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

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2016 Brazilian Stata Users Group meeting

São Paulo
02/12/2016

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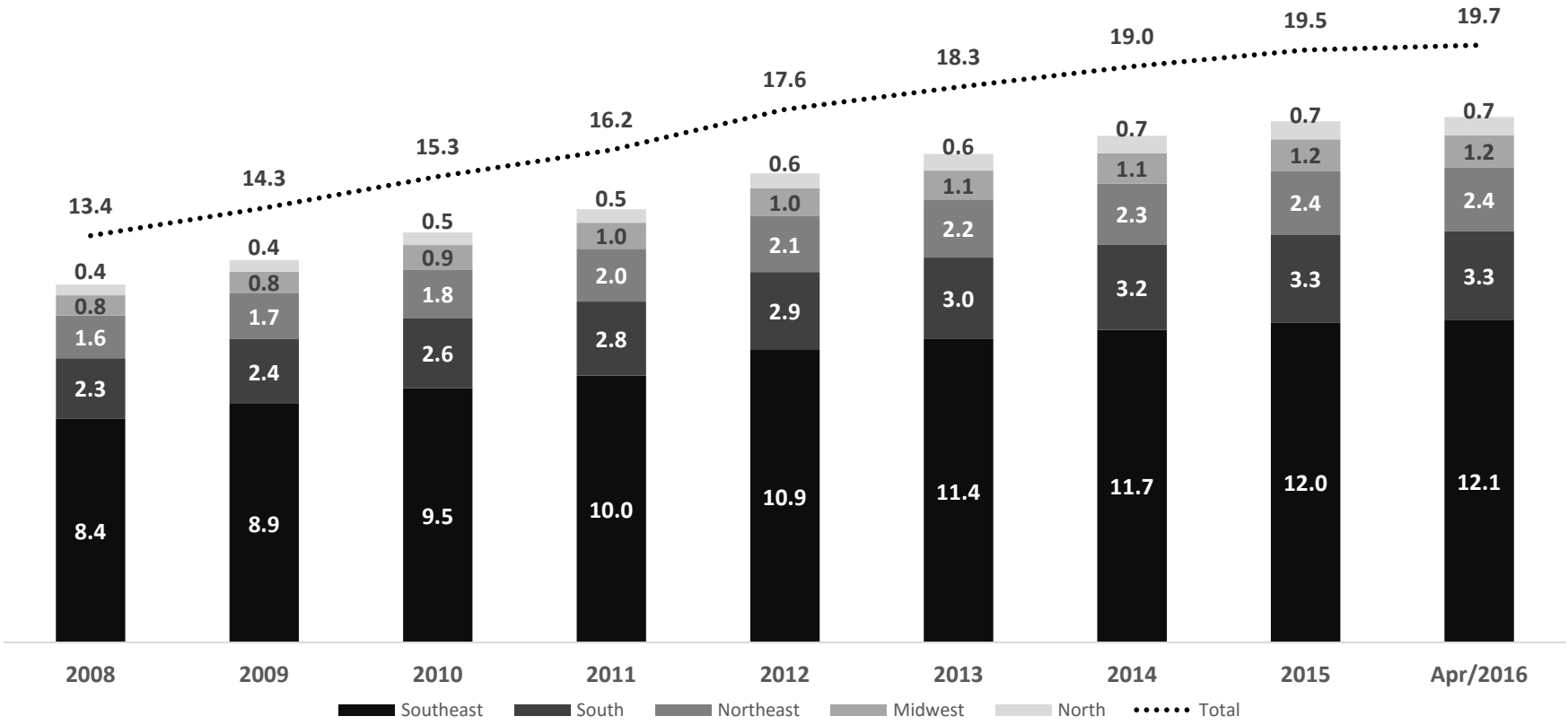
Figure: Millions of workers receiving benefits from PAT



Programa de Alimentacao dos Trabalhadores (PAT)

- Created in 1976 aiming to provide nutritionally adequate meals for (low income) workers in order to increase their productivity
- Firms can deduce up to 4% due income tax and benefits are **not salary**
- There are two different ways to implement the program:
  1. Self-management: firm provides cooked or non-cooked meals (e.g. restaurants and cesta basica)
  2. Outsourcing: firm delegates the above tasks to an specialized firm and/or provides debt cards or coupons that can only be exchanged for food items (*vouchers*)

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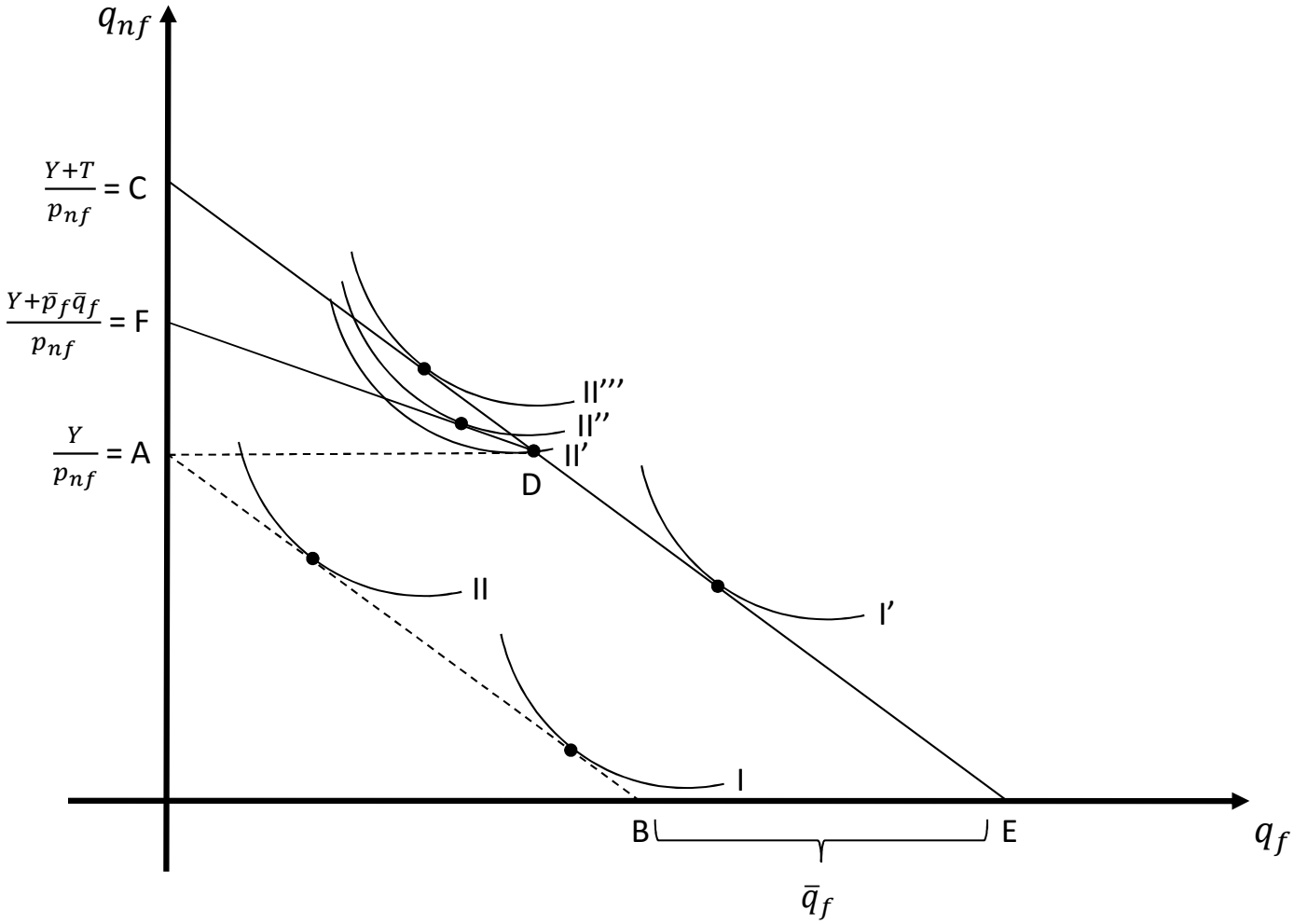
$$D_f(\bar{q}_f) = EM_f(\bar{q}_f) - NB_f(\bar{q}_f) = q_f^{In-kind} - q_f^{Cash}$$

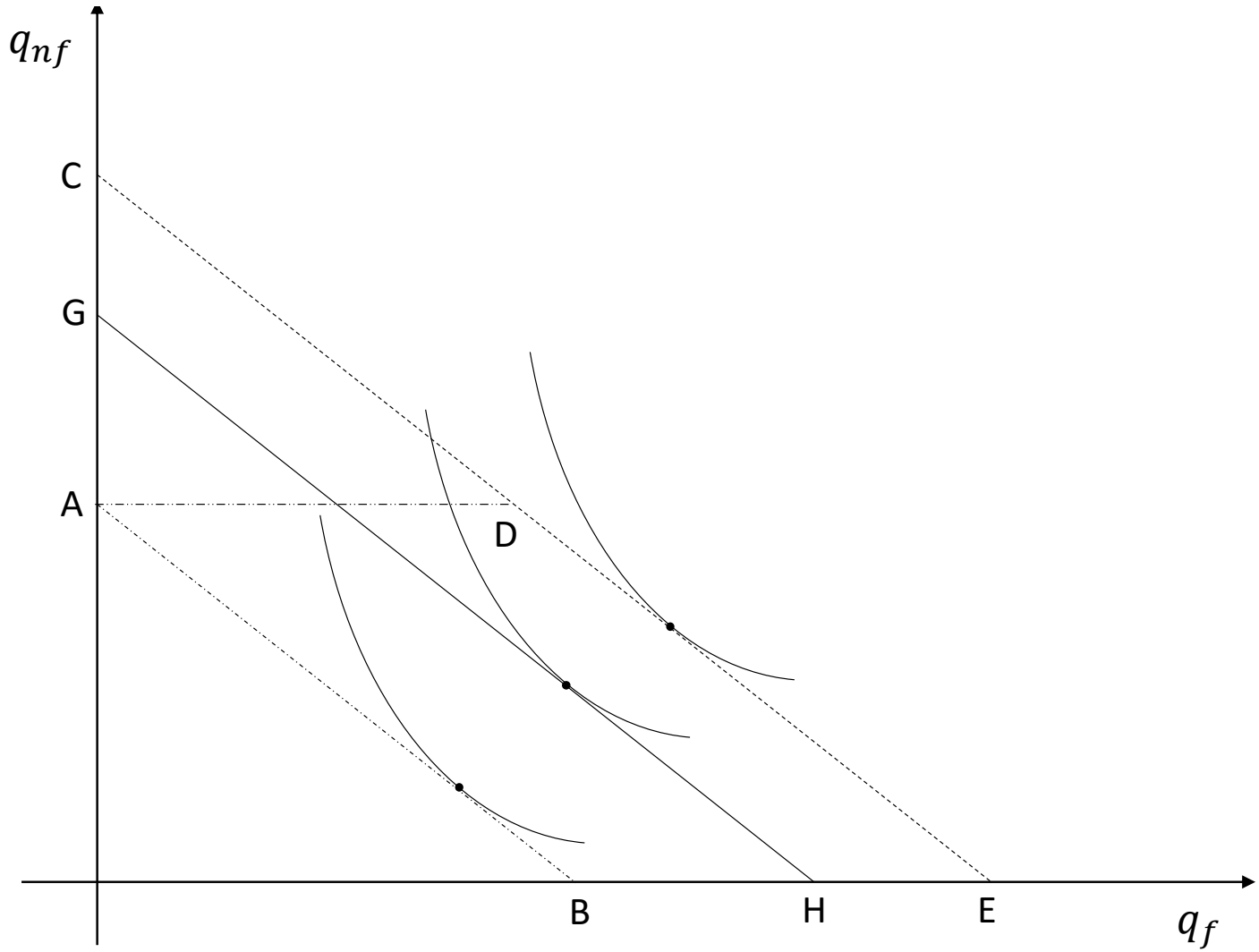


Source: Based on Cunha (2014), own elaboration

Taxes may turn cash transfers worse than in-kind

- For an additional R$1.00 in salary, firms pay R$0.48 in taxes
- Workers pay from 8% to 22% in taxes, depending on income level
- So cash transfers are discounted: $T' = (1 - \tau)T$
- Discounted cash transfer are not always preferred to in-kind

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



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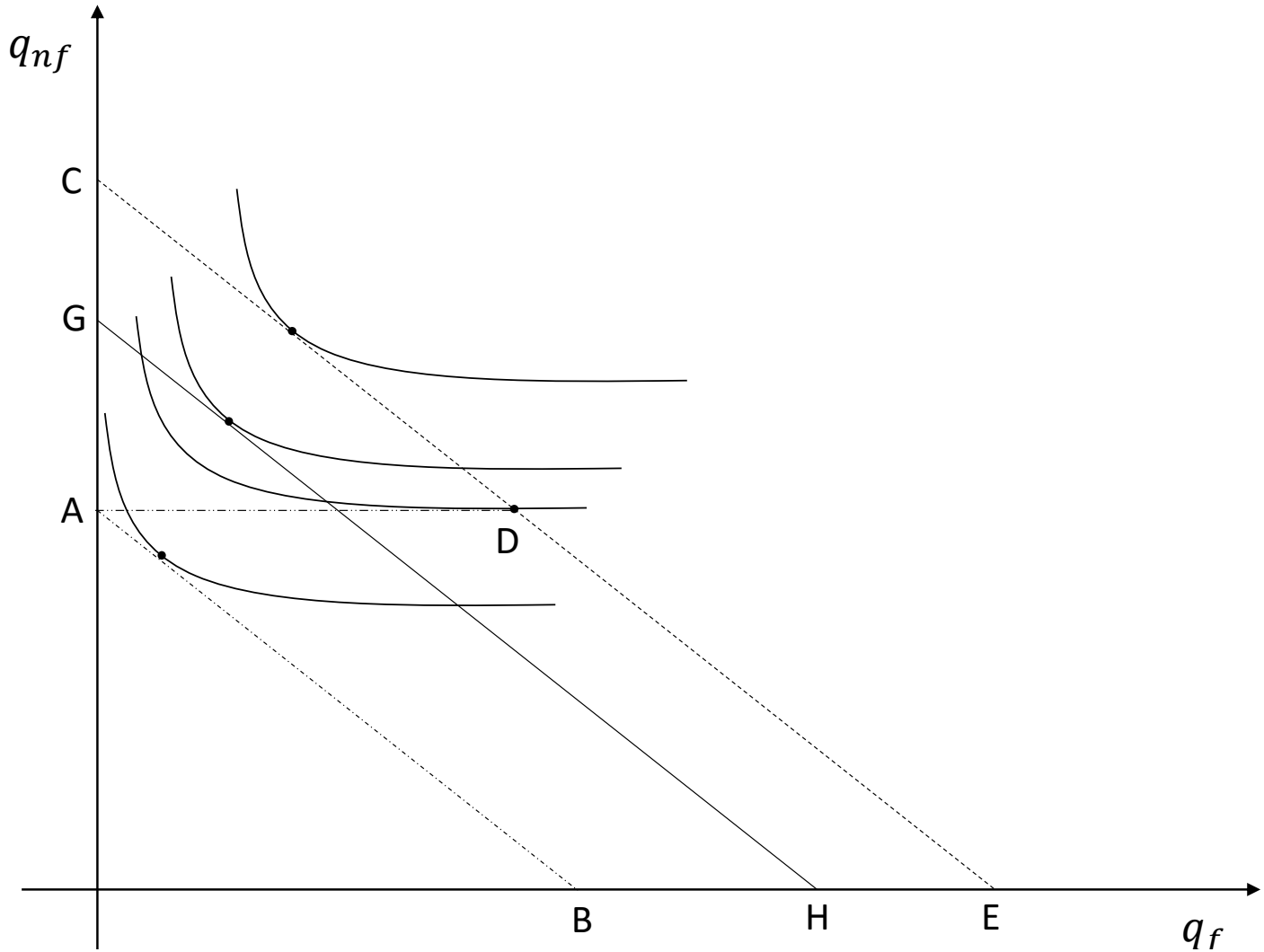

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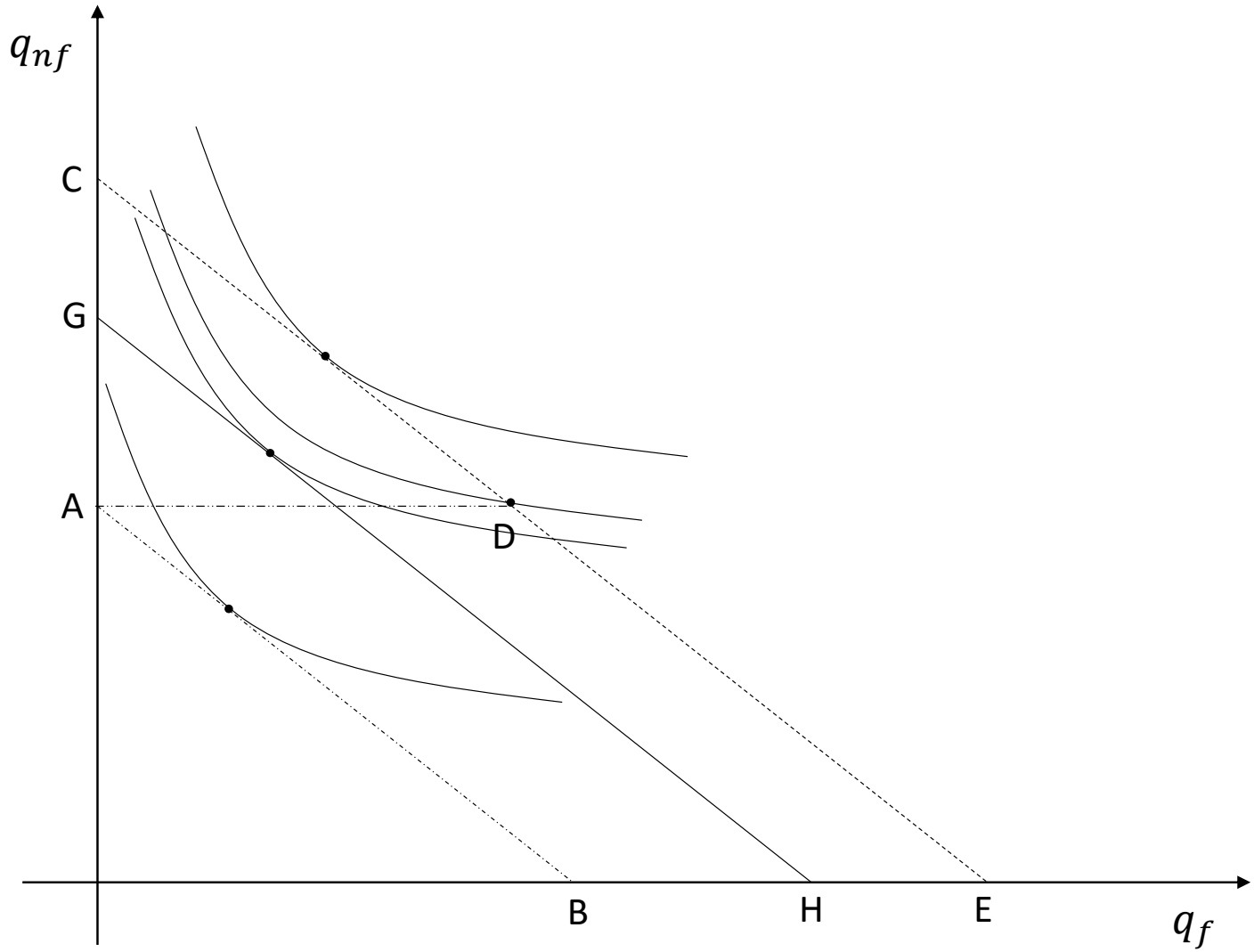

