidence-based development approach. The findings of this thesis suggest that policy makers are bound to commit with the generation of more reliable data to assess the extent to which these successful interventions work over the length of exposure. Since this thesis has been based on observational data with non-experimental methods, randomised controlled trials need to extend their scope beyond a binary random assignment of SAP beneficiaries to control and treatment groups. The assessment of the continuous treatment effects of the length of exposure also needs experimental data, in the sense that the random assignment should also be applied to the duration of the benefits in order to find more credible results.

The non-recurrence of poverty principle has several practical applications. Firstly, it points out the acknowledgement that antipoverty policy is not limited to the facilitation of a social minimum determined by poverty or eligibility thresholds. This principle implies that further participation is needed when SAP beneficiaries leave poverty at some (still effective) length

of exposure. It also implies that more budgetary studies need to be done in order to allow a longer length of duration of programmes for non-eligible participants. In practice, policy makers might expect that the spending on the implementation of a SAP will be limited by the expected duration of poverty or eligibility status. The non-recurrence of poverty principle modifies such expectations towards the incorporation of additional tax-funding to cover the participation of non-poor individuals or households. Another policy implication of this principle is that in some developing countries legal or institutional frameworks need to be adapted, as they can prevent SAPs to transfer income to individuals or households not entitled to receive them. The latter includes social and political costs, since the opposition to SAPs can increase as they transfer income to non-poor households.

Finally, the policy implications of this thesis have been extracted from the implementation of CCTs. The external validity does not focus on the replicability of these findings in similar interventions. Instead, the general external validity of this thesis relies on the conceptualisation of the exit conditions that have been considered consistent with the observed implementation of SAPs in developing countries. As any SAP in a given developing countries generate and effect and face the poverty dynamics of it beneficiaries, such conceptualization is adaptable not only to CCTs but to any programme aimed at alleviating poverty. Each programme will need to generate its own evidence based on the exit condition principles that have been developed in this thesis.

VI-4. Future research suggestions

This thesis has opened a new field of research. As it was shown in Chapter I (introduction), very little research has been done on the exit conditions of beneficiaries from SAPs in developing countries. This thesis has provided an analytical and empirical framework that has been focused on CCT programmes. Further empirical analysis is needed for other types of antipoverty transfers within a similar application of exit condition principles. Some other perspectives might be taken into consideration in terms of a long run antipoverty strategy, such as the transfer from a given intervention with exhausted effectiveness into other complementary programmes. Complementary programmes can help households or individuals tackle poverty towards the achievement of a social minimum that determines poverty or eligibility. This thesis has just given the first step in the understanding of exit conditions from one single intervention, but further response is needed when poverty is persistent.

The findings in this thesis are subject to at least three limitations. First, the economic model developed in Chapter II and the *Sisben* data apply only to a CCT programme as it has

been designed and implemented in Colombia. As it was mentioned before, more evidence under the exhausted effectiveness and non-recurrence principle is needed to understand the exit conditions in other kind of interventions. Second, the empirical evidence employs econometric models based on a non-experimental method and on Markovian transition models. Better data is needed to analyse the exit conditions that cover other dimensions different from child human capital. Better information on incomes or expenditures would lead to the estimation vulnerability to poverty not only from the transition point of view but also from the perspectives of expected consumption or utility. Third, the non-recurrence of poverty principle was based on the binary classification of the population between eligible and ineligible participants. More research is needed in other types of exit from SAPs due to a change in the socioeconomic identification of their participants.

Future research should therefore also concentrate on the investigation of gradual phase out schemes. Instead of a binary in or out of the programme, another alternative could be the analysis of a continuous exit condition from antipoverty programmes in developing countries. In some OECD countries, tax credit schemes are phased out gradually as the individual income increases. The behavioural responses are considered as an exit rule, in the sense that labour participation remains unaffected (Saez 2002). Exit conditions from SAPs in low or middle income countries can be understood from the behavioural response of the phasing out of the transfers according to other dimensions (education, health, child labour, wellbeing, etc.). This thesis has shed light on how the transfers could be totally withdrawn, it is also a policy matter to decide if such withdrawal should be abrupt or gradual.

Finally, this thesis has highlighted the need to understand the exit conditions of beneficiaries form SAPs assuming that the budgetary conditions are unchanged. As an important amount of SAPs are funded within the framework of developing projects, the findings here raise the questions on how the cost-benefits and cost-effectiveness analyses can be modified. These analyses are sometime an important element in the policy decision making on which intervention offers the highest benefits and effects. On one hand, the cost-benefit analysis should eventually incorporate the implications of transferring income to non-eligible participants in the medium run as the non-recurrence of poverty principle indicates. On the other, a cost-effectiveness analysis can also be studied from the point of view of a time-varying effectiveness. The time frame of the project can be modified by the length of exposure of beneficiaries to the intervention. The latter may respond differently among several SAP choices.

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