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Means-tested transit subsidies in Latin America

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Abstract

This paper reviews three targeted transit subsidies applied in Latin America. First, we present the experience of Bogota and Buenos Aires, where demand side means-tested subsidies were introduced during the last decade. In these two cases, criteria from the general welfare system are used to determine eligibility and both have been implemented using smartcard payment technology. We review the available information on the design, operation, and distributional outcomes for each case. This review provides useful information for policymakers interested in the design and implementation of targeted transit subsidies. The third experienced is Brazil's *Vale Transporte* scheme introduced in 1985. Although widely cited, the distributive impact and potential behavioral changes induced by this subsidy have not been presented in the literature. In this paper we use household survey data for 26 metropolitan areas of Brazil to estimate the distributional impact of the *Vale Transporte* scheme. The results indicate that this program is badly targeted to low-income individuals. In 19 of the 26 cities, this subsidy is regressive. The reason is that only formal sector workers are eligible for this benefit while many low-income individuals work in the informal sector in Brazil. In addition, since this subsidy is paid by employers it is reasonable to expect compensating equilibrium effects in wages or unemployment. We present evidence that suggests that this may have occurred with wages.

1. Introduction

Formal transit services are commonly subsidized in Latin America. These subsidies represent on average 0.23 percent of GDP in the region, with wide variations by country and city (Rivas et al, 2020). At the high end of this range are Chile (0.4% of GDP) and Argentina (0.8% of GDP). Formal transit systems in Mexico City, Buenos Aires, Panama City, Santiago, Bogota, Sao Paulo, Montevideo, and many Bus Rapid Transit (BRT) systems in medium-sized cities of Colombia are subsidized (Basso and Silva, 2014; Gómez-Lobo, 2020; Rivas et al., 2020).

Most often these subsidies are either universal (benefiting all passengers by lowering fares across the board) or categorical (students, elderly, war veterans, etc.). The evidence of the targeting and

distributional properties of these subsidies has been, at best, mixed (Serebrisky et al., 2009; Fay et al., 2017). In part, this is due to lower access by the low-income individuals to formal transport services. They tend to rely more on informal services like vans, moto-taxis and micro buses. When categorical benefits are funded through cross-subsidies, the incidence of the funding dimension will also have a bearing on the distributional results (Gómez-Lobo, 2009).

Transit subsidies are usually motivated by the need to address affordability problems for low-income individuals who depend on public transport for their daily activities. However, monetary transfers could be a better way to help this group than sectoral subsidies. As argued by Gwilliam (2017), low incomes may be the root cause of transport affordability problems faced by the poor rather than high transit fares. Nevertheless, there may be special reasons to subsidize transit directly. For example, to improve access to education or health services or to overcome poorly functioning welfare systems that hinder the administration of monetary transfers. They may also be a better way to distribute resources to certain groups that, due to intrahousehold resource allocation problems, may be difficult to target using monetary transfers (e.g., school-age students). Another justification for transit subsidies is to improve resource allocation in a second-best setting or where labor market mismatches are exacerbated by transport barriers (Franklin, 2017). For these and other reasons, monetary transfers to low-income individuals may not always be a good policy substitute for sectoral transit subsidies.

The new fiscal context post Covid-19 adds an additional element to the discussion of transit subsidies. The financial deficits of transit systems have skyrocketed as demand for public transport has yet to recover pre-pandemic levels. Given the overall fiscal strain faced by most countries, financing these deficits is becoming very challenging to transport authorities. In this context, fares may need to increase, and universal subsidies rolled back, to achieve financial sustainability of transit systems in the region.

The challenge then is how to increase fare revenues without unduly affecting the mobility needs of low-income individuals. The alternative may be to introduce targeted subsidies. With limited financial resources, concentrating benefits on the neediest individuals may be the only viable alternative.

Therefore, it is useful and timely to examine the design, implementation, and outcomes of means-tested transit subsidies. In this paper we review three such experiences in Latin America with special emphasis on their distributional outcomes. Ultimately, the purpose of this review is to provide information and general conclusions for policymakers interested in the design and implementation of targeted transit subsidies both in Latin America as well as in other regions of the world.

We begin by reviewing the experience of Bogota, Colombia, and Buenos Aires, Argentina. In both cases, transit benefits have been introduced during the last decade that use criteria from the general welfare system to determine eligibility for the subsidy. A facilitating element for implementing the policy in both cities was the electronic smartcard technology already in use in their respective transit systems. As such, reforms that modernize public transport systems and payment technology may be a policy complement to targeted transit subsidies. We review the experience in Bogota and Buenos Aires, describing each subsidy and presenting available evidence on the distributional, budgetary, or demand impacts of these schemes. The available evidence suggests that the subsidy introduced in Bogota had a positive distributional impact, benefiting mostly lower income individuals. However, the distributional outcome for the case of Buenos Aires is less clear.

Then, we analyze the *Vale Transporte* scheme used in Brazil. This is one of the oldest transit subsidies in the region and benefits formal sector workers. Despite being one of the most cited transit benefits in Latin America (Gwilliam, 2017; Vasconcelos, 2018), as far as we are aware the distributional and labor market impacts of the *Vale Transporte* scheme have not been studied in the literature.

The *Vale Transporte* is not explicitly designed as a means-tested subsidy. However, certain design features imply that only low wage workers would opt for the benefit, making it in practice a targeted subsidy (Gwilliam, 2017). We use labor market survey data for the largest metropolitan areas of Brazil to estimate the distributional incidence of this benefit. We also empirically analyze potential labor market equilibrium effects that this subsidy may generate and discuss how they may affect the incidence analysis. We find that the scheme is poorly targeted benefiting mostly middle to upper middle-class workers. The reason is not hard to find. Since the subsidy only applies to formal sector workers in a country with a large informal sector, many low wage workers are excluded from the benefit.[1] In addition, since the subsidy is partly paid by the employer there may be compensating general equilibrium changes in wages or employment that reduce the net benefit to workers. We find evidence suggesting that this may have occurred in Brazil.

This paper is organized as follows. In the next section we present the case of Bogota and Buenos Aires, where we summarize the available evidence on the distributional impact of the schemes and some labor market outcomes. Then, we present the case of the Brazilian *Vale Transporte* scheme. We estimate the distributional impact of this scheme using survey data presenting novel results in the literature. For all three cases we present a description of the subsidy and the eligibility criteria used. Where available, we also describe modifications introduced after implementation and the fiscal budgetary implications of each policy. The document concludes with a summary of results and policy lessons.

2. The case of Bogota

It is relevant to analyze transit subsidy schemