UNIVERSIDADE DE SÃO PAULO
FACULDADE DE ECONOMIA, ADMINISTRAÇÃO E CONTABILIDADE
DEPARTAMENTO DE ECONOMIA
PROGRAMA DE PÓS-GRADUAÇÃO EM ECONOMIA

In-kind transfers in Brazil: household consumption and welfare effects

Transferências em produto no Brasil: efeitos sobre bem-estar e consumo das famílias

Bruno Toni Palialol

Orientadora: Profa. Dra. Paula Carvalho Pereda

São Paulo - Brasil
2016

Prof. Dr. Marco Antonio Zago

Reitor da Universidade de São Paulo

Prof. Dr. Adalberto Américo Fischmann

Diretor da Faculdade de Economia, Administração e Contabilidade

Prof. Dr. Hélio Nogueira da Cruz

Chefe do Departamento de Economia

Prof. Dr. Márcio Issao Nakane

Coordenador do Programa de Pós-Graduação em Economia

BRUNO TONI PALIALOL

In-kind transfers in Brazil: household consumption and welfare effects

Transferências em produto no Brasil: efeitos sobre bem-estar e consumo das famílias

Dissertação apresentada ao Programa de Pós-Graduação em Economia do Departamento de Economia da Faculdade de Economia, Administração e Contabilidade da Universidade de São Paulo como requisito parcial para a obtenção do título de Mestre em Ciências.

Orientadora: Profa. Dra. Paula Carvalho Pereda

Versão Corrigida

(versão original disponível na Biblioteca da Faculdade de Economia, Administração e Contabilidade)

São Paulo - Brasil

2016

FICHA CATALOGRÁFICA
Elaborada pela Seção de Processamento Técnico do SBD/FEA/USP

Palialol, Bruno Toni
In-kind transfers in Brazil: household consumption and welfare effects / Bruno Toni Palialol -- São Paulo, 2016.
73 p.

Dissertação (Mestrado) – Universidade de São Paulo, 2016.
Orientador: Paula Carvalho Pereda.

1. Economia de mercado 2. Medidas econômicas 3. Econometria I. Universidade de São Paulo. Faculdade de Economia, Administração e Contabilidade. II. Título.

CDD – 332.6323

Dedicada àqueles com coragem de enfrentar

os desafios que a vida lhes impõe.

Agradecimentos

Em primeiro lugar, agradeço à minha orientadora, Paula Pereda, pelo entusiasmo inabalável e busca incessante por aprimoramentos. Sem ela, o presente trabalho certamente não teria sido possível.

Agradeço à minha mãe, Sonia Toni, pela paciência, compreensão, carinho e por tornar os útimos anos de trabalho um pouco mais confortáveis.

À Marina Sacchi, pelo apoio incondicional e por me enxergar de uma forma que nem eu mesmo sou capaz. Sua admiração me encoraja a alçar voos cada vez mais altos.

Aos queridos Danilo Souza e Raí Chicoli, pela companhia e amizade sincera desde a graduação. As risadas compartilhadas nos corredores tornaram os dias mais leves e motivantes. Os próximos quatro anos serão ainda melhores.

Aos amigos Rafael Neves, pela inestimável ajuda com a base de dados e Elias Cavalcante Filho, pelo interesse e espírito crítico, que culminaram na configuração final deste trabalho.

Agradeço à CAPES (Coordenação de Aperfeiçoamento de Pessoal de Nível Superior) pela concessão da bolsa durante todo o período de realização deste mestrado.

Aos membros do Núcleo de Economia Regional e Urbana da Universidade de São Paulo (NEREUS), por me acolherem em seu espaço e contribuirem enormemente para o andamento dos trabalhos.

À minha família e amigos, cujos exemplos me moldaram enquanto pessoa e me permitiram chegar tão longe.

Por fim, agradeço aos colegas do IPE-USP, cujo interesse e curiosidade alavancaram meu crescimento profissional.

“ **One cannot think well, love well, sleep well, if one has not dined well.”**

Virginia Woolf

Resumo

Atualmente, o Programa de Alimentação dos Trabalhadores (PAT) cria incentivos para que firmas brasileiras realizem transferências em produto, tipicamente na forma de vales ou tíquetes, para cerca de 20 milhões de trabalhadores. O presente trabalho utiliza uma metodologia baseada em escore de propensão para testar se tais benefícios distorcem as decisões de consumo das famílias quando comparadas a transferências em dinheiro, considerando que essas últimas estão sujeitas a deduções fiscais características do mercado de trabalho. Os resultados sugerem que domicílios de baixa renda que recebem o benefício consomem de 15,7% a 25,0% mais comida do que se recebessem dinheiro e que o peso morto associado às distorções atinge US$63,1 (R$150,1) milhões. Entretanto, não há evidências de que o excesso de consumo de alimentos esteja, como se desejaria, tornando os trabalhadores mais saudáveis e produtivos. Apesar da necessidade de uma análise mais detalhada em termos de nutrientes, esta é uma primeira evidência de que o PAT pode não estar atingindo seus principais objetivos.

Palavras-chaves: Transferências em produto; Programa de Alimentação dos Trabalhadores; Bem-estar.

Abstract

Today in Brazil, *Programa de Alimentação dos Trabalhadores* (PAT) creates incentives for firms to provide 20 million workers with in-kind transfers, typically in voucher form. This work uses a propensity score framework to test whether such benefits distort consumption decisions when compared to cash transfers, considering the latter are subject to payroll taxes. Results suggest poor households consume from 15.7% to 25.0% more food when receiving benefits instead of cash and that deadweight loss associated with distortions reach US$63.1 (R$150.1) million. Overconsumption, however, may not be increasing worker's health and productivity as desired. Although further analysis needs to be made in terms of nutrient intakes, this is a first evidence that PAT may not achieve its main objectives.

Key-words: In-kind transfers; *Programa de Alimentação dos Trabalhadores* (PAT); Welfare.

List of Figures

List of Tables

Contents

1 Introduction

Although recent progress has been made by poor countries in terms of economic growth and, consequently, poverty reduction, there are still vulnerable regions demanding assistance. Specially in rural Africa, chronic poverty and social vulnerability remains a problem to be addressed by international authorities. Safety nets support needy communities, providing them with regular and reliable transfers, which can be delivered in cash or in-kind (MONCHUK, 2014).

The term "in-kind transfer" characterizes give aways that constrain consumers acquisition possibilities. In these poor countries food typically represent such assistance. It can be be delivered as physical items or through vouchers and coupons, exclusively exchangeable for comestibles. Theory shows there are possible distortions associated with food transfers, when compared to cash, where overfeeding arises as evidence [1]. Thus, understanding its impacts on beneficiaries' allocations is crucial for policy design.

This work sheds light on a Brazilian meal transfer scheme named *Programa de Alimentação dos Trabalhadores* (PAT) which benefits almost 20 million workers countrywide according to Ministry of Labor. Federal government grants tax breaks for those firms willing to provide food benefits to subordinates. Abatements are usually small (limited to 4% of companies' total income tax), however, evidences suggest this limit is not binding.

Program was created in 1976 after FAO [2] data showed Brazil had workers living with minimum acceptable calorie patterns (SILVA, 1998). Based on the literature which linked nutrition and labor efficiency [3], policy was designed to improve nutritional intake of laborers, raising their productivity and economy's production.

In the year of its 40th anniversary, PAT has faced little changes while Brazilian productive structure is considerably different, presenting better nourished and educated workers. Of course there are still plenty of social issues to be addressed in Brazil, but an

1 Hoynes and Schanzenbach (2009) and Ninno and Dorosh (2003)
2 Food and Agriculture Organization of the United States.
3 According to Kedir (2009), works like Leibenstein (1957), Stiglitz (1976), Mirrlees (1976) and Bliss and Stern (1978) studied the link between productivity and consumption.

evaluation of PAT is necessary to determine whether this specific policy is beneficial and if it is worth spending US$1.0 (R$2.4) billion yearly in tax breaks (Appendix A).

Since PAT is inserted in labor market context, in-kind transfers are not levied on. In this case, traditional welfare superiority of cash transfers [4] over in-kind transfers is no longer obvious, because the former are considered wage increasing and, therefore, are subject to tax deductions. Within such context, this dissertation tests whether food vouchers and *cestas básicas* supply distort consumption and evaluates possible impacts on welfare.

In order to remove selection bias and identify PAT's effects, regional, sectoral and socioeconomic differences among beneficiaries and non-beneficiaries are explored. Regional variables to account for fiscal incentives; sectoral indicators for labor unions pressure and attempts in rising workers' productivity; and, finally, socioeconomic characteristics to control for individual preferences. A propensity score framework is applied using data from *Pesquisa de Orçamentos Familiares* (POF) [5] and it is possible to show that program distorts poor families' consumption while rich households are not affected, consuming first-best quantities. This result makes sense since food expenditures of richer households are, on average, higher than food voucher values.

Deadweight loss related to distortions is also estimated and lies between US$31.5 (R$74.9) and US$63.1 (R$150.1) million, which represent 3.2% to 6.4% of government tax breaks. Further estimates show no relation between food overconsumption and increased intake of healthier aliments. That means program may be failing into fulfilling its objectives of improved nourishment and, consequently, labor productivity.

This dissertation contributes to literature in many ways. It is pioneer in evaluating PAT using microeconomic theory along with an impact evaluation methodology. So far, program assessment consisted in judging firm's specific initiatives in terms of nutritional adequacy [6]. Additionally, welfare considerations allow a cost-benefit analysis, raising evi-

[4] Under cash transfers consumers face a greater set of choices than under in-kind.
[5] A traditional Brazilian household consumption survey.
[6] Moura (1986); Burlandy and Anjos (2001); Veloso and Santana (2002); Savio et al. (2005); and Geraldo, Bandoni and Jaime (2008).

dences to discuss in which extent PAT benefits Brazilian workers. It also states foundations for further research, described in Section 7.

The work is divided into 7 sections, considering this introduction. Section 2 establishes conceptual basis of in-kind transfer analysis and how it is applied to PAT. Section 3 explains program assignment and identification strategy used to eliminate bias selection. Section 4 details dataset and shows relevant descriptive statistics. Sections 5 and 6 respectively present estimation results and welfare considerations. Finally, Section 7 summarizes findings, proposes policy measures and suggests future research agenda.

2 In-kind transfers

2.1 In-kind versus cash transfers

In-kind transfer is a general term attributed to give aways that restricts the bundle of products that may be acquired by consumers, such as food or non-food items, vouchers, coupons and others. Alternatively, cash transfers allow agents to buy whatever fits their budget constraint. Thus, many researchers are interested in comparing their effects, specially on food consumption. According to Gentilini (2007), Engel's law and consumer theory contributed for this literature.

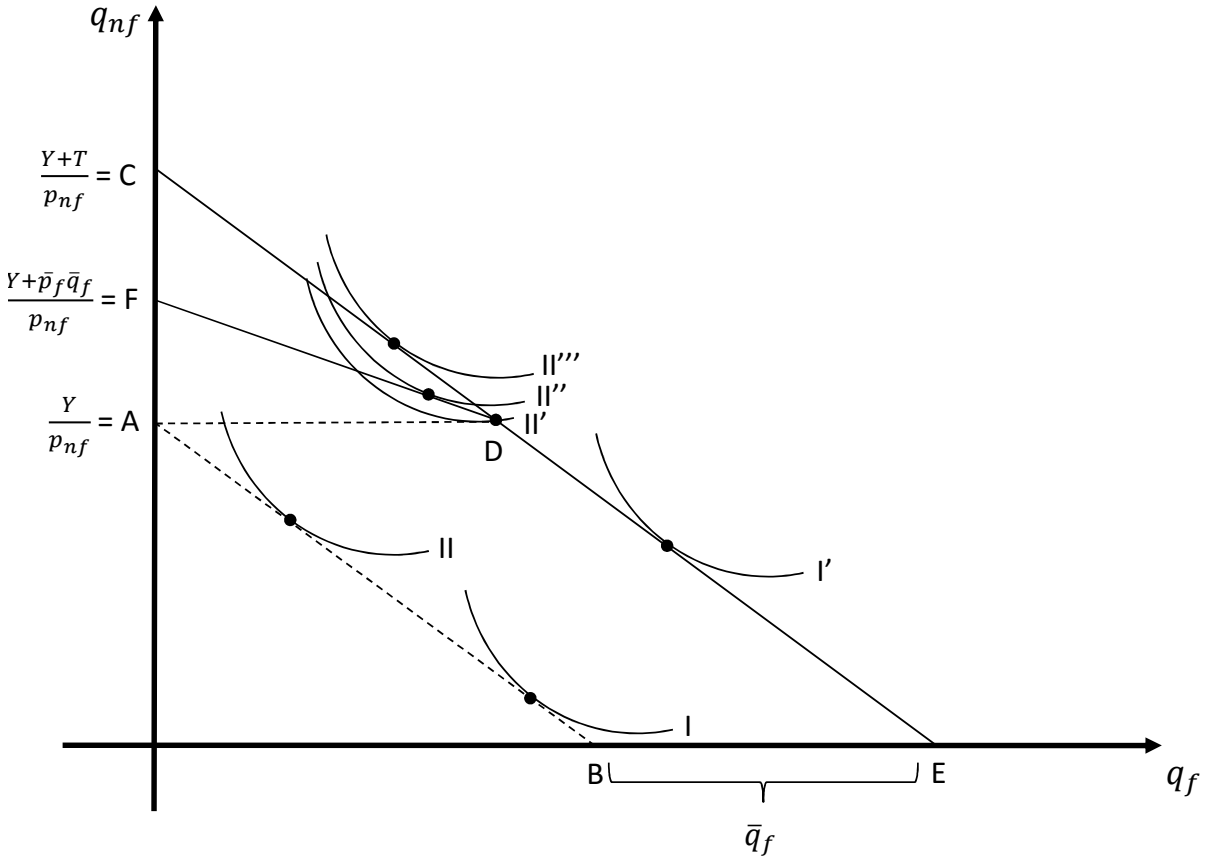
Engel's law asserts that as income rises, proportion spent on food items decreases, even if actual expenditure on food increases. In other words, income elasticity of food lies between zero and one, being higher for poorer than richer families. Thus, cash transfers may be useful for increasing low-income households' food consumption. One example is *Bolsa Família*, a Brazilian conditional cash transfer program whose objective is to alleviate poverty and boost human capital accumulation of 14 million families or 57 million people (CAMPELLO; NERI, 2013).

Regarding consumer theory, it supports that individuals are guided by their preferences, so they maximize utility subject to a budget constraint. Following Cunha (2014), suppose consumers demand food (q_f) and other goods (or non-food items, q_{nf}) and that they maximize an utility function $U(q_f, q_{nf})$ strictly increasing and concave in both arguments. Let p_f and p_{nf} be prices of food items and other goods, respectively. Budget constraint may be written as $p_f q_f + p_{nf} q_{nf} \leq Y$, where Y is income. Line segment $\overline{AB}$ in Figure 1 represents this restriction.

Suppose a cash transfer of value T which will shift budget constraint to $\overline{CE}$ and an in-kind transfer of same value $\bar{q}_f = \frac{T}{p_f}$ which creates a kink [7], depending on food reselling

[7] Kink is created where $q = \bar{q}_f$, which is $\overline{AD}$ size.

