Rural credit and the time allocation of agricultural households: the case of Pronaf in Brazil

Regis A. Ely[a], Rafael Parfitt[a], André Carraro[a], Felipe Garcia Ribeiro[a]

[a]*Department of Economics, Federal University of Pelotas, CEP 96010-610, Pelotas, RS, Brazil*

Área ANPEC 11 - Economia Agrícola e do Meio Ambiente

Abstract

This paper evaluates the impact of the Brazil's National Program for the Strengthening of Family Farming (Pronaf) on the time allocation of members inside the households. We use data from the 2014 Pesquisa Nacional por Amostra de Domicílios (PNAD) and we apply methods for propensity score using complex surveys recently recommended in the literature. We find that Pronaf helps to increase productivity through an increased focus in the agricultural activities, but it also stimulates female partners to engage in unpaid work. The results show significant effects of Pronaf on child labor and on the gender-specific division of labor inside the households, while it does not have the usual adverse effects of microcredit programs on school enrollment.

Keywords: Time allocation, Rural credit, Household economics.
JEL classification: Q12, J22, D13.

Resumo

Este artigo avalia o impacto do Programa Nacional de Fortalecimento da Agricultura Familiar (Pronaf) na alocação de tempo dos indivíduos do domicílio. Foram utilizados dados da Pesquisa Nacional por Amostra de Domicílios (PNAD) de 2014 e métodos de escore de propensão para amostras complexas recentemente recomendados pela literatura. Os resultados demonstram que o Pronaf melhora a produtividade dos trabalhadores através do aumento da jornada de trabalho nas atividades agrícolas, porém estimula os cônjuges mulheres a exercerem atividade não remunerada. Também foram encontrados efeitos adversos do Pronaf no trabalho infantil e na divisão de trabalho de gênero, embora não há efeitos negativos na frequência escolar.

Palavras-chave: Alocação de tempo, Crédito rural, Economia domiciliar.
Classificação JEL: Q12, J22, D13.

---

*Corresponding author: Regis A. Ely.
E-mail addresses: regisaely@gmail.com (Regis A. Ely), rafael_parfitt@hotmail.com (Rafael Parfitt), andre.carraro@gmail.com (André Carraro), felipe.garcia.rs@gmail.com (Felipe Garcia Ribeiro)

1. Introduction

Rural households in developing countries are usually affected by credit constraints due to lack of information, less tangible assets to pledge as collateral, contract enforcement problems, as well as the poor financial development of these countries. The existence of specific lines of credit targeted to family agriculture helps to provide financial services, such as loans, that allow households to take advantage of productive opportunities. Since the households' members have heterogeneous preferences, the allocation of time in productive and leisure activities as a response to the contracting of a loan may change between men, women and children inside the household. The possibility of accessing new technologies by increasing their funding capacity may have welfare consequences for the household's gendered division of labor, as pointed out by Haile et al. (2012).

Although there are evidences in the literature that microfinancing institutions can help to raise income and consumption levels of households, reduce income inequality and enhance welfare, - such as Mahjabeen (2008) for Bangladesh and Li et al. (2011) for China - a recent randomized evaluation performed by Banerjee et al. (2015) in the slums of Hyderabad in India suggested that households which received loans invested more in their existing businesses, but there were no changes in any of the development outcomes that are often believed to be affected by microfinance, including health, education, and women's empowerment. At the same time, the household's access to microcredit may have unintended consequences such as an increase in child labor, as reported by Hazarika and Sarangi (2008) in rural Malawi, which may serve as a channel through which rural households reduce their demand for their children's schooling, as reported by Maldonado and González-Vega (2008) in Bolivia.

Rural credit from microfinancing institutions is specially important in countries where the rural population faces tighter credit due to lack of access to the formal banking system. The supply of rural credit for family farming in Brazil has traditionally been restrained due to the collusive structure of the banking system and the substantial presence of large landholdings in rural areas (Maia et al., 2016). These factors are responsible for the existence of market failures which justify the formulation of public policies for family farming in Brazil. In the last two decades, rural credit programs financed more than 50 billion dollars in around 27 million contracts for different types of farmers in Brazil. In 2014, the agribusiness sector, including production agriculture and processing and distribution, accounted for 21 percent of Brazil's GDP (Vendemiatti Junior and Clerk, 2016). The magnitude of this public policy and the importance of agricultural production in Brazil's GDP makes it one the most important countries to study the effects of rural credit on the time allocation of members inside the households.

In this paper we evaluate the impact of the most widely disseminated rural development policy in Brazil which is characterized by funding family farming through low interest rates: the National Program for the Strengthening of Family Farming (Pronaf). We are interested in studying whether the households benefited from Pronaf change their decisions of time allocation between their members, an evaluation that has not been done in the literature until now. We are able to identify the beneficiaries of Pronaf through data from the 2014 Pesquisa Nacional por Amostra de Domicílios (PNAD), which is held by Instituto Brasileiro de Geografia e Estatística (IBGE), and we estimate the effect of receiving credit from Pronaf by applying methods of propensity score using complex surveys recently suggested in the literature (DuGoff et al., 2014; Austin et al., 2016). Such evidences may help to answer the following questions: i) Do couples tend to increase focus in the main productive activity once they receive funding?; ii) Does microfinancing have an impact on women's insertion in the labor market and the gendered division of labor?; iii) What are the undesirable effects of such policies in terms of child labor and school attendance?

Our results show that Pronaf helps to increase productivity through an increased focus in the agricultural activities, but it also stimulates female partners and female adolescents to engage in unpaid work. We show strong evidence that female partners and their children are helping the male heads

of family in the agricultural activity while other female members of the family are left to perform domestic tasks. This implies that Pronaf enhances a division of labor based on the gender and the role of the person in the family and it may have negative effects in terms of child labor. However, we did not find evidence of an adverse effect of Pronaf on school enrollment.

The structure of the paper is as follows. In section 2 we present a brief theoretical and empirical literature review about the impact of rural microcredit on welfare and time allocation. In section 3 we describe the functioning of Brazil's National Program for the Strengthening of Family Farming (Pronaf). In section 4 we point out the data we used and the econometric methods we applied in this paper. In section 5 we present and discuss the results. In section 6 we perform some robustness regressions and sensitivity analysis to further investigate our results. Finally, in section 7 we make our final remarks about this study.

2. Brief literature review

The economic approach traditionally analyzes the problem of allocating family's resources as a problem of maximizing an homogeneous unit, in which income and its distribution among family members are part of the same set of preferences (unitary model). In the common case of a family where its members have the same preferences and the resource allocation is solved through a central planner, the final allocation follows the solution of a utility maximization problem with family members dedicating their time to activities with the best comparative advantage (Becker, 1965, 2009).

The problem of time allocation becomes more interesting when some of the usual assumptions are relaxed. Traditional models analyze income as the sum of the incomes of family members, and a marginal change in the income of a family member has the same effect on the labor supply of a change in the income of other members. In the words of Gary Becker: "Members who are relatively more efficient at market activities would use less of their time at household activities than would other members" (Becker, 1965).

New models that relax these hypothesis became known as bargain models (Udry, 1994; Haddad et al., 1997; Cuesta, 2004). Within the bargain models approach, interaction between family members can have elements of cooperation and conflict at the same time. Cooperation is maintained as long as the gains of family members are greater than in the case of conflict. However, under the assumption of heterogeneous preferences for each family member, the results depend on the relative bargaining power of each member (Agarwal, 1997).

One of the main applications of bargain models is the study of time allocation of married couples and their children. In the case of family farmers, the optimal decision of a household may be influenced by the supply of credit available, since it changes relative prices and affects the marginal income of labor, which reflects the opportunity costs of leisure. The recent expansion of microcredit programs for rural workers may have various positive or negative social outcomes in terms of the optimal decision of time allocation inside the households.

Microfinance is seen as a key development tool and one of the most widespread assistance programs, which include services such as microcredit, microsavings, microinsurance, and cash transfers. These programs enable microentrepreneurs to build businesses and increase their income, as well as reduce poverty in developing countries. By providing financial services through lines of credit targeted to the poor, microfinance programs enhance the capability of the beneficiaries to invest, save and acquire productive assets and human capital, which may improve other non-financial outcomes, such as health, food-security, nutrition, education, women's empowerment, housing, job creation, and social cohesion (Van Rooyen et al., 2012).

Rural credit is one of the main avenues for microcredit policies. In the literature on economic development, there are a number of studies dedicated to assess the effects of rural development policies on indicators of productivity and welfare of beneficiaries. Such as Khandker and Faruqee (2003),

who used a sample of 217 villages and 4380 families in Pakistan to find, through the method of instrumental variables, that rural credit contributed to increasing domestic welfare and its impact is greater for small landholders than for large ones. They also found that women's working hours are more affected by rural credit than men's. Also, Mazumder and Lu (2015) found that microfinance appears to increase basic rights and improve rural livelihood in Bangladesh, while the positive changes are consistently higher in non-governmental microfinance recipients.

The literature have also questioned some of these positive impacts. Banerjee et al. (2015) have found no significant changes in health, education and women's empowerment from a randomized evaluation of a group lending microcredit program in Hyderabad, India. Islam and Choe (2013) have found evidence of an increase in child labor and a decrease in school enrollment for a microcredit program in rural Bangladesh. More specifically, the authors used a sample of 2034 families with children with 7 to 16 years old and found that the girls' education are negatively affected if the father or mother received microcredit. This adverse effects are more pronounced in poorer and less educated households, while girls are more affected than boys, and younger children are more affected than older ones.

In addition, part of the literature on microcredit has studied its impact on the time and labor allocation within the household. Swaminathan et al. (2010) examined the influence of formal and informal access to credit by men and women in Malawi through the use of instrumental variables and found that formal credit programs that intended to target women for self-employment are indeed engaging women in such activities. At the same time, Shimamura and Lastarria-Cornhiel (2010) reveal that, when working adults become more involved in income-generating activities financed by credit, young female children in Malawi may be exploited as child labor either at home or in the field, since credit uptake decreased school attendance.

Pronaf is the main rural development program in Brazil, and while there are some works that measured the effect of Pronaf on productivity and consumption, there is no empirical evidence of its effects on the time allocation within the households. The lack of substantial empirical evidence is due to the fact that Pronaf did not undergo any experimental evaluation phase, and as Castro et al. (2014) pointed out, the objectives of Pronaf are not easily matched with quantitative variables.

Through the use of data from the Brazilian Agricultural Census, Garcia et al. (2016) evaluated the effects of the interaction between Pronaf and Bolsa Família[1] on land productivity, income per family worker and child labor in municipalities with higher incidence of agrarian establishments benefited from the programs. The authors found evidence of positive synergy effects between the two programs on land productivity and income per household worker in the establishments. However, attention is drawn to the evidence that Pronaf is at least positively correlated with child labor in agricultural establishments, a clearly undesirable outcome.

Maia et al. (2016), using the Brazilian Agricultural Census and propensity score matching models, found that individuals who had access to Pronaf had a positive and significant net increase on the production of about 18%. The authors also found significant heterogeneous effects from different regions of the country.

Although the evidences regarding the impact of Pronaf on rural households have found positive effects on productivity, it also raised concerns about the correlation between the program and the presence of child labor in agricultural establishments. In this paper we propose to answer such questions by studying whether the households benefited from Pronaf change their decisions of time allocation between their members. We also address methodological issues present in the estimation of propensity score models with complex surveys by using econometric methods recently suggested by the specialized literature.

[1]Bolsa Familia was created in 2003 and it is the largest social development program in Brazil and one of the largest in the world. Its objective is to promote assistance to families in extreme poverty through conditional cash transfers.

3. The National Program for the Strengthening of Family Farming

The supply of rural credit for family farming in Brazil until the 1990s was reduced due to the substantial presence of large landholdings in rural areas, which competed in the credit market with small producers, as pointed out by Castro et al. (2014). Credit access to small producers began to increase in 1995 with the creation of the National Program for the Strengthening of Family Farming (Pronaf). The program targets family farmers and settlers of the agrarian reform, and the funding can be used for the agroindustrial activity, the costing of the crop or for the investment in machinery, equipment or infrastructure.

Pronaf aims to stimulate income generation and enhance the use of family labor in rural establishments or nearby community areas. In the year 2017, to be eligible for receiving credit from Pronaf, the farmers must meet the following requirements: the annual gross income of the farmer should be less than R$ 360 thousand; the number of permanent employees should be less than the number of persons in the family; the family must reside near the productive establishment; and the size of the rural property must not exceed four fiscal modules, which varies across municipalities and corresponds to the minimum area required for a rural property to be economically viable. There is also a specific line of credit targeted to low income families (Pronaf Group B), which attends farmers with annual income less than R$ 20 thousand.

Pronaf was initially established by the Resolution nº 2191 from the Central Bank of Brazil, issued in August 1995, and later on reformulated by Presidential Decree nº 1946 from June 1996. In the initial year of operation, a total of R$ 650 million[2] were financed, while in 2015/2016 around R$ 29 billion were made available in almost 2 million different contracts (MDA, 2015). The Ministry of Agrarian Development (MDA) estimates that around 40% of Brazilian family farmers are attended by the program, while Pronaf is present in 97% of the municipalities of Brazil. Over time, the program has been modified to include different credit lines and to attend distinct profiles of rural families. There is specific lines of credit for women, for young people, for logging activities, and for funding and marketing of family agroindustries. Based on data from MDA, of the total volume of contracts, 48% was located in the southern region of the country, followed by 22% in the southeast region and 14% in the northeast region. The average value financed in contracts signed by women was R$ 7,432.35, while in contracts signed by men was R$ 15,157.97.

Low interest rates constitute one of Pronaf's main characteristics and it is central to the program's approach to strengthen family farming and to allow farmers with lower income to be able to access credit. Interest rates vary according to the use of the credit and the amount financed. Over time interest rates have been reduced. In 2015, the effective annual interest rate of credit for production costs was 2.5% for values up to R$10,000.00, 4.5% for values from R$10,000.00 to R$30,000.00, and 5.5% for values from R$30,000.00 to R$100,000.00. Since the inflation rate in 2015 was 10.67% in Brazil (measured by IPCA), this financial contracts had negative real interest rates. The average public financing interest rate for the agricultural sector in the 2014/2015 crop was 6.5% per year, while in private institutions were 14.6% per year (BC, 2017).

