Incentives in Brazilian *Bolsa Família* CCT Program: Adverse selection, moral hazard, improving mechanisms and simulations*

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Abstract

The Bolsa Família Program (BFP) successfully contributed to poverty reduction in Brazil. This paper analyzes the incentives the program induces on agents, and identifies problems of adverse selection and moral hazard. Then, it proposes three theoretic mechanisms for its improvement. The Citizens' Contribution Mechanism requires beneficiaries to devote time to the BFP encouraging recipients with higher income to leave. The Graduation Mechanism offers financial incentives to ensure sustainable emancipation of qualified beneficiaries. The Human Capital Mechanism increases transfers to efficient municipalities. We show that these mechanisms help solving the problems of adverse selection and moral hazard of the beneficiaries and, a moral hazard problem of local managers. A simulation based on 2010 census data suggests the mechanisms could yield increases in the reach and precision of the BFP and cost reductions in the range of R\$4.6 billion (Brazilian currency) within six years of their implementation.

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1 Introduction

The Bolsa Família Program (BFP), acclaimed both nationally and internationally as a successful example of the fight against poverty and inequality in Brazil (Wetzel, 2013), celebrated its 10th anniversary in 2013. During this consolidating decade, dozens of studies were conducted, aimed at assessing its performance and outcomes. Most studies (Tapajós, Quiroga, Ritzi, & Taga, 2010; Barros, Carvalho, Franco, & Mendonça, 2007; Ipea, 2006; F. V. Soares, Ribas, & Osorio, 2007; S. Soares & Sátyro, 2009) corroborate the view that "the BFP alleviated poverty and inequality, promoted the inclusion of public policies for education and health, reduced food insecurity, and improved school attendance and the health of children and adolescents" (Campello, 2013, p.19).¹

On the negative side, studies also documented evidence of a decrease in the BFP recipients' labor supply (Teixeira, 2011; Pedrozo, 2010). Furthermore, the empirical analysis of the microdata of the 2010 Population Census in Souza et al. (2018) suggests that there is room for improvement in the focus of the program. The paper estimated that 50.5% of the eligible population in the country are not included in the program, which corresponds to type I error of the targeting. On the other hand, it estimated that almost 10% of ineligible population were enrolled in the program, the type II targeting error. Simulations suggested that if it were possible to transfer the resources used with ineligible beneficiaries (type II error) to the eligible non-beneficiaries (type I error), this would be enough to universalize the program among the eligible population.

However, in the current program design, this is not a trivial task due to the high risk of leakage, i.e., enrolling new noncompliant citizens while trying to increase the number of beneficiaries. In order to efficiently increase the reach of the BFP, we need a mechanism design analysis aimed at mitigating the problems arising from asymmetric information, inducing self-exclusion of the ineligible.

There is a paucity of studies (Oliveira & Soares, 2012) on the problems arising from the contract negotiated between the federal government and the program's beneficiaries, such as moral hazard and adverse selection. The existence of these problems may produce undesirable outcomes from a public policy standpoint, and a mechanism design analysis may suggest opportunities for improvement of the program.

The first aim of this study is to identify possible adverse incentives in the BFP

¹ See also Salm (2006); Foguel and Barros (2010); Oliveira and Soares (2012); Souza, Duarte, Neves, Oliveira, and Gadelha (2018); Garcia, Helfand, and Souza (2016); Chioda, Mello, and Soares (2016); F. G. Ribeiro, Shikida, and Hillbrecht (2017).

design. The second is to propose mechanisms that aim to reduce the presence of such adverse incentives. The third is to evaluate the cost and efficiency effect of the proposed mechanisms based on real census and program data. In order to achieve its goal, this paper draws on the economics of information and incentives and on applied mechanism design theory and is organized as follows.

Section 2 develops a decision theory model that highlights two major problems affecting the program's reach and precision. The first one is a moral hazard problem that arises because access to the program is granted when income is below the poverty line. Given that requirement, agents with less productive capacity, but who could still generate an income slightly above the poverty line, might be encouraged to reduce their workload in order to be able to apply for the program's benefits. The second in an adverse selection problem associated with the stochastic technology for checking the income of program's applicants. Indeed, on the one hand, there is a significant probability that income misreporting is not exposed; on the other hand, when it is exposed, the typical and only expected punishment is exclusion from the program. Therefore, even citizens with higher income will be encouraged to apply for the benefits.

Based on that assessment, section 3 proposes three adjustment mechanisms to the BFP design, aimed at reducing the moral hazard and adverse selection problems. The first proposal, named the Citizens' Contribution Mechanism (CCM), consists in requiring that beneficiaries devote time to the BFP. This provides a wide range of advantages to the program as a whole and to its recipients in particular and can be used to make the program more transformative.² More importantly, this requirement seeks to endogenously solve the adverse selection problem by inducing self-exclusion of beneficiaries with a high income. Due to their high productivity, a working hour of these agents generates income way above the BFP grant. Hence, when facing the decision between devoting their time to the program and dedicating it to their most productive task, these applicants will prefer to give up the grant in order to dedicate their time to the higher income generating activity.

The second mechanism, named the Graduation Mechanism (GM), is aimed at supporting beneficiaries who can demonstrate proof of ability to generate income. In that case, they will graduate from the PBF but will be assisted with a range of financial incentives for three years until they can strengthen their economic status as new members of the Brazilian middle class. In addition to creating a broad array of benefits both to the program and to the citizen

 $^{^2}$ In the sense discussed in Molyneux, Jones, and Samuels (2016).

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graduated from it, this essentially self-sustaining mechanism seeks to solve the moral hazard problem, as agents will no longer be interested in underworking in order to remain in the program; quite on the contrary, they will be keen on earning an increasingly higher income so as to be selected among the applicants to the GM's valuable benefits.

The third mechanism, named the Human Capital Incentive (HCI), consists of a 10% increase in the basic value transferred to municipalities via the Municipal Decentralized Management Index (IGD-M) transfer program, conditional on the efficient management of the CCM and the GM. The HCI mechanism provides incentives for the BFP local manager to dedicate effort and resources to preparing and qualifying beneficiaries in the best possible way, allowing them to succeed in the emancipation process initiated with the Graduation Mechanism, thereby cutting down on BFP costs and allowing larger transfers to the local manager.

Section 4 presents a carefully calibrated simulation of the fiscal impact and of the effect on the range and precision of the BFP when the proposed mechanisms are implemented, over a period of six years. We simulate three different scenarios, depending on the pace of implementation of the mechanisms and on the BFP manager's ability to select the beneficiary households belonging to the target population. The first, optimistic scenario assumes a quick implementation of the mechanisms and good selection capabilities for new vacancies and concludes that full reach would be attained within 5 years. Furthermore, precision would also improve, nearing 0.9 by the end of the six-year period. The second (conservative) and third (pessimistic) scenarios assume slower pace of implementation of the mechanisms and less efficient selection capabilities, but there would still be a steady and significant improvement both of the reach and the precision of the program.

Finally, section 5 concludes the paper.

2 Diagnostics: Information and incentives in the Bolsa Família Program

2.1 Reach and precision of a social program

Using the terminology of Anuatti Neto, Fernandes, and Pazello (2001) and Tavares, Pazello, Fernandes, and Camelo (2009), we define the *reach* of a social program to be its ability to include targeted agents,³ i.e. citizens presently living

 $^{^3}$ This is what Wodon (1997) defines as sensitivity based on the ROC (Relative Operating Characteristics) literature.

in poverty or in extreme poverty. The BFP's reach is $R = \Lambda_I - \Lambda_E$, where Λ_I denotes the percentage of agents below the poverty line who receive the grant and Λ_E corresponds to the percentage of agents below the poverty line who do not.

Note that $\Lambda_E = 1 - \Lambda_I$ and, therefore, $R = 2\Lambda_I - 1 \in [-1, 1]$. Thus, the closer to -1 this value is, the worse the program's reach will be. In the extreme case where R = -1, none of the agents targeted by the program receive the grant. Symmetrically, the closer to 1 the value is, the better the reach of the program will be. In the ideal case where R = 1, every targeted agent receives the grant.

Furthermore, the *precision* of a social program measures its ability to prevent non-targeted agents from becoming beneficiaries of that program, i.e. the citizens with income above the poverty line.⁴ The BFP precision is $P = \Pi_E - \Pi_I$, where Π_E denotes the percentage of agents above the poverty line who do not receive the grant whereas Π_I corresponds to the percentage of agents above the poverty line who wrongly receive the grant. Note that $P = 2\Pi_E - 1 \in [-1, 1]$.

2.2 Basic model for agents' time allocation without a cash transfer program

As a benchmark for future comparison, this subsection analyzes how agents allocate their time in a society without any cash transfer program. The main source of heterogeneity here lies in the fact that the ability to generate income is distinct among agents, as some are more productive than others.

The primitives of the model

There are three types of agents in society (i = 1, 2, 3): the least productive (type i = 1), the moderately productive (type i = 2), and the most productive (type i = 3). The number of agents of type i is N_i , for i = 1, 2, 3. Therefore, the total population is $N = N_1 + N_2 + N_3$ and the percentage of agents of type i is $n_i = N_i/(N_1 + N_2 + N_3)$, for i = 1, 2, 3. Each agent has a unit of time to allocate to work, which generates income and thus allows for utility-yielding private consumption.

Agents of type *i* generate income $s_i t$ if they allocate $t, 0 \le t \le 1$, units of time to work. The coefficient s_i can be interpreted as the wage received by agents for each unit of time worked. Note that, the larger s_i is, the more income agent *i* will receive for the same hours worked; so, s_i can be regarded

 $^{^4}$ This is what Wodon (1997) defines as *specificity* based on the ROC literature.

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as the agent's productivity or her ability to generate income. An agent who finished college education is expected to have a much larger s_i than an illiterate agent, for instance.⁵ The very distinction between the three types of agents is made based on their productivity s_i . Suppose, without loss of generality, that $0 < s_1 < s_2 < s_3$, i.e., that agents of type 1 are the least productive, agents of type 2 are moderately productive, and agents of type 3 are the most productive.

Working has a cost for any agent, irrespective of type. For the sake of simplicity, let us suppose that the cost of allocating t units of time to work is the same for all agents and that it is given by the strictly increasing and strictly convex c(t), continuously differentiable function. To ensure an internal solution to the problem faced by the agent, assume the Inada regularity conditions hold: c(t) = 0, $\lim_{t\to 1^-} c(t) = +\infty$. Suppose also that the agent's utility is linear in consumption, such that we can write the utility of an agent of type i who allocates t units of time to work as $u_i(t) = s_i t - c(t)$.

Agents' optimal choices

To determine the time to be allocated to work, an agent of type i solves the following utility maximization problem:

$$\max_{0 \le t \le 1} u_i(t) = s_i t - c(t).$$
(1)

The solution to problem (1), given by the first-order condition, is $t_i^* = (c')^{-1}(s_i)$, for i = 1, 2, 3.

Note that, since c is strictly convex, $t_1^* < t_2^* < t_3^*$. Therefore, the least efficient agent works less than the moderately efficient agent who, in turn, works less than the most efficient one. Consequently, the overall income received by an agent of type 1, r_1^* , is lower than that earned by an agent of type 2, r_2^* , which, in turn, is lower than that received by an agent of type 3, r_3^* : $r_1^* = s_1 t_1^* < r_2^* = s_2 t_2^* < r_3^* = s_3 t_3^*$. This result is compatible with the literature on nonlinear optimal taxation that treats differences in income as being due to unobserved differences in ability (Varian, 1980). The present analysis indicates that heterogeneous productivity, which possibly results from heterogeneous education or, in general, from heterogeneous opportunities, eventually produces largely heterogeneous incomes.⁶

 $^{^5}$ See, for example, Diebold, Neumark, and Polsky (1994), Farber (2011), or Rehm (2011).

⁶ Section A.1 in Appendix provides empirical evidence of the correlation between the productivity, hours dedicated to work and income, based on Brazilian 2010 Census data. The data confirms increases in mean productivity and worked hours as we move from the lowest to the highest

2.3 Poverty, vulnerability, and a theoretic justification for the BFP

Suppose now that the federal government regards an agent with an income smaller than a given minimum value, m, as being below the poverty line and an agent with an income greater than m but smaller than a given higher value, v > m, as being in a vulnerable situation. Suppose also agents of type 1 have incomes below the poverty line, agents of type 2 have income slightly above that poverty line but below the vulnerability threshold, and agents of type 3 have income above these limits, as shown next:

$$r_1^* = s_1 t_1^* \le m < r_2^* = s_2 t_2^* \le v < r_3^* = s_3 t_3^*.$$
(2)

In the present model, the least productive agents are classified as *poor*, moderately productive agents are called *vulnerable*, and the most productive ones are the *well offs*. The government's goal is to end poverty. Therefore, it will be necessary to complement the income of agents of type 1, because, due to their low productivity, they will not generate income above the poverty line out of their exclusive effort. This is the theoretical justification for the existence of the BFP.