Figure 1 – Impacts of in-kind and cash transfers on consumption



Source: Based on Cunha (2014), own elaboration

price, $\bar{p}_f$:

$$p_f q_f + p_{nf} q_{nf} \leq \begin{cases} Y + \bar{p}_f \bar{q}_f, & if \quad q_f \leq \bar{q}_f \\ Y + p_f \bar{q}_f = Y + T, & if \quad q_f > \bar{q}_f \end{cases} \tag{2.1}$$

When reselling is allowed at market price ($\bar{p}_f = p_f$) then $p_f q_f + p_{nf} q_{nf} \leq Y + T$ (restriction $\overline{CE}$) which is equivalent to a cash transfer of value T. If negotiation occurs at a fraction of full price ($\bar{p}_f \in (0, p_f)$), then $p_f q_f + p_{nf} q_{nf} \leq Y + \bar{p}_f \bar{q}_f$ (restriction $\overline{FDE}$). Finally, for the case trade is not permitted ($\bar{p}_f = 0$), then restriction of interest is $\overline{ADE}$.

Based on Figure 1, cash transfers weakly dominate in-kind since consumers face a greater set of choices. Exception occurs when $\bar{p}_f = p_f$ as consumers face identical budget constraints. Indifference curves I and II represent two types of agents, whose choices are evaluated in order to assess possible distortions associated with in-kind transfers.

For consumer II, $\bar{q}_f$ is *extra-marginal* because it provides a greater amount of food than he would have chosen under a cash transfer. To see this note that under cash transfer, consumer II chooses optimal quantity associated with II''' which is lesser than $\bar{q}_f$. For consumer I the in-kind transfer is *infra-marginal* since under cash transfer he demands more food (optimal quantity associated with I') when compared to $\bar{q}_f$.

That is to say that only *extra-marginal* transfers distort consumer choices. Individual II receives more food than desired (optimal quantities associated with II' or II'') when his best is achieved at II'''. Consumer I, on the other hand, is indifferent between both transfer schemes. Distortion caused by an *extra-marginal* transfers is measured as:

$$EM_f(\bar{q}_f) = \begin{cases} \bar{q}_f - q_f^{Cash}, & if \quad q_f^{Cash} < \bar{q}_f \\ 0, & otherwise \end{cases} \tag{2.2}$$

An in-kind transfer is classified as *binding* when consumer demands more food than it was transferred. That is the case of individual I who demands optimal quantity associated with I' but only receives $\bar{q}_f$. For consumer II, transfer is considered *non-binding* since demands associated with II'' and II''' are both smaller than $\bar{q}_f$. In this case, only *non-binding* transfers distort consumer choices and can be measured by:

$$NB_f(\bar{q}_f) = \begin{cases} \bar{q}_f - q_f^{In-kind}, & if \quad q_f^{In-kind} < \bar{q}_f \\ 0, & otherwise \end{cases} \tag{2.3}$$

Note the main difference between those concepts is comparison base. When evaluating an in-kind transfer in terms of extra-marginality, $\bar{q}_f$ is compared with consumer choice under cash transfer. However, to define *binding* transfers, comparison occurs with choice under in-kind transfer.

Hence, total distortion associated with an in-kind transfer of size $\bar{q}_f$ can be seen as the amount consumed above cash transfer. In terms of the previous definitions:

$$D_f(\bar{q}_f) = EM_f(\bar{q}_f) - NB_f(\bar{q}_f) = q_f^{In-kind} - q_f^{Cash} \tag{2.4}$$

Intuitively, $D_f(\bar{q}_f)$ evaluates food quantities received above cash transfer optimum

(which is bad for consumer), but discounted from non-binding transfers, that improve his welfare since he is receiving an extra amount of food. In other words, extra-marginal transfers move consumer away from optimality but this effect is partially compensated by a surplus in provision, which actually improves well-being.

However, it is hard to empirically measure $D_f(\bar{q}_f)$ since individuals cannot be observed under both transfer schemes. As for Cunha (2014), distorting effects of in-kind transfers and its magnitude have fundamental importance for policy makers. A lack of empirical evidence exists since counterfactual behavior can never be observed. Such problem will be addressed using matching principles discussed in Section 3.

From discussion above, cash transfers weakly dominate in-kind since there may be a distortion associated with the latter. Next section uses this framework to analyze potential distortions associated with an important Brazilian public policy, *Programa de Alimentação dos Trabalhadores*[8].

2.2 Brazilian context

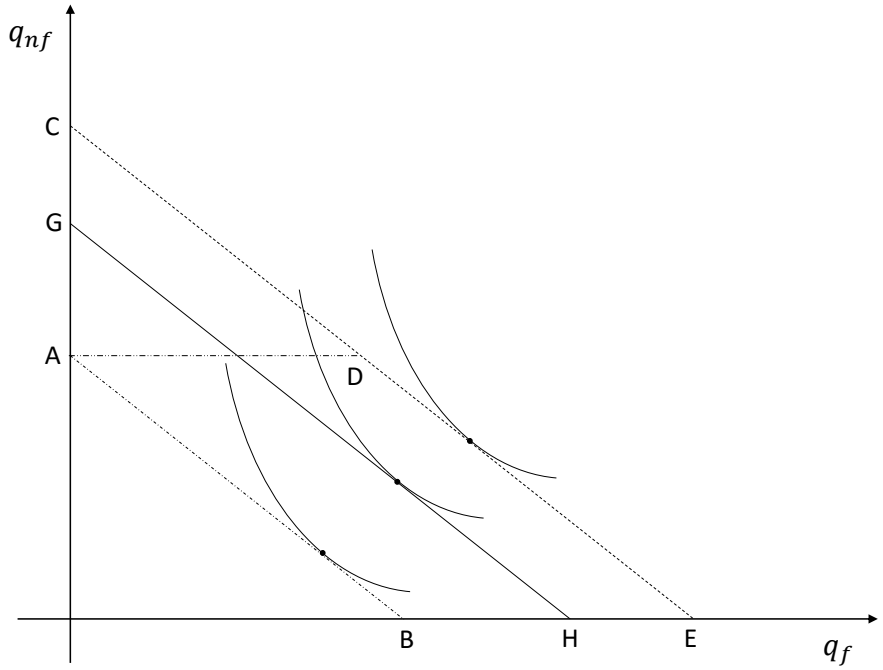
Programa de Alimentação dos Trabalhadores is a voluntary Brazilian food program created in 1976 whose objective is to provide nutritionally adequate meals, specially for low income workers, granting them more productivity. Federal government grants tax breaks for firms willing to provide food benefits for its workers on a monthly basis. For workers and companies, the main advantage of such benefits is that regular payroll and income taxes do not apply.

In order to maintain eligibility, firms must keep all employees situation strictly inside law. Any sign of labor rights violation results in total removal of fiscal privileges. A full detailed description of PAT can be found in Appendix A.

When transfers are not made in-kind, they are considered salary raise and taxed accordingly, resulting in a discounted transfer $T' = (1 - \tau)T$. Discount factors (τ) are detailed in Appendix A and represent payroll taxes applied over labor income in Brazil.

[8] Worker Food Program in a free translation.

Figure 2 – $q(Y+T,\mathbf{p}) \sim q(Y+p_f\bar{q}_f,\mathbf{p}) \succ q(Y+T',\mathbf{p})$



For each additional R$1.0 payment companies pay R$1.48 and workers receive minus 8.0% to 22.2%, depending on income level. It changes traditional analysis in a way that is not obvious that T' is preferable to in-kind transfers.

Consumer preferences are represented by Figures 2, 3 and 4. $\overline{AB}$, $\overline{CE}$ and $\overline{ADE}$ represent same budget restrictions of Figure 1. Only difference among figures is restriction $\overline{GH}$, which represents a monetary transfer $T' = (1-\tau)T < T$. Such transfer may be superior (Figure 3) or inferior (Figures 2 and 4) to in-kind, depending on individuals preferences.

In other words, considering firms would not increase their spending when deciding to provide in-kind transfers or cash transfers [9], it is not trivial to infer their workers would be better off or not in terms of consumption.

For simplification purposes, analysis sticks to the case where benefits are not renegotiated (ADE restriction). In fact, PAT does not allow beneficiaries to resell benefits, but it is known that illegal traders charge consumers wiling to exchange vouchers for

[9] Or they could shift consumers' budget constraint back to an equal valued cash transfer.

Figure 3 – $q(Y+T,\mathbf{p}) \succ q(Y+T',\mathbf{p}) \succ q(Y+p_f\bar{q}_f,\mathbf{p})$

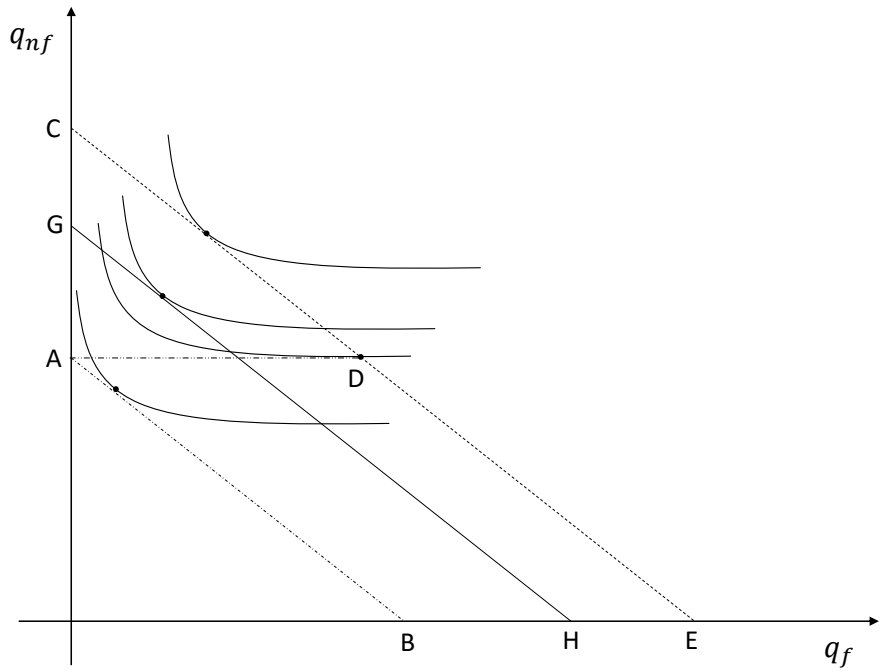
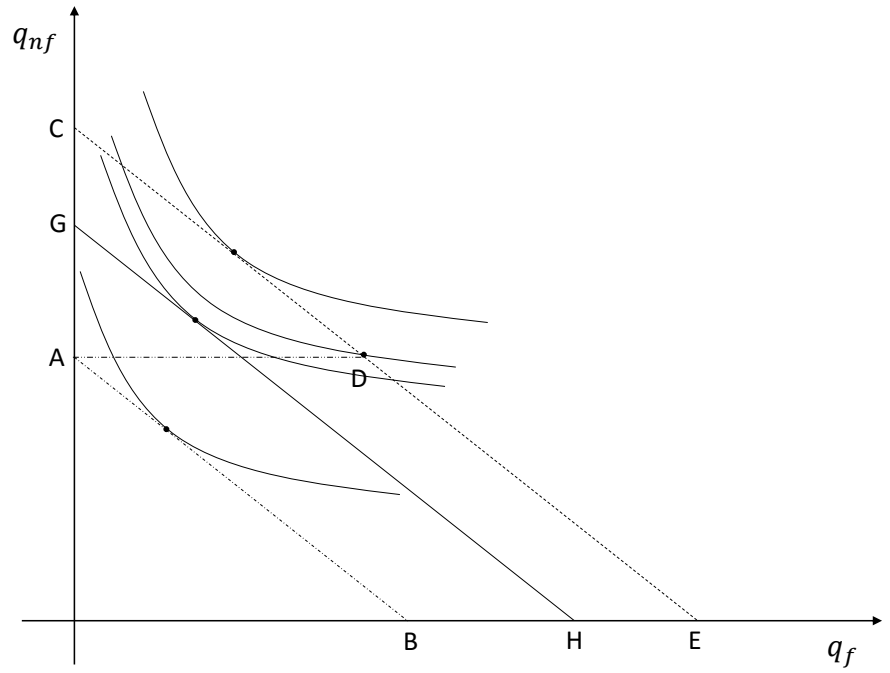


Figure 4 – $q(Y+T,\mathbf{p}) \succ q(Y+p_f\bar{q}_f,\mathbf{p}) \succ q(Y+T',\mathbf{p})$



cash [10].

This dissertation evaluates those potential distortions in food consumption (in terms of equation 2.4) for program beneficiaries. Concluding PAT transfers are not distortional when compared to a discounted cash transfer, mean program reaches a first-best situation, equalizing full cash transfers (Figure 2). Now, in case program actually distorts food consumption, scenario is twofold: (i) cash transfers may be preferable (Figure 3); or (ii) in-kind transfers may be preferable (Figure 4). They are both second-best situations and results ultimately depend on consumer preferences.

Next section discusses the empirical strategy to estimate possible distortions in Brazilian provision of in-kind transfer for different types of consumers.

[10] There are legal restrictions to this practice, although the exact proportion of benefits informally exchanged is unknown.

3 Identification strategy

In order to identify a causal effect of PAT, potential food consumption of individual i when receiving in-kind transfers ($D_i = 1$) and cash transfers ($D_i = 0$) benefits ($q^f_{D_i=1} - q^f_{D_i=0}$) should be observed. This constitutes the fundamental problem of causal inference, since a person cannot be observed simultaneously in both states.

Adequately estimating a counterfactual in this work involves evaluating food acquisition of an individual receiving a cash transfer instead of an in-kind transfer (equation 2.4). Computing such difference between treatment and control individuals allows for calculation of an average impact of PAT on its beneficiaries, or an Average Treatment Effect on Treated (ATT), which can be expressed as:

$$E[q^f_{1i} - q^f_{0i} | D_i = 1] = E(q^f_{1i} | D_i = 1) - E(q^f_{0i} | D_i = 1) \tag{3.1}$$

Beneficiaries (or treatment group) are formal workers of private sector [11] who are legally aged to work (16-65) and receive any kind of food benefit. Accordingly, non-beneficiaries (or control group) are formal workers of the private sector who do not receive any type of food assistance.

Understanding benefit assignment is crucial for eliminating potential selection bias. Firstly, joining PAT is a firm's call and there are three main reasons believed to motivate participation decision: (i) fiscal incentives; (ii) labor unions pressure; and (iii) attempt to rise workers' productivity. Secondly, benefits may influence individual choices regarding job offers, leading those whose preferences are food tendentious to only accept assisted positions. Such mechanisms are further discussed hereafter.

As for fiscal incentives, PAT's rules establish that participating companies can deduce up to 4% of due income tax. However, eligibility is restricted to those opting for *lucro real* accounting concept, which allows only firms whose revenues exceed $ 32.8 (R$78.0) million a year to partake (Appendix A). This fact limits eligibility to big corporations, usually located in Southeast and South regions, (Figure 11). That is, spatial location

[11] Public firms are not eligible for tax breaks, so they were removed from analysis since incentives they face are probably different from those described in Section 3.

correlates to program assignment.

Regarding labor unions, DIEESE (2013) presents data of 197 agreements for all sectors signed between 2011 and 2012. Around 60% (120 accords) presented clauses mentioning workforce rights towards food. Associations' strength is reflected in Table 2, which shows services, industry and commerce sectors, known for suffering great syndicate pressure, concentrate most of PAT beneficiaries and this tendency is not shared by non-beneficiaries. In other words, distribution across sector changes for PAT participants.

When it comes to labor productivity, firms may use food benefits to increase production. Popkin (1978), Dasgupta and Ray (1986) and Strauss (1986) provide evidence on nutrition positively affecting labor outputs, mainly for handwork. Industry and construction sectors are aware of such results, and facilitate employees' access to adequate nutrition through PAT.

Finally, food assistance may drive individual decisions towards accepting specific job offers. Choosing between one or another depends on consumer preferences (Figures 3 and 4) [12]. Typically, low income workers tend to care more about food, thus their willingness to accept meal assisted jobs is higher. However, those employees are the ones with less bargaining power when seeking work, so it is not true they will always face this choice. Customers tastes, along with bargain control may be translated in terms of socioeconomic variables such as income and education.