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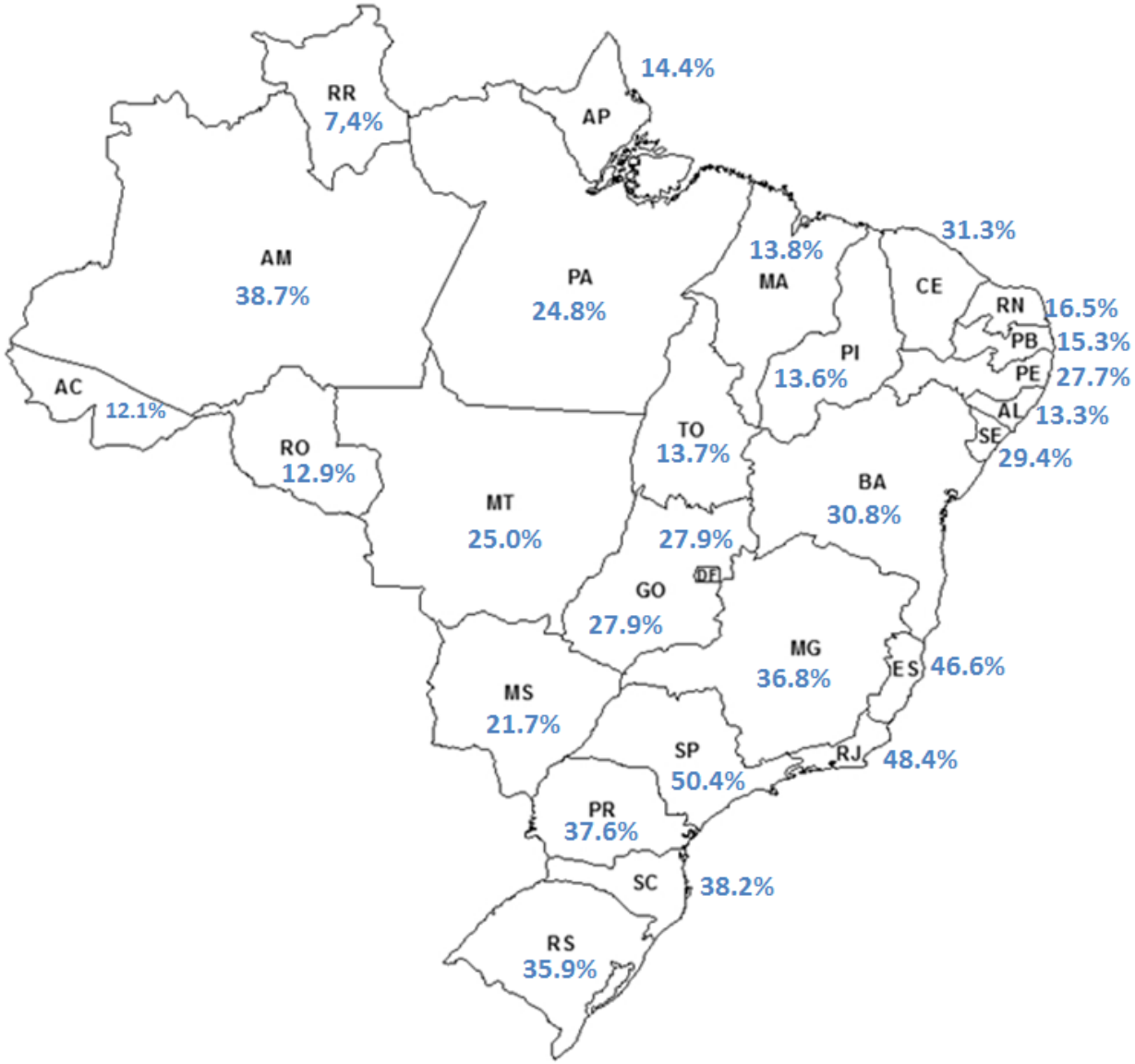
Understanding program assignment

$$E[q_{1i}^f - q_{0i}^f | D_i = 1] = E(q_{1i}^f | D_i = 1) - E(q_{0i}^f | D_i = 1)$$

- Factors that affect program assignment must be controlled:
- Firms:
  1. Fiscal incentives limit eligibility to big corporations
  2. Labor unions pressure for benefits, so sector influence participation
  3. Providing food may be a firm strategy to raise labor productivity and attract workers in low skilled sectors
- Individuals: preferences towards food may affect job seeking, which is translated in socioeconomic variables

Figure: % of eligible workers receiving benefits from PAT (2014)



Source: MTE (RAIS), own elaboration

Table: 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.

Correction for selection bias

- Regional, sectoral and socioeconomic variables correct for selection bias:

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

And according to Rosenbaum and Rubin (1983):

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

Propensity score matching

- Distortion is estimated using PSM
- Preferred to other methods because does not require specific functional form, adapts better to nonlinearities and presents strong internal validity
- If X is well specified, balancing is achieved and common support holds, estimates are causal effects of PAT

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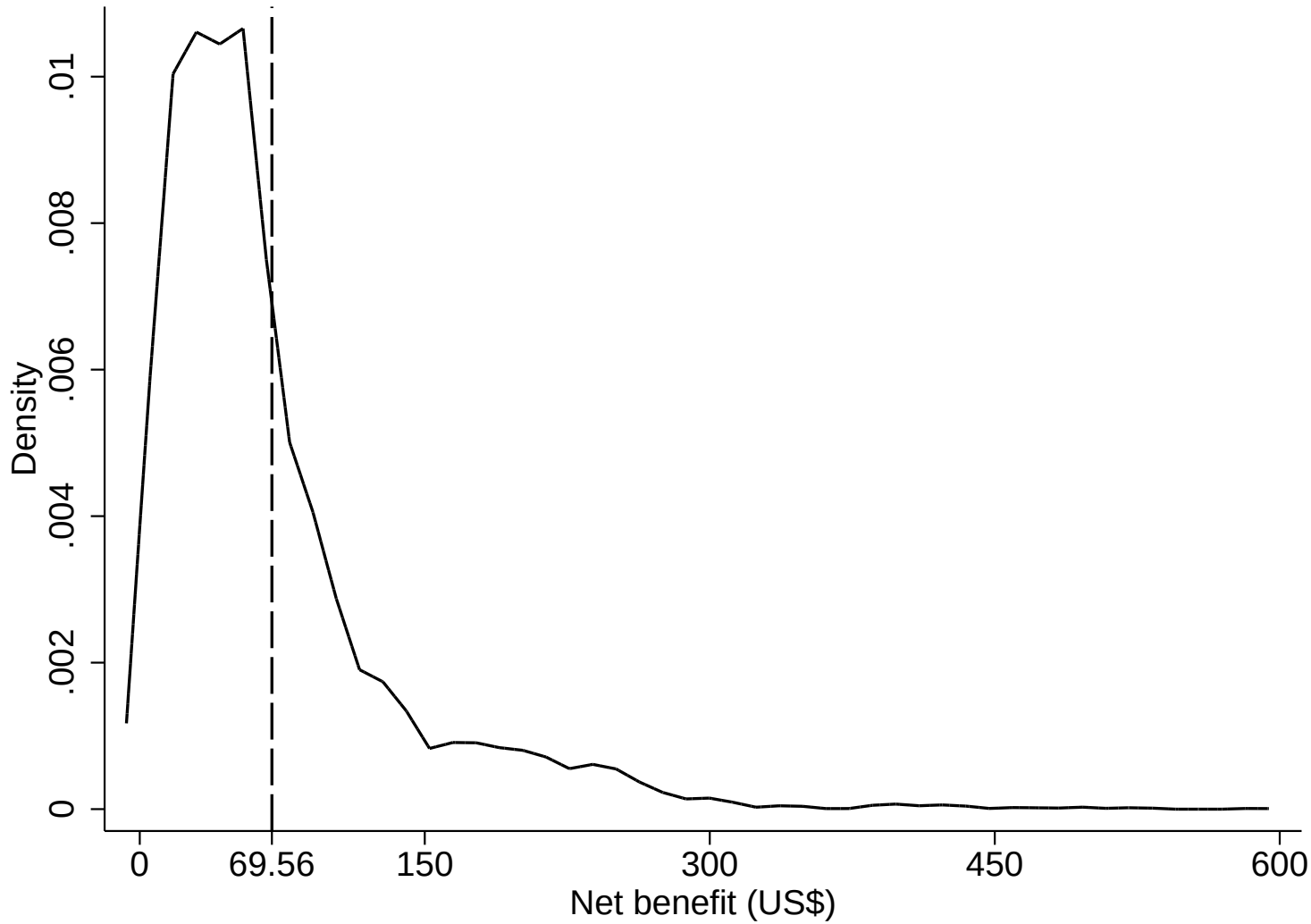
Pesquisa de Orcamentos Familiares - POF