Let us, then, assume that the government establishes a monetary benefit in the amount b targeting those agents with an income smaller than or equal to m, which, in the present model, corresponds to agents of type 1. There exist N_1 agents living in poverty, each of them requiring a benefit $b = m - r_1^* > 0$ in order to move out of this income bracket. Therefore, in order to end poverty in Brazil, the government needs a budget $B^* = N_1 b = N_1 (m - r_1^*)$.

Assume, in what follows, that the federal government allocates amount B to the BFP, allowing every agent with an income lower than or equal to m to apply for benefit $b = m - r_1^*$. Hence, if $B < B^*$, then the BFP's budget is not enough to meet the needs of the poor population; if $B = B^*$, then the budget is sufficient to cover those needs; and finally, if $B > B^*$, then the BFP's budget exceeds the amount necessary to meet the needs of the poor population. In general, if B is the BFP's budget, then the total number of benefits is $B_1 = B/b$.

2.4 Time allocation of BFP beneficiaries

In what follows, we analyze the incentives generated by the BFP and their effects on the working decisions of agents for different scenarios that depend on the information capabilities of BFP managers.

income brackets.

Scenario 1: No income monitoring

For the sake of future comparison, the analysis begins with the simplest situation in which the government makes use of no income monitoring technology at all. In this case, each agent declares her income spontaneously, without any additional requirement. Since the PBF becomes a no-targeting benefit, every citizen, regardless of actual income, will find it in her best interest to apply for the benefit,⁷ which, in practice, represents universal access. It should be noted that, since this is a no-targeting benefit, the participation in the BFP does not change the agents' decision about time allocation. So, agents will continue to solve a problem equivalent to problem (1) with the same solution.

Naturally, there are not enough resources to meet the demand of all agents. Suppose the benefit is granted based on the order of application, in a "first come, first served" system. Assume, furthermore, a random order of application for the benefits. Therefore, the probability that an agent of type *i* receives the benefit is precisely her incidence in society, i.e., $\text{Prob}(i = 1) = n_i = N_i/(N_1 + N_2 + N_3)$, for i = 1, 2, 3.

Thus, in this scenario, the distribution of types among recipients is the same as their distribution in society. In particular, the poor will receive a total amount equal to n_1B reais, the vulnerable ones will receive n_2B reais and the remainder will be granted n_3B reais, where B is the program's total budget. Therefore, the expected number of poor beneficiaries will be n_1B_1 , n_2B_1 , and n_3B_1 for types 1, 2 and 3, respectively.

Hence,

$$\Lambda_I = \frac{n_1 B_1}{N_1} = n_1 \frac{B_1}{N_1}, \qquad \Lambda_E = 1 - n_1 \frac{B_1}{N_1},$$

and the reach R_1 of the program is

$$R_1 = 2\frac{B_1}{N_1 + N_2 + N_3} - 1.$$

Note that the expression above only makes sense when $B_1 \leq N_1 + N_2 + N_3 = N$, which is the natural assumption we make here—i.e., the number of benefits does not exceed the total population. In terms of precision, the expected number of agents not targeted by the program who receive the benefits is $(n_2 + n_3)B_1$.

⁷ Even though she might need to misreport her income in the application procedure.

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Thus,

$$\Pi_I = \frac{(n_2 + n_3)B_1}{N_2 + N_3} = \frac{B_1}{N_1 + N_2 + N_3}.$$

Therefore, the precision P_1 of the program is

$$P_1 = 1 - 2\frac{B_1}{N_1 + N_2 + N_3} = -R_1.$$

In the absence of funds for universalization of the benefit regardless of income, or in the absence of political consensus on the desire of society to walk this path, it is natural that the government will seek to actively monitor the benefit on income so as to allocate the assistance to those who really need it. In the subsequent sections, we assess the effect of the program when income eligibility is monitored in different scenarios.

Scenario 2: Perfect productivity monitoring

Suppose the ideal and hypothetical situation in which BFP managers can precisely observe the productivity s_i , i = 1, 2, 3, of each agent. In this case of perfect information, the government knows that agents of type 2 and 3 can generate income above the poverty line, owing to their productivity.

Therefore, the government will grant the benefit only to agents of type 1, i.e., to the poor. Note that, given the full information setting and the hypothesis of separability between labor cost and (linear) income utility, no agent will change her decision on work, and thus the optimal work time allocation $t_1^* < t_2^* < t_3^*$ will be chosen. In this case, the reach of the BFP depends exclusively upon the amount of available funds. Suppose, first, that the budget is equal to $B = B^*$. Then all poor citizens will receive the benefit and the reach will be 1. Suppose, next, a smaller budget: $B < B^* \Leftrightarrow B_1 < N_1$. Then, $\Lambda_I = (B_1/N_1) < 1$ is the percentage of poor agents included in the program. Hence, the program's reach will be $R_2 = 2(B_1/N_1) - 1 < 1$.

Furthermore, due to full information, no agents of type 2 and 3 will receive any benefit, and the precision will always be perfect, regardless of the budget: $P_2 = 1$.

Note that, in this extreme case of full information on agents' productivity, there exists a somewhat unrealistic balance between perfect reach and perfect precision. If agents of type 2, for instance, apply for the benefit claiming (and proving) to have an income lower than m, for example, the application will be denied on the grounds that they are able to generate income above m. Naturally, this is an unrealistic case discussed here for the sake of future comparison.

Scenario 3: No productivity monitoring but perfect income monitoring

Consider now the hypothetical situation in which the government can perfectly observe the applicant's income. However, we have the more realistic hypothesis that the program cannot verify agents' productivity. Therefore, the BFP managers would grant the benefit, should there be available funds, to any agent with income below the poverty line m.

Naturally, in this scenario, the issue of income eligibility the poor agents will continue dedicating time t_1^* to the income-generating activity, deriving income $r_1^* = s_1 t_1^* \leq m$ and, being entitled to BFP's benefits b.

Differently, agents of types i = 2, 3 are faced with the following tradeoff. If they choose the optimal time allocation to work in the absence of BFP, they will not be granted the benefit, because their income will be too high. Conversely, if they reduce the amount of time dedicated to work, they may be able to apply for the benefit, but they will not be maximizing the optimization problem (1).

Let t'_i , i = 2,3, be the maximum time dedicated to work compatible with the BFP. Then, it must be the case that $t'_i < t^*_i$ and $r'_i = s_i t'_i = m$. In other words, to be entitled to the benefit, an agent of type i = 2,3 will have to reduce the amount of time dedicated to work in order to maintain her income within the limit set up by the BFP, m. In that case, we say the citizen strategically reduces income.

Figure 1 shows the strategic reduction of time allocated to work for agents of type 2 (vulnerable, orange arrow) and of type 3 (well off, green arrow). Note that, due to the optimality of the choice of t_i^* , $s_i t_i^* - c(t_i^*) > s_i t_i' - c(t_i')$, and there is a direct loss of utility as a result of the strategic reduction. However, this loss may be compensated for by the program's benefit.

Let p be the (endogenous) probability of an agent being granted the benefit when income is strategically reduced. This probability is not 1 due to the budgetary constraints of the program, B. Thus, in order to decide whether or not to strategically reduce their income, agents of type i = 2,3 compare the two options below.

- **Option 1: Not acting strategically.** Agents choose $t_i = t'_i$, do not receive the benefit, and have utility $u_i(t^*_i) = s_i t^*_i c(t^*_i)$.
- **Option 2: Acting strategically.** Agents choose $t_i = t'_i$, receive the benefit with probability p and have an expected utility of $u_i(t'_i) + pb = s_it'_i c(t'_i) + pb$.

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Source: Authors' calculations.

Figure 1. Strategic reduction of time allocated to labor.

Therefore, agent i = 2,3 will choose to strategically reduce the amount of time dedicated to work if the following condition is satisfied:

$$pb > [s_i t_i^* - c(t_i^*)] - [s_i t_i' - c(t_i')] = \Delta u_i.$$
(3)

As Figure 1 illustrates, the loss of utility associated with strategic behavior is small for vulnerable agents (of type 2), whereas it is quite high for the well-off agents of type 3. Therefore, only vulnerable citizens are expected to strategically reduce their income. We make this assumption here.

Therefore, there will be a demand for $N_1 + N_2$ benefits for a supply of B_1 benefits. Hence, the probability (p) that an agent of type 1 is included in the program is $N_1/(N_1 + N_2)$. Since only B_1 benefits are available, assuming that $B_1 < N_1 + N_2$, then

$$\Lambda_I = \frac{N_1}{N_1 + N_2} B_1 \frac{1}{N_1} = \frac{B_1}{N_1 + N_2}.$$

Therefore, the reach is $R_3 = 2\frac{B_1}{N_1+N_2} - 1$.

It is easy to check that $R_1 < R_3 < R_2$, i.e., there is a broader reach compared to the case where income eligibility is not controlled for. This is due to the fact that, in this extreme case, agents of type 3 do not seek BFP benefits. On the other hand, the reach is smaller compared to the case of full information about productivity. This is due to the fact that now agents of type 2 become potential beneficiaries by strategically reducing their income, competing with agents of type 1 for the same volume of benefits.

Note that although all agents who apply for the benefit are all actually vulnerable, only those of type 1 actually belong in the target population. Therefore, precision in this case is $P_3 = 1 - 2 \frac{N_2}{N_2 + N_3} \frac{B_1}{N_1 + N_2}$.

It is also easy to check that $P_1 < P_3 < P_2$, i.e., there is higher precision compared to the case of no control of income but lower precision than in the case of perfect monitoring of citizens' productivity capabilities.

To summarize, the introduction of the BFP tends to create an adverse incentive regarding the decision of agents of type 2, the ones who would be in a situation close to poverty, causing them to work less.

It is noteworthy that the empirical evidence does not seem to clearly confirm this finding. As a matter of fact, several studies on the assessment of the BFP (F. V. Soares et al., 2007; Ferro & Nicollela, 2007; Tavares, 2008; Foguel & Barros, 2010; Teixeira, 2011) tested the existence of the so-called *laziness-effect* (which can be explained by the adverse incentive of moral hazard) and, even though some authors observed negative effects on labor supply, they tend to conclude that the effect is negligible.

Regarding the hypothesis of income verifiability, according to Controladoria Geral da União (CGU, 2012), more than 660,000 families were excluded from the BFP in 2011 and 2012 for income misreporting, thereby allowing for the reallocation of over 75 million reals (the Brazilian currency) to needy families. Therefore, it is clear that the perfect income verifiability hypothesis should only be used as a reference for future comparisons and that one should actually assess the intermediate case of imperfect control over eligibility.

Scenario 4: Imperfect income monitoring

Suppose now that the government cannot perfectly monitor citizens' incomes. In this case, if agents wrogfully request the benefit, the government will detect their income misreporting only with probability π , in which case the applicants' request will be denied. This is the scenario that faithfully portrays the reality of the BFP, where the government utilizes a wide range of instruments to detect irregularities in the distribution of benefits but cannot perfectly verify the income of each beneficiary household.

Note that the only punishment for having an income above the poverty line and requesting the benefit is the exclusion from the program. For the sake of simplicity, we assume that when an agent is caught misreporting his income, and thereby is excluded from the program, the administrative procedure is such that there is not enough time for another citizen to receive that benefit⁸ in the same fiscal year. Since no additional penalty exists, in this case, all agents will be encouraged to request the benefit, even those of type 3, who are not interested in strategically reducing their income.⁹

As for type 2 citizens, they are now faced with a slightly different tradeoff, because of the advantage of not reducing their income increases, as they can request the benefit anyway. Their options are:

- **Option 1: Not acting strategically.** Agents choose $t_2 = t_2^*$, request the benefit, and receive it with probability $p(1 - \pi)$, where p represents the competition for the benefit in society and $1 - \pi$ stands for the imperfect control of income eligibility by the BFP managers. The agent's utility in this case is $u_2(t_2^*) + p(1 - \pi)b = s_2t_2^* - c(t_2^*) + p(1 - \pi)b$.
- **Option 2: Acting strategically.** Agents choose $t_2 = t'_2$, receive the benefit with probability p and have an expected utility $u_2(t'_2) + pb = s_2t'_2 c(t'_2) + pb$.

Type 2 citizens will choose to strategically reduce the amount of time dedicated to work if $u_2(t'_2) + pb > u_2(t^*_2) + p(1 - \pi)b$, or if the following condition is satisfied:

$$\pi pb > [s_2 t_2^* - c(t_2^*)] - [s_2 t_2' - c(t_2')] = \Delta u_2.$$
(4)

As in expression (3), expression (4) clearly establishes the trade-offs agents face. The difference now is that it is less interesting to strategically reduce income, as it is possible to *fool* the government, pretending to be an agent with a low income without actually reducing it, due to the imperfect income monitoring.

Thus, agents will decide between options 1 and 2, depending on the probability π . For higher levels of π , vulnerable agents strategically reduce their income to ensure that, if the program selects them, they will receive the benefit with probability 1. Indeed, this is a replication of the previous equilibrium. For lower

 $^{^8}$ On a dynamic perspective, this means that the benefit will only become available for society in the following period.

⁹ Since type 3 citizens were not interested in strategically reducing their income under perfect income monitoring, they will not be interested in doing so under partial monitoring either.

levels of π , a vulnerable agent decides to risk losing the benefit, generating income above the established threshold for the program. This behavior is analogous to that of agents of type 3.

Note that regardless of type 2 strategic decision, all agents will apply for the benefit. Given the hypothesis of no immediate replacement of the successfully audited high-income applicants, the reach does not depend of type 2 citizens' choice. It is, as in the first case analyzed, $R_4 = 2 \frac{B_1}{N_1 + N_2 + N_3} - 1 = R_1$.

Precision, on the other hand, depends on the efficiency π of income control but also on the strategic choice of type 2 citizens. The corresponding results are

$$P_4 = 1 - 2\frac{N_2 + (1 - \pi)N_3}{N_2 + N_3} \frac{B_1}{N_1 + N_2 + N_3} > 1 - 2\frac{1}{N_1 + N_2 + N_3}B_1 = P_1,$$

if there is a strategic reduction; and

$$P_4 = 1 - 2(1 - \pi) \frac{B_1}{N_1 + N_2 + N_3} > 1 - 2 \frac{1}{N_1 + N_2 + N_3} B_1 = P_1,$$

if there is no strategic reduction.

Hence, it is not clear whether P_4 is greater or smaller than P_3 . This is so because there are conflicting trends in scenario 4. Indeed, since there is imperfect monitoring, all agents have incentive to apply for the benefit. This would tend to make the precision worse in the present scenario. On the other hand, the audit technology allows us to detect and exclude some applicants that would have strategically reduced their income in the previous scenario. If the technology is efficient enough, this tends to increase precision.

Since 2016, the government's audit technology has improved substantially, increasing the value of π . The government has made it mandatory to register each member of beneficiary families in the "Cadastro de Pessoas Físicas" (CPF), including children. Furthermore, it started to periodically cross information from different federal government databases, such as RAIS, CAGED, INSS, SIGEPE, FGTS and GPS.¹⁰ As CAGED is monthly updated, databases are crosschecked every month, and this allows the monitoring of BPF beneficiaries who eventually entered the job market without reporting the new income. Therefore, for simplicity of comparison, we assume there is strategic income reduction in

¹⁰ RAIS: Relação Anual de Informações Sociais; CAGED: Cadastro Geral de Empregados e Desempregados; INSS: Instituto Nacional do Seguro Social, SIGEPE: Sistema Integrado de Gestão de Pessoas; FGTS: Fundo de Garantia do Tempo de Serviço; GPS: Guia da Previdência Social.

this scenario.¹¹

In those cases where the family temporarily has an income higher than the poverty line, there is a permanence rule that allows the benefit to continue for two years, as long as the new family income does not exceed half a minimum wage per capita. But if the beneficiary does not report the increase in income, the family is disconnected from the program. Since 2016, in two years, around 5 million families have been disconnected from the program due to fraud or income incompatible with their target audience.

2.5 Conclusion: Moral hazard and adverse selection in the Bolsa Familia CCT Program

Table 1 summarizes the reach and precision of the BFP in different scenarios, assuming strategic income reduction of agents of type 2.

The analysis indicates the non-monitoring scenario 1 as the worst of all in terms of reach and precision. The poor result is due to the fact that all agents with an income above the poverty line have an incentive to apply for the BFP, as all citizens regard it as a universal benefit. The case of imperfect income monitoring, a situation that closely resembles the actual current reality of the BFP (scenario 4), also yields the worst reach for the BFP.

Symmetrically, the best scenario would be the one in which the government could verify income and also productivity of each agent (scenario 2). In that case, precision is perfect and so is the reach, if the budget is high enough. Scenario 2, however, is unrealistic because it demands a level of information from the government that is hardly attainable.

Scenarios 3 and 4 yield intermediate results in terms of reach and precision. In scenario 4, in addition to the moral hazard problem observed in scenario 3, there is also an adverse selection problem since, even with a high income, agents are encouraged to request the benefit, in the hope that the government will not be able to monitor their income.

The coexistence of these two typical problems of economics of information and incentives naturally reduces the reach and the precision of the BFP, not allowing the scarce public funds to reach the actually poor families they target. This fact is corroborated by several studies that assessed the BFP and its precursors, among which we may cite Anuatti Neto et al. (2001), the assessment made by the Brazilian Court of Accounts (TCU, 2005), the study conducted by

¹¹ This assumption allows us to reduce one line in Table 2 without any important loss. The complete analysis is available upon request to the authors.

 $N_1 + N_2 + N_3$ $P_3 = 1 - 2 \frac{1}{N_2 + N_3} \frac{1}{N_1 + N_2}$ B_1 $P_1 = 1 - 2 \frac{1}{N_1 + N_2 + N_3}$ \overline{B}_1 B_1 $P_4 = 1 - 2\frac{N_2 + (1 - \pi)N_3}{1 - 1}$ Precision $P_{2} = 1$ $N_{2} + N_{3}$ N_2 if $B = B^*$ if $B < B^*$ T $R_4 = 2 \frac{1}{N_1 + N_2 + N_3}$ $R_1 = 2 \frac{B_1}{N_1 + N_2 + N_3}$ $\frac{B_1}{N_1+N_2}$ Reach -1 B_1 $R_{3} = 2$. N P , S $R_2 =$ Perfect monitoring of productivity Imperfect income monitoring Perfect income monitoring No income monitoring Control Scenario ---2 c 4

Source: Authors' calculations.

Table 1. Reach and precision of the BFP in different information and incentive scenarios with strategic reduction of income.

the World Bank (Lindert, Skoufias, & Shapiro, 2006), the study conducted by the Ministry of Social Development and by the Center of Regional Planning & Development of the Federal University of Minas Gerais (MDS-Cedeplar, 2007) as well as the work by Tavares et al. (2009) and by CGU (2012).

3 Proposed mechanisms: Institutional innovations for incentive compatibility between managers and beneficiaries

In light of the established evidence of moral hazard and adverse selection in the present design of the PBF, we use applied mechanism design theory to propose institutional innovations aimed at solving the existing problems. We begin proposing a new conditionality, which, in addition to improving the beneficiaries' human capital, induces self-exclusion of beneficiaries of type 3, whose productivity and income far exceed the poverty line.

Next, we focus on those whose productivity is enough to generate income above the poverty line, but who are still vulnerable, the beneficiaries of type 2. We propose an innovation that aims to ensure the sustainable emancipation of these agents from the program within a three-year period, moving them from vulnerability to a situation of stable income generation, allowing them to mingle into the new Brazilian middle class.

The third proposal concerns the Municipal Decentralized Management Index (IGD-M) mechanism, whose goal is to create incentives for the BFP local manager to dedicate himself to implementing the innovations in an efficient manner.

3.1 Proposal 1: Compatibility of incentives for more productive agents – the Citizens' Contribution Mechanism

Regardless of the government's ability to monitor income misreporting (the parameter π in the model), there is a strong incentive for the population to request the benefit, even those who are not the target beneficiaries. This occurs because the punishment for this illegal behavior is simply exclusion from the program.

One possible way to reduce participation of ineligible citizens is to increase the cost for agents when illegal behavior is detected (Becker, 1968). Even though the economic theory of crime literature clearly shows the inhibitory effects of punishment on the decision to adopt illegal behaviors, it is our opinion that there exist many limitations to increasing the punishment of wrongdoers in the case of the BFP. In fact, besides legal and political limitations, the very principle of the BFP is against any punishment that would exclude a beneficiary from the program indefinitely, given that the agent may eventually face extreme poverty in the future. Hence, it is more convenient to focus on a simpler, straightforward and efficient instrument, namely, the design of a self-selection mechanism.

The Citizens' Contribution Mechanism

The previous analysis demonstrates that the difference in productivity among citizens makes more productive agents dedicate more time to income-generating activities. Therefore, the opportunity cost of time is much larger for the most productive agents and much lower for the least productive ones. Based on this insight, we suggest anticipating the potential for self-exclusion of agents by requiring recipients to dedicate time to the BFP. This is the essence of the Citizens' Contribution Mechanism.

This mechanism can be implemented in different ways. Focusing on support for public education and health, perhaps the most critical areas in need of federal government interventions, especially in poorer communities where the target beneficiaries of the BFP are to be found, the beneficiary may be requested to: (i) help take care of the garden at schools or at health centers; (ii) help clean schools or health centers; (iii) help teachers in schools or physicians in health centers (acting as a assistants, organizing and monitoring sports activities in schools or health centers, invigilating students); etc.

Now focusing on the investment in beneficiaries' human capital, the beneficiary may be requested to: (i) participate in adult literacy programs to learn how to read and write; (ii) participate in professional training programs; (iii) participate as assistants in *Family Health* teams or monitor those beneficiaries whose children have failed to meet school attendance and vaccination requirements; etc.

In sum, there exists a broad range of options for the productive implementation of the time conditionality, some of which are actually already set up by the IGD-M regulations, such as "BFP complementary programs", for which IGD-M funds are available, as described in MDS (2011).

Note that, by contributing to the program in order to receive the benefit, beneficiaries change their status from passive recipients of public funds to that of active contributors for the national effort towards the reduction of poverty and inequality. They go from the condition of users to that of main actors. The benefit is no longer a social action associated with poverty and now represents a reward for the contribution of agents to the program. This suggests a strengthening of the recipients' feeling of citizenship, attaching value to their social contribution. For that reason, this mechanism was called the *Citizens' Contribution Mechanism*.

Agents' decision in the presence of the Citizens' Contribution Mechanism: a selection problem

Let us suppose that an applicant should devote h hours to the BFP. During that period, the beneficiary will contribute to the program and, therefore, cannot generate income. How should we set the value of h? To answer this question, consider the effects of this requirement on agents' work decisions.

- **Type 1: The poor.** These agents work t_1^* units of time in the absence of other incentives. We would not like the BFP to change this choice, that is, we do not want the new requirement to compete with the time the poor allocate to work. So, we must choose h such that $t_1^* + h \leq 1$, or $h \leq 1 - t_1^*$. Moreover, requiring allocation of time to the program from group 1 would cause a disutility of time allocation, modeled by the strictly increasing and strictly convex function $\gamma(h)$, which should not be larger than the utility offered by the payment of benefit b. Thus, in order for agents of type 1 not to change their option to participate in the program, h must be chosen so that $b \geq \gamma(h)$, or $h \leq \gamma^{-1}(b)$. In other words, this conditionality must be non-binding for the poorer citizens.
- Type 2: The vulnerable. The behavior of vulnerable agents also depends on whether the requirement for time allocation to the program is active or not. The natural hypothesis is that, since vulnerable agents have an optimal decision to work and an income closer to that of the poor, and they are already strategically reducing their income, the constraint will not be binding to them either, so that analysis performed for type 1 repeats. Thus, the vulnerable will choose the program provided that $h \leq 1 - t'_2$ and that $h \leq \gamma^{-1}(b)$.
- **Type 3: The well off.** These agents work t_3^* hours. Naturally, if $t_3^* + h \leq 1$, then the requirement of time allocation to the BFP will be very weak and the agents will be able to apply for the benefit. A way to ensure the self-exclusion of these agents is to choose h such that $t_3^* + h > 1$. In this case, the beneficiaries will have to give up their productive time to dedicate themselves to the BFP, reducing their labor earnings.

Moreover, if agents do not apply for the benefit, the utility of an agent of type 3 will be given by $u_3(t_3^*) = s_3t_3^* - c(t_3^*)$, where the time allocated to work

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 t_3^* maximizes the utility $u_3(t)$. Since $t_3^* + h > 1$, if the benefit is granted, the agents must dedicate their time h to the BFP and, therefore, they will only be able to allocate time $t_3'' = 1 - h < t_3^*$ to the productive labor. Thus, their labor earnings will decrease to $u_3(t_3'') = s_3t_3'' - c(t_3'') < u_3(t_3^*)$.