Recapitulating, PAT assignment mechanism suggests regional, sectoral and socioeconomic variables are related to participation. Therefore, a vector X of covariates intended to eliminate selection bias should consider such factors. Once X is adequately specified, equation 3.1 may be rewritten as:

$$E[q_{1i}^f - q_{0i}^f | D_i = 1, X] = E(q_{1i}^f | D_i = 1, X) - E(q_{0i}^f | D_i = 1, X) \tag{3.2}$$

In other words, even if q_{1i}^f and q_{0i}^f are correlated with D_i, they become independent given X_i [13]. This condition is known as Conditional Independence Assumption (CIA). As

[12] Selection occurs if those who value food more are able to choose jobs which provide benefits.

[13] $q_{1i}^f, q_{0i}^f \perp\!\!\!\perp D_i | X_i, \forall i$.

shown by Rosenbaum and Rubin (1983), X may be merged into a propensity score, $P(X)$, and equation 3.2 remains valid with a slight modification:

$$E[q_{1i}^f - q_{0i}^f | D_i = 1, P(X)] = \\ E(q_{1i}^f | D_i = 1, P(X)) - E(q_{0i}^f | D_i = 1, P(X)) \tag{3.3}$$

Equation 3.3 is valid under common support or overlap assumption (CSA), which states that for each X or $P(X)$ there may be observations in both treatment and control groups. There are evidences that CSA is valid in all specifications.

Estimate equation 2.4 using Propensity Score Matching (PSM) [14] does not require an specific functional form for the food demand equation (Section 6), thus, it adapts better to possible nonlinearities involved in estimating benefit and food consumption relation. Moreover, assistance specificities regarding labor market and its use mostly throughout working hours demand strong internal validity [15]. Spatial program concentration and labor unions influence, which prevalently act in specific economic sectors, creates a unique market configuration where program assignment needs more degrees of freedom to be modeled. Estimates are causal effects of PAT if both X contains all relevant observables [16] and common support holds.

Regarding this issue, Heckman, Ichimura and Todd (1998) and Bryson, Dorsett and Purdon (2002) discuss a trade off when using propensity score since more covariates mean higher chances of violating common support hypothesis. In other words, including independent variables reduces bias but increases estimator variance.

Such trade off is illustrated by different types of matching. On the one hand, nearest neighbor matching matches each beneficiary with closest (measured by propensity score) control, and others are discarded. In this case, bias is minimum since each treated individual will be compared with only one control (DEHEJIA; WAHBA, 1999). At the same time, estimator variance increases since parameters will be calculated based on a

[14] Rubin (1974), Rosenbaum and Rubin (1983), Heckman, Ichimura and Todd (1998).
[15] Achieved with PSM in comparison with other methods.
[16] Also if those variables are balanced for treatment and control groups after matching.

smaller number of combinations [17] (SMITH; TODD, 2005).

On the other hand, considering a kernel based matching, individuals receive a higher weight if similar to treatment, not equal, as in neighbor matching. It increases number of controls and estimator variance diminishes. However, bias increase since quality of matchings might get worse (SMITH; TODD, 2005). Empirically, one must be aware robustness is important when choosing covariates. In this sense, Appendix C shows results are robust to other specifications.

About matching algorithms, King and Nielsen (2015) discuss how propensity score may increase imbalance, model dependence and bias, approximating a completely randomized experiment rather than a fully blocked experiment. Authors conclude Mahalanobis Distance Matching (MDM) is less susceptible to latter problems. For this reason, ATT was calculated with MDM in all specifications.

Summarizing, propensity score simulates an experiment at X (or $P(X)$) and, therefore, allows for good estimate of effects when there is selection on observed (X). Intuitively, it is possible to find for each PAT participant, a similar untreated individual based on characteristics of X. Therefore, it is possible to attribute differences between both groups to treatment effect. (HECKMAN; ICHIMURA; TODD, 1998)

Finally, an underlying hypothesis of this work is that beneficiaries food consumption does not influence market prices. Increased expending in food would shift demand outwards, pressure prices up and, consequently, diminish demand of non program participants, resulting in distortion overestimation. However, this is not believed to be true since people would continue spending money to eat in case of program absence. Moreover, a great number of restaurants and supermarkets spatially well distributed approximates food market of a competitive equilibrium, eliminating such interference.

Next section describes Pesquisa de Orçamentos Familiares (POF), a Brazilian household expenditure survey used for estimations.

[17] Variance continuously diminishes even if new combinations present low quality. That is, for variance what matters is quantity, not quality of matchings.

4 Dataset

Pesquisa de Orçamentos Familiares (POF) is a national Brazilian household budget survey which provides income, expenses and sociodemographic information for more than 57,000 Brazilian families. It is collected by Brazilian Bureau of Geography and Statistics (IBGE), an entity run by federal administration [18], which is in charge of government statistics in country. Last time IBGE collected POF was in 2008-09 [19].

Data was collected between May 19^{th}, 2008 and May 18^{th}, 2009 and all monetary values were normalized for January 15^{th}, 2009 to mitigate risk of absolute and relative price changes. Unit of analysis is families and attention was focused on demographic, consumption and income [20] information through questionnaires 1, 2 and 3, and 5, respectively. A detailed description of each questionnaire content can be found in Appendix B.

As for units standardization, consumption of food items [21] were treated in kilograms and other categories in units [22]. Expenses were annualized but are presented monthly when convenient. All values represent dollars considering an exchange rate of R$/US$2.38 [23]. Data did not allow differentiation between PAT modalities. For this reason, treatment represents receiving at least one of PAT benefits. Still, program modalities are presented below for clarification purposes.

PAT can be implemented through self-management and/or outsourcing. Self-management represents firms which provide cooked or non-cooked meals for its workers. It may involve *in natura* food supply and own restaurants. Outsourcing defines firms which delegate the latter tasks to an specialized firm and/or provide debt cards and coupons restricted to food acquisition. Companies are free to provide benefits in more than one modality (e.g. one runs a personal restaurant and provide workers with meal vouchers). More program details are presented in Appendix A.

---

18 Under Ministry of Planning, Budget and Management.

19 Next survey version, called POF 2015-16 is expected to be released on March, 2017.

20 Including benefits.

21 Analysis consider both items consumed inside and outside the house.

22 For example, acquisition of a shirt or socks were both treated as one clothing unit. Other categories besides food are only used in Section 6 for a demand system analysis.

23 Exchange rate in January 15^{th}, 2009.

From total expanded sample of 57,814,083 families, 7,926,638 (13.7%) have at least one member receiving food benefits [24]. For 2008, official data (Appendix A) reported program had 13.4 million beneficiaries, which is compatible with 1.69 PAT workers per family. Monthly average net benefit is US$69.6 (R$165.6) per month and distribution is positively skewed (Figure 5).

Beneficiaries are those individuals aged between 16 and 65, not working in public sector and receiving any type of food benefits, which are identified in POF as meal vouchers or *cestas básicas* [25]. Accordingly, non-beneficiaries present equal characteristics but do not receive benefits.

Regarding household head characteristics of beneficiary families, 70.85% are man, 54.89% caucasian, 73.10% married, 48.17% own health insurance and most are literate. Compared to eligible families, program households present 0.06 more dwellers on average, heads are 1.11 years younger, more educated (2.21 years) and have a higher income (annual: US$797.2 and per capita: US$243.5) (Table 1). Except for gender, all differences are statistically significant at 1% level.

From an economic activity perspective, distribution is concentrated, with participant head of households working most in services and industry, which account for 52% of them (Table 2). These evidences, along with income differences among groups (Figure 6), suggest that socioeconomic and sectoral factors are relevant to explain program assignment. Moreover, as for previous discussion, income is crucial for analysis, receiving special attention in Section 5, which presents results.

[24] Ideally, analysis should have been performed using individuals. However, POF does not provide food consumption at such disaggregated level.

[25] *Cesta básica* is a food box containing essential food items consumed by a typical Brazilian family such as rice, beans, milk, flour, sugar, among others.

Figure 5 – Family monthly average net benefit (2009 US$)

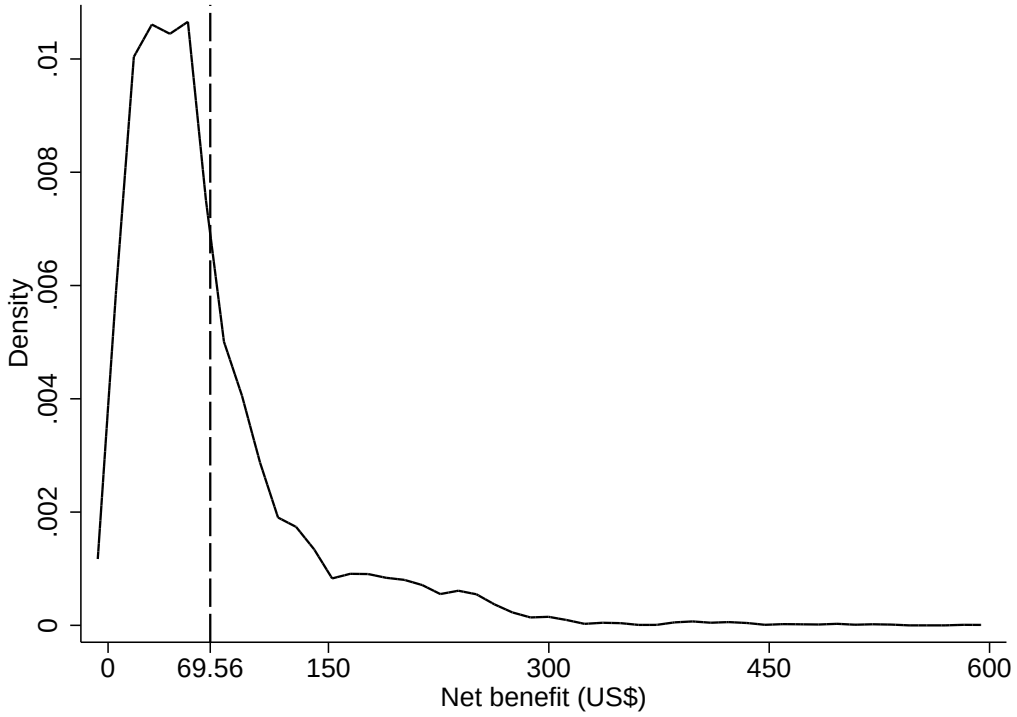


Table 1 – Household heads - differences between beneficiaries (B) and non-beneficiaries (NB)

Characteristics	**B mean**	**NB mean**	**Difference**
# dwellers	3.46	3.39	0.06***
Man (%)	70.85	70.50	0.35
Caucasian (%)	54.89	46.09	8.80***
Married (%)	73.10	68.74	4.36***
Literate (%)	97.55	88.34	9.21***
Health insurance (%)	48.17	22.99	25.18***
Age (years)	41.98	43.09	-1.11***
Education (years)	9.15	6.94	2.21***
Annual income (US$)	1,775.88	978.66	797.22***
Annual per capita income (US$)	606.84	363.33	243.5***

*p<0.1; **p<0.05; ***p<0.01

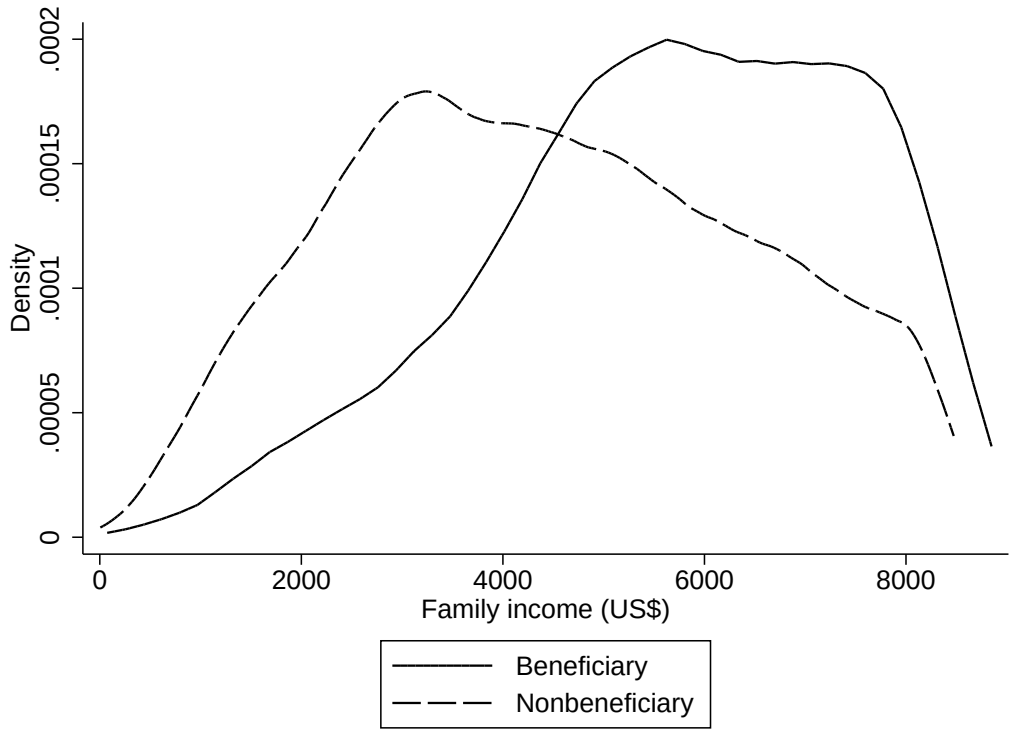
Table presents beneficiary (B) and non-beneficiary (NB) mean samples for selected variables. Traditional mean difference test is applied to verify differences among groups. Where (%), difference is in percentual points. Otherwise, it follows variable measure.

Table 2 – Percentage of beneficiaries and non-beneficiaries by economic activity

Economic activity	**Beneficiaries**	**Non-Beneficiaries**
Services	27%	20%
Industry	25%	16%
Commerce	16%	19%
Education and Health	11%	8%
Construction	10%	12%
Transportation	8%	6%
Agriculture	2%	19%

Table shows percentage of beneficiaries and non-beneficiaries by economic sector. 27% of beneficiaries work with services, while only 20% of non-beneficiaries participate in this sector. Other sectors present a similar tendency, showing their importance in explaining benefit provision.

Figure 6 – Annual income distribution of beneficiary and non-beneficiary families (2009 US$)



5 Results

According to previous discussion (Section 2.1), possible distortions associated with in-kind transfers are measured by differences in food consumption:

$$D_f(\bar{q}_f) = q_f^{In-kind} - q_f^{Cash} \tag{5.1}$$

$D_f(\bar{q}_f)$ represents family food consumption when receiving an in-kind transfer minus demand when under cash transfer. Estimating equation 5.1 involves a counterfactual problem, addressed by a Propensity Score Matching (PSM) approach (Section 3). Using income to match is vital due to its relevance in food consumption (Engel's Law). Those who did not receive any benefits but received a higher income that equals benefit value were used to estimate $\hat{q}_f^{cash}$. Estimations are performed in two versions:

1. Firstly one considers equality between income (Y) for untreated and income + benefit value (T) for treated. Such version simulates decisions firms traditionally face, provide \$K in cash or an equivalent value in-kind:

$$Y_{D=0} = Y_{D=1} + T \Leftrightarrow T = \Delta Y$$

2. Secondly one adapts for Brazilian labor market reality. Alternatively to $\$K$ in cash, beneficiary workers are provided with $\$K(1-\tau\%)$, where $\tau\%$ are taxes [26]:

$$Y_{D=0} = Y_{D=1} + T[1-\tau\%] \Leftrightarrow T = \Delta Y[1-\tau\%]$$

Considering discussion of Sections 3 and 4 a mahalanobis matching was estimated using regional, sectoral and socioeconomic covariates. Table 3 presents results of our favorite specification using simple regression bias correction, following Abadie and Imbens (2002).