4. Data and Method

We evaluate the effect of receiving Pronaf on the time allocation of the members of the household using data from the 2014 Pesquisa Nacional por Amostra de Domicílios (PNAD), which is a national representative cross-section household complex survey held by Instituto Brasileiro de Geografia e Estatística (IBGE) that gathers information on demographic and socio-economic characteristics of

[2]This value represents R$ 2.7 billion in prices of January 2016, adjusted by IPCA (Índice Preços ao Consumidor Amplo), the inflation index officially used by the Brazilian Government.

all members of the households sampled. In the year 2014, this survey included a supplement about productive inclusion programs such as Pronaf.

Our initial sample includes 21,952 individuals who are in households that have at least one member which: i) is self-employed or employer with at most five permanent employees in agricultural activities; ii) either received credit from Pronaf or did not receive credit from other programs. There are a total of 6,381 households and 6,742 families who meet these criteria. We selected this particular sample based on data availability, since the question about Pronaf was answered by agricultural producers with at most five permanent employees - which may characterize family farming. Table 1 summarizes the characteristics of our sample, including the number of individuals in each role in the family (head of family, partner, child and other member).

Table 1: Caracterization of the sample

	Total	Men	Women
	Total Sample		
Nº of observations	21,952	11,792	10,160
Pronaf in household	1,930	1,035	895
Pronaf in household (perc.)	0.088	0.088	0.088
	Heads of family		
Nº of observations	6,723	5,390	1,333
Pronaf in household	625	552	73
Pronaf in household (perc.)	0.093	0.102	0.055
	Partners		
Nº of observations	5,365	736	4,629
Pronaf in household	538	47	491
Pronaf in household (perc.)	0.100	0.064	0.106
	Children (< 10)		
Nº of observations	2,554	1,315	1,239
Pronaf in household	181	95	86
Pronaf in household (perc.)	0.071	0.072	0.069
	Children (10 to 17)		
Nº of observations	2,993	1,637	1,356
Pronaf in household	233	125	108
Pronaf in household (perc.)	0.078	0.076	0.080
	Others (≥ 18)		
Nº of observations	3,537	2,273	1,264
Pronaf in household	322	199	123
Pronaf in household (perc.)	0.091	0.088	0.097
	Others (< 18)		
Nº of observations	780	441	339
Pronaf in household	31	17	14
Pronaf in household (perc.)	0.040	0.039	0.041

Note: Our initial sample corresponds to 21,952 individuals who are in households that have at least one member which: i) is self-employed or employer with at most five permanent employees in agricultural activities; ii) either received credit from Pronaf or did not receive credit from other programs.

We can see that around 8.8% of the total individuals of our sample are in households in which someone received credit from Pronaf. Most heads of family are men while there is an almost equal percentage of men and women amongst the children. The other members of the family with 18 years or more include sons, daughters and other relatives, while the other members with less than 18 years

are not children of the head of the family.

In our regressions, the treatment variable is a dummy that indicates if someone in the household received credit from Pronaf, while the dependent variables are related to the probability of work, hours of work, domestic labor and school attendance. We also include many control variables for individual, household, demographic and production characteristics, as well as dummies for different family structures. Table 2 presents a full description of the variables used in our econometric models.

Table 2: Description of the variables

Variables	Description
	Treatment Variable
Pronaf at household	1 if someone in the household received credit from Pronaf, 0 if no one received credit from any program.
	Dependent Variables
Probability of working	1 if working at the moment, 0 otherwise.
Probability of rural activity	1 if working in rural activity, 0 otherwise.
Probability of paid work	1 if the work is paid, 0 otherwise.
Probability of unpaid work	1 if the work is unpaid, 0 otherwise.
Probability of work for own consumption	1 if the work is for own consumption, 0 otherwise.
Probability of more than one job	1 if working in more than one job, 0 otherwise.
Hours of work in main job	Logarithm of the weekly hours worked in main job.
Hours of work in all jobs	Logarithm of the weekly hours worked in all jobs.
Probability of domestic labor	1 if performs household tasks, 0 otherwise.
Hours of domestic labor	Logarithm of the weekly hours of domestic labor.
School attendance	1 if child goes to school, 0 otherwise
	Covariates
White	1 if individual is white or yellow, 0 if black, mulatto or indigenous.
Age	Age of the individual in years.
Years of study	Number of years of study.
Size of the family	Number of members of the family.
Nº of families in the household	Number of families that lives inside the household.
Couple without children	1 if the couple has no children, 0 otherwise.
Couple with children under 14 years	1 if all children from the couple are younger than 14 years, 0 otherwise.
Couple with children over 14 years	1 if all children from the couple are older than 14 years, 0 otherwise.
Single mother with children	1 if the head of family is a single mother with children, 0 otherwise.
Other families	1 if for other types of families, 0 otherwise.
Literacy of the head of household	1 if the head of the household is literate, 0 otherwise.
Year of study of the head of household	Number of years of study of the head of the household.
Nº of bedrooms	Number of bedrooms inside the household.
Nº of bathrooms	Number of bathrooms inside the household.
Owner of the land	1 if someone in the household is the owner of the land, 0 otherwise.
Have permanent employees	1 if the household has at least one permanent employee, 0 otherwise.
Urban area	1 if the household is at an urban area, 0 if it is at a rural area.
Born in the state of residence	1 if the individual was born in the state of residence, 0 otherwise.
UF	Dummies for each of the 27 Federation Units in Brazil, with 1 in the state of residence of the individual.

Since PNAD is a cross-section complex survey, in order to perform a proper identification of the impact of Pronaf, we apply propensity score methods using complex survey weights. The propensity score is the probability of treatment assignment conditional on observed baseline characteristics. It allows one to design and analyze an observational (nonrandomized) study so that it mimics some of the particular characteristics of a randomized controlled trial. Conditional on the propensity score, the distribution of observed baseline covariates will be similar between treated and untreated subjects. In general, this method allows to compare two individuals, one in control group and another in

the treatment group, with very similar observable characteristics, such that the only factor that will differentiate them will be the participation on the treatment.

There are four previous papers, as far as we know, that addressed methodological issues in the use of propensity score methods with complex surveys: Zanutto (2006), DuGoff et al. (2014), Ridgeway et al. (2015) and Austin et al. (2016). According to DuGoff et al. (2014), combining a propensity score method and survey weighting is necessary to achieve unbiased treatment effect estimates that are generalizable to the original survey target population. In their study, they perform monte carlo simulations where the minimum absolute bias on the estimation of the average treatment effect on the treated were obtained when they used propensity score weighting with the weights from the propensity score multiplied by the survey weights. In a recent study, Austin et al. (2016) criticized the limitation of the monte carlo simulation of DuGoff et al. (2014). They simulated a more complex design, recommending that when using propensity score matching with complex surveys the matched control subjects should retain their complex sampling weights.

In this paper we estimate three models for every dependent variable. The first model is a linear regression with complex survey weights (Survey-OLS). The second model is a propensity score weighting using both weights from the logistic regression and from the complex survey (Survey-PSW). In order to estimate this model we first run a logistic regression using the survey weights and then we run a linear regression using the weights from the logistic regression multiplied by the survey weights. We use this method for the propensity score weighting based on the recommendations of DuGoff et al. (2014). The third model is a propensity score matching using the survey weights (Survey-PSM). In order to estimate this model we first run a nearest neighbour algorithm to match treated and control and then we run a linear regression using the survey weights. This method is based on the recommendations of Austin et al. (2016). We estimate these three models for different family structures and different groups of individuals according to their role in the family. We also split all the regressions by gender.