Therefore, if the benefit is granted, the utility will be:

$$b + u_3(t_3'') - \gamma(h) = b + s_3 t_3'' - c(t_3'') - \gamma(h) = b + s_3(1-h) - c(1-h) - \gamma(h).$$

The term $\gamma(h)$ in the expression above represents the additional cost for an agent to allocate time to the BFP, as pointed out earlier. Hence, in order for agents of type 3 not to apply for the BFP, it will be necessary (and sufficient) that the following incentive compatibility condition be satisfied:

$$u_3(t_3^*) = s_3 t_3^* - c(t_3^*) > b + u_3(t_3'') - \gamma(h) = b + s_3(1-h) - c(1-h) - \gamma(h).$$

By assuming that, in the limit, in the presence of indifference, agents would rather not apply for the benefit, we conclude that the minimum number of hours dedicated to the BFP to be required from the agents is the value h^* of h, which satisfies: $s_3(1-h) - c(1-h) = s_3t_3^* - c(t_3^*) - (b - \gamma(h))$.

Figure 2 shows the selection of h. The value of h should be sufficiently high such that the sum of the utility derived from restricted time, $u_3(t''_3) = u_3(1-h)$ (vertical blue arrow), with an additional gain from taking part in the BFP, $b - \gamma(h)$ (vertical black arrow), will not reach the utility derived from optimally devoting to productive labor $u_3(t^*_3)$ (vertical red arrow).

In brief, by taking all conditions into consideration, the Citizens' Contribution Mechanism will induce the right incentives provided that the required hours satisfies: $h^* < h \le \min\{1 - t_2^*, \gamma^{-1}(b)\}.$

Thus, the requirement for time allocation to the program, once clearly defined, aims to promote the self-exclusion of agents of type 3, without any need for additional cost associated with income monitoring of these agents. This property is known in the economics of information and incentives literature as screening or selection (Barelli, Basov, Bugarin, & King, 2014; Basov, 2005; Laffont & Martimort, 2001; Salanié, 1997).

Let us analyze the effect of introducing the requirement for time allocation on the program's reach and precision. Under the hypothesis of no strategic income reduction of type 2 agents (for simplicity), the program's reach will be exactly the reach obtained for the case of perfect income monitoring: $R_5 = 2\frac{B_1}{N_1+N_2} - 1 = R_3$.

Note that this result could be obtained originally only if the government



Source: Authors' calculations.

Figure 2. The self-selection inducing effect of the Citizens' Contribution Mechanism.

could observe exactly the income of every applicant (scenario 3 in Table 1). Although scenario 3 is unrealistic, as discussed earlier, the introduction of the time dedication conditionality suggests that this reach may be approximated in a realistic environment of imperfect information about the beneficiaries' income. This is the main contribution of the mechanism for the efficiency increase in of the BFP.

Furthermore, the precision is $P_5 = 1 - 2 \frac{N_2}{N_2 + N_3} \frac{B_1}{N_1 + N_2} = P_3$.

In summary, the introduction of the requirement for time allocation tends to minimize the precision problem and to maximize reach to the level obtained in the case of full income monitoring. For the sake of space, important additional practical issues on the implementation of this mechanism are discussed in Appendix.

Note, however, that both the moral hazard and the adverse selection problems persist for vulnerable agents, as discussed previously. That issue will be dealt with in the next proposal.

3.2 Proposal 2: Support focused on vulnerable agents – The Graduation Mechanism

The proposition described in this section aims to support agents of type 2 (vulnerable agents) to opt out of the program voluntarily. These agents will be able to devote their optimal time to their productive activity, having their

decision financially supported by the BFP. The purpose is to have these agents become part of the new middle class within a three-year period.

The proposition consists of a Graduation Mechanism in which agents are officially acknowledged to be out of poverty, receiving support for three years to become totally independent from the BFP.

The Graduation Mechanism

As discussed earlier, vulnerable citizens will be encouraged to either strategically reduce their income (moral hazard), thus guaranteeing their benefit, or to declare a lower income than they actually receive in the hope of not being detected and keeping the benefit (adverse selection). The aim of this section is to propose a mechanism that encourages agents of type 2, who, given their productive capacity, may generate an income compatible with self-sufficiency without the BFP, to opt out of the program.

The mechanism proposed herein is based on some fundamental principles:

- (a) First, beneficiaries experience a sense of pride and social prestige when they can proclaim that they no longer depend on the BFP. Emancipation from the program means professional success and social climbing.
- (b) Second, beneficiaries of type 2 (vulnerable agents), even though they have potential to generate an income above the poverty line, do not have enough savings to protect themselves against setbacks in the labor market. In general, they barely have enough capital to open up a business from which they can derive a higher income in a sustainable fashion.
- (c) Finally, these beneficiaries typically face high levels of restricted consumption and a very low intertemporal discount factor. In other words, beneficiaries have a large discount of the future and any funds they are granted today are worth much more to them than to richer agents, compared with their future earnings.

The *Graduation Mechanism* consists of a package of additional benefits for those who, on their own initiative, decide to demonstrate that they have a larger income and therefore no longer depend on the program. The additional benefits are described next:

(i) Formal Graduation Ceremony, to which the mayor, the local BFP manager, representatives of the local community, and family members of the Graduates are invited. A Graduate is a BFP beneficiary who can prove to the local BFP manager that he no longer depends on the payment of the benefit, being thus released from the program. The aim of the Graduation Ceremony is to heighten the Graduate's social prestige, highlighting the importance of this step towards self-sufficiency. This initiative is associated with item (a) above.

- (*ii*) Maintenance of the benefit. Guarantee that the benefit will be paid to the Graduate for a period of k months. The aim is to conciliate independence from the program and the existing rule that allows beneficiaries not to inform that they have achieved a higher income, so that they continue receiving the benefit until their data are updated in the system. In addition, this guarantee is related to item (b) above. The suggestion made here is for the choice of k = 6 months.
- (*iii*) Monetary Graduation bonus. At the moment of Graduation, agents receive a fixed amount g to help them organize their economic activity or to improve their living standards. This initiative addresses items (b) and (c) above. The suggestion is that the monetary bonus should be equivalent to six months on the program, g = 6b.
- (*iv*) Savings incentive. After the period of k months of automatic payment of the BFP grant, for every six months that beneficiaries remain off the BFP, an amount of money p is deposited into a savings account for a maximum number of times n. The aim is to help them save up and go through future periods of financial hardship, as they will not rely on the BFP any longer. This initiative is also related to item (*b*) above. The suggestion here is that the savings amount be equivalent to 3 months on the program, p = 3b; in addition, the deposit will be made for n = 4 times, every 6 months, corresponding to a maximum period of 3 years. After this period, agents will be granted full access to the accrued savings, which could not have been withdrawn until then.
- (v) Microcredit.¹² After the period of k months of automatic payment of the BFP grant, beneficiaries are entitled to a microcredit facility subsidized by a public financial institution. This benefit is annually renewed for a maximum of 3 years if beneficiaries remain off the BFP. The aim is to help agents with the new business probably opened with the monetary Graduation bonus, or

¹² The microcredit mechanism is hinged upon the experiences of democratization of productive credit developed by the federal government in the context of the National Program on Oriented and Productive Microcredit (PNMPO), set forth by Act no. 11,110/2005. The mechanism revolves around the concept of microfinances, which goes beyond the access to credit, running the gamut from the technical follow-up of the borrower's business or finances to the inclusion in other financial services (Aghion & Morduch, 2005; C. Ribeiro & Carvalho, 2006).

even with unexpected financial demands. This initiative addresses item (b) above. Therefore, assuming k = 6, agents would have the right to microcredit seven months after being released from the program, with a new credit facility made available in the same month for the subsequent two years. The suggestion here is that the microcredit be equivalent to 12 months on the program, m = 12b. Microcredit is similar to the monetary Graduation bonus, but the difference, in addition to the amount paid, is that it is repayable, although the interest rates are subsidized. The microcredit cost for the BFP is limited to the cost of subsidy.

Using the month of January as annual reference for Graduation from the program, the timeline in Figure 3 shows the dates and the amounts of the respective benefits paid to graduates, using the monthly benefit paid by the program as a unit of measure. Note that, in the first year after release from the program, the cost of the Graduation bonus plus 6 months of the benefit correspond to the total cost the BFP would incur had agents not been released from the program. The only additional cost refers to the subsidy associated with microcredit interest rates. Hence, except for this cost, there is fiscal neutrality in the first year.

In the second and third years, there are savings equivalent to 12 months of BFP grant payment for each year, which covers the savings costs for 6 months and includes a positive balance to cover the subsidy costs associated with microcredit interest rates for 6 months, in addition to expanding the program with the introduction of new beneficiaries without any additional cost to the public treasury. Except for the subsidy costs associated with microcredit interest rates, we may say that, from the second year onward, for every two Graduates, the savings would be enough to include a new BFP beneficiary.



Source: Authors' calculations.

Figure 3. Timeline of Graduation benefits.

Finally, after being fully independent from the program, in the fourth year, Graduates will not incur any cost to the BFP, being allowed to use their savings in the way they see fit. Therefore, for every two Graduates, another beneficiary can be included, in addition to the one included in the second year. Basically, the mechanism is self-sustainable, allowing for the self-sufficiency of Graduates and for the inclusion of new beneficiaries in the second and fourth year, financed by the savings generated.

We believe that the working paper version of this article may have influenced the launch of the "Progredir" microcredit policy in 2017. This subsidized credit line is intended for the development of small businesses. In order to have access to credit, the PBF beneficiary needs to have their own income validated by signed portfolio or other proof of income, to have a guarantor and, depending on the bank supplying the credit, they need to formalize the enterprise through the registration of an Individual Microentrepreneur (MEI). If the credit line is successful and the beneficiary's business develops, the micro-entrepreneur must request the voluntary termination of Bolsa Família. In cases where the business goes bankrupt, it is possible to receive the PBF benefit again. The objective of "Progredir", therefore, is to encourage entrepreneurship so that families will no longer depend on Bolsa Família.

Vulnerable agents' decision in the presence of the Graduation Mechanism: A dynamic analysis

The aim of this section is to assess the decision made by agents of type 2, who strategically reduced their income and qualified for the BFP grant but are now eligible for the Graduation Mechanism. To that end, we develop a dynamic analysis of agents' decisions.

There is no time limit for remaining on the BFP, as this is determined by agents' needs, and so the benefit is granted indefinitely while the strategic reduction of income persists. Thus, if he remains a beneficiary, the agent derives the utility below at every period, where $\gamma(h)$ stands for the additional disutility of the time allocated to the BFP: $u_2(t'_2) + b - \gamma(h) = s_2t'_2 - c(t'_2) + b - \gamma(h)$.

Therefore, if we take into consideration the present value of the future utility flow, we obtain the following expression, where δ is the beneficiary's intertemporal discount factor:

$$\sum_{t \ge 0} \delta^t [u_2(t'_2) + b - \gamma(h)] = \frac{u_2(t'_2) + b - \gamma(h)}{1 - \delta}.$$

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On the other hand, if the agent is released from the program this month, she will choose the optimal time to be allocated to work, generating the utility below every time period: $u_2(t_2^*) = s_2t_2^* - c(t_2^*)$.

In addition, she will receive benefit b for k periods, the Graduation bonus g and the savings benefit p, every 6 months, after the k-th month, in a total of n times, besides the social prestige enjoyed by the Graduate from the program modeled here by parameter s—and the access to the subsidized microcredit for three years, whose net benefit is modeled by parameter mc.

Hence, by taking into account the present value of the future utility flow, we obtain the following expression:

$$\begin{split} \sum_{t\geq 0} \delta^t u_2(t_2^*) + \sum_{t=0}^{k-1} \delta^t b + g + \sum_{t=1}^n \delta^{k+1+6t} p + s + \sum_{t=0}^2 \delta^{k+12t} mc \\ &= \frac{u_2(t_2^*)}{1-\delta} + \frac{1-\delta^k}{1-\delta} b + \delta^{k+1+6} \frac{1-\delta^{6n}}{1-\delta^6} p + \delta^k \frac{1-\delta^{36}}{1-\delta^{12}} mc + g + s \,. \end{split}$$

For simplicity, we begin by assuming out saving and subsidized microcredit incentives, i.e., p = mc = 0. Thus, agents would rather opt-out of the program if their future utility flow oversteps the future utility flow of being kept on the program, i.e., if the following condition is satisfied:

$$\frac{u_2(t_2^*)}{1-\delta} + \frac{1-\delta^k}{1-\delta}b + g + s \geq \frac{u_2(t_2') + b - \gamma(h)}{1-\delta}$$

That expression can be rewritten as follows, where $\Delta u_2 = u_2(t_2^*) - u_2(t_2')$:

$$\Delta u_2 + \gamma(h) + (1 - \delta)(g + s) \ge \delta^k b.$$
(5)

Expression (5) clearly states the trade-offs associated with the decisions of agents of type 2. The benefits provided by graduation are shown on the left-hand side: additional utility of labor and absence of cost associated with the time allocated to the BFP, monetary Graduation bonus, and social prestige (only once, at the moment of graduation). The benefits derived from being kept on the program are shown on the right-hand side: maintenance of benefit b from the k-th period on.