[26] Percentuals of Table 6 were applied for estimations.

Table 3 – Estimated distortion effects of PAT benefits on food consumption (in kilograms) with bias correction

	(1) Full sample	(2) Poor	(3) Rich	(4) Full Sample	(5) Poor	(6) Rich
Benefit	11.23*	30.40**	14.33	14.95**	30.40**	28.34*
	(6.74)	(14.67)	(16.36)	(6.72)	(13.93)	(16.73)
Observations	18,235	3,648	3,625	18,235	3,647	3,625
Controls	YES	YES	YES	YES	YES	YES
Income	1	1	1	2	2	2

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
Table presents effects of treatment on food consumption in kilograms.
Income 1: $Y_{D=0} = Y_{D=1} + T \Leftrightarrow T = \Delta Y$.
Income 2: $Y_{D=0} = Y_{D=1} + T[1 - \tau\%] \Leftrightarrow T = \Delta Y[1 - \tau\%]$.
Besides income, other controls are #dwellers, education, race, transportation, services, south and north. Poor and Rich samples represent, respectively, 20 percent bottom and 20 percent top of income distribution.

Covariates balance as well as estimates without bias correction (for robustness purposes) are presented in Appendix C. Overconsumption estimates considering labor market taxes range from 4.1% to 5.7% for full sample and 13.0% to 21.2% for poor households [27]. Benefits would still be distortive even when compared to cash transfers after deducting taxes [28]. Richer families, however, did not present signs of excess in food consumption.

Only formal workers [29] were used for analysis since formality is an exigence for program eligibility. Moreover, POF only provides information for three (out of six) types of benefits: voucher *alimentação*, voucher *refeição* and *cesta básica* (Figure 12). This is not a problem for estimations. Possible other beneficiaries are not being classified accordingly, but still receive food benefits. So, if there is a distortion even without considering such workers, calculated effects probably represent a lower bound.

Specialized literature highlights that even slight misspecification of propensity score

[27] Percentages calculated over mean annual consumption of control group.
[28] In other words, distortion is not a result of payroll taxes. Even with equally valued cash transfers, consumers would still buy more food when receiving in-kind.
[29] Were considered formal those workers who payed income tax.

model can result in substantial bias of estimated treatment effects (Kang and Schafer (2007); Smith and Todd (2005)). Thus, inspired by Imai and Ratkovic (2014), who focus on propensity score balance when defining covariates, an iterative non-discretionary method is proposed to define which variables should be used for matching.

Strategy consists in: (i) run probit regression in order to exclude variables which do not statistically change treatment probability; and (ii) iteratively eliminate variables whose remaining bias (in %) was the largest between treated and control groups after matching. Step (ii) is repeated until no significant remaining bias is achieved for all covariates.

During estimation process, however, it was difficult to balance income, leading to sets of covariates where it was pruned. This is unacceptable due to its importance in explaining food consumption. For this reason, process was run for a initial variable set which did not contain such variable and then added after balance was performed.

Curiously, final set of covariates after iterative method did not present socioeconomic variables, although contained sectoral and demographic controls, as in favorite specification. This was surprising since they were expected to play an important role in determining food consumption.

Still, results were robust for both bias corrected and average treatment on treated estimates. They are presented along with balance statistics in Appendix C. Consumption excess varies from 5.3% to 8.1% in full sample and 15.7% to 25.0% for poor. Again, richer families did not present evidence of distortion and taxation did not influence results.

Another point of attention is that estimates consider families from rural areas. Some of them produce their own food , which could distort consumption analysis. However, they represent only around 10% of total sample and results remain unchanged if they are removed from analysis.

Literature on this subject reports evidences in favor and against distortions. Hoynes and Schanzenbach (2009) shows food stamp benefits provided in voucher form [30] lead to a

[30] In the context of Supplemental Nutrition Assistance Program (SNAP), the old Food Stamp Program (FSP).

small increase in food consumption. Accordingly, Ninno and Dorosh (2003) reports that transfers in-kind targeted to poor women and children in Bangladesh increased wheat consumption when compared to cash transfers. Cunha (2014) and Skoufias, Unar and González-Cossío (2008), on the other hand, find there is no differential effect in consumption when comparing in-kind and cash transfers for *Programa de Apoyo Alimentario* (PAL) [31].

Results suggest PAT benefits are distortive in general, but mainly for poor families. Based on analysis developed in Section 2.1, not all households are reaching higher indifference curves, so welfare considerations ultimate depend on their preferences (Figures 3 and 4). Rich people, however, consume food as in a first-best situation (Figure 2). Clearly, they are better off receiving benefits [32], but in terms of food consumption, program is innocuous.

A higher consumption, however, might not imply better nutrition. PAT objective is to provide nutritionally adequate meals for workers so they can raise productivity. In order to assess what such extra consumption means in terms of quality we break food into seven categories: cereals and pasta, fruits and vegetables, sugar and candies, proteins, non-alcoholic beverages, alcoholic beverages and industrialized.

As before, specifications used are favorite specification and iterative method, both considering a cash transfer with or without tax incidence and bias correction through regression. Results are presented in Table 4.

[31] A Mexican government's food assistance program to the rural poor.
[32] In-kind transfer releases income to be spent in other goods.

Table 4 – Estimated distortion effects for $T = \Delta Y[1 - \tau\%]$ - Quantity (annual kg per capita) with bias correction for seven food categories

		Favorite specification	Iterative method
Full sample	Cereal and pasta	-5.09**	-4.42*
	Fruits and vegetables	-3.90**	-3.28
	Sugar and candies	-1.71*	-1.63
	Meat/Chicken/Fish	-1.47	-1.77
	Nonalcoholic beverages	2.06	0.78
	Alcoholic beverages	1.14	1.56
	Industrialized	1.35	1.56
20% poor	Cereal and pasta	7.80	12.63**
	Fruits and vegetables	1.29	3.90
	Sugar and candies	-1.16	-0.91
	Meat/Chicken/Fish	-3.19	-2.29
	Nonalcoholic beverages	6.86*	8.01*
	Alcoholic beverages	0.15	0.14
	Industrialized	5.51	6.61*
20% rich	Cereal and pasta	-9.89**	-10.25**
	Fruits and vegetables	-2.41	-4.90
	Sugar and candies	-1.11	-1.47
	Meat/Chicken/Fish	-4.96	-6.95*
	Nonalcoholic beverages	9.87	2.21
	Alcoholic beverages	4.96*	4.83
	Industrialized	4.92	3.49

*p<0.1; **p<0.05; ***p<0.01

Table measures treatment effect on treated (in kilograms) considering bias correction for seven food categories. Favorite specification includes income, # dwellers, education, race, transportation, services, south and north dummies. Variables of iterative method are income, #dwellers, industry, construction, commerce, northeast and southeast.

Considering full sample, results show decreasing consumption of cereal and pasta, mainly driven for rich households, as well as reduced consumption of fruits and vegetables. Regarding poor families, there is positive distortion for non-alcoholic beverages and cereals. Also, although not significant, industrialized products and alcoholic beverages present consumption raising. Appendix C presents covariates balance and robustness without bias correction. Besides highlighted effects, there seems to be no significant change in consumption patterns, leading to a conclusion of no program influence in food categories. Maybe, total distortion estimated in Table 3 is evenly distributed among groups.

Analysis provide first insights on how consumers change their food choices once under the program. However, a complete qualitative analysis should necessarily consider vitamins, macro and micro nutrients intakes, similar to Pereda and Alves (2012). Authors calculate income elasticities for such variables and conclude 1% variation for poorer families increase consumption of fat and cholesterol proportionally more, which can be harmful in terms of health. If PAT produces a similar pattern for its beneficiaries, authorities should be concerned regarding healthy impacts of policy.

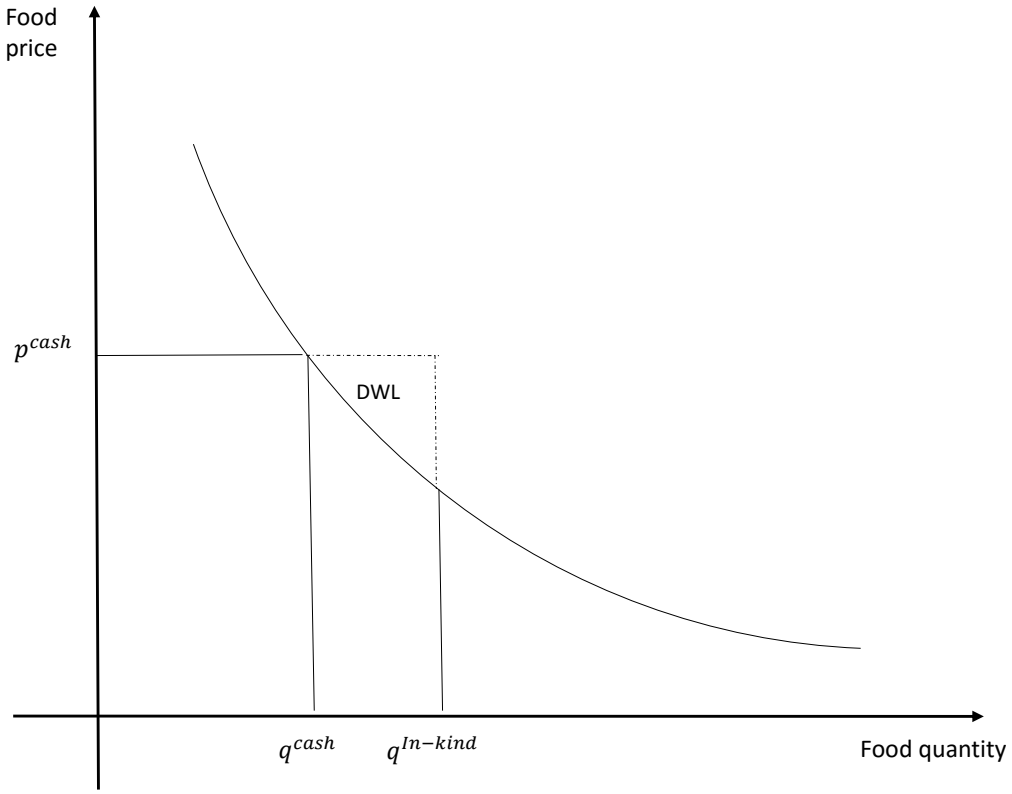
Additionally, excess of food consumption may be harmful for consumers in terms of welfare. Next section provides some thoughts on the subject.

6 Welfare considerations

As previously discussed, evidence suggests PAT benefits distort food consumption, delivering more food at a fixed price than consumers would buy under cash transfers. In other terms, households are forced to acquire goods at a higher price than desired, damaging welfare. Figure 7 depicts this situation where deadweight loss (DWL) can be approximated through a triangle [33]:

$$DWL \approx \frac{1}{2}\left(\Delta Q.\frac{\Delta Q}{\epsilon_{P,Q}}.\frac{P^m}{Q^m}\right) < 0 \tag{6.1}$$

Figure 7 – Deadweight Loss



Equation 6.1 is a lower bound since exact DWL area is bounded by demand curve, not a straight line. Quantity variation (ΔQ) is estimated in Section 5, so demand price elasticity ($\epsilon_{P,Q}$) must be accounted [34]. A demand system framework is used for this purpose.

[33] Note that $\Delta P = \frac{\Delta Q}{\epsilon_{P,Q}}.\frac{P^m}{Q^m}$. P^m and Q^m are, respectively, mean prices and quantities.

[34] Note deadweight loss is negative because individuals are consuming larger quantities than they would

A comprehensive review of literature on the subject can be found in Pereda (2008). Succinctly, demand equations evolution was always guided to satisfy restrictions derived from consumer rational behavior. Almost Ideal Demand System (AIDS) proposed by Deaton and Muellbauer (1980) is theory consistent as long additivity, homogeneity and symmetry constraints are valid. Model was lately improved by Blundell, Pashardes and Weber (1993) and Banks, Blundell and Lewbel (1997) to account for empirical nonlinearities between expenditure and income. This model is known as Quadratic Almost Ideal Demand System (QUAIDS).

This work uses an extended version of QUAIDS (Poi (2002)) which incorporates demographics using a scaling technique introduced by Ray (1983) (POI, 2012). Equation is described below:

$$w_i = \alpha_i + \sum_{j=1}^{k} \gamma_{ij} lnp_j + (\beta_i + \eta_i^{'} z) ln\left[\frac{m}{\bar{m}_0(\mathbf{z})a(\mathbf{p})}\right] + \\ + \frac{\lambda_i}{b(\mathbf{p})c(\mathbf{p},\mathbf{z})}\left\{ln\left[\frac{m}{\bar{m}_0(\mathbf{z})a(\mathbf{p})}\right]\right\}^2 \tag{6.2}$$

where $c(\mathbf{p},\mathbf{z}) = \prod_{j=1}^{k} p_j^{\eta_j{}'\mathbf{z}}$.

On the equation, $w_i = p_i q_i / m$ is category i's expenditure share; α_i a constant; lnp_j log of prices; m is household income; $a(\mathbf{p})$ and $b(\mathbf{p})$ are price functions; and $\bar{m}_0(\mathbf{z})$ account for household characteristics. Expenditure share equations and elasticities are obtained using iterated feasible generalized nonlinear least-squares, as described in Poi (2012).

Besides food, other nine categories [35] completed demand system: beauty and clothing, cleaning and hygiene; communication and transportation; education; equipment and furniture; health; housing and others; leisure; and utilities and maintenance. Expenditure and quantities consumed were merged by family to allow price calculations. When not available [36], prices of the closest region were used as proxy.

Compensated price elasticities for food were calculated between 0.35-0.38 [37] in a

be willing to at given prices, p^{cash}.

35 Categories were created aggregating similar products provided by POF.

36 At given prices, families may optimally choose for not consuming a good but price in this case is not observable.

37 Estimated price elasticities decreases with income.

demand system accounting for regional, sectoral and socioeconomic variables. Estimates, along with beneficiary families (Section 4), are used to estimate deadweight loss associated with distortion. Results are presented in Table 5.

For the market as whole [38], deadweight loss is evaluated between US$31.5 (R$74.9) and US$63.1 (R$150.1) million. Poor households alone account for US$4.3-5.8 (R$10.1-13.8) million, which represents 9.2-13.6% of total distortion value.

Values represent around 3.2-6.4% of total tax breaks provided by federal government, i.e., on average, 4.8% of government investments in PAT are lost due to distortions.

Next section concludes and provides insights in terms of policy.

[38] Market size is US$26.3 (R$62.7) million (Appendix A).

Table 5 – Deadweight loss associated with distortion in food consumption (US$)

Sample	Full		20% Poor	
Model specification	Favorite specification	Iterative method	Favorite specification	Iterative method
Quantity (Control)	366.1	365.8	233.3	233.8
Quantity (Treated)	387.0	395.5	282.7	292.3
Price (US$ 2015)	2.64	2.65	2.30	2.29
Comp. price-elasticity	0.385	0.385	0.357	0.357
DWL per family (US$)	3.97	7.96	30.50	41.66
# of families	7,926,638	7,926,638	139,885	139,885
DWL (US$ million 2015)	**31.46**	**63.07**	**4.27**	**5.83**

Table calculates deadweight associated with distortion in food consumption. For each sample, both favorite and iterative model specifications are considered. Analysis focus in two subsamples: full; and 20% bottom of income distribution. Compensated price-elasticities are calculated for each sample.