One of the limitations of propensity score methods is the possibility of hidden biases due to unobservable variables. In order to check the robustness of our results we perform a sensitivity analysis based on the Rosenbaum bounds (Rosenbaum, 2002), which focus on the hidden biases from unobservable variables and therefore the violation of the assumption of random assignment of treatment after matching through propensity scores. There is hidden bias when pairs look comparable in their observable characteristics but differ in their actual probability of receiving the treatment. For continuous variables such as the hours of work and domestic labor, we apply the Rosenbaum bounds to the Wilcoxon sign rank test, which is a non-parametric statistical hypothesis test used to check if the difference between the outcomes of treated and control groups are significant after the matching. To binary variables, such as the probability of working and the school attendance, we apply the Rosenbaum bounds to the McNemar's test, a commonly used statistical test to check if there are differences on a dichotomous dependent variable between two related groups.

Rosenbaum's sensitivity analysis relies on the parameter Γ, which measures the degree of departure from random assignment of treatment. The idea is that two subjects with the same observed characteristics may differ in the odds of receiving the treatment by at most a factor of Γ. In order to check for the robustness of the difference between means of the outcomes for the treated and the matched control groups, we calculate the Wilcoxon sign rank test p-values and McNemar's test p-values for different values of Γ and check how the test of the null hypothesis changes for increasing values of Γ. The result shows high sensitivity to hidden bias if the conclusion of the test changes for values of Γ just slightly higher than one, while it shows low sensitivity if the conclusions change only with large values of Γ. We use upper and lower bounds on the p-values of these tests in order to check how the conclusions of the test changes in the presence of bias due to unobserved confounders.

5. Results

In order to evaluate the impact of Pronaf on the time allocation of individuals inside the households we run several regressions including the three different models discussed in the last section (Survey-OLS, Survey-PSW and Survey-PSM) for every dependent variable presented in Table 2. We also estimate the regressions for different groups of individuals and family structures. In all tables of results we split the regressions by gender and we omit the control variable coefficients for space considerations.

Table 3 presents the impact of Pronaf for all male heads of family and all female partners in households that have at least one member which is self-employed or employer with at most five permanent employees in agricultural activities.

Table 3: Time allocation for male heads of family and female partners

	Male heads of family			Female partners		
Dependent variable:	Survey OLS	Survey PSW	Survey PSM	Survey OLS	Survey PSW	Survey PSM
	(1)	(2)	(3)	(4)	(5)	(6)
Prob. of working	0.015**	0.013*	0.024**	0.081***	0.076***	0.087***
	(0.007)	(0.008)	(0.010)	(0.022)	(0.022)	(0.028)
N	5,390	5,390	1,104	4,629	4,629	982
Prob. of rural activity	0.048***	0.065***	0.067***	0.108***	0.102***	0.114***
	(0.009)	(0.014)	(0.015)	(0.024)	(0.026)	(0.028)
N	5,390	5,390	1,104	4,629	4,629	982
Prob. of paid work	0.013	0.004	0.029**	−0.035	−0.035	−0.043
	(0.009)	(0.012)	(0.014)	(0.024)	(0.029)	(0.029)
N	5,390	5,390	1,104	4,629	4,629	982
Prob. of unpaid work	0.001	0.008	0.001	0.106***	0.114***	0.099***
	(0.004)	(0.008)	(0.005)	(0.026)	(0.028)	(0.028)
N	5,390	5,390	1,104	4,629	4,629	982
Prob. of work for own consumption	0.001	0.002	−0.007	0.010	−0.003	0.031
	(0.005)	(0.006)	(0.008)	(0.018)	(0.020)	(0.022)
N	5,390	5,390	1,104	4,629	4,629	982
Prob. of more than one job	−0.007	−0.010	−0.010	0.009	0.012	0.018
	(0.012)	(0.016)	(0.015)	(0.012)	(0.015)	(0.014)
N	5,192	5,192	1,084	3,084	3,084	770
Hours of work in main job	0.166***	0.171***	0.219***	0.341***	0.363***	0.334***
	(0.031)	(0.035)	(0.047)	(0.073)	(0.076)	(0.097)
N	5,390	5,390	1,104	4,629	4,629	982
Hours of work in all jobs	0.161***	0.168***	0.212***	0.349***	0.373***	0.345***
	(0.030)	(0.033)	(0.045)	(0.072)	(0.075)	(0.097)
N	5,390	5,390	1,104	4,629	4,629	982
Prob. of domestic labor	0.078***	0.063*	0.073**	−0.003	−0.009	−0.005
	(0.026)	(0.033)	(0.032)	(0.008)	(0.009)	(0.009)
N	5,390	5,390	1,104	4,629	4,629	982
Hours of domestic labor	0.115*	0.049	0.079	0.023	−0.038	0.018
	(0.060)	(0.066)	(0.074)	(0.037)	(0.047)	(0.044)
N	5,390	5,390	1,104	4,629	4,629	982

Note: This table contains the estimation of the effect of Pronaf on the time allocation of all males head of family and all females partners in the sample characterized in Table 1. Control variables were omitted for space considerations. Values in parentheses are the standard deviations of the coefficients. The symbols *, ** and *** represent significance of 10%, 5% and 1%, respectively.

In Table 1 we can see that there are few households that received credit from Pronaf in which the woman is the head of family or the man is the spouse/partner. For that reason we did not include those individuals in the regressions of Table 3. We can also see that there is a total of 5,390 male heads of family and 4,629 female partners in our sample, in which 552 males and 491 females are in households that received credit from Pronaf. Notice that the Survey-PSM model, in columns 3 and 6 of Table 3, matches each treated unit with one control unit, such that we will have 1,104 observations for male heads of family and 982 observations for female partners.

The results of Table 3 indicate that Pronaf has a positive impact on the probability of working of around 2.4 percentage points (pp) for men and 8.7 pp for women based on the Survey-PSM model. The probability of performing rural activities also increases in 6.7 pp for men and 11.4 pp for women. We considered three types of works in our regressions: paid word, unpaid work and work for own consumption. While male heads of family increase the probability of paid work in 2.9 pp, female partners increase the probability of unpaid work in almost 10 pp. Pronaf has a higher impact on the probability of working for female partners, but they tend to engage in unpaid works that are related with rural activities, which means they are probably helping the male heads of family in the main productive activity that was benefited by the credit from Pronaf, rather than entering the labor market independently.

Table 3 also shows an increase in the hours of work in the main job and in all jobs of around 23% for men and 39% for women. Notice that since our measure of hours of work is in logarithm and our independent variable is a dummy, the percentage variation in the hours of work due to receiving credit from Pronaf is obtained from $\exp(\beta) - 1$, where β is the estimated coefficient. Also, the percentage of increase in the hours of work is relative to the mean of all individuals in the sample, including the ones that were not employed (or performing zero hours of work) at the time of the survey.