Expression (5) indicates that the larger the Graduation bonus and/or the social prestige derived from it, the shorter the necessary maintenance period of the benefit, k. Furthermore, the more the future is discounted, i.e., the more

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impatient agents are, the smaller the factor δ , and, consequently, the smaller the Graduation bonus will be for agents of type 2 to be interested in signing out of the program.

For a rough estimate of the time necessary of maintenance of the the benefit after graduating, assume that g = s = 0, i.e., there is neither a Graduation bonus nor social prestige associated with graduating from the program. Then, condition (5) is reduced to

$$\delta^k b \le \Delta u_2 + \gamma(h) \Leftrightarrow k \log(\delta) \le \log(\Delta u_2 + \gamma(h)) - \log(b)$$

or

$$k \ge \frac{\log(\Delta u_2 + \gamma(h)) - \log(b)}{\log(\delta)}$$

Suppose, for instance, that $\delta = 0.9$, b = 100, $\Delta u_2 = 40$, $\gamma(h) = 15$; then, the right-hand side of the inequality is 5.67. Therefore, it would suffice to guarantee the benefit for 6 months for the vulnerable agents to show interest in graduating from the program, even if there were not a Graduation bonus or additional utility from the social prestige associated with the release from the program. This finding is consistent with proposing k = 6 months.

In this simulation, note the importance of the agent's impatience, i.e., having a value smaller for δ : Agents will have maximum utility in a single period if they can simultaneously keep benefit b, do not need to devote time h to the BFP, and dedicate optimal time to an income-generating job. Since the Graduation Mechanism allows for overlapping advantages for several periods (k) and as agents attach less value to the future, they will be lured by this mechanism, even in the absence of significant advantages g, p or s.

Reciprocally, an upper bound can be obtained for the Graduation bonus under the extreme hypothesis of no social prestige with the release from the program and loss of the benefit after signing out of the program, i.e., s = k = 0. In this case, condition (5) is reduced to $\Delta u_2 + \gamma(h) + (1 - \delta)g \ge b$, which leads to condition $g \ge \frac{b - \Delta u_2 + \gamma(h)}{1 - \delta}$.

If, as before, $\delta = 0.9$, b = 100, $\Delta u_2 = 40$, $\gamma(h) = 15$, then $\frac{b - \Delta u_2 + \gamma(h)}{1 - \delta} = 750$. Thus, the beneficiary should receive the value of R\$ 750 to decide spontaneously to leave the program, even in the absence of any guarantee for the payment of the benefit for some time after being released from the BFP. In fact, this is a very small value, which corresponds to approximately one monthly minimum wage. For the sake of space, we present in Appendix a complementary but important discussion on issues regarding the implementation of the GM. Next proposal aims at creating incentives for local BFP managers can be aligned so as to yield the best possible social returns from the Graduation Mechanism.

3.3 Proposal 3: Adjusting the Decentralized Management Index (IGD-M), focusing on local managers – The Human Capital Incentive Mechanism

Proposals 1 and 2 focused on BFP beneficiaries of types 2 and 3. However, there is another fundamental agent for the proper operation of the program: the BFP local manager. In fact, it is the manager's duty to keep track of the time allocated by beneficiaries to human capital formation and to prepare for future emancipation from the program. It is also the manager's duty to select those beneficiaries who will graduate, thereby having access to the Graduation Mechanism benefits.

The aim of the present proposal is to adjust the IGD-M mechanism so as to align the local manager's incentives with the goals of the mechanisms in proposals 1 and 2. In what follows, we describe the elements of this adjustment.

The Human Capital Incentive: Additional IGD-M funds for the administration of the Citizens' Contribution and Graduation Mechanisms.

"The IGD-M is an index number ranging from 0 to 1 that assesses the quality and update of information in the Single Registry of Social Assistance (Cadastro Único de Assistência Social) and the quality and integrity of information about conditionality in the areas of education and health." (MDS, 2011). That index number is used for the calculation of the values to be transferred to the municipality and to be used in managing the BFP.

Roughly speaking, the amount of funds to be transferred to a municipality is calculated multiplying the IGD-M by the number of BFP beneficiary families in the municipality times R\$2.50. To this basic value, we add financial incentives from four categories, which can amount to 10% of the basic value. Financial incentives are aimed at rewarding the municipality for its efficient management of the BFP concerning the following aspects: (i) follow-up of beneficiary families that have failed to meet the program's requirements; (ii) assessment of possible problems with the local management of the BFP; (iii) update of data on local management; and (iv) distribution of the BFP cash cards (MDS, 2011).

Proposal 3 suggests creating a fifth category of incentives, which we designate as Human Capital Incentive. This incentive adds a supplementary 10% of the basic value to the IGD-M, which corresponds to the previous four categories together. The aim of this additional incentive is to provide the local manager with extra funds for the better qualification of beneficiaries, preparing them for their graduation from the program in a sustainable manner.

Conditionality and effort of the BFP local manager

Naturally, an additional supply of IGD-M funds is always welcome by the BFP local manager. The public sector economy, however, draws attention to the reckless use of funds received by a state without any contribution of its own fiscal effort, the co-called *flypaper effect* (Inman, 2008). Therefore, aiming that the additional fund will be actually used for the better implementation of the suggested mechanisms, we propose creating a dynamic interdependence between the incentive value and the success of the Graduation program, as described next.

Success of the Graduation Mechanism conditionality

From the second year of operation of the mechanism, the amount of additional funds in the new category of incentives will be multiplied by an index ranging from 0 to 1. The index will be calculated according to the success of the Graduation Mechanism. The success of the mechanism is measured as follows. First, we calculate the number of Graduates, ng for the past four years. After that, we calculate the number of Graduates who, in the past four years, returned to the Single Registry as BFP applicants or beneficiaries, i.e., as agents living in poverty or in extreme poverty, in this municipality, f (failure). Thus, the success rate, is, will be given by: $is = \max\left\{0, \frac{ng-f}{ng}\right\}$.

Hence, if no Graduate slipped back into poverty, then the index value will be equal to 1 and the municipality will receive an additional 10% of the basic value for the efficient management of the Graduation Mechanism. Conversely, if the number of BFP Graduates who returned to the Single Registry in the past four years as applicants or beneficiaries is equal to or greater than the number of Graduates, then the municipality will not receive any additional fund under this category. Recall that agents who returned to the Single Registry as applicants in the past four years may have been released from the program a long time ago. For that reason, it is possible (albeit unexpected) that the number of *returnees* will exceed the number of Graduates within the same time interval. What is the expected effect of human capital incentive on the BFP local manager?

First, note that, since the manager wishes to guarantee the highest possible amount of funds for his municipality, the conditionality will make him especially concerned about the possibility of a BFP Graduate returning to poverty. As a matter of fact, every Graduate who is pushed back into poverty directly reduces local funds, in addition to competing with other agents in need of the BFP. Hence, the manager will try to guarantee, in the best possible way, the economic sustainability of his Graduates.

To that end, the manager basically utilizes two instruments: complementary qualification and training activities and the selection process for the Graduation mechanism.

Complementary activities are the instrument used for human capital formation. To ensure the Graduate's self-sufficiency, the local manager will have a large incentive to invest heavily on complementary activities, a crucial part of the BFP, unfortunately underdeveloped, according to CGU (2012). The manager has incentives to focus on training beneficiaries so that they can administer their own income after they are released from the program, through different actions targeted at exploring the comparative advantages of each municipality. Suppose, for instance, that the geological situation of a municipality is favorable to ecotourism. The manager will then be able to develop training workshops in the field of ecotourism, providing qualification to local guides, restorers, etc., ensuring thereby sustainable income for the beneficiaries.¹³

As discussed previously, given the wide reach of benefits, the Graduation Mechanism has the potential to attract a large number of BFP Graduation candidates among beneficiaries. The conditionality intends to align their incentives with public interest, and the manager will seek to select only the candidates with the largest potential for self-sufficiency to be released from the program, ensuring the municipality a continuous flow of transfers over time.

Also, note that the conditionality on success produces a reputational effect of the manager on his population. In fact, the higher the success rate, the more additional funds the municipality will receive, bringing satisfaction to the local residents and improving the manager's reputation of a good administrator. Thus, aside from the manager's personal interest in obtaining more funds for his administration, there exists the fear that a low success rate will make her lose

¹³ Such programs are provided for in the IGM-D transfer regulation and are the essence of the recent focus on the "transformative" CCT programs (Molyneux et al., 2016) and is also part of Mexico's Prospera program (Holmes & Jones, 2013).

political support from the local community, which is another incentive for the careful selection of BFP Graduates.

4 Simulations: Fiscal impact of the proposed mechanisms

This section presents simulations of the estimated fiscal impact of the proposed mechanisms over a six-year period encompassing four complete cycles of graduation. Our departing point is the 2010 year, when the latest Brazilian population Census was conducted by IBGE. The 2010 Census included not only the typical questions regarding household income, but also the additional questions regarding the BFP benefits. Therefore, we were able to calculate the pre-PBF income of all households and to determine which households received the PBF as well as their corresponding per capita income. Since the total number of benefit-recipient households did not entirely match the PBF data, an adjustment had to be made in order to reflect the more precise PBF numbers,¹⁴ as shall be explained in this section.

Our simulations keep the 2010 picture as static in the sense that we do not include any population dynamics for the next six years. Furthermore, we do not include any changes in the BFP's budget, i.e., we assume that the 2010 PBF budget is repeated without increase throughout the six-year period. Our goal is to estimate to effect of the proposed mechanisms on the BFP's budget, reach and precision without considering additional effects associated to the changes in size or economic situation of the population in that period that are not associated to the workings for the PBF itself,¹⁵ nor any exogenous increase in the program's budget.

We consider three possible scenarios depending on the speed and efficiency of the implementation of the mechanisms, an optimistic, a conservative and a pessimistic scenario. For each scenario, we calculate the additional costs and the additional savings associated to the implementation of the mechanisms. When

¹⁴ We prioritize the PBF numbers because they refer to actually paid benefits and also because there is expected to be some untruthful reporting by Census respondents, as some poor citizens might be ashamed of declaring they receive the benefit or still some wealthier beneficiaries might not declare because they are afraid the BFP authorities may find out that they are wrongful recipients. Regarding the issue of income misreporting in surveys see Hurst, Li, and Pugsley (2014), for example.

¹⁵ This is done in order to obtain a purer measure of the effect of the new mechanisms. Suppose, for example, a sustainable cycle of economic growth took place over that period, reducing overall poverty levels; then the reach of the program will increase regardless of the new mechanisms only because there will be fewer poor citizens in need of the PBF.

the savings are higher than the costs, we include new beneficiaries into the PBF up to the amount of resources freed by the new mechanisms. The hypotheses regarding the distribution of types of entrants is explained in each one of the scenarios. Our simulations allow for savings in a certain year to be lower than costs, in which case no new beneficiary is included, the deficit is recorded and reduced from the surplus the following year. However, as we shall see in this section, there are no deficits in any of the scenarios.

In each case, we calculate the new reach and precision of the program along the six initial years of implementation. For that calculation, we consider our target households to be only those in group 1, the households living in extreme poverty or in poverty. The ability of the PBF to select the "right" beneficiaries, the group 1 citizens, will depend on the assumptions in each scenario, as described below.

4.1 Calibration parameters

For the sake of simplicity, we kept the original income figures in Brazilian currency, the Real (R\$). The BFP defined its target population as households with monthly per capita income up to R\$140. These are the households in our group 1, the type 1, poor households. Furthermore, according to the PBF any household beneficiary could remain in the program for up to 2 years if its per capita income exceeded R\$140 but remained below R\$255. These correspond to the households in our group 2, the type 2, vulnerable households. Finally, all households with per capita income higher than R\$255 belong in our group 3, the type 3, well off households.