- Household Budget Survey 2008-09
- Provide income, expenses and socioeconomic information for 56,000 Brazilian families
- Conversion: all food items calculated in kg
- All values annualized (annualization factor) and corrected for 2009 R$ (monetary correction).
- Exchange rate R$/US$2.38

Figure: Family monthly average net benefit (2009 US$)



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 nonbeneficiary (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.

Figure: Annual income distribution of beneficiary and nonbeneficiary families (2009 US$)

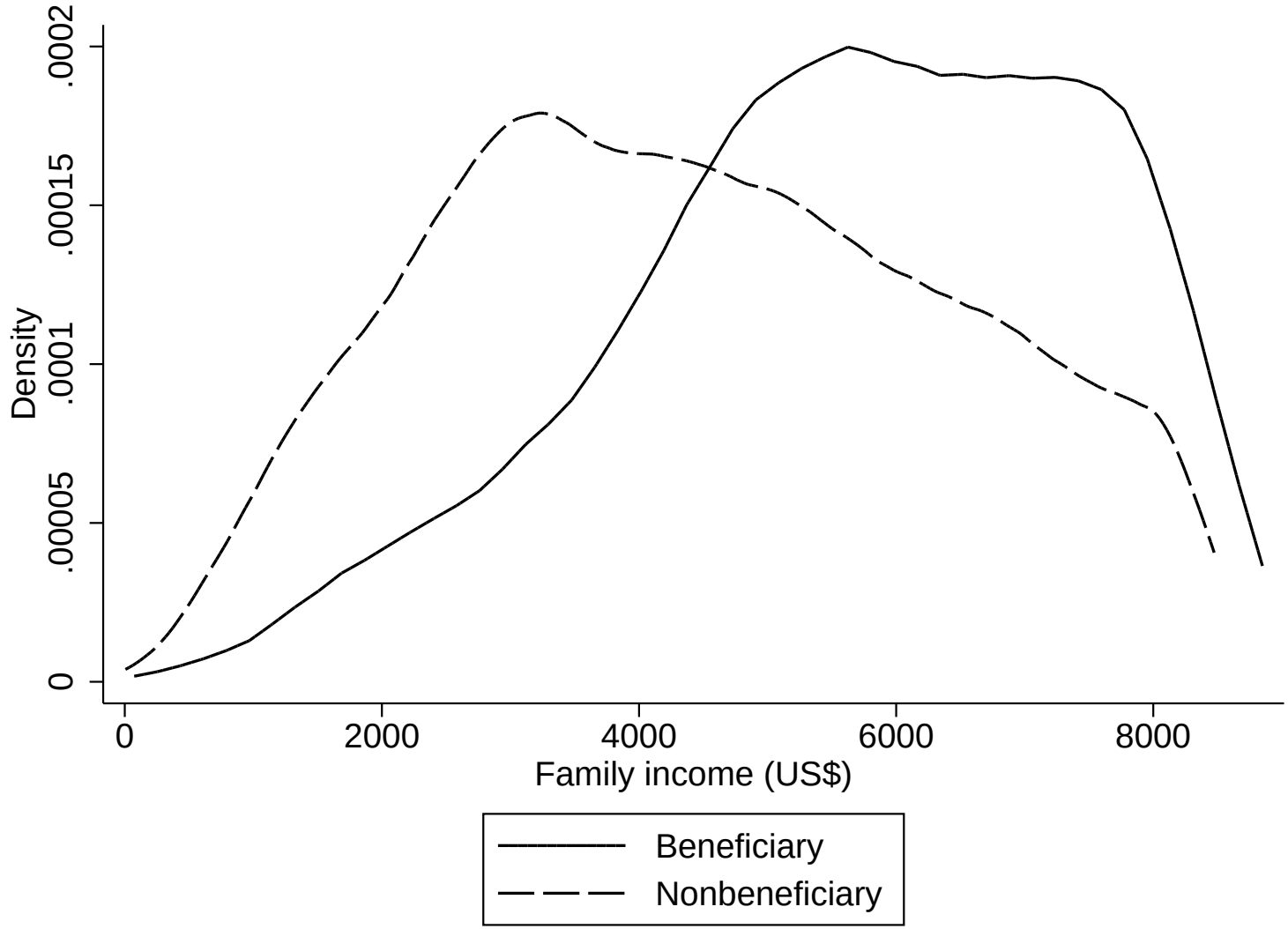
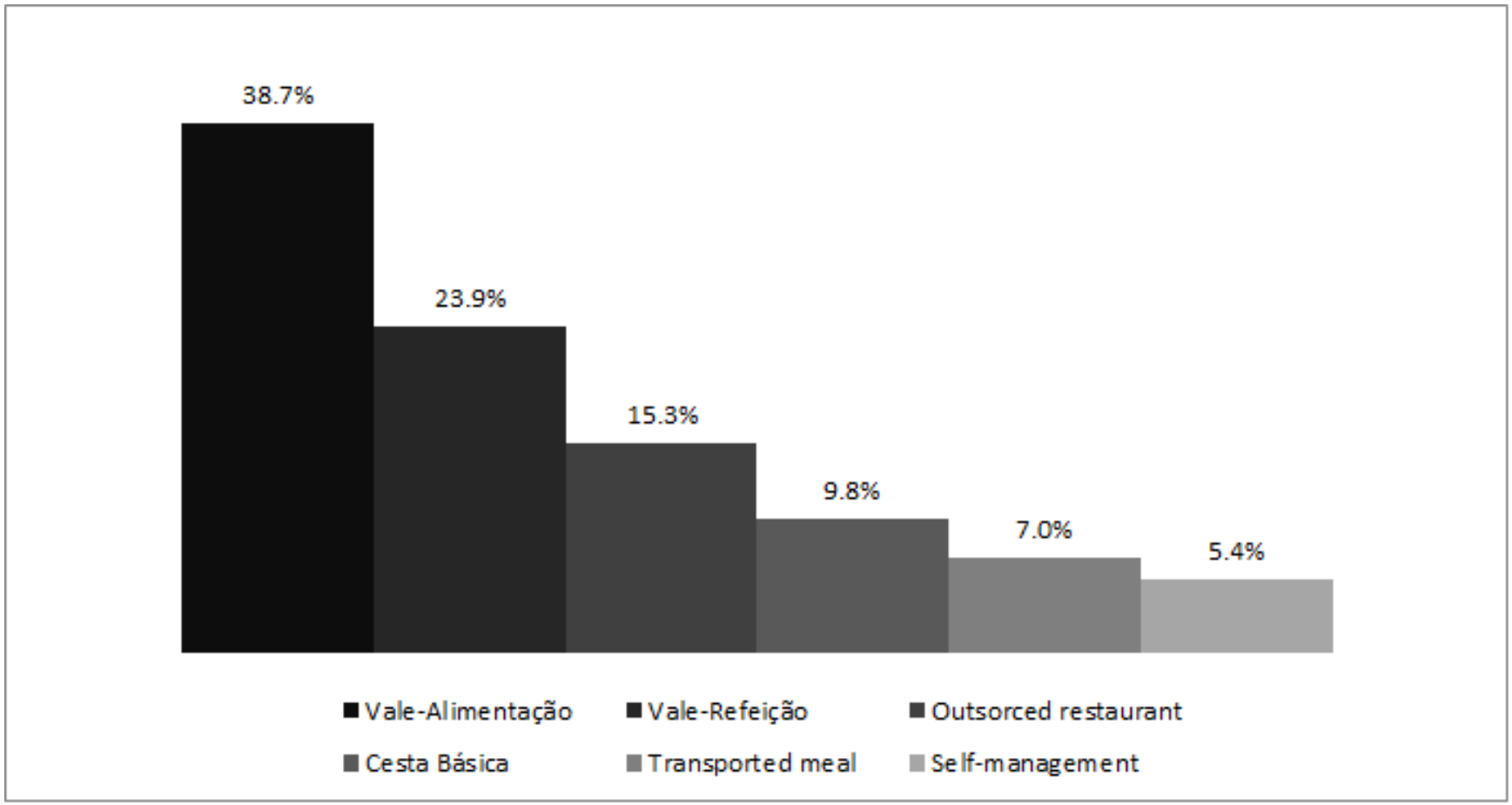


Figure: % of workers receiving each type of benefit (2015). Source: mte.gov.br



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Methodology to estimate benefit distortion

- We need to estimate the following difference:

$$D_f(\bar{q}_f) = q_f^{in-kind} - q_f^{cash} \tag{1}$$

- We do not observe q_f^{cash}
- Strategy: run PSM to control for observables and compare matches in income. Those who not received the benefit but received a higher income that equals the benefit value will be used to estimate $\hat{q}_f^{cash}$
  1. $Y_{D=0} = Y_{D=1} + T \Leftrightarrow T = \Delta Y$
  2. $Y_{D=0} = Y_{D=1} + T[1 - \tau\%] \Leftrightarrow T = \Delta Y[1 - \tau\%]$

PSM specification

- *Variables used*: regional, sectoral and socioeconomic.
- Favorite specification: #dwellers, education, race, transportation, services, south and north.
- Only formal workers of the private sector were considered for the analysis
- Mahalanobis matching (King and Nielsen (2015)) with replacement and bias correction (Abadie and Imbens (2002)).
- As for Abadie and Imbens (2008), bootstrap estimation of S.E. are usually not valid for matching procedures, so we use the estimator proposed by Abadie and Imbens (2006).

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

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.