These results show that Pronaf has a positive impact of increasing the focus on the main activity for both men and women, but the effects are heterogeneous. Not only women increase their working hours much more than men, but also their probability of working is higher than men. While men are inserted in the labor market, women are engaging in unpaid works, probably helping the husband in the agricultural activity.

Our findings are in line with the evidence that Pronaf increases productivity of land and labor, found by Garcias and Kassouf (2016), as well as the evidence that microcredit, in general, can increase labor participation and generate extra income, although, as discussed by Haile et al. (2012), this can help to perpetuate inequalities and reconfirm a gender-specific division of labor. The increased hours of work for both men and women also suggest that households which received loans invest more in their existing businesses, as found by Banerjee et al. (2015).

We did not find significant effects on the probability of more than one job and in the hours of domestic labor for both men and women, but there is a significant positive effect of around 7.3 pp on the probability of performing domestic labor by male heads of family. This positive effect may be a consequence of the female partners increasing their working hours and engaging in agricultural activities, raising the need for men to perform domestic tasks.

The balance tables for the control variables after the matching in the regressions of columns 3 and 6 of our Tables were omitted for space considerations, but there is no significant differences between the mean of the treated and control groups after the matching. The nearest neighbor algorithm perfectly balances the samples across the covariates.

Table 4 shows the impact that Pronaf has on children from 10 to 17 years old. As discussed in the literature review, the household's access to rural credit may increase child labor, as reported by Hazarika and Sarangi (2008) in rural Malawi and Islam and Choe (2013) in Bangladesh, which acts as a channel through which rural households reduce their demand for their children's schooling, as discussed by Maldonado and González-Vega (2008) in Bolivia. In the case of Pronaf, we see evidence of an increase in child labor for female adolescents, which is related to unpaid work in rural activities.

Table 4: Time allocation for children from 10 to 17 years

	Men			Women		
	Survey	Survey	Survey	Survey	Survey	Survey
Dependent variable:	OLS	PSW	PSM	OLS	PSW	PSM
	(1)	(2)	(3)	(4)	(5)	(6)
Prob. of working	0.081	0.088	0.033	0.099**	0.097	0.118**
	(0.050)	(0.057)	(0.056)	(0.050)	(0.066)	(0.054)
N	1,637	1,637	250	1,356	1,356	216
Prob. of rural activity	0.098*	0.129**	0.076	0.102**	0.121*	0.135***
	(0.051)	(0.055)	(0.055)	(0.048)	(0.065)	(0.050)
N	1,637	1,637	250	1,356	1,356	216
Prob. of paid work	−0.005	−0.013	0.002	0.001	−0.020	−0.016
	(0.021)	(0.021)	(0.024)	(0.025)	(0.028)	(0.036)
N	1,637	1,637	250	1,356	1,356	216
Prob. of unpaid work	0.079	0.074	0.026	0.105**	0.110*	0.132***
	(0.051)	(0.060)	(0.056)	(0.050)	(0.065)	(0.051)
N	1,637	1,637	250	1,356	1,356	216
Prob. of work for own consumption	0.008	0.027	0.005	−0.007	0.008	0.003
	(0.020)	(0.029)	(0.029)	(0.011)	(0.014)	(0.015)
N	1,637	1,637	250	1,356	1,356	216
Hours of work in main job	0.265*	0.271*	0.133	0.263*	0.291	0.335**
	(0.147)	(0.160)	(0.162)	(0.151)	(0.204)	(0.158)
N	1,637	1,637	250	1,356	1,356	216
Hours of work in all jobs	0.261*	0.256	0.117	0.261*	0.291	0.332**
	(0.148)	(0.160)	(0.165)	(0.151)	(0.204)	(0.158)
N	1,637	1,637	250	1,356	1,356	216
Prob. of domestic labor	0.001	−0.073	−0.048	0.034	0.021	0.008
	(0.055)	(0.072)	(0.061)	(0.033)	(0.035)	(0.038)
N	1,637	1,637	250	1,356	1,356	216
Hours of domestic labor	−0.079	−0.166	−0.152	0.141	0.104	0.037
	(0.105)	(0.136)	(0.123)	(0.099)	(0.127)	(0.118)
N	1,637	1,637	250	1,356	1,356	216
School attendance	−0.005	0.011	−0.012	−0.007	−0.017	−0.008
	(0.024)	(0.018)	(0.026)	(0.019)	(0.022)	(0.023)
N	1,637	1,637	250	1,356	1,356	216

Note: This table contains the estimation of the effect of Pronaf on the time allocation of all children from 10 to 17 years in the sample characterized in Table 1. Control variables were omitted for space considerations. Values in parentheses are the standard deviations of the coefficients. The symbols *, ** and *** represent significance of 10%, 5% and 1%, respectively.

The results show an increase of around 12 pp in the probability of working for female adolescents, while there is also an increase in almost the same magnitude in the probability of working in rural activities and unpaid jobs. This supports the conclusion that female adolescents are helping the head of the family in the agricultural activity that received credit from Pronaf. The program may have adverse effects in terms of child labor.

Policies that promote labor-intensive production, such as rural microcredit, may increase the substitution effect between child labor and school attendance, specially in developing countries in which rural production is the comparative advantage (Ravallion and Wodon, 2000). While there is evidence of a significant increase in the hours of work for female adolescents of more than 30%, there is no significant negative effects on school attendance. In rural areas of developing countries, the demand for schooling may also be influenced by many other determinants of human capital such as

health and nutrition, productivity gains and income transfers programs. The latter is very present in Brazil, and is found to have significant positive effects on school attendance (Bourguignon et al., 2003; Portela Souza and Cardoso, 2004; Cacciamali et al., 2010), which may help to mitigate some adverse effects of microfinancing programs in child's education.

We have found no significant adverse effects of Pronaf on male adolescents. Since Table 4 considers all types of families, we further investigate the impact of Pronaf on different family structures and found evidence of male child labor in certain types of families. We discuss these results on section 6.

Table 5 shows the impact of Pronaf on other members of the family, which include sons, daughters and other relatives with 18 years or more. We see a significant positive effect on the probability of domestic labor and in the hours of domestic labor for women. Credit from Pronaf increases by 13 pp the probability of other adult female members of the family perform domestic labor. The hours spent in domestic tasks are also increased in around 58% ($\exp(\beta) - 1$). There is also evidence of an increase in the probability of rural activities and unpaid work for other female members.