According to IBGE 2010 Census, there were a total of 7,548,550 households enrolled in the BFP in 2010. Our calculations estimated that 53.98% of these belonged in group 1, 25.29% in group 2 and the remaining 20.73% belonged in group 3. However, the Ministry of Social Development (MDS), which manages the PBF and, thereby, holds detailed accounts of beneficiaries, informs that there were 12,778,220 beneficiary households. The MDS has no precise information about the group distribution of beneficiaries. Therefore, we used our group distribution calculations based on the Census data to estimate the number of households in each group among the 12,778,220 beneficiaries.¹⁶ A similar calculation was performed in order to estimate the total cash amount of benefits

¹⁶ Note that our calculations may be underestimating the number of type 3 households in the BFP, as it may be more likely that misreporting occurs from those who are wrongfully receiving the benefit. If that happens to be the case, then the gains of the new mechanisms are, actually, higher than those found in the simulations.

received by PBF households in 2010, per income group. Table 2 presents the corresponding numbers, in addition to an estimate of the distribution of the total Brazilian household population in 2010 into the three income categories.

Using the estimates in Table 2 we can calculate the number of households in each group that are non-beneficiaries (the first line minus the third line) and also calculate the *reach* and the *precision* of the BFP in the beginning of the 2010. These are:¹⁷ $R^0 = 0.474$, $P^0 = 0.743$.

Table 3 contains the estimates of the average benefit and of the fitted average benefit granted to BFP beneficiaries according to their income bracket, in addition to the mean per capita income for the whole population in each income group. We carried out a fit analogous to the one described above to match the estimated average benefit with the average benefit reported by the MDS. For simplicity, our simulations' calculations are based on the weighted fitted average benefit of the entire PBF household recipients, which was computed using the relative distribution of each income group. The resulting benefit, in 2010 Brazilian Real, is R\$1,124.78, which corresponds to a monthly average of b = R\$93.73.

The Graduation Mechanism establishes a subsidized microcredit to be granted three times throughout a three years period to each graduate. The subsidy cost is calculated as the difference between the SELIC interest rate and the TJLP long-term interest rate plus an additional percentage that reflects default costs. The SELIC is the interest rate set by the Brazilian Central Bank and reflects the cost of public financing; it was set to 10.66% a year in July 2010, when the first microcredit would have been awarded.¹⁸ The TJLP is a subsidized interest rate that is used by the Brazilian Social and Economic Development Bank (BNDES) and is taken here as the benchmark rate for BFP microcredit; it was set at 0.5% throughout 2010.¹⁹ We set the default cost as 5.7% of total credit, the default rate in Brazil in December 2010.²⁰ Therefore, the microcredit subsidy cost parameter is s = 15.86.

Finally, the Human Capital Mechanism incentive mechanism establishes a potential 10% increase in transfers from the Decentralized Management Index (IGD-M). The total amount of transfers via the IGD-M in 2010 was R\$288,849,118.67. Therefore, the yearly cost of that mechanism is $0.1IGD_{2010} = 28,884,912$.

 $^{^{17}}$ This calculation was first developed in Souza et al. (2018).

¹⁸ The SELIC interest rate is available at https://www.bcb.gov.br/?COPOMJUROS

¹⁹ The TJLP interest rate is available at http://www.receita.fazenda.gov.br/PessoaJuridica/Refis/ TJLP.htm

 $^{^{20}}$ See Martello (2012).

Table 2. Brazilian household population, househol per income bracket (denominated in Brazilian curre	lds enrolled in the <i>Bols</i> ency in 2010 values, and	ı Família Program and d number of household	their corresponding to s).	otal benefits by
		Group		
	Group 1	Group 2	Group 3	TOTAL
Income bracket	per capita income < R\$140.00	R\$ 140.00 ≤ per capita income < R\$ 255.00	per capita income $\geq R$ \$ 255.00	All
Household population (2010 Census)	8,853,960	7,778,737	40,811,336	57,444,033
Number of beneficiary households (2010 Census)	3,855,762	1,991,966	1,700,822	7,548,550
Fitted number of beneficiary household (MDS)	6,527,052	3,372,008	2,879,160	12,778,220
Total 2010 benefit (in R\$, 2010 Census)	4,767,575	2,233,247	1,831,349	8,832,171
Fitted total 2010 benefit (in R\$, MDS)	7,758,333	3,634,191	2,980,177	14,372,702
Source: Authors' calculations based on IBGE 2010 Census and Br	azilian Ministry of Social Deve	slopment (MDS).		

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Group	Group 1	Group 2	Group 3
Average benefit	1,236.48	1,121.13	1,076.74
Fitted average benefit	1,188.64	1,077.75	1,035.09
Mean per capita income	52.25	206.29	1,284.23

Table 3.	Average Benefit	and Mean pe	r Capita Incon	ne (in R ^g	\$, 2010 value	s).
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Source: Authors' calculations based on IBGE 2010 Census and Brazilian Ministry of Social Development (MDS).

4.2 Simulations: the optimistic, conservative and pessimistic scenarios

This section assesses the fiscal impact of the implementation of the three mechanisms proposed herein on the BFP over a six-year period based on different hypotheses about the speed of implementation of these mechanisms and about the BFP's management capability to select the target households, as will be explained more precisely later. The following hypotheses are supposed to hold for all scenarios:

- (i) Graduation and self-exclusion occur in the first month of each year. New vacancies are also fulfilled in the first month of every year.
- (ii) The Graduation Mechanism is carefully implemented, so that only citizens of type 2 graduate.
- (*iii*) The graduates become citizens of group 3 by the end of the three-year support period.
- (iv) The implementation of the Citizen Contribution Mechanism is enough to scare non-beneficiary group 3 citizens out of applying to the BFP. Therefore, once the mechanisms are implemented, only citizens form group 1 and 2 apply for eventual new vacancies.

In what follows, we show in detail the specific hypotheses that differ in each scenario and we present the resulting simulations. The detailed simulation algorithms are available upon request to the authors.

The optimistic scenario

In this scenario we postulate that the Citizens' Contribution Mechanism (CCM) fully achieves its goals within the first year of implementation. Hence, the mechanism leads to the self-exclusion of over 2.8 million BFP beneficiaries that make a household per capita income greater than R\$255.00 in 2010, the type 3

agents. Note that, in this case, the benefit from self-exclusion is permanent, enabling savings for the program every year on.

The savings generated by the CCM and the GM will allow the program to select new beneficiaries. This scenario assumes that the entrants in one year belong to groups 1 and 2 according to the proportions of these groups in the beneficiary population by the end of the previous year, i.e., the capability of the BFP management that allowed the previous year's relative distribution of beneficiaries in groups 1 and 2 is maintained. Naturally, if the potential beneficiaries in one of the groups in the non-beneficiary population are exhausted, then the remaining vacancies are completely filled by households of the remaining group. If there are no more potential beneficiaries from group 1 or group 2 in the non-beneficiary population, then the vacancies are not filled, and the program generates net savings.

The Graduation Mechanism graduates 10% of the household population of type 2 in the first year and continues to release that same number of the households of type 2 in subsequent years. Naturally, if the type 2 household among the beneficiary population exhausts, then there will be a smaller or null number of graduates.

Table 4 presents the fiscal impact and dynamic evolution of the PBF throughout the six-year period. Under the very optimistic hypotheses of this scenario, all type 1 households become beneficiaries of the BFP by the 5th year of implementation of the new mechanisms. Therefore, we attain full reach by that fifth year.

Furthermore, precision increases from 0.74 to 0.874 by the $6^{\rm th}$ year of implementation.

The mechanisms reduce the cost of the BFP by a total amount of over 4.6 billion reals (R\$4,611,045,171). That saving allows the program to include over 4 million (4,099,504) new household beneficiaries throughout the six-year period.

Figure 4 presents the dynamic evolution of the share of each type of household among the beneficiaries of the BFP in the form of a 100% stacked column graph. Figure 5 presents the corresponding dynamics for the households that are not beneficiaries of the BFP. In these graphs as well as in the following we use the "traffic light" bar coloring to stress that the green series correspond to the target population, the yellow to the vulnerable, and the red to the antagonistic populations. Therefore, for the BFP beneficiary graph (Figure 4), the type 1, poor households are colored green, whereas for the non-beneficiary graph (Figure 5), the type 3, the well off, are colored green.

	Optimistic scenario					
	year 1	year 2	year 3	year 4	year 5	year 6
SAVINGS (R\$1,000)						
Self-excluded, group 3	3,238,425	3,238,425	3,238,425	3,238,425	3,238,425	3,238,425
Graduates, group 2	379,277	758,554	1,137,832	1,517,109	1,896,386	2,275,663
Total	3,617,702	3,996,979	4,376,257	4,755,534	5,134,811	5,514,088
COSTS (R\$1,000)						
Graduation bonus	189,639	189,639	189,639	189,639	189,639	189,639
Maintenance of benefit	189,639	189,639	189,639	189,639	189,639	189,639
Savings incentive	0	189,639	379,277	379,277	379,277	379,277
Microcredit cost	38,535	77,069	115,604	115,604	115,604	115,604
Human Capital mechanism	28,885	28,885	28,885	28,885	28,885	28,885
New entrants	3,171,005	3,322,110	3,473,214	3,852,491	4,231,768	4,611,045
Total	3,617,702	3,996,979	4,376,257	4,755,534	5,134,811	5,514,088
FISCAL IMPACT OF THE PROPOSED	MECHANIS	MS (R\$1,0	00)			
Funds freed for BFP expansion	3,171,005	151,104	151,104	379,277	379,277	379,277
INCLUSION OF NEW BENEFICIARIES (1,000 UNIT	S)				
Number of new household beneficiaries	2,819	134	134	337	337	337
Reach (Year $0 = 0.474$)	0.891	0.909	0.927	0.982	1.000	1.000
Precision (Year $0 = 0.743$)	0.836	0.848	0.861	0.871	0.874	0.874

Table 4. Fiscal impact and dynamic evolution of the BFP – OPTIMISTIC SCENARIO (R\$ 2010 values and number of households).

Source: Author's calculations. Detailed algorithm available upon request.



Source: Authors' calculations.

Figure 4. Dynamic evolution of the relative share of household types among the BFP beneficiaries – Optimistic scenario.



Source: Authors' calculations.

Figure 5. Dynamic evolution of the relative share of household types among the non-beneficiaries of BFP – Optimistic scenario.

Figure 5 shows the end of the well-off households among the beneficiaries in the very year of implementation of the mechanisms and also shows the increasing participation of the target households among the beneficiaries. Full reach is attained in the 5th year of implementation, so that the last two columns are identical. However, as Figure 5 shows, the effect of Graduation continues even after full reach is achieved, since graduates move from type 2 to type 3 households, so that the last two columns in Figure 5 differ. In other words, the new mechanisms also reduce the vulnerable population. This is an additional benefit of the proposed mechanisms that does appear in the calculations of reach and precision of the BFP.

Note an important fiscal feature of these mechanisms: no extra burden on the program's cost is needed in order to incorporate these additional 4,099,504 households, i.e., the mechanisms are self-supported.

The conservative scenario

In this scenario, we assume gradual efficiency of the implementation of the Citizens' Contribution Mechanism. With progressive enforcement of the time dedication requirement, self-exclusion occurs only gradually. Our assumption is that every year, 20% of the total of group 3 beneficiaries in 2010 self-exclude themselves.

Moreover, the Graduation Mechanism graduates now only 5% of the household population of type 2 in the first year and continues to release that same number of the beneficiaries of type 2 in subsequent years. Naturally, if the type 2 households among the beneficiary population exhausts, then there will be a smaller, or even null number of graduates.

As in the previous scenario, new households are selected to receive benefits funded by the freed resources. For the sake of realism, we assume in this scenario and also in the subsequent (pessimistic) one—that the entrants take the new vacancies according a weighted average of the beginning of the year's proportions of type 1 and 2 citizens in the BFP and of those in the non-beneficiary population. The higher the weight in the BFP beneficiaries, the better is the selection process. We postulate a weight parameter $\alpha = 1/2$ for this conservative scenario. In this language, the previous optimistic scenario corresponds to $\alpha = 1$, i.e., all the weight goes to the proportions of groups in the BFP. Table 5 presents the dynamic evolution of the PBF throughout the six-year period.

Table 5. Fiscal impact and dynamic evolution of the BFP – CONSERVATIVE SCENARIO (R\$ 2010 values and number of households).