7 Remarks and policy considerations

Economic literature predicts there may be distortion effects associated with in-kind transfers when compared to cash transfers. that can be calculated in terms of food consumption. Doing so consists in comparing individuals both receiving and not benefits, a classical counterfactual or missing data problem.

Programa de Alimentação dos Trabalhadores (PAT) is an important Brazilian food assistance public policy whose objective is to provide nutritional adequate meals for workers to raise their health and productivity. A propensity score matching framework was used to test whether program presents such distortions.

Results indicate PAT transfers are distortive, but only for poor households. Among them, affirming which family prefers cash or in-kind transfers ultimately depends on their preferences. Rich families, on the other hand, face a first-best situation where program is innocuous in rising food consumption and, therefore, their productivity. A demand system analysis consistent with consumer theory showed around 4.8% of government tax breaks or US$47.3 (R$112.5) million are wasted annually as result of deadweight loss.

Two policy considerations arise from evidences. Firstly, PAT participation should be a choice also for workers, not only firms. This would improve poor employees' welfare which depends on preferences under distortion. Those who reach higher indifference curves under program transfers would participate (Figure 4), while others (Figure 3) could receive cash instead, maximizing utility.

Secondly, high income employees should not be able to receive benefits. They are unquestionably better off in this situation, but transfers do not contribute for PAT in reaching its higher productivity objective. From government point of view, resources could be saved or reallocated for more efficient results.

However, defining a threshold for poor workers is no trivial task. According to today's rules, they receive less than five minimum wages US$1,848.80 (R$4,400.00) a month. It may be rational to adapt this value depending on economic sector. Manual jobs

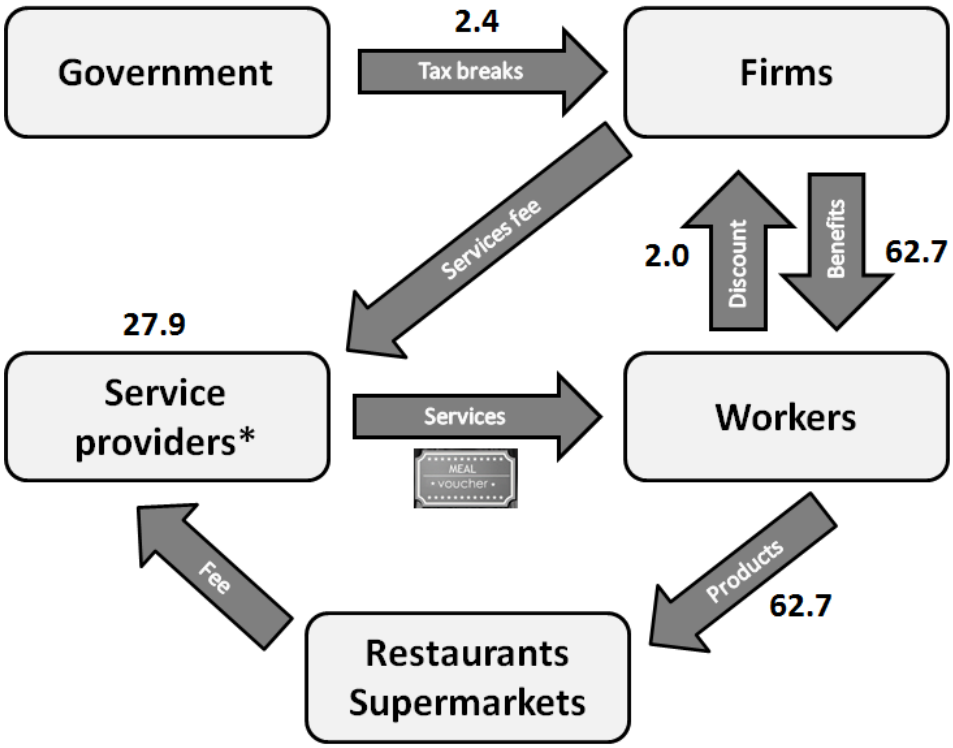
usually demand more calorie intake, so laborers should present a higher turning point. Specific researches should be conducted in this sense.

Same propensity score analysis was conducted for food subgroups and no pattern emerged, i.e., there is no significant alteration in terms of consumption quality. Such result indicates program may be failing in improving labor efficiency. Still, no conclusion should be settled until further analysis in terms of vitamins, macro and micro nutrients is conducted. As highlighted in Section 5, nutritional aspects will shed light on program's real impacts on health.

These evidences will allow a discussion regarding program real importance. If, in fact, no nutritional improvement is reached, PAT fails in its essence. Thus, are there reasons why it should not cease to exist? Certainly, spillover effects may be one. PAT benefits are widely used, boosting other sectors such as restaurants and supermarkets or even creating new ones, as meal voucher providers. They create job positions, which impulse income, generating taxes that may even cover program inefficiencies.

These issues are briefly discussed below. Figure 8 shows approximated annual income flux among them for 2015. Calculations were performed parsimoniously, meaning monetary transfers represent a market lower bound.

Figure 8 – Players interaction in meal voucher market. Annual values in billion 2015 R$



Source: Own elaboration.
*Includes meal voucher providers and companies which offer kitchen administration and transported meal services.

- Government: Federal government is responsible for program's existence. It provides tax breaks [39] of R$2.4 billion per year for companies willing to offer meal benefits to its employees. Such estimative was made using data from Ministry of Labor, IBGE and Brazilian Federal Revenue Office. Total revenues were considered a sum of average taxes payed from PAT and non-PAT companies. Payments were adjusted by company size.

- Firms: Are provided with tax breaks to offer food benefits [40] to its employees. They are allowed by law to charge their subordinates up to 20% of total value assistance [41] (around R$2.0 billion). Data from POF suggests companies charge only 3.14% on average. This percentage was multiplied by R$62.7 billion, resulting in R$2.0 billion.

[39] Limited at 4% of due income tax.
[40] Self-managed or outsourced.
[41] For example, R$100 transfers may be charged up to 20%.

- Service providers: Companies specialized in restaurant administration, in providing transported meals and/or meal vouchers [42] in form of debt cards. They receive variable fees [43] from firms for its services. Market size was estimated in R$27.9, which is a sum of percentages (4% and 5%) received from firms (R$2.5 billion), restaurants and supermarkets (R$3.1 billion) plus meal service provision [44] (R$22.2 billion).

- Workers: Receive variable benefits [45] from firms (R$62.7 billion) and pay up to 20% [46] the value of the benefit received. They use their benefits in restaurants and supermarkets that accept vouchers as payment methods [47]. This value was estimated considering an average payment received per employee (POF), times beneficiaries number provided by Ministry of Labor.

- Restaurants and supermarkets: Sell food items to workers (R$62.7 billion [48]) and pay service providers a fee for all transactions made using its specific vouchers.

There are other two effects worth mentioning. One is taxes generated by food sector, which increases government collection. They appear when voucher expending increment sector turnover and when people are formally hired, paying labor taxes. Second is general economy boost. Food sector demands inputs from others [49], which are indirectly impulsed and also generate taxes. These effects can be assessed using traditional input-output analysis.

[42] There is an association called *Associação das Empresas de Refeição e Alimentação Convênio para o Trabalhador* (ASSERT) which represents 20 among biggest companies in this market. Some famous companies are Alelo, Sodexo, Ticket and VR.

[43] For voucher provision, firms are charged in 4%, on average. When it comes to restaurants and supermarkets, each debt pays around 5%. Percentages were applied over R$62.7 billion to estimate market size, which is probably underestimated.

[44] Calculated using minimal meal price per region from ASSERT research, times number of workers (Ministry of Labor) and percentage of outsourced restaurants, *cesta básica* and transported meal in sample.

[45] Federal government suggests firms should provide workers with balanced meals that meet minimum nutritional requirements (for self-management) or minimum values allowing to buy food in near restaurants (for meal vouchers). Official orientations from government regarding this issue were not found, but Alelo releases a research with minimal and average meal values by state: <http://www.valoresminimospat.com.br/>.

[46] Employers are free to decide whether workers pay any fee from 0% to 20%.

[47] Vouchers acceptance depends on bilateral agreements between service providers and establishments.

[48] Considering workers spend all benefits received in both restaurants and/or supermarkets.

[49] e.g. agriculture, oil & gas (for plastic packing), transportation, and others.

Bibliography

ABADIE, A.; IMBENS, G. SIMPLE AND BIAS-CORRECTED MATCHING ESTIMATORS FOR AVERAGE TREATMENT EFFECTS. 2002. Disponível em: <http://www.nber.org/papers/t0283>. 33, 63

ABADIE, A.; IMBENS, G. W. Large sample properties of matching estimators for average tratment effects. *Econometrica*, v. 74, n. 1, p. 235–267, 2006. ISSN 0012-9682. 63

ARAÚJO, M. d. P. N.; COSTA-SOUZA, J.; TRAD, L. A. B. A alimentação do trabalhador no Brasil: um resgate da produção científica nacional. *História, Ciências, Saúde – Manguinhos*, v. 17, n. 4, p. p.975–992, 2010. ISSN 0104-5970. Disponível em: <http://www.scielo.br/pdf/hcsm/v17n4/08.pdf>. 52

BANKS, J.; BLUNDELL, R.; LEWBEL, A. Quadratic Engel Curves and Consumer Demand. *The Review of Economics and Statistics*, v. 79, n. 4, p. 527–539, 1997. 40

BLUNDELL, R.; PASHARDES, P.; WEBER, G. What Do We Learn About Consumer Demand Patterns from Micro Data? *The American Economic Review*, v. 83, n. 3, p. 570–597, 1993. ISSN 00028282. Disponível em: <http://discovery.ucl.ac.uk/15744/>. 40

BRYSON, A.; DORSETT, R.; PURDON, S. *The use of propensity score matching in the evaluation of active labour market policies*. 2002. 57 p. 27

BURLANDY, L.; ANJOS, L. A. D. Acesso a vale-refeição e estado nutricional de adultos beneficiários do Programa de Alimentação do Trabalhador no Nordeste e Sudeste do Brasil, 1997. *Cadernos de Saúde Pública*, v. 17, n. 6, p. 1457–1464, 2001. ISSN 0102-311X. 14

CAMPELLO, T.; NERI, M. C. *Programa Bolsa Família: uma década de inclusão e cidadania*. [S.l.: s.n.], 2013. 502 p. ISBN 9788578111861. 17

CUNHA, J. M. Testing Paternalism: Cash versus In-Kind Transfers. *American Economic Journal: Applied Economics*, v. 6, n. September, p. 195–230, 2014. ISSN 1945-7782. Disponível em: <http://search.proquest.com/docview/1511797736?accountid=13042$\delimiter"026E30F$nhttp://oxfordsfx.hosted.exlibrisgroup.com/oxford?url{_}ver=Z39.88-2004{&}rft{_}val{_}fmt=info:ofi/fmt:kev:mtx:journal{&}genre=article{&}sid=ProQ:ProQ:econlitshell{&}atitle=Testing+Pater>. 17, 18, 20, 36

DASGUPTA, P.; RAY, D. Inequality as a Determinant of Malnutrition and Unemployment: Theory. *The Economic Journal*, v. 96, n. 384, p. 1011–1034, 1986. 26

DEATON, A.; MUELLBAUER, J. An Almost Ideal Demand System. *The American Economic Review*, v. 70, n. 3, p. 312–326, 1980. 40

DEHEJIA, R. H.; WAHBA, S. Causal effects in nonexperimental studies: Reevaluating the evaluation of training programs. *Journal of the American statistical Association*, v. 94, n. 448, p. 1053–1062, 1999. ISSN 0162-1459. 27

DIEESE. *Relatório final sobre o Programa de Alimentação do Trabalhador (PAT)*. [S.l.], 2013. 223 p. 26, 51, 52, 55, 56

GENTILINI, U. *Cash and Food Transfers : A primer*. Rome, Italy, 2007. 34 p. 17

GERALDO, A. P. G.; BANDONI, D. H.; JAIME, P. C. Aspectos dietéticos das refeições oferecidas por empresas participantes do Programa de Alimentação do Trabalhador na Cidade de São Paulo, Brasil. *Revista Panamericana de Salud Pública*, v. 23, n. 1, p. 19–25, 2008. ISSN 1020-4989. 14

HECKMAN, J. J.; ICHIMURA, H.; TODD, P. Matching as an econometric evaluation estimator. *Review of Economic Studies*, v. 65, p. 261–294, 1998. ISSN 0034-6527. Disponível em: <http://restud.oxfordjournals.org/content/65/2/261.short>. 27, 28

HOYNES, H. W.; SCHANZENBACH, D. Consumption Responses to In-Kind Transfers: Evidence from the Introduction of the Food Stamp Program. *American Economic Journal: Applied Economics*, n. 13025, p. 109–139, 2009. ISSN 1945-7782. 13, 35

IMAI, K.; RATKOVIC, M. Covariate Balancing Propensity Score. *Journal of the Royal Statistical Society*, v. 76, p. 243–263, 2014. 35

KANG, J. D. Y.; SCHAFER, J. L. Demystifying double robustness: a comparison of alternative strategies for estimating a population mean from incomplete data. *Statistical Science*, v. 22, n. 4, p. 523–539, 2007. ISSN 0883-4237. Disponível em: <http://arxiv.org/abs/0804.2973>. 35

KEDIR, A. Health and productivity: Panel data evidence from Ethiopia. *African Development Bank 2009*, v. 44, n. 0, p. 59–72, 2009. 13

KING, G.; NIELSEN, R. Why Propensity Scores should not be used for matching. 2015. 28, 63

MONCHUK, V. *Reducing Poverty and Investing in People. The New Role of Safety Nets in Africa*. [S.l.]: The World Bank, 2014. 165 p. ISBN 9781464800948. 13

MOURA, J. B. de. Avaliação do do programa de alimentação do trabalhador no Estado de Pernambuco, Brasil. *Revista de Saude Publica*, v. 20, n. 2, p. 115–128, 1986. ISSN 00348910. 14

MTE. *PAT Responde*. 2015. Disponível em: <http://acesso.mte.gov.br/pat/programa-de-alimentacao-do-trabalhador-pat.htm>. 52

NINNO, C. D.; DOROSH, P. *Impacts of in-kind transfers on household food consumption: Evidence from targeted food programmes in Bangladesh*. [S.l.: s.n.], 2003. v. 40. 48–78 p. ISSN 0022-0388. 13, 36

PEREDA, P. *Estimação das equações de demanda por nutrientes usando o modelo Quadratic Almost Ideal Demand System (QUAIDS)*. 124 p. Tese (Dissertação de Mestrado) — Universidade de São Paulo, 2008. 40

PEREDA, P. C.; ALVES, D. C. d. O. Qualidade alimentar dos brasileiros: teoria e evidência usando demanda por nutrientes. *Pesquisa e Planejamento Economico*, v. 42, n. 2, p. 239–260, 2012. ISSN 01000551. 38

PESSANHA, L. D. R. A experiência brasileira em políticas públicas para a garantia do direito ao alimento. 2002. 51

POI, B. *Dairy policy and consumer welfare*. Tese (Doutorado) — Michigan University, 2002. 40

POI, B. P. Easy demand-system estimation with quaids. *Stata Journal*, v. 12, n. 3, p. 433–446, 2012. ISSN 1536867X. 40

POPKIN, B. M. Nutrition and labor productivity. *Social Science & Medicine*, v. 12, n. 1-2, p. 117–125, 1978. 26

RAY, R. Measuring the costs of children: an alternative approach. *Journal of Public Economics*, v. 22, p. 89–102, 1983. 40

ROSENBAUM, P. R.; RUBIN, D. B. The Central Role of the Propensity Score in Observational Studies for Causal Effects. *Biometrika*, v. 70, n. 1, p. 41–55, 1983. 27

RUBIN, D. B. Estimating causal effects of treatment in randomized and nonrandomized studies. *Journal of Educational Psychology*, v. 66, n. 5, p. 688–701, 1974. 27

SAVIO, K. E. O. et al. Avaliação do almoço servido a participantes do programa de alimentação do trabalhador. *Revista de saude publica*, v. 39, n. 2, p. 148–155, 2005. ISSN 0034-8910. 14

SILVA, A. C. da. De Vargas a Itamar: políticas e programas de alimentação e nutrição. *Estudos Avançados*, v. 9, n. 23, p. 87–107, 1995. 52

SILVA, M. H. O. da. *Programa de Alimentação do Trabalhador (PAT). Estudo do desempenho e evolução de uma política social*. 145 p. Tese (Dissertação de Mestrado) — Fundação Oswaldo Cruz, 1998. 13, 51

SKOUFIAS, E.; UNAR, M.; GONZÁLEZ-COSSÍO, T. The Impacts of Cash and In-Kind Transfers on Consumption and Labor Supply : Experimental Evidence from Rural Mexico. 2008. 36

SMITH, J. A.; TODD, P. E. Does matching overcome LaLonde's critique of nonexperimental estimators? *Journal of Econometrics*, v. 125, p. 305–353, 2005. ISSN 03044076. 28, 35

STRAUSS, J. Does better nutrition raise farm productivity? *Journal of Political Economy*, v. 94, n. 2, p. 297–320, 1986. 26

VELOSO, I. S.; SANTANA, V. S. Impacto nutricional do programa de alimentação do trabalhador no Brasil. *Revista Panamericana de Salud Pública*, v. 11, n. 1, p. 24–31, 2002. ISSN 10204989. 14

Appendix A

A brief history of PAT

According to DIEESE (2013), *Programa de Alimentação dos Trabalhadores* [50] (PAT) creation took place in a wider context of food and nutrition programs in Brazil [51]. Subject became a concern during Getulio Vargas government (1934-1937) when malnutrition was identified among Brazilian workers.