Table 5: Time allocation for other members of the family with 18 years or more

	Men			Women		
	Survey	Survey	Survey	Survey	Survey	Survey
Dependent variable:	OLS	PSW	PSM	OLS	PSW	PSM
	(1)	(2)	(3)	(4)	(5)	(6)
Prob. of working	0.041	0.016	0.031	−0.022	0.021	0.001
	(0.026)	(0.027)	(0.028)	(0.045)	(0.052)	(0.055)
N	2,273	2,273	398	1,264	1,264	246
Prob. of rural activity	0.133***	0.139***	0.072	0.005	0.051	0.093**
	(0.041)	(0.049)	(0.046)	(0.032)	(0.042)	(0.043)
N	2,273	2,273	398	1,264	1,264	246
Prob. of paid work	−0.053	−0.063	−0.033	−0.039	−0.038	−0.071
	(0.046)	(0.060)	(0.055)	(0.043)	(0.047)	(0.049)
N	2,273	2,273	398	1,264	1,264	246
Prob. of unpaid work	0.095**	0.088	0.054	0.043	0.077*	0.081*
	(0.048)	(0.055)	(0.055)	(0.032)	(0.043)	(0.042)
N	2,273	2,273	398	1,264	1,264	246
Prob. of work for own consumption	−0.001	−0.009	0.010	−0.026	−0.019	−0.009
	(0.014)	(0.013)	(0.016)	(0.018)	(0.024)	(0.025)
N	2,273	2,273	398	1,264	1,264	246
Hours of work in main job	0.208**	0.141	0.161	0.034	0.214	0.108
	(0.104)	(0.116)	(0.113)	(0.160)	(0.175)	(0.186)
N	2,273	2,273	398	1,264	1,264	246
Hours of work in all jobs	0.203*	0.125	0.145	0.049	0.212	0.116
	(0.105)	(0.116)	(0.113)	(0.162)	(0.176)	(0.185)
N	2,273	2,273	398	1,264	1,264	246
Prob. of domestic labor	0.062	0.024	0.065	0.037	0.045	0.131***
	(0.039)	(0.050)	(0.050)	(0.041)	(0.046)	(0.044)
N	2,273	2,273	398	1,264	1,264	246
Hours of domestic labor	0.144	0.019	0.164	0.126	0.189	0.462***
	(0.089)	(0.107)	(0.108)	(0.134)	(0.147)	(0.151)
N	2,273	2,273	398	1,264	1,264	246

Note: This table contains the estimation of the effect of Pronaf on the time allocation of all members of the family with 18 years or more (which are not the head of family or the partner) in the sample characterized in Table 1. Control variables were omitted for space considerations. Values in parentheses are the standard deviations of the coefficients. The symbols *, ** and *** represent significance of 10%, 5% and 1%, respectively.

These results indicate that while female partners and female adolescents help the head of family in the main agricultural activity, other adult female members of the family increase substantially the hours spent in domestic tasks. This implies a division of labor based on the gender and the role of the person in the family.

In general, our results indicate that Pronaf has significant effects on the time allocation and the gender-specific division of labor inside the households, what may bring some negative consequences in terms of women empowerment. We also found adverse effects of Pronaf in terms of female child labor. However, the program helps to increase productivity through an increased focus in the main activities while not having the usual adverse effects of microcredit programs on school enrollment. In the next section we discuss the evidences for different family structures and the sensitive analysis based on the Rosenbaum bounds.

6. Family structures and sensitivity analysis

We also performed regressions for specific types of family structures in order to check in more detail the impact of Pronaf on the time allocation of the members of the family. We considered married couples with and without children where the man is the head of the family. Table 6 shows the impact of Pronaf on couples with children from 10 to 17 years in which the man is the head of family.

When we look at this specific family structure, we also find significant effect of Pronaf on the hours of work for couples and in the probability of paid work for men, while women are engaging in unpaid work. Although the magnitude of the coefficients are similar than in the case of all types of family structures, reported in Table 3, in this case we also find a decrease in paid work for women of around 10 pp, which supports the fact that they are leaving paid jobs to help the male head of the family in the main productive activity.

Table 7 shows the effect of Pronaf only on the children of married couples where the man is the head of the family. In this case, we found not only an increase in the hours of work and in the probability of working for female adolescents, but also for male adolescents.

While the impact of Pronaf on female adolescents for married couples are similar than in the case of all types of family structures, the probability of male adolescents performing rural activities and engaging in unpaid works increase in 19.7 pp and 14 pp, respectively. This result may reflect the fact that male children from single mothers and other types of family where the head of family performs agricultural activities are already working and assisting their parents. We can see that, once we estimate the regression only for married couples, the adverse effect of Pronaf on male adolescents is even higher than female adolescents. Although in both cases school attendance is not negatively affected by Pronaf.

We also consider the impact of Pronaf on couples with children younger than 10 years, older than 17 years or without children in Table 8. The results are also similar with the ones we have obtained for other types of family. Female partners are increasing their probability of performing unpaid works in around 8.7 pp. Both men and women are engaging in rural activities and increasing their hours of work. As a consequence of the insertion of women in the labor market, men are also increasing their probability of performing domestic tasks in around 10 pp.

In general, when we look at different family structures, the results support the evidence that Pronaf increases the hours of work of couples and the probability of female partners engage in unpaid work and agricultural activities. But we also found evidence that not only female adolescents are performing child labor but also male adolescents in families with married couples. The balance tables for the control variables after the matching in Tables 6 to 8 were omitted for space considerations, but there is no significant differences between the mean of the treated and control groups after the matching.

Since both groups are balanced after the matching, we reduce the selection bias due to observable variables, but it is still possible to exist hidden biases from unobservable variables. In order to access

Table 6: Time allocation for couples with children from 10 to 17 years

	Male head of family			Female partner		
	Survey	Survey	Survey	Survey	Survey	Survey
Dependent variable:	OLS	PSW	PSM	OLS	PSW	PSM
	(1)	(2)	(3)	(4)	(5)	(6)
Prob. of working	0.016***	0.014**	0.013	0.100***	0.075**	0.070
	(0.005)	(0.007)	(0.009)	(0.034)	(0.036)	(0.044)
N	1,513	1,513	296	1,513	1,513	296
Prob. of rural activity	0.045***	0.046**	0.084***	0.141***	0.142***	0.076
	(0.016)	(0.020)	(0.028)	(0.040)	(0.048)	(0.052)
N	1,513	1,513	296	1,513	1,513	296
Prob. of paid work	0.028***	0.025***	0.030**	−0.098**	−0.130**	−0.106*
	(0.007)	(0.008)	(0.013)	(0.041)	(0.052)	(0.055)
N	1,513	1,513	296	1,513	1,513	296
Prob. of unpaid work	−0.005	−0.007	−0.010	0.193***	0.226***	0.172***
	(0.003)	(0.004)	(0.006)	(0.045)	(0.053)	(0.052)
N	1,513	1,513	296	1,513	1,513	296
Prob. of work for own consumption	−0.006**	−0.003	−0.007	0.005	−0.021	0.005
	(0.003)	(0.002)	(0.007)	(0.028)	(0.024)	(0.032)
N	1,513	1,513	296	1,513	1,513	296
Prob. of more than one job	0.033	−0.008	0.024	0.032	0.025	0.036
	(0.027)	(0.028)	(0.034)	(0.026)	(0.032)	(0.031)
N	1,486	1,486	296	1,100	1,100	252
Hours of work in main job	0.158***	0.184***	0.176***	0.405***	0.374***	0.335**
	(0.042)	(0.052)	(0.062)	(0.113)	(0.127)	(0.152)
N	1,513	1,513	296	1,513	1,513	296
Hours of work in all jobs	0.170***	0.180***	0.179***	0.425***	0.381***	0.359**
	(0.040)	(0.051)	(0.061)	(0.115)	(0.127)	(0.153)
N	1,513	1,513	296	1,513	1,513	296
Prob. of domestic labor	0.107**	0.045	0.133**	−0.006	−0.021	0.016
	(0.052)	(0.065)	(0.058)	(0.011)	(0.019)	(0.022)
N	1,513	1,513	296	1,513	1,513	296
Hours of domestic labor	0.167	0.014	0.237*	−0.045	−0.125	−0.002
	(0.117)	(0.137)	(0.126)	(0.060)	(0.084)	(0.086)
N	1,513	1,513	296	1,513	1,513	296

Note: This table contains the estimation of the effect of Pronaf on the time allocation of the males head of family and their female partners for couples in Table 1 with at least one children from 10 to 17 years. Control variables were omitted for space considerations. Values in parentheses are the standard deviations of the coefficients. The symbols *, ** and *** represent significance of 10%, 5% and 1%, respectively.