Alternative PSM specification

- Slight mispecification of the propensity score model can result in substantial bias of estimated treatment effects (Kang and Schafer (2007), Smith and Todd (2005)).
- Idea of an iterative (non discretionary) method inspired in Imai and Ratkovic (2014).
- First step: probit regression indicates which variables will be used for matching (significance used: 1%).
- Second step: eliminate iteratively those variables that we were unable to balance.
- Iterative method: #dwellers, industry, construction, commerce, northeast, southeast.

Results

- Consumption excess vary from 5.3% to 8.1% in full sample and from 15.7% to 25.0% for poor. Rich did not present any distortion.
- Poor families welfare depend on their preferences
- Rich are in first-best situation, so program is innocuous for them

Heterogeneity 1 - Education

	Favorite Specification		Iterative Method	
Benefit	23.21***	12.03	29.05***	10.78
	(8.89)	(10.32)	(10.08)	(11.54)
Observations	10,876	7,359	9,426	6,433
Controls	YES	YES	YES	YES
Education	0-8 years	9-15+ years	0-8 years	9-15+ years

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
Table presents effects of treatment on food consumption in kilograms.
Controls for Favorite Specification: income, education, race, #dwellers, transportation, services, south and north.
Controls for Iterative Method: income, #dwellers, industry, construction, commerce, northeast and southeast.

Heterogeneity 2 - Sector

	Favorite Specification		Iterative Method	
Benefit	14.09*	-4.57	26.48**	12.85
	(7.89)	(12.05)	(11.09)	(8.55)
Observations	10,873	6,864	7,030	12,687
Controls	YES	YES	YES	YES
Sector set	A	B	A	B

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
Table presents effects of treatment on food consumption in kilograms.
Controls for Favorite Specification: income, education, race, #dwellers, transportation, services, south and north.
Controls for Iterative Method: income, #dwellers, industry, construction, commerce, northeast and southeast.
Sector set A: services, industry and commerce.
Sector set B: education and health, construction, transportation and agriculture.

Food compostion analysis

- Higher food consumption does not imply better nutrition
- Food is broken into the following categories: cereal and pasta; fuits and vegetables; sugar and candies; meats; nonalcoholic beverages; alcoholic beverages; and industrialized
- Same analysis apply

		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 # dwellers, education, race, transportation, services, south and north dummies. Variables of iterative method are #dwellers industry, construction, commerce, northeast and southeast.

Robustness

- All results are robust to both specifications and types of income
- Method was capable to balance all covariates in all specifications
- Common support holds

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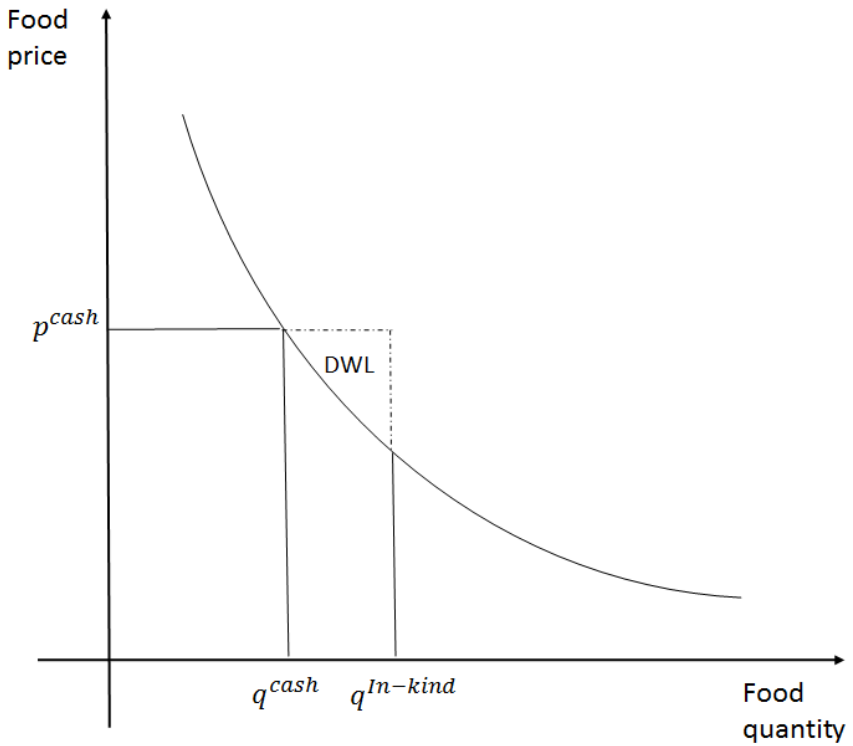
Welfare considerations

Figure: Deadweight Loss



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

Estimating compensated elasticities

- Demand estimation through QUAIDS, augmented to consider demographic variables:

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

- Ray(1983) introduced demographics in AIDS and Poi(2002) extended his work to QUAIDS
- $\mathbf{z}$ represents a vector of s characteristics

Table: 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.

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Results and policy considerations

- Low income families consume more food than desired while rich families are not affected
- Policy alternatives:
  1. Allow poor workers decide whether to receive benefits in cash or in-kind
  2. Remove benefits from rich and reallocate resources
- Although further analysis is needed, there is no evidence that transfers improve worker's nutritional status
- Conclusion: PAT may be not reaching its objectives
- Deadweight loss associated with distortions reach US$63.1 (R$150.2) million annually

Main contributions

- To the best of our knowledge: first work to evaluate PAT using microeconomic theory and robust impact evaluation framework
- Discuss program impacts on economic welfare, allowing cost-benefit analysis
- Raise evidences to discuss in which extent PAT benefits Brazilian workers
- Policy suggestions for discussion
- State foundations for further research: nutrients, impacts in other economic sectors and government budget