Later, during the 50s and 60s tendency continued. A first version of Food National Plan and North American Project for Food and Peace are some examples. They counted on external support, usually provided by FAO through World Food Program (WFP). (PESSANHA, 2002)

Through the 70s, Food and Agriculture Organization of the United Nations (FAO) released statistics about calories and protein consumption of undeveloped countries. Government realized Brazilians living in northeast region had minimum acceptable calorie patterns. (SILVA, 1998)

In order to revert situation, *Instituto Nacional de Alimentação* [52] (INAN) was created in 1972, being responsible for development of a *Programa Nacional de Alimentação e Nutrição* [53] (PRONAN). As a result, a set of ten programs were created, each one designed for different purposes and handed to diverse government departments. PAT was among them.

Program was created on April 14^{th}, 1976 through Law No. 6.321, regulated by Decree No. 5 of January 14^{th}, 1991 and headed by Department of Labor. PAT is a federal government program of voluntary membership which grants tax breaks for firms willing to provide nutritionally adequate food to low-income workers [54]. PAT's objectives

[50] Workers Food Program in a free translation.

[51] To name a few programs created in the 40s: *Instituto de Tecnologia Alimentar* in 1944; *Conselho Nacional de Alimentação* (CNA) in 1945; and *Serviço de Alimentação da Previdência Social* (Saps) in 1940. Saps was responsible for installing restaurants inside big firms and provide hot meals at low costs to small firms.

[52] National Institute of Alimentation in a free translation.

[53] National Program of Food and Nutrition in a free translation.

[54] Low-income workers are those who make less than five minimum wages per month. Today, minimum

are to improve nutritional status of low-income workers, increasing their health [55] and productivity (MTE, 2015).

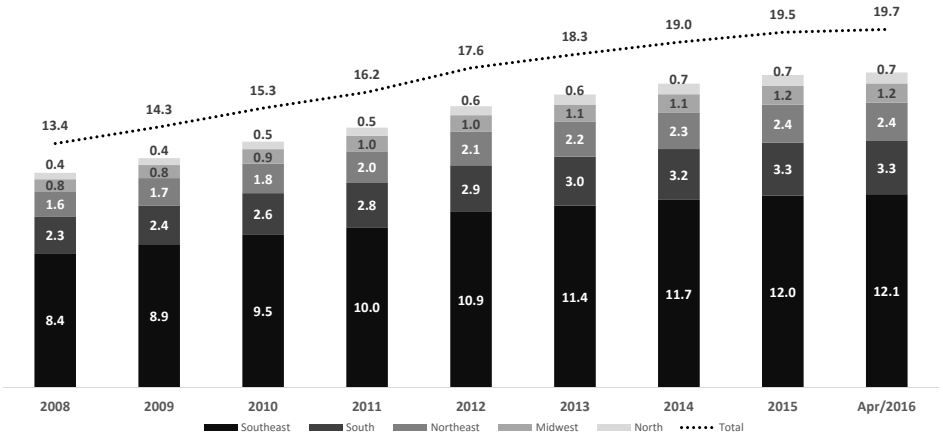
Program rapidly expanded through industrialized centers with São Paulo concentrating more than two thirds of all participating firms. It started attending 0.8 million workers in 1977 until reaching 7.8 million in 1992 (SILVA, 1995).

During the 1990s, most programs launched by PRONAN were already abandoned. Only PAT and *Programa Nacional de Alimentação Escolar* [56] (PNAE) kept functional, both facing little changes. According to Araújo, Costa-Souza and Trad (2010) these two are, at present, food assistance's oldest programs in country (DIEESE, 2013).

Facts and figures

Nowadays, PAT provides food benefits for almost 20 million formal workers[57], most of them, as in past, still concentrated in Southeast region. As for Figure 9, 61.3% (12.1 million) of PAT workers are established in this region. North and Midwest regions have been showing a higher growth rate (Figure 10), but are far from reaching its relative importance. Moreover, beneficiaries have been constantly increasing during last few years. It shows program's relevance as a public policy.

Figure 9 – Millions of formal workers receiving benefits from PAT by region



Source: Own elaboration. Data retrieved from mte.gov.br

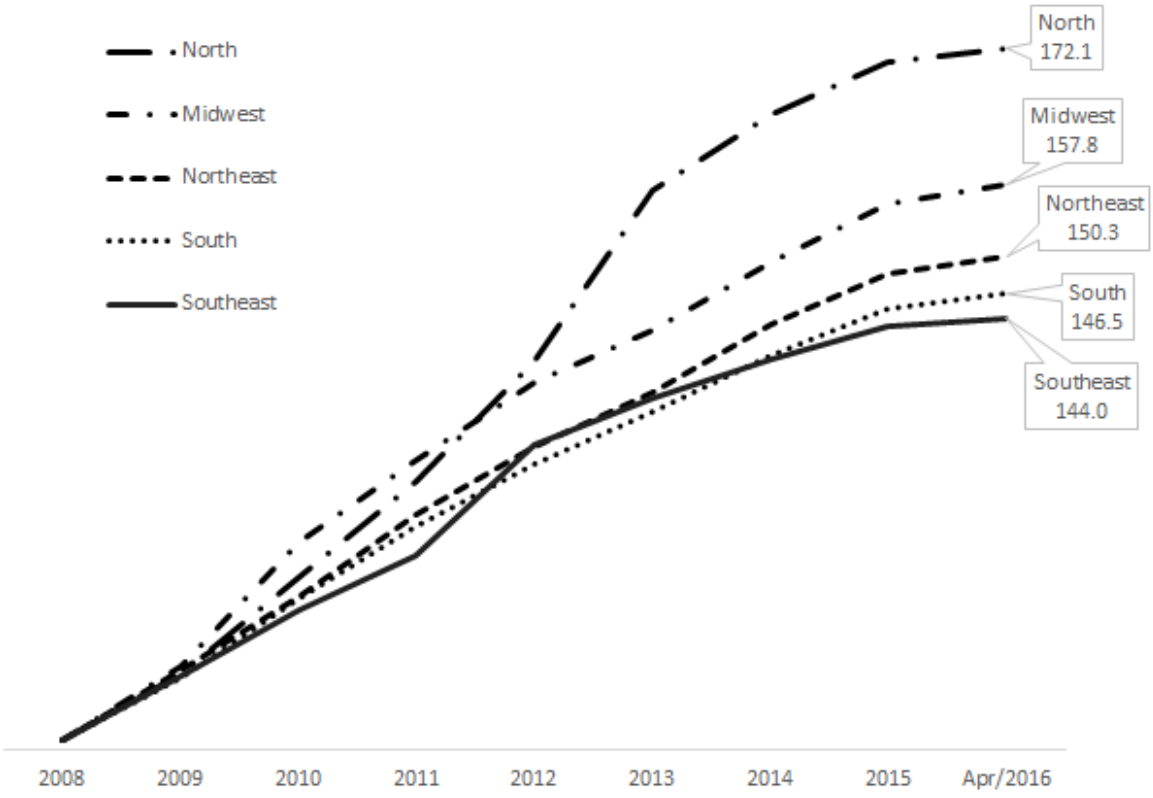
wage in Brazil is R$880.00 a month. Approximately 83% of PAT beneficiaries earn less than this.

55 Reducing incidence of diseases related to food and nutrition.

56 National School Feeding Program in a free translation.

57 *Bolsa Família*, perhaps the most famous Brazilian assistance program, reaches 13.9 million families.

Figure 10 – Growth by region (Index: 2008 = 100)



Source: Own elaboration. Data retrieved from mte.gov.br

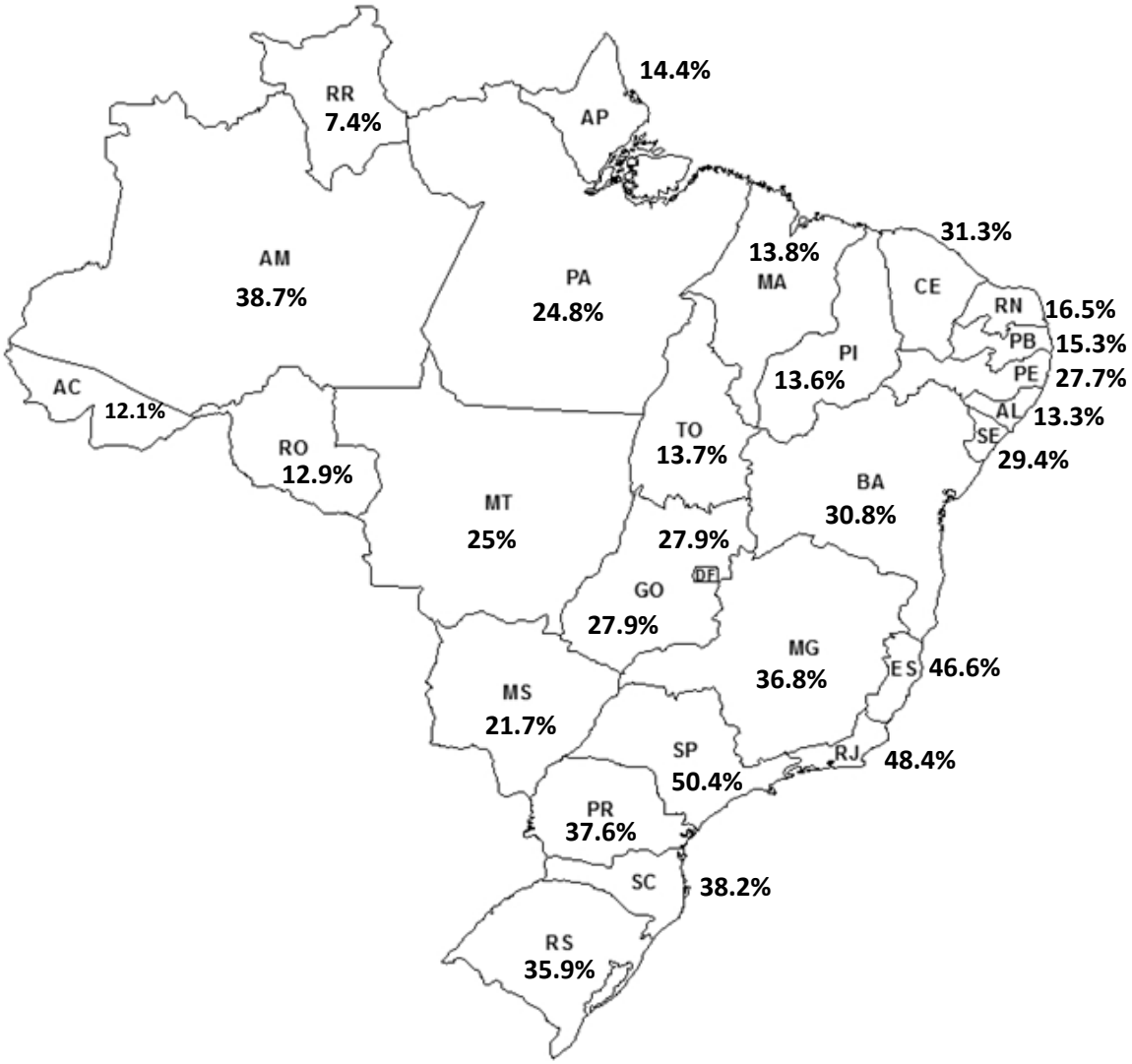
Analyzing PAT's beneficiaries relatively to eligible workers only confirms program concentration. As for Figure 11, more than 50% of São Paulo workers receive one or more benefits from program. Rio de Janeiro and Espírito Santo have, respectively, 48.4% and 46.6% of its workers inside firms that joined the program. No other state presents such high participation rates. Amazonas, in North region, reaches 38.7%.

Rules for companies to join and maintain program eligibility can be summarized as follows:

1. Only firms that use the *lucro real* [58] accounting concept are eligible for deduction. For this reason, only firms whose annual gross revenue exceeds R$78 million can use

[58] Brazilian government allows three forms of income tax payment: *Lucro Real*, *Lucro Presumido* and *Simples Nacional*. Firms opting for *Simples Nacional* pay lowest taxes, but its annual gross revenue cannot exceed R$3.6 million. As for *Lucro Presumido* duties are intermediary, but revenues cannot surpass R$78 million. Finally, in case option is *Lucro Real*, companies are charged with highest rates. Choosing between one or other concept is no trivial accounting decision and depends which sector firm belongs.

Figure 11 – PAT workers in % of eligible workers (2014)



Source: Own elaboration. Data retrieved from mte.gov.br

PAT's credits as tax breaks.

2. Once participating, firms caught hiring informal workers loose eligibility.

3. Firms must prioritize workers who receive less than five minimum wages per month (low income workers). Above this threshold it is not mandatory to provide benefits and values cannot overpass those of smaller salaries'.

PAT generates credits that can be deducted from due income tax. Deduced amount (Y) is calculated as follows.

- Y is defined as a benefit [59] cost times number provided:

$$Y = X * Q$$

where X is cost per meal and Q total number of meals provided by firm

- X, however, is calculated beforehand by taking 15% of all expenses with benefits:

$$X = \frac{15\% * TC}{Q}$$

where TC represents firm's total cost with food benefits

However, there is a rule to define X value: if $X < 2.49$ [60] than set $X < 2.49$ but if $X \geq 2.49$, then set $X = 80\% * 2.49 = 1.99$. Finally, there is a global limit deduction of 4% of due income tax (IT). In other words, if $Y \leq 4\% * IT$, the amount to be deduced is Y, but, if $Y > 4\% * IT$ deduction equals $(4\% * IT)$.

As an example, suppose a company that provides 100 meals a month ($Q = 100$) for its workers at a total cost of $R\$20$ per meal ($TC = 2000$). In this case, X should equals $\frac{0.15*2000}{100} = 3$ but as it exceeds 2.49, $X = 1.99$. So, company is able to deduce $Y = 100 * 1.99 = R\$199$ from due income taxes, respecting the limit of 4% of its total income tax [61].