Table 7: Time allocation for children from 10 to 17 years of the couples in Table 6

	Men			Women		
Dependent variable:	Survey OLS	Survey PSW	Survey PSM	Survey OLS	Survey PSW	Survey PSM
	(1)	(2)	(3)	(4)	(5)	(6)
Prob. of working	0.075	0.077	0.179***	0.122**	0.104	0.138**
	(0.053)	(0.059)	(0.052)	(0.052)	(0.064)	(0.061)
N	1,299	1,299	212	1,052	1,052	196
Prob. of rural activity	0.103**	0.121**	0.197***	0.114**	0.127**	0.154***
	(0.052)	(0.055)	(0.053)	(0.052)	(0.064)	(0.056)
N	1,299	1,299	212	1,052	1,052	196
Prob. of paid work	−0.005	−0.005	0.008	0.013	−0.019	−0.004
	(0.023)	(0.022)	(0.027)	(0.027)	(0.031)	(0.035)
N	1,299	1,299	212	1,052	1,052	196
Prob. of unpaid work	0.086	0.076	0.140***	0.121**	0.127**	0.125**
	(0.053)	(0.060)	(0.053)	(0.054)	(0.063)	(0.056)
N	1,299	1,299	212	1,052	1,052	196
Prob. of work for own consumption	−0.005	0.007	0.031	−0.012	−0.004	0.017
	(0.020)	(0.031)	(0.023)	(0.010)	(0.012)	(0.011)
N	1,299	1,299	212	1,052	1,052	196
Hours of work in main job	0.261*	0.244	0.546***	0.331**	0.304	0.375**
	(0.154)	(0.162)	(0.156)	(0.157)	(0.202)	(0.190)
N	1,299	1,299	212	1,052	1,052	196
Hours of work in all jobs	0.259*	0.230	0.534***	0.330**	0.304	0.375**
	(0.155)	(0.162)	(0.157)	(0.157)	(0.201)	(0.190)
N	1,299	1,299	212	1,052	1,052	196
Prob. of domestic labor	0.009	−0.089	−0.076	0.045	0.030	0.081*
	(0.061)	(0.080)	(0.077)	(0.035)	(0.032)	(0.048)
N	1,299	1,299	212	1,052	1,052	196
Hours of domestic labor	−0.079	−0.204	−0.233	0.162	0.146	0.217
	(0.119)	(0.152)	(0.162)	(0.107)	(0.119)	(0.148)
N	1,299	1,299	212	1,052	1,052	196
School attendance	−0.019	−0.005	−0.035	−0.010	−0.015	0.018
	(0.027)	(0.020)	(0.024)	(0.021)	(0.025)	(0.028)
N	1,299	1,299	212	1,052	1,052	196

Note: This table contains the estimation of the effect of Pronaf on the time allocation of children from 10 to 17 years for couples in Table 1 with at least one children in this age range and in which the man is the head of the family. Control variables were omitted for space considerations. Values in parentheses are the standard deviations of the coefficients. The symbols *, ** and *** represent significance of 10%, 5% and 1%, respectively.

Table 8: Time allocation for other couples in the sample

	Male head of family			Female partner		
Dependent variable:	Survey OLS	Survey PSW	Survey PSM	Survey OLS	Survey PSW	Survey PSM
	(1)	(2)	(3)	(4)	(5)	(6)
Prob. of working	0.022***	0.021*	0.024*	0.076***	0.080***	0.077**
	(0.008)	(0.011)	(0.013)	(0.027)	(0.029)	(0.033)
N	3,103	3,103	684	3,103	3,103	684
Prob. of rural activity	0.058***	0.080***	0.063***	0.097***	0.093***	0.097***
	(0.013)	(0.021)	(0.020)	(0.030)	(0.033)	(0.035)
N	3,103	3,103	684	3,103	3,103	684
Prob. of paid work	0.014	−0.0003	0.007	−0.005	−0.006	−0.015
	(0.013)	(0.019)	(0.018)	(0.029)	(0.038)	(0.036)
N	3,103	3,103	684	3,103	3,103	684
Prob. of unpaid work	0.003	0.013	0.006	0.073**	0.078**	0.087**
	(0.006)	(0.013)	(0.010)	(0.028)	(0.036)	(0.035)
N	3,103	3,103	684	3,103	3,103	684
Prob. of work for own consumption	0.006	0.009	0.011	0.009	0.008	0.005
	(0.008)	(0.008)	(0.009)	(0.022)	(0.025)	(0.026)
N	3,103	3,103	684	3,103	3,103	684
Prob. of more than one job	−0.015	−0.006	−0.010	0.001	−0.002	−0.008
	(0.015)	(0.023)	(0.020)	(0.014)	(0.020)	(0.018)
N	2,972	2,972	672	1,974	1,974	516
Hours of work in main job	0.190***	0.190***	0.188***	0.328***	0.362***	0.387***
	(0.041)	(0.053)	(0.058)	(0.094)	(0.103)	(0.115)
N	3,103	3,103	684	3,103	3,103	684
Hours of work in all jobs	0.181***	0.190***	0.197***	0.332***	0.369***	0.386***
	(0.040)	(0.050)	(0.057)	(0.094)	(0.103)	(0.116)
N	3,103	3,103	684	3,103	3,103	684
Prob. of domestic labor	0.097***	0.100***	0.107***	−0.003	−0.004	−0.001
	(0.030)	(0.036)	(0.038)	(0.010)	(0.011)	(0.013)
N	3,103	3,103	684	3,103	3,103	684
Hours of domestic labor	0.147**	0.118	0.167*	0.046	0.005	0.022
	(0.069)	(0.082)	(0.091)	(0.045)	(0.058)	(0.055)
N	3,103	3,103	684	3,103	3,103	684

Note: This table contains the estimation of the effect of Pronaf on the time allocation of the males head of family and their female partners for couples in Table 1 without children from 10 to 17 years (this includes couples with children from other age ranges and without children). Control variables were omitted for space considerations. Values in parentheses are the standard deviations of the coefficients. The symbols *, ** and *** represent significance of 10%, 5% and 1%, respectively.

the existence of hidden biases we performed a sensitivity analysis for the Survey-PSM regressions through the Rosenbaum bounds for the Wilcoxon sign rank test and the McNeman's test, as discussed in section 4. The Wilcoxon sign rank test is applied to continuous variables, such as the hours of work and domestic labor, while the McNemar's test is applied to binary variables such as the probability of work and school attendance.