	Conservative scenario						
	year 1	year 2	year 3	year 4	year 5	year 6	
SAVINGS (R\$1,000)							
Self-excluded, group 3	647,685	1,295,370	1,943,055	2,590,740	3,238,425	3,238,425	
Graduates, group 2	189,639	379,277	568,916	758,554	948,193	1,137,832	
Total	837,324	1,674,647	2,511,971	3,349,294	4,186,618	4,376,257	
COSTS (R\$1,000)							
Graduation bonus	94,819	94,819	94,819	94,819	94,819	94,819	
Maintenance of benefit	94,819	94,819	94,819	94,819	94,819	94,819	
Savings incentive	0	94,819	189,639	189,639	189,639	189,639	
Microcredit cost	30,077	60,153	90,230	90,230	90,230	90,230	
Human Capital mechanism	28,885	28,885	28,885	28,885	28,885	28,885	
New entrants	588,723	1,301,151	2,013,579	2,850,902	3,688,226	3,877,864	
Total	837,324	1,674,647	2,511,971	3,349,294	4,186,618	4,376,257	
FISCAL IMPACT OF THE PROPOSED MECHANISMS (R\$1,000)							
Funds freed for BFP expansion	588,723	712,428	712,428	837,324	837,324	189,639	
INCLUSION OF NEW BENEFICIARIES (1	,000 UNIT	S)					
Number of new household beneficiaries	523	633	633	744	744	169	
Reach (Year $0 = 0.474$)	0.534	0.605	0.675	0.755	0.832	0.849	
Precision (Year 0 = 0.743)	0.763	0.780	0.797	0.812	0.826	0.829	

Source: Author's calculations. Detailed algorithm available upon request.

Under the more realistic hypotheses of this scenario, we do not attain full reach within the first six years of implementation. However, the reach of the PBF almost doubles in that time period, increasing from 0.474 in 2010 to 0.849 in 2015. Furthermore, precision also improves, increasing from 0.743 to 0.829 by the 6^{th} year of implementation.

The mechanisms reduce the cost of the PBF by a total amount of almost 4 billion reals (3,877,864,401) throughout the six-year period. That saving allows the program to include almost 3.5 million (3,447,661) new household beneficiaries.

For the sake of space, the graphs plotting the dynamic evolution of the shares of each type of households among beneficiaries and non-beneficiaries are presented in Appendix (subsection A.2, page 51).

The pessimistic scenario

In this scenario, we also assume gradual efficiency of the implementation of the Citizens' Contribution Mechanism, so that increasing enforcement of the time dedication requirement, self-exclusion occurs only gradually.

However, our assumption now is that every year, only 10% of the total of group 3 beneficiaries in 2010 self-exclude themselves.

Moreover, the Graduation Mechanism is also less efficient and graduates now only 2.5% of the household population of type 2 in the first year and continues to release that same number of the beneficiaries of type 2 in subsequent years. Table 6 presents the dynamic evolution of the PBF throughout the six-year period.

As in the previous scenario, we assume that the entrants take the new vacancies according a weighted average of the beginning of the year's proportions of type 1 and 2 citizens in the BFP and of those in the non-beneficiary population. The higher the weight in the BFP beneficiaries, the better is the selection process. We postulate a weight parameter $\alpha = 1/3$ for this more pessimistic scenario.

Under the more pessimistic hypotheses of this scenario, the benefits of the mechanisms display a slower dynamic. Indeed, the reach of the PBF increases less than 50% from 0.474 in 2010 to 0.672 in 2015. Furthermore, precision also improves at a slower rate, increasing from 0.743 to 0.788 by the $6^{\rm th}$ year of implementation.

Nevertheless, the mechanisms allow for a savings of over 2 billion reals (R\$2,248,332,239), which is used to include new beneficiaries. Throughout the period a total of almost 2 million households (1,998,906.139) are incorporated in the BFP.

For the sake of space, the graphs plotting the dynamic evolution of the shares of each type of households among beneficiaries and non-beneficiaries are presented in Appendix (subsection A.2, page 51).

	Pessimistic scenario							
	year 1	year 2	year 3	year 4	year 5	year б		
SAVINGS (R\$1,000)								
Self-excluded, group 3	323,842	647,685	971,527	1,295,370	1,619,212	1,943,055		
Graduates, group 2	94,819	189,639	284,458	379,277	474,097	568,916		
Total	418,662	837,324	1,255,985	1,674,647	2,093,309	2,511,971		
COSTS (R\$1,000)								
Graduation bonus	47,410	47,410	47,410	47,410	47,410	47,410		
Maintenance of benefit	47,410	47,410	47,410	47,410	47,410	47,410		
Savings incentive	0	47,410	94,819	94,819	94,819	94,819		
Microcredit cost	15,038	30,077	45,115	45,115	45,115	45,115		
Human Capital mechanism	28,885	28,885	28,885	28,885	28,885	28,885		
New entrants	279,919	636,133	992,347	1,411,009	1,829,670	2,248,332		
Total	418,662	837,324	1,255,985	1,674,647	2,093,309	2,511,971		
FISCAL IMPACT OF THE PROPOSED MECHANISMS (R\$1,000)								
Funds freed for BFP expansion	279,919	356,214	356,214	418,662	418,662	418,662		
INCLUSION OF NEW BENEFICIARIES (1,000 UNITS)								
Number of new household beneficiaries	249	317	317	372	372	372		
Reach (Year $0 = 0.474$)	0.500	0.532	0.563	0.600	0.636	0.672		
Precision (Year $0 = 0.743$)	0.752	0.760	0.769	0.775	0.782	0.788		

Table 6. Fiscal impact and dynamic evolution of the BFP – PESSIMISTIC SCENARIO (R\$ 2010 values and number of households).

Source: Author's calculations. Detailed algorithm available upon request.

4.3 Summary

The three simulations present evidence of two very important properties of the proposed mechanisms.

First, the results suggest that the mechanisms may be effective means of improving the *reach* and the *precision* of the PBF. In the most optimistic scenario, the mechanisms allow for full reach within 5 years and precision nears 0.9 after 6 years of implementation. Even in the most pessimistic scenario, the reach increases by almost 50% to 0.67 and the precision also improves.

Second, the mechanisms are self-supported in the sense that they do not require, at any moment, any supplementation of resources. This last property is especially important when we consider the present days situation in Brazil where the government is heavily budget constrained and cannot increase expenditures.

The main explanation for these properties is the very high savings that the Citizen Contribution Mechanism (CCM) has the potential to generate. If the CCM is implemented too slowly, there could, eventually, be a period of need for supplementary resources. For example, if the Graduation Mechanism (GM) is implemented before the CCM, there will be a net deficit in the PBF. Therefore, in order to ensure sustainability of the proposed mechanisms, all mechanisms should be implemented at the same time or, if not, the CCM mechanism must be firstly implemented. In general, the longer is the lag between the implementation of the CCM and the implementation of the other two mechanisms, the higher the initial savings for the program will be.

5 Conclusion

This paper sought to shed a new light upon the BFP, using the theoretical background of the economics of information and incentives and of applied mechanism design theory. The study was divided into three large parts.

The first part assessed the possible incentive and selection problems in the BFP's current design. The theoretical analysis highlighted two major problems that affect the reach and precision of the program.

The first problem refers to an adverse incentive or moral hazard problem. The problem arises from the requirement that income be below the poverty line for agents to be eligible. Given such requirement, agents with a lower productive capacity who can derive an income slightly above the poverty line may be encouraged to underwork in order to comply with the income requirement.

The second problem refers to adverse selection and is associated with the stochastic technology for the verification of the income of BFP applicants. Considering the nontrivial probability that the government will not detect income misreporting, and also considering that, if a misreport is uncovered, the typical and only punishment is exclusion from the program, then, some agents with higher income will be encouraged to apply.

Based on these diagnostics, the second part of the study suggests adjusting the design of the BFP in order to tackle the existing moral hazard and selection problems. Therefore, we propose three new mechanisms.

The first, the Citizens' Contribution Mechanism (CCM), consists in adding the requirement that applicants dedicate time to the BFP. This requirement aims to solve the adverse selection problem by inducing the self-exclusion of beneficiaries with high income. Due to their high productivity, a working hour of these agents generates an income way above the BFP grant. For that reason, faced with having to decide between devoting their time to the program and dedicating it to their most productive task, applicants tend to choose not to participate in the program in order to receive a higher income from the other activity. The second proposal, the Graduation Mechanism (GM), is aimed at supporting beneficiaries who can make proof of their ability to generate income. In that case, they will graduate from the PBF but will be assisted with a range of financial incentives for three years until they can strengthen their economic status as new members of the Brazilian middle class. In addition to creating a broad array of benefits both to the program and to the citizen graduated from it, this essentially self-sustaining mechanism aims to solve the moral hazard problem, as agents will no longer be interested in underworking in order to remain in the program, because, quite on the contrary, they will be keen on earning an increasingly higher income so as to be selected among the applicants to the Graduation Mechanism's valuable benefits.

Finally, the third mechanism, the Human Capital Incentive (HCI), consists of a 10% increase in the basic value transferred to municipalities via the Municipal Decentralized Management Index (IGD-M) transfer program, conditional on the efficient management of the CCM and the GM. The HCI mechanism provides incentives for the BFP local manager dedicate effort and resources in preparing and qualifying beneficiaries in the best possible way, allowing them to succeed in the emancipation process initiated with the Graduation Mechanism, thereby cutting down on BFP costs and allowing larger transfers to the local manager.

Since these mechanisms are intended to considerably reduce the adverse selection and moral hazard problems, they may contribute to BFP attaining deeper reach, better precision and, consequently, higher focalization, thereby allowing for the larger allocation of financial funds to the neediest population.

The third and final part of the study presented a carefully calibrated simulation of the fiscal impact and of the effect on the range and precision of the PBF when the proposed mechanisms are implemented, over a period of six years. We analyzed three different scenarios according to different assumptions on the pace of implementation of the mechanisms and on the PBF manager's ability to select the beneficiary households belonging in the target population to fill the new vacancies.

The first, optimistic scenario assumes a quick implementation and good selection capabilities and concludes that full reach is attained within 5 years. Furthermore, precision also improves, nearing 0.9 by the end of the six-year period. The second, more, conservative scenario, assumes slower pace of implementation of the mechanisms and less efficient selection capabilities. In that case, full reach is not attained but the reach of the program almost doubles within six years. Its precision also improves throughout the period. Finally, the third, pessimistic

scenario postulates a still slower implementation pace and a still less efficient selection capability in the part of the BFP managers. The simulations show that even in this case there is a steady improvement both of the reach, which increases by almost 50%, and the precision of the program.

In all three cases there is significant cost-reduction running from about 2 billion Brazilian reals, in the pessimistic case, to over 4.6 billion reals in the optimistic case. When the savings are used to include new beneficiary household, almost 2 million families can become beneficiaries in the most pessimistic scenario and over 4.5 million new families enter the program in the optimistic case.

In spite of the positive potential of the proposed mechanisms, it is important to keep in mind that the models used in this paper are feeble approximations or the very complex reality and should be taken as a guideline rather than a strict policy to be implemented. Several additional explorations may be developed to assess the strength of the proposed mechanisms. One important issue is the cost of complying with the time dedication requirement for the beneficiaries that do not self-exclude from the program, that may include transportation, meals, and even psychological costs, for example. These costs may lead to the self-exclusion of the poor citizens that the program targets. Other extensions involve the fact that, as the reach and the precision of the program increase, it becomes much harder and costly to identify the correct beneficiaries for inclusion in the program. Manipulation of the graduation mechanism, in spite of the incentives created by the human capital mechanism may also pose a challenge to the implementation of the proposed adjustments. The extension of the basic models studied here to analyze these difficulties is left here as a suggestion for future research.

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Appendix

A.1 Preliminary empirical evidence

The theoretical model suggests that more productive agents derive higher income and work more. To assess whether these findings of the theoretical model are consistent with the empirical evidence, we use the Brazilian 2010 Census, in which respondents explicitly informed whether they were BFP recipients. Following the modeling of agents' types, we split the sample into three cohorts according to the income per capita prior to the payment of the BFP benefit, hereinafter referred to as *ex-ante* per capita income. These cohorts take into account only agents with positive labor earnings, according to the classification below:

- **Type 1:** *ex-ante* household per capita income up to R\$140.00, which makes agents eligible for the program.
- **Type 2:** *ex-ante* household per capita income between R\$140.01 and R\$255.00, that is, vulnerable agents.
- Type 3: ex-ante household income per capita over R\$255.00, the well-off agents.

Figure A-1 shows the box-plot diagrams for agents' productivity per household income for the full sample and for the BFP beneficiaries, respectively, including agents aged 10 or more years old with positive labor earnings. The concept of productivity corresponds to the monthly labor earnings divided by hours worked. The idea of performing the analysis based on all agents and on BFP recipients aims at checking whether large differences exist between them. The figure shows that 50% of distribution centers (second and third quartiles) grow as one moves from a lower income bracket to a higher one, although this movement is less pronounced for the sample of beneficiaries. This corroborates the precept of the model that more productive agents are found in higher household income brackets.

Likewise, Table A-1 shows the means and standard deviations for the productivity of each group for the full sample and for the sample of beneficiaries. To assess whether the means of each group are statistically different—as suggested by the boxplots—tests of difference were performed between the means of group 1



Source: Authors' calculations from IBGE 2010 Census data.

Figure A-1. Productivity per working hour of citizens of type 1, 2 and 3 for Brazilian population and for PBF beneficiaries (in 2010 Brazilian reals).

	Full sample			Sam	ple of BFP be	FP beneficiaries	
Types of agents	N	Mean	Standard error	N	Mean	Standard error	
1	1,079,407	6.31	0.01	216,8	44 5.01	0.02	
2	1,241,464	13.08	0.02	139,3	02 10.96	0.05	
3	6,734,003	37.93	0.09	168,1	54 18.00	0.13	

Table A-1. Mean per capita productivity for each type of agent.

Source: 2010 Population Census - IBGE (Instituto Brasileiro de Geografia e Estatística).

and those of group 2 and between those of group 2 and those of group 3.

Using a t test, we confirm that the differences between the means are statistically significant at 1%, in each of the samples. Therefore, we reject the null hypothesis that the mean productivity of agents of types 1, 2 and 3 is the same.

Figure A-2 shows the boxplots for hours worked per income bracket for the full sample and for the BFP beneficiaries. The figure shows that the three groups have medians close to 40 hours, except for group 1 in the sample of beneficiaries. Group 3 in the full sample has a smaller spread, suggesting these agents have formal job contracts. Groups 1 and 2, on the other hand, have a very high spread. Unlike the boxplots for productivity, it is not possible to identify right away whether there is a large difference in hours worked between the groups.

Again, with the aim of checking whether the difference between the means is significant, t tests were performed to determine the difference between group 1 and group 2 and between group 2 and group 3. The results indicate rejection of



Source: Authors' calculations from IBGE 2010 Census data.

Figure A-2. Weekly working hours of working citizens of type 1, 2 and 3 for Brazilian population and for PBF beneficiaries (in 2010 Brazilian reals).

the hypothesis of equality between the means in both cases at 1% of significance.

Therefore, this section suggests an increase in mean productivity and mean worked hours between the household income brackets analyzed. Recall that, although this finding supports the hypotheses of the model, it should be viewed as preliminary evidence and further analyses may be needed in order to confirm this evidence.

Table A-2 presents he means of each group for the full sample and for the sample of beneficiaries.

	Full sample			Sample	of BFP be	neficiaries	
Types of agents	N	Mean	Standard error		N	Mean	Standard error
1	1,079,407	34.82	0.02		216,844	30.52	0.04
2	1,241,464	38.62	0.01		139,302	33.21	0.05
3	6,734,003	40.56	0.01		168,154	35.78	0.04

Table A-2. Mean productivity per capita for each type of agent.

Source: 2010 Census - IBGE. Authors' calculations.

A.2 Simulation. Dynamic evolution of each household type among beneficiaries and non-beneficiaries in the PBF with the proposed mechanisms – the conservative scenario

Figure A-3 presents the dynamic evolution of the share of each type of household among the beneficiaries of the BFP in the form of a 100% stacked column graph. Figure A-4 presents the corresponding dynamics for the households that are not beneficiaries of the BFP.

Figure A-3 shows the progressive self-exclusion of type 3 beneficiaries from the program, which takes five years to conclude. It also shows the increasing proportion of type 1 households. However, that increase slows down as the years go by, due to the difficulties of selecting the target households for the new vacancies. Figure A-4 highlights the increase in the percentage of type 3 household among the non-recipients, which impacts favorably the precision of the program. Note that, it is also the case in this scenario that the mechanisms are self-supported, i.e., no extra burden on the program's cost is needed in order to incorporate these additional 3,447,661 households.

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Source: Authors' calculations.

Figure A-3. Dynamic evolution of the relative share of household types among the BFP beneficiaries – Conservative scenario.



Source: Authors' calculations.

Figure A-4. Dynamic evolution of the relative share of household types among the non-beneficiaries of BFP – Conservative scenario.

A.3 Simulation. Dynamic evolution of each household type among beneficiaries and non-beneficiaries in the PBF with the proposed mechanisms - the pessimistic scenario

Figure A-5 presents the dynamic evolution of the share of each type of household among the beneficiaries of the BFP in the form of a 100% stacked column graph. Figure A-6 presents the corresponding dynamics for the households that are not beneficiaries of the BFP. The slower implementation of the CCM is such that there still remain a considerable number of type 3 households by the $6^{\rm th}$ year of implementation. However, the target population grows from about 50% to almost 60% of total beneficiaries. Conversely, it reduces significantly in the non-beneficiary population.

Therefore, even under the very pessimistic hypothesis of this scenario, the mechanisms generate a significant improvement in the reach and precision at no additional cost to the BFP, i.e., no extra burden on the program's cost is needed in order to include the additional 2 million households.

A.4 A Discussion on Implementing the Citizens' Contribution Mechanism

Monitoring cost

Requiring beneficiaries to dedicate time to the program may ask that the administrator incur in additional monitoring cost. These costs may belong to one of two categories, depending on the activity the beneficiary will be joining. If the activity is of the type that helps the municipality in providing public services, such as taking care of a school yard or cleaning the school grounds, the school principal will most likely be pleased to manage the monitoring. On the other hand, if the activity focuses on developing the beneficiary human capital, such as job training, literacy programs, etc., then this is precisely where the additional budget coming from the Human Capital Incentive Mechanism should be used. Therefore, albeit costly, there is additional budget for that very activity.²¹

Rigidity in the labor market and exemption from the time allocation requirement

The theoretical analysis developed above is based on the finding that poorer agents of type 1, being less productive, devote less time to work. Nonetheless,

 $^{^{21}}$ The authors are grateful to an anonymous referee for pointing out the monitoring costs issue.

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Source: Authors' calculations.

Figure A-5. Dynamic evolution of the relative share of household types among the BFP beneficiaries – Pessimistic scenario.





Figure A-6. Dynamic evolution of the relative share of household types among the non-beneficiaries of BFP – Pessimistic scenario.

a series of frictions exist in the real world that may call this hypothesis into question, such as rigidity in the labor market. Some workers, although they earn less, are formally employed to work 40 or 44 hours a week and are often unable to choose to work less. An additional requirement for time allocation might have an adverse effect, jeopardizing agents' professional activity.

To tackle the rigidity problem, one could include an exceptionality rule, by which those who can prove they work full-time should be excused from the time allocation requirement.

The advantage of this rule is threefold. First, it allows agents who work full-time and earn less (lower household per capita income) to proceed with their activities and receive the benefit.

Second, this rule still discourages agents of type 3 from applying for the benefit. In fact, for being released from the time allocation requirement, these agents would have to provide proof that they generate an income above the poverty line and are thus not allowed to receive the benefit. Therefore, this release from the time allocation requirement does not affect the self-exclusion incentives of agents of type 3.

Finally, this release from the time allocation requirement has an unexpected effect: it favors formal job contracts, whenever possible. Actually, the best way to prove one works full-time is by producing one's work contract; thus, the necessity of this proof accentuates the importance of a formal job contract.

Productivity-based self-exclusion

A simpler alternative model could assume that, when agents are expected to devote some of their time to the program, cost-effectiveness would be estimated by comparing the benefit granted by the program per unit of time (hour) dedicated to it, b/h, with productivity. As the benefit is fixed, the more hours required for the program, the smaller the benefit per hour, and the larger the incentive to sign out of the program. Quite interestingly, this type of model would basically yield similar conclusions.

Taking into account the wealth of data on the Brazilian 2010 Census, i.e., the variability in the values of benefits paid and in productivity, even between households within the same income bracket, it is possible to estimate the percentage of beneficiaries in each income bracket who would sign out of the program for each level h required under the Citizens' Contribution Mechanism.

To look at these results in more detail, we split the BFP beneficiaries into five income brackets: below R\$140 (group 1), between R\$140 and R\$255 (group 2), between R\$255 and R\$510 (group 3), between R\$510 and R\$1,020 (group 4)

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and over R\$1,020 (group 5). Recall that group 1 corresponds to agents of type 1, group 2 includes agents of type 2, and the remaining groups are made up of agents of type 3 in our theoretical model. The result of this experiment is shown in Figure A-7. Note that, under these hypotheses, there would always be a percentage of agents in the higher income brackets who insist on remaining in the program, meeting the requirements for time allocation, even if this percentage sharply decreases with the increase in the number of hours worked.

Conversely, regardless of the amount of time devoted to the program, a percentage of beneficiaries from group 1 would sign out of the program, setting up a trade-off. As more hours are required, the larger will be the percentage of self-excluded beneficiaries with a higher income. Unfortunately, the undesired self-exclusion of legitimate beneficiaries would also increase.

According to the simulation, if one weekly hour is required, less than 2% of the total number of agents of type 1 will give up the benefit. In the higher income bracket, nearly 47% of the agents will self-exclude from the program. On the other hand, increasing the requirement to three weekly hours, even though self-exclusion in the higher income bracket increases by almost 80%, self-exclusion would also increase in the lower income bracket by over 12%. Nevertheless, if agents of type 1, working full-time, are excused from allocating some of their time to the program, then self-exclusion will be reduced in this group, allowing



Source: Authors' calculations based on IBGE 2010 Census.

Figure A-7. Citizen's Contribution and Exclusion: Percentage of beneficiaries who would self-exclude by income bracket as a function of the number of hours required.

for the requirement of more hours from the Citizens' Contribution Mechanism.

Note that any number of hours required from the Citizens' Contribution Mechanism might imply the sign-out of legitimate beneficiaries, producing an undesirable effect. Therefore, pilot programs with different requirements in different municipalities may be needed to calibrate the parameter h.

A.5 Discussion on Implications and implementation of the Graduation Mechanism

The high value of Graduation benefits producing a paradigm shift in society

The Graduation Mechanism encourages agents of type 2 to voluntarily opt out of the BFP, even when we do not take into account the additional advantages of social status, the savings incentive, and microcredit. Therefore, this mechanism is expected to boost the demand from BFP beneficiaries. This is a change in paradigm in society, from the present situation in which vulnerable citizens wish to remain under the protection the PBF to a new situation where they wish to leave it in order to receive its benefits.²² This important feature of the mechanism will allow the BFP to become more efficient, maintaining, in the medium run, only those agents of type 1, who are unable to escape poverty should they be left unassisted, due to their low productivity.

The significant benefits of graduating from the BFP and Graduation control

The low intertemporal discount factor, δ , favors a higher demand for BFP Graduation. This demand may be extended to agents of type 1 who are unable to generate an income that is compatible with self-sufficiency and should not opt out of the program. Therefore, it is very important that the beneficiaries prove they can generate sufficient income before they sign out of the program.

A very natural rule is the classification according to the reported income. Those who prove they are able to generate a higher income are less likely to go back to the BFP. Hence, their Graduation must be given priority. However, it should be highlighted that the first proposed mechanism addresses agents of type 3, whose income is above the poverty line. These agents should not have been on the BFP at the outset and, therefore, should be banned from the GM. A

²² However, it should be borne in mind that, in the current design of the program, the release of vulnerable agents from the program poses a large risk of pushing them back into poverty and, naturally, this should not be blindly encouraged.

second rule, which is quite natural, is the limitation of the number of Graduates per year to a percentage of the total number of beneficiaries in each municipality. The rationale behind this rule is that it stimulates the competition between applicants in each municipality, so that the selected agents are those less likely to go back to the BFP in the future.

Graduation benefits and the incentive to go back to the program

Taking into consideration all the benefits associated with the Graduation Mechanism, one should expect that some beneficiaries will seek to sign out of the BFP, but as soon as the benefits cease to be paid, they are likely to go back to living in poverty and to apply again for the program.

There are three natural ways to deal with this problem. First, it must be clear that, by opting out of the program, agents relinquish the permanence rule, the current rule that allows any beneficiary to leave the program spontaneously for having a sufficient income and to return automatically if the income becomes insufficient within a two-year period. When agents opt out of the program, they will have to wait in line, as any other applicant, if their financial health deteriorates and they wish to return to it.

Second, as there is great concern about the chronological order of benefits, and the competition for the Graduation Mechanism discussed above, it is very unlikely that Graduates from the program will slip back into poverty within the first three years. In fact, the mechanism offers the conditions for financial reinforcement in the first three years after being released from the program. Thus, during this period, the existing benefits ensure that agents will do their best to remain in the mechanism.

Finally, it is important to establish that agents will only have access to the Graduation Mechanism once. As the mechanism is aimed at facilitating independence from the program, agents who have already had the opportunity to be released from the program but did not seize it are not allowed to be put ahead of another agent who has not been given such opportunity yet. Therefore, beneficiaries who leave the program, but due to an insufficient income in the future need to go back to the program, will be automatically excluded from the selection process of the Graduation Mechanism.

Based on the discussion made in this section, we expect the incentives for beneficiaries to be well aligned with the goals of the mechanism.