There is a lot involved in a firm's decision to join PAT. Accountability decisions [62] and possibility of tax deduction, as mentioned above, are two examples. There are, however, external factors like labor unions that may interfere in this process. DIEESE (2013) presents data regarding 197 union agreements signed between 2011 and 2012. Around 120 agreements (60.9% of total) presented clauses regarding workers' rights towards food. For example, 100% of transportation and urban industry constracts (35 in total) mentioned food.

59 For example, a hot meal. Each formal worker will get at least 20 of them per month.

60 Values in R$ of 2015.

61 From a rational point of view, a participating firm has incentives to reach maximum discount (4%). Suppose a company that does not bind deduction restriction. It is optimum to exchange salary for benefits, until limit is achieved.

62 Again, only companies in *lucro real* regimen are eligible.

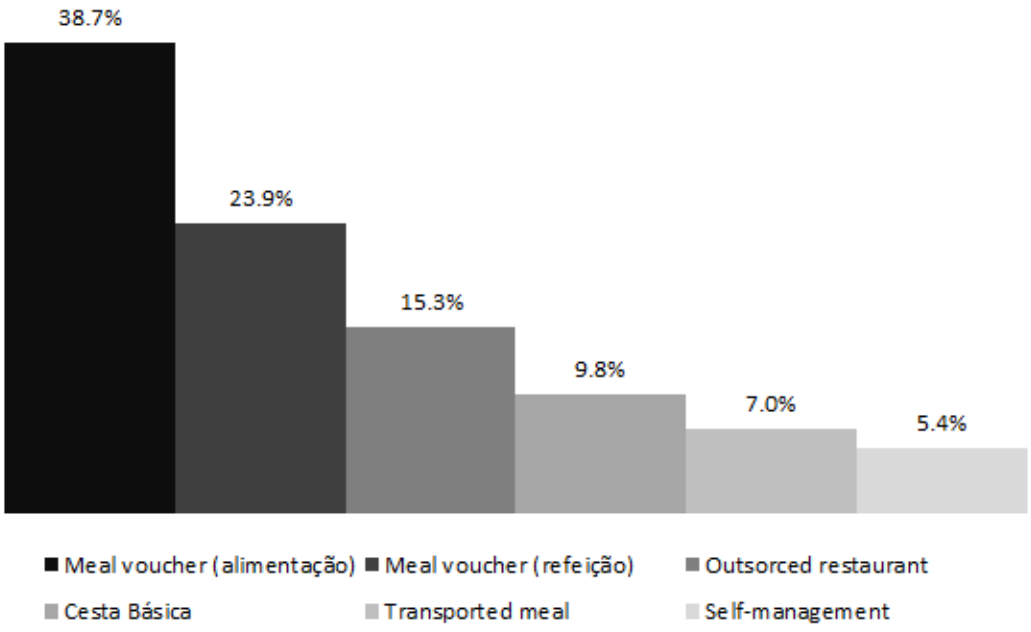
Regarding program implementation, DIEESE (2013) describes the two possible ways:

1. Self-management: firm provides cooked or non-cooked meals (e.g. own restaurants and *cesta básica*);

2. Outsourcing: firm delegates above-mentioned tasks to an specialized firm and/or provides debt cards or coupons that can only be exchanged for food items (*meal vouchers* [63])

There are no legal restrictions for companies providing more than one modality of benefit. For example, firms may run a private restaurant, deliver *cestas básicas* every month and also provide workers with meal vouchers. Figure 12 shows that between 2008-15 more than 64.0% of beneficiaries received meal vouchers (*alimentação* - 38.7% and *refeição* - 23.9%). 9.8% received *cestas básicas* and only 5.4% self-manage their benefits.

Figure 12 – % of benefits provided by modality



Source: Own elaboration. Data retrieved from mte.gov.br

Incentives faced by firms and workers

This section analyzes firms and employees incentives in providing and receiving benefits from PAT. Besides tax breaks, participant corporations have another advantage.

[63] In Brazil, *meal vouchers* are called *vale-refeição* when used to buy food in restaurants and *vale-alimentação* when used in supermarkets.

Transfers are not considered salary, so there is no incidence of payroll taxes. As it will be shown below, those can be a heavy burden.

From worker's point of view, there are two disadvantages regarding assistance. First is that, in case of vouchers, expending is restricted to restaurants or supermarkets [64]. Second is above mentioned charges of 20% over values provided.

Therefore, as there are advantages and disadvantages for both firms and individuals in giving/receiving benefits, it is not obvious they would like to enroll PAT. In order to clarify this issue, analysis of payroll tax structure for companies and workers is assessed in Table 6.

First, costs monthly incurred by Brazilian firms are detailed. Most workers' rights in Brazil were established by president Getúlio Vargas in 1943 with Decree-Law No. 5,452, known as *Consolidação das Leis do Trabalho* (CLT). Law stated that workers must receive an extra payment by the end of each year, named *13th salary*. Also, during vacation period, which is also paid, they should receive an additional 1/3 of their salaries, called constitutional allowance (*abono constitucional*).

Companies are also responsible for paying social contributions. *Fundo de Garantia por Tempo de Serviço* [65] (FGTS) is a saving account monthly filled with 8% of worker's salary. This personal account aims at providing them financial safety and equity liquidity, respectively, in case of involuntary unemployment and realty acquisition. *Instituto Nacional do Seguro Social* [66] (INSS) represents Brazilian social security system for which firms must pay 20% of employees' remuneration every month. It assures minimum income flow in cases of unemployment, retirement, maternity, disablement and pension for family in case of death. FGTS and INSS are also calculated over 13^{th} salary and vacation period.

There are other contributions such as accident insurance and *alíquota de terceiros*, a contribution to finance professional entities connected to labor unions in Brazil [67]. They

[64] For other modalities, as self-managed refectories, consumption is restricted to available goods in an specific moment.
[65] Guarantee Fund for Employees.
[66] National Institute for Social Security.
[67] Senai, Sesi, Sesc, Senac, and others - also known as the "S" system.

increase companie's costs in approximately 5.8% every month.

Table 6 – Monthly tax incidence over companies and individuals in Brazil (2015 R$)

	Salary considered	880.0	1,651.6	2,117.9	2,579.3	3,288.8	4,207.4	6,663.8
	Bands for payroll tax incidence	Below 1,399.13	From 1,399.13 to 1,903.98	From 1,903.99 to 2,331.88	From 2,331.89 to 2,826.65	From 2,826.66 to 3,751.05	From 3,751.06 to 4,663.75	Above 4,663.75
Company costs	13^{th} salary	65.7	137.6	176.5	214.9	274.1	350.6	555.3
	1/3 Vacation	21.9	45.9	58.8	71.6	91.4	116.9	185.1
	FGTS	70.0	146.8	188.3	229.3	292.3	374.0	592.3
	INSS	175.1	367.0	470.7	573.2	730.9	935.0	1,480.8
	Others*	45.7	95.8	122.8	149.6	190.8	244.0	386.5
	Salary + taxes	**1,166.4**	**2,444.7**	**3,135.0**	**3,817.9**	**4,868.2**	**6,227.9**	**9,863.8**
	% increase	**48.0%**	**48.0%**	**48.0%**	**48.0%**	**48.0%**	**48.0%**	**48.0%**
Worker costs	Income tax	0.0	0.0	16.0	50.6	138.5	310.5	963.2
	INSS	63.0	148.6	190.6	283.7	361.8	462.8	513.0
	Total costs	63.0	148.6	206.7	334.4	500.3	773.4	1,476.2
	Net income	**725.0**	**1,502.9**	**1,911.3**	**2,244.9**	**2,788.5**	**3,434.0**	**5,187.6**
	% decrease	**-8.0%**	**-9.0%**	**-9.8%**	**-13.0%**	**-15.2%**	**-18.4%**	**-22.2%**

Table shows, by income band, estimated payroll taxes for Brazil, both for companies and laborers. Estimates consider average salary of each band. For lowest band, minimum salary (R$880.00) was considered. From corporations point of view, salary paid for any given band actually represents a cost 48% higher. Considering subordinates, gross payment received is discounted at increasing rates which vary from 8% to 22.2%. Averages may vary according to economic sectors.

Source: Departments of Social Security and the Treasure and Decree-Law No. 5,452, May 1^{st}, 1943. Own elaboration.

So, as for Table 6, payrolls increase companies' duties by approximately 48%. Therefore, an additional cash transfer of R$100 actually costs R$148 and does not vary with income bands.

For workers's, however, duties do vary with salary level. Income tax, for example, starts with 0% aliquot for wages below US$800.00 (R$1,903.98). As income increases, contribution increases to 7.5%, then doubles to 15%, 22.5% and finally 27.5% [68] for those whose earnings exceed US$1,959.95 (R$4,664.68).

Laborers also pay INSS. Difference from firms lies on lower aliquots. While companies pay a fixed 20% rate, workers pay 8% if they make less than US$587.86 (R$1,399.12); 9% up to US$979.78 (R$2,331.88); and 11% until reaching US$1,959.56 (R$4,663.75). Above this threshold, contribution is fixed. Thus, when considering all taxes, cash transfers suffer deductions that vary from 8% to 22%, depending on wage.

Suppose a firm has got an extra R$100 to spend with one worker. It has to decide between two options. First it is to raise worker's salary in an amount that, including 48% taxes, results in expending R$100. Second, give R$100 as food benefit. Table 7 analyzes costs incurred by firm in both cases.

Table 7 – Firm costs to raise worker's income through cash and food benefit

	Benefit	**Cash**
Value provided	**100**	**67.6**
Taxes	0%	48%
Total costs	**100**	**100**

So, from firms' point of view, food benefits worth R$67.6 equal cash transfers of R$100. Other costs of benefit providing are not considered, such as 4% payment for meal voucher companies. On the other hand, tax breaks firms are entitled to are also not being taken into account. As for previous discussion, corporations can save a maximum of 4% in income taxes. Still, this is arguably a valid approximation and salary raises are way more costly than benefits.

[68] It is important to emphasize that once achieving a new band, higher percentage is applied over the difference between your new income and limit of previous band.

Appendix B

Questionnaire 1 interviewed families to collect characteristics of the residence and residents. Residence information involves type (house, apartment), situation (own home or rent), material of floor and ceiling and utility services provision. Resident information aims at identifying dwellers' characteristics such as condition (reference person, spouse, son), sex, age, weight, height, education and skin color.

Questionnaires 2 and 3, named POF2 and POF3, respectively bring information about families' purchases. Expenses on non-food items are measured quarterly or monthly by POF2 and comprehend utility expenses, domestic fuels, maintenance of house and equipments, construction, equipment and furniture acquisition, domestic services, decoration, rent and taxes. POF3 is measured weekly and focus on food items bought for the house. The detail level of information is high. For example, it is possible to identify a family which bought 0.5 kilograms of cheese in a supermarket paying R$10 with a credit card.

Finally, questionnaire 5 analyzes family members' income in a monthly basis. Analyzed variables include number of works, weekly worked hours, salary and benefits, deductions, economic activity (agriculture, industry), occupation (manager, army forces, professional of arts), position (public or private sector, rural) and investments.

Appendix C

Results and balance for favorite specification

Table 8 and Figure 13 present covariate balance and estimates without bias correction [69] for $T = \Delta Y$. Analogously, Table 9 and Figure 14 present for $T = \Delta Y[1 - \tau\%]$. Matching procedure was mahalanobis (King and Nielsen (2015)) with replacement (Abadie and Imbens (2002)) and standard errors calculated as in (Abadie and Imbens (2006)).

[69] That is, traditional ATT.

Table 8 – ATT for $T = \Delta Y$ - Quantity (annual kg per capita)

		Treated	Control	Difference	% Bias
Full sample	**ATT**	**387.0**	**364.5**	**22.51*** **	**-**
	# Obs	3322	14913	-	-
	Log Income	0.7	0.7	-	0.8
	Education	8.3	8.3	-	0.1
	Black	0.1	0.1	-	0.0
	Dwellers	3.6	3.6	-	0.3
	Transport	0.1	0.1	-	0.0
	Services	0.1	0.1	-	0.0
	South	0.2	0.2	-	0.0
	North	0.1	0.1	-	0.0
20% poor	**ATT**	**281.0**	**234.2**	**46.77** **	**-**
	# Obs	315	3333	-	-
	Log Income	0.6	0.6	-	0.3
	Education	6.1	6.0	-	2.8
	Black	0.1	0.1	-	0.0
	Dwellers	4.8	4.8	-	2.4
	Transport	0.0	0.0	-	0.0
	Services	0.1	0.1	-	0.0
	South	0.1	0.1	-	0.0
	North	0.1	0.1	-	0.0
20% rich	**ATT**	**490.2**	**456.9**	**33.32***	**-**
	# Obs	987	2638	-	-
	Log Income	0.8	0.8	-	1.8
	Education	10.5	10.5	-	-0.8
	Black	0.1	0.1	-	0.0
	Dwellers	3.0	3.0	-	0.5
	Transport	0.1	0.1	-	0.0
	Services	0.2	0.2	-	0.0
	South	0.2	0.2	-	0.0
	North	0.1	0.1	-	0.0

*p<0.1; **p<0.05; ***p<0.01

ATT shows mean differences between treated and control.

Obs presents number of observations.

% Bias = Remaining percentage bias after matching procedures.

Table 9 – ATT for $T = \Delta Y[1 - \tau\%]$ - Quantity (annual kg per capita)

		Treated	Control	Difference	% Bias
Full sample	**ATT**	**387.0**	**366.1**	**20.86****	**-**
	# Obs	3322	14913	-	-
	Log Income	0.7	0.7	-	0.4
	Education	8.3	8.3	-	0.0
	Black	0.1	0.1	-	0.0
	Dwellers	3.6	3.6	-	0.4
	Transport	0.1	0.1	-	0.0
	Services	0.1	0.1	-	0.0
	South	0.2	0.2	-	0.0
	North	0.1	0.1	-	0.0
20% poor	**ATT**	**282.7**	**233.3**	**49.42*****	**-**
	# Obs	358	3289	-	-
	Log Income	0.6	0.6	-	-1.3
	Education	6.2	6.1	-	2.9
	Black	0.1	0.1	-	0.0
	Dwellers	4.7	4.7	-	2.2
	Transport	0.1	0.1	-	0.0
	Services	0.1	0.1	-	0.0
	South	0.1	0.1	-	0.0
	North	0.1	0.1	-	0.0
20% rich	**ATT**	**501.2**	**484.6**	**16.55**	**-**
	# Obs	929	2696	-	-
	Log Income	0.8	0.8	-	1.8
	Education	10.6	10.6	-	-0.9
	Black	0.1	0.1	-	0.0
	Dwellers	3.0	3.0	-	0.8
	Transport	0.1	0.1	-	0.0
	Services	0.2	0.2	-	0.0
	South	0.2	0.2	-	0.0
	North	0.1	0.1	-	0.0

*p<0.1; **p<0.05; ***p<0.01

ATT shows mean differences between treated and control.

Obs presents number of observations.

% Bias = Remaining percentage bias after matching procedures.

Figure 13 – Log Income balance - $T = \Delta Y$

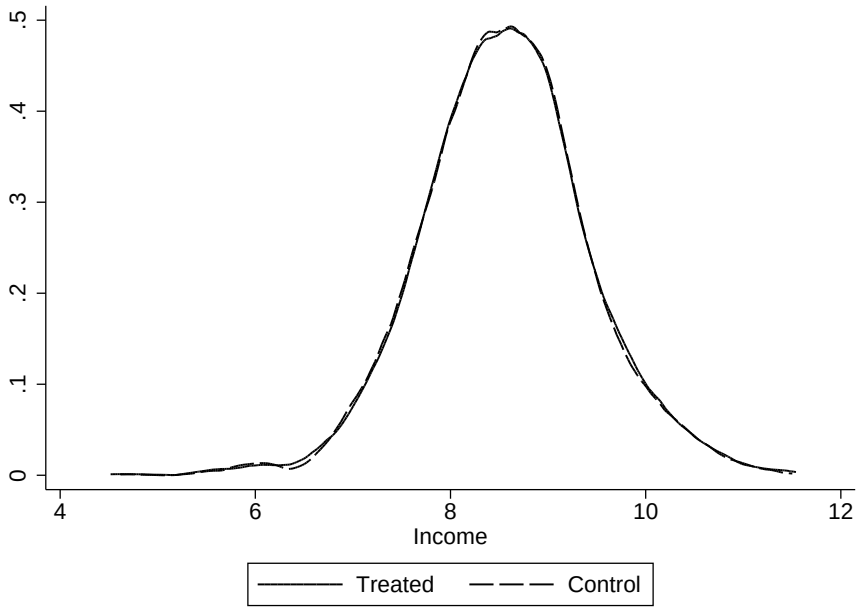
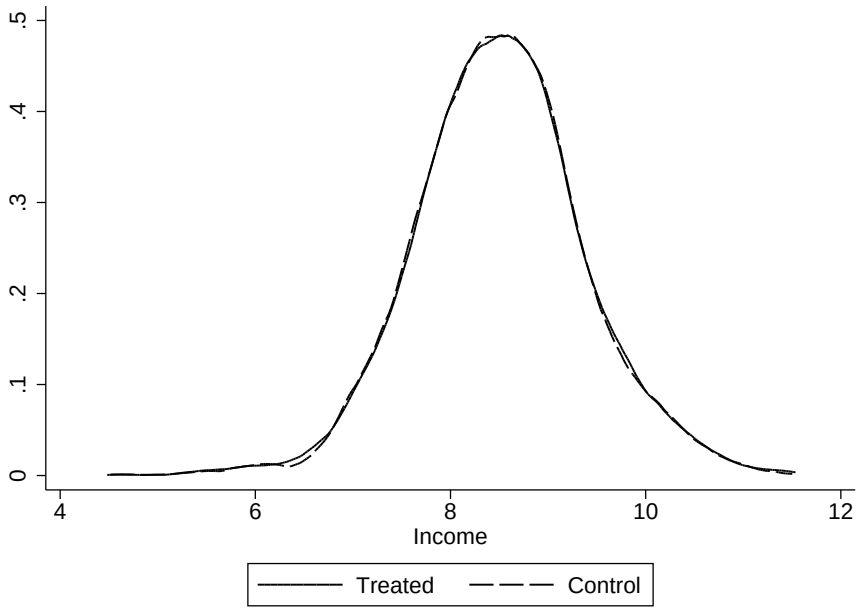


Figure 14 – Log Income balance - $T = \Delta Y[1 - \tau\%]$



Results and balance for iterative method

Table 10, shows bias corrected distortion considering iterative method. Table 11 and Figure 15 present covariate balance and estimates without bias correction [70] for $T = \Delta Y$. Analogously, Table 12 and Figure 16 present for $T = \Delta Y[1 - \tau\%]$.

Table 10 – Estimated distortion effects of PAT benefits on food consumption (in kilograms) with bias correction - iterative method

	(1) Full Sample	(2) Poor	(3) Rich	(4) Full Sample	(5) Poor	(6) Rich
Benefit	15.35**	44.61***	18.10	19.45**	36.70**	20.38
	(7.58)	(16.14)	(18.81)	(7.55)	(15.05)	(18.94)
Observations	15,859	3,366	3,091	15,859	3,361	3,095
Controls	YES	YES	YES	YES	YES	YES
Income	1	1	1	2	2	2

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
Table presents effects of treatment on food consumption in kilograms.
Income 1: $Y_{D=0} = Y_{D=1} + T \Leftrightarrow T = \Delta Y$.
Income 2: $Y_{D=0} = Y_{D=1} + T[1 - \tau\%] \Leftrightarrow T = \Delta Y[1 - \tau\%]$.
Besides income, other controls are #dwellers, education, race, transportation, services, south and north. Poor and Rich samples represent, respectively, 20 percent bottom and 20 percent top of income distribution.

[70] Or ATT.

Table 11 – ATT for $T = \Delta Y$ - Quantity (annual kg per capita) - iterative method

		Treated	Control	Difference	% Bias
Full sample	**ATT**	**395.5**	**385.1**	**10.44**	**-**
	# Obs	2654	11073	-	-
	Log Income	0.7	0.7	-	0.4
	Dwellers	3.5	3.5	-	0.3
	Industry	0.1	0.1	-	0.0
	Construction	0.1	0.1	-	0.0
	Commerce	0.2	0.2	-	0.0
	Northeast	0.2	0.2	-	0.0
	Southeast	0.4	0.4	-	0.0
20% poor	**ATT**	**295.3**	**240.7**	**54.57*** **	**-**
	# Obs	341	2821	-	-
	Log Income	0.6	0.6	-	-0.5
	Dwellers	4.6	4.6	-	0.8
	Industry	0.1	0.1	-	0.0
	Construction	0.1	0.1	-	0.0
	Commerce	0.1	0.1	-	0.0
	Northeast	0.3	0.3	-	0.6
	Southeast	0.3	0.3	-	0.0
20% rich	**ATT**	**519.2**	**498.1**	**21.13**	**-**
	# Obs	656	1710	-	-
	Log Income	0.8	0.8	-	1.2
	Dwellers	2.8	2.8	-	0.0
	Industry	0.1	0.1	-	0.0
	Construction	0.1	0.1	-	0.0
	Commerce	0.2	0.2	-	0.0
	Northeast	0.1	0.1	-	0.0
	Southeast	0.4	0.4	-	-0.3

*p<0.1; **p<0.05; ***p<0.01

ATT shows mean differences between treated and control.

Obs presents number of observations.

% Bias = Remaining percentage bias after matching procedures.

Table 12 – ATT for $T = \Delta Y[1 - \tau\%]$ - Quantity (annual kg per capita) - iterative method

		Treated	Control	Difference	% Bias
Full sample	**ATT**	**395.5**	**365.8**	**29.65*** **	**-**
	# Obs	2654	11073	-	-
	Log Income	0.7	0.7	-	0.4
	Dwellers	3.5	3.5	-	0.2
	Industry	0.1	0.1	-	0.0
	Construction	0.1	0.1	-	0.0
	Commerce	0.2	0.2	-	0.0
	Northeast	0.2	0.2	-	0.0
	Southeast	0.4	0.4	-	0.0
20% poor	**ATT**	**292.3**	**233.8**	**58.52*** **	**-**
	# Obs	384	2775	-	-
	Log Income	0.6	0.6	-	-0.7
	Dwellers	4.5	4.5	-	1.4
	Industry	0.1	0.1	-	0.0
	Construction	0.1	0.1	-	0.0
	Commerce	0.1	0.1	-	0.0
	Northeast	0.3	0.3	-	0.5
	Southeast	0.3	0.3	-	0.0
20% rich	**ATT**	**523.2**	**497.5**	**25.65**	**-**
	# Obs	624	1752	-	-
	Log Income	0.8	0.8	-	1.2
	Dwellers	2.8	2.8	-	0.3
	Industry	0.1	0.1	-	0.0
	Construction	0.1	0.1	-	0.0
	Commerce	0.2	0.2	-	0.0
	Northeast	0.2	0.2	-	0.0
	Southeast	0.4	0.4	-	-0.3

*p<0.1; **p<0.05; ***p<0.01

ATT shows mean differences between treated and control.

Obs presents number of observations.

% Bias = Remaining percentage bias after matching procedures.

Figure 15 – Log Income balance - $T = \Delta Y$ - iterative method

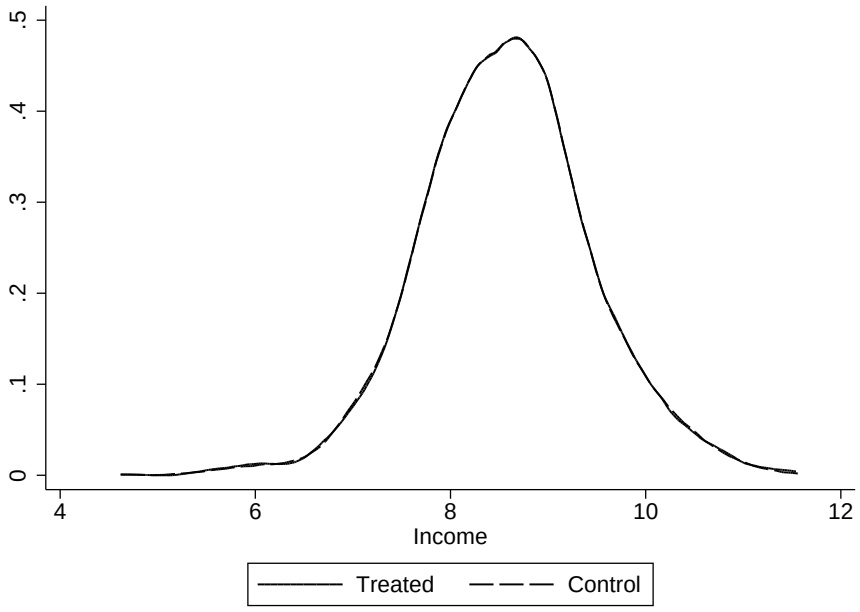
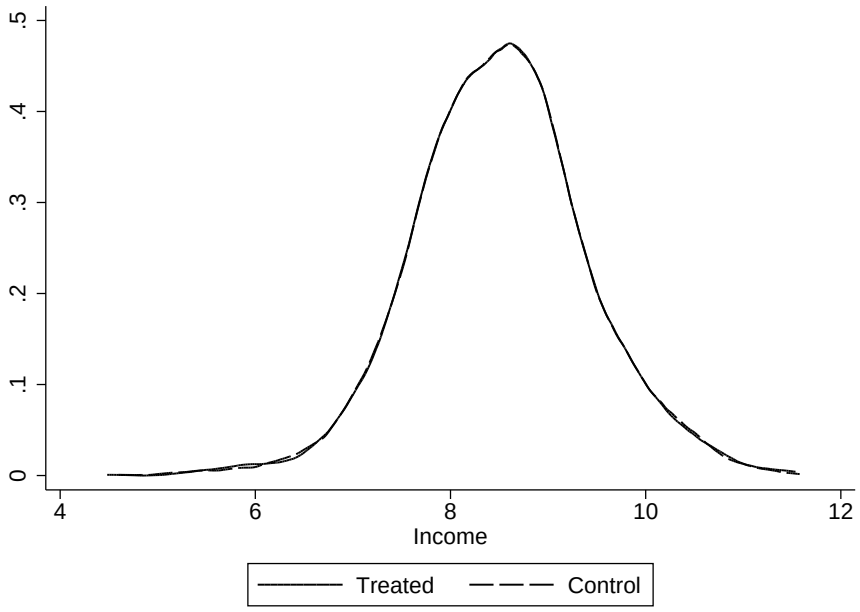


Figure 16 – Log Income balance - $T = \Delta Y[1 - \tau\%]$ - iterative method



Food decomposition analysis robustness

Tables 13 presents average treatment effect on treated estimations of food decomposition without bias correction. Tables 14 and 15 respectively show covariates balance for favorite specification and iterative method.

Table 13 – ATT for $T = \Delta Y[1 - \tau\%]$ - Quantity (annual kg per capita) - no bias correction

		Favorite specification	Iterative method
Full sample	Cereal and pasta	-4.17*	-2.92
	Fruits and vegetables	-3.56*	0.96
	Sugar and candies	-1.23	-0.77
	Meat/Chicken/Fish	-0.59	0.01
	Nonalcoholic beverages	1.76	6.23*
	Alcoholic beverages	1.93*	0.96
	Industrialized	3.90**	2.68
20% poor	Cereal and pasta	12.83*	6.82
	Fruits and vegetables	8.09**	2.56
	Sugar and candies	0.38	-0.83
	Meat/Chicken/Fish	0.97	-0.37
	Nonalcoholic beverages	5.25	19.07***
	Alcoholic beverages	0.34	0.99
	Industrialized	6.77*	10.59**
20% rich	Cereal and pasta	-11.78**	-3.52
	Fruits and vegetables	-4.48	-7.78
	Sugar and candies	-3.09	2.06
	Meat/Chicken/Fish	-4.75*	-5.62
	Nonalcoholic beverages	-0.94	8.62
	Alcoholic beverages	0.17	4.41
	Industrialized	8.87*	4.74

*p<0.1; **p<0.05; ***p<0.01

Table measures treatment effect on treated (in kilograms) considering no bias correction for seven food categories. Favorite specification includes # dwellers, education, race, transportation, services, south and north dummies. Variables of iterative method are #dwellers industry, construction, commerce, northeast and southeast.

Table 14 – Favorite specification - Balance for $T = \Delta Y[1 - \tau\%]$

		Treated	Control	% Bias
Full sample	# Obs	3167	13797	-
	Log Income	0.7	0.7	0.4
	Education	8.3	8.3	0.0
	Black	0.1	0.1	0.0
	Dwellers	3.6	3.6	0.4
	Transport	0.1	0.1	0.0
	Services	0.1	0.1	0.0
	South	0.2	0.2	0.0
	North	0.1	0.1	0.0
20% poor	# Obs	339	3091	-
	Log Income	0.6	0.6	-1.8
	Education	6.1	6.1	2.3
	Black	0.1	0.1	0.0
	Dwellers	4.8	4.7	2.8
	Transport	0.0	0.0	0.0
	Services	0.1	0.1	0.0
	South	0.1	0.1	0.0
	North	0.1	0.1	0.0
20% rich	# Obs	884	2484	-
	Log Income	0.8	0.8	1.5
	Education	10.6	10.6	-0.8
	Black	0.1	0.1	0.0
	Dwellers	3.1	3.0	0.7
	Transport	0.1	0.1	0.0
	Services	0.2	0.2	0.0
	South	0.2	0.2	0.0
	North	0.1	0.1	0.0

*p<0.1; **p<0.05; ***p<0.01

ATT shows mean differences between treated and control.

Obs presents number of observations.

% Bias = Remaining percentage bias after matching procedures.

Table 15 – Iterative method - Balance for $T = \Delta Y[1 - \tau\%]$

		Treated	Control	% Bias
Full sample	# Obs	2501	10097	-
	Log Income	0.7	0.7	0.5
	Dwellers	3.5	3.5	0.1
	Industry	0.1	0.1	0.0
	Construction	0.1	0.1	0.0
	Commerce	0.2	0.2	0.0
	Northeast	0.2	0.2	0.0
	Southeast	0.4	0.4	0.0
20% poor	# Obs	356	2566	-
	Log Income	0.6	0.6	0.3
	Dwellers	4.5	4.5	1.7
	Industry	0.1	0.1	0.0
	Construction	0.1	0.1	0.0
	Commerce	0.1	0.1	0.0
	Northeast	0.4	0.4	0.6
	Southeast	0.3	0.3	0.0
20% rich	# Obs	579	1593	-
	Log Income	0.8	0.8	1.6
	Dwellers	2.8	2.8	0.0
	Industry	0.1	0.1	0.0
	Construction	0.1	0.1	0.0
	Commerce	0.2	0.2	0.0
	Northeast	0.2	0.2	0.0
	Southeast	0.4	0.4	-0.4

*p<0.1; **p<0.05; ***p<0.01

ATT shows mean differences between treated and control.

Obs presents number of observations.

% Bias = Remaining percentage bias after matching procedures.