For space considerations, we have omitted the results of the Rosenbaum bounds, but we found that the sensitivity analysis supports the conclusions of a positive and significant effect of Pronaf on the hours of work for couples and the probability of female partners engaging in agricultural activities and unpaid works, as well as the adverse effect of child labor. Usually the results start to became sensitive to hidden bias when we use gammas higher than 1.2. The heterogeneity of households and the problem of self-selection are challenging for the evaluation of treatments in social programs. This is particularly the case for rural credit programs such as Pronaf, which have voluntary participation and heterogeneous outcomes. Econometric methods such as propensity score matching can help to overcome these problems but observational studies in social sciences are usually highly sensitive to hidden bias. For this reason, we used low increments in Γ to check robustness of the results when the odds of receiving treatment differ.

7. Final remarks

We have been discussing the effects of a rural credit program such as Pronaf on the time allocation of the members inside the households. We have applied recent methods of propensity score using complex surveys to perform estimations of the effect of this program in many variables related to the labor market, domestic labor and school attendance for male heads of family, female partners, children from 10 to 17 years and other members of the family. Pronaf has significant adverse effects on the gender-specific division of labor and on child labor, but it also increases the focus in the agricultural activity and it does not have a negative effect on school attendance.

The results of this paper contribute to the literature about the effects of rural credit programs on the time allocation of members inside the houlseholds by evaluating the most widely spread rural development policy in Brazil. We also report novel results that indicate the existence of an adverse effect of rural credit programs on woman's independence in the labor market. These evidences urge the need to increase the participation of women in credit-based income generation programs such as Pronaf in order to strengthen the economic role of women in the family.

References

Agarwal, B., 1997. "Bargaining" and Gender Relations: Within and Beyond the Household. Feminist economics 3 (1), 1–51.

Austin, P. C., Jembere, N., Chiu, M., 2016. Propensity score matching and complex surveys. Statistical Methods in Medical Research. *Forthcoming*.

Banerjee, A., Duflo, E., Glennerster, R., Kinnan, C., 2015. The miracle of microfinance? Evidence from a randomized evaluation. American Economic Journal: Applied Economics 7 (1), 22–53.

BC, 2017. FAQ - Programa Nacional de Fortalecimento da Agricultura Familiar (Pronaf). Tech. rep., Banco Central do Brasil.

Becker, G. S., 1965. A Theory of the Allocation of Time. The economic journal, 493–517.

Becker, G. S., 2009. A Treatise on the Family. Harvard university press.

Bourguignon, F., Ferreira, F. H., Leite, P. G., 2003. Conditional cash transfers, schooling, and child labor: Micro-simulating brazil's bolsa escola program. The World Bank Economic Review 17 (2), 229–254.

Cacciamali, M. C., Tatei, F., Batista, N. F., 08 2010. Impactos do Programa Bolsa Família federal sobre o trabalho infantil e a frequência escolar. Revista de Economia Contemporânea 14, 269 – 301.

Castro, C. N. d., Resende, G. M., Pires, M. J. d. S., 2014. Avaliação dos impactos regionais do Programa Nacional de Fortalecimento da Agricultura Familiar (PRONAF). In: Avaliação de Políticas Públicas no Brasil. Vol. 1. Guilherme Mendes Resende, pp. 253–306.

Cuesta, J., 2004. Social transfers as a determinant of intrahousehold distribution: The case of Chile (MPRA Paper 12410.

DuGoff, E. H., Schuler, M., Stuart, E. A., 2014. Generalizing observational study results: applying propensity score methods to complex surveys. Health services research 49 (1), 284–303.

Garcia, F., Helfand, S. M., Souza, A. P., 2016. Transferencias monetarias condicionadas y políticas de desarrollo rural en Brasil: posibles sinergias entre Bolsa Familia y el pronaf. Protección, producción, promoción: explorando sinergias entre protección social y fomento productivo rural en América Latina 1, 69 – 115.

Garcias, M. O., Kassouf, A. L., September 2016. Assessment of rural credit impact on land and labor productivity for brazilian family farmers. Nova Economia 26 (3), 721–746.

Haddad, L. J., Hoddinott, J., Alderman, H., 1997. Intrahousehold resource allocation in developing countries. Johns Hopkins University Press.

Haile, H. B., Bock, B., Folmer, H., 2012. Microfinance and female empowerment: Do institutions matter? Women's Studies International Forum 35 (4), 256 – 265.

Hazarika, G., Sarangi, S., 2008. Household access to microcredit and child work in rural Malawi. World Development 36 (5), 843–859.

Islam, A., Choe, C., 2013. Child labor and schooling responses to access to microcredit in rural bangladesh. Economic Inquiry 51 (1), 46–61.

Khandker, S. R., Faruqee, R. R., 2003. The impact of farm credit in Pakistan. Agricultural Economics 28 (3), 197–213.

Li, X., Gan, C., Hu, B., 2011. The welfare impact of microcredit on rural households in China. The Journal of Socio-Economics 40 (4), 404–411.

Mahjabeen, R., 2008. Microfinancing in bangladesh: Impact on households, consumption and welfare. Journal of Policy Modeling 30 (6), 1083 – 1092.

Maia, A. G., Eusebio, G. S., Silveira, R. L., 2016. Impact of microcredit on small-farm agricultural production: evidence from Brazil. In: 2016 Annual Meeting, July 31-August 2, 2016, Boston, Massachusetts. Agricultural and Applied Economics Association.

Maldonado, J. H., González-Vega, C., 2008. Impact of microfinance on schooling: Evidence from poor rural households in Bolivia. World Development 36 (11), 2440–2455.

Mazumder, M. S. U., Lu, W., 2015. What impact does microfinance have on rural livelihood? a comparison of governmental and non-governmental microfinance programs in bangladesh. World Development 68, 336 – 354.

MDA, 2015. Pronaf 20 anos - 1995-2015 - avanços e desafios. Tech. rep., Ministério de Desenvolvimento Agrário, Brasil.

Portela Souza, A., Cardoso, E., 2004. Impact of cash transfers on child labor and school attendance in brazil, the.

Ravallion, M., Wodon, Q., 2000. Does child labour displace schooling? evidence on behavioural responses to an enrollment subsidy. The Economic Journal 110 (462), 158–175.

Ridgeway, G., Kovalchik, S. A., Griffin, B. A., Kabeto, M. U., 2015. Propensity Score Analysis with Survey Weighted Data. Journal of Causal Inference 3 (2), 237–249.

Rosenbaum, P. R., 2002. Observational Studies. Springer New York, New York, NY, pp. 105–170.

Shimamura, Y., Lastarria-Cornhiel, S., 2010. Credit program participation and child schooling in rural malawi. World Development 38 (4), 567 – 580.

Swaminathan, H., Du Bois, R. S., Findeis, J. L., 2010. Impact of access to credit on labor allocation patterns in Malawi. World Development 38 (4), 555–566.

Udry, C., 1994. Risk and insurance in a rural credit market: An empirical investigation in northern Nigeria. The Review of Economic Studies 61 (3), 495–526.

Van Rooyen, C., Stewart, R., De Wet, T., 2012. The impact of microfinance in sub-Saharan Africa: a systematic review of the evidence. World Development 40 (11), 2249–2262.

Vendemiatti Junior, A., Clerk, M., 2016. Brazil agricultural economic fact sheet. Tech. rep., Global Agricultural Information Network.

Zanutto, E. L., 2006. A comparison of propensity score and linear regression analysis of complex survey data. Journal of data Science 4 (1), 67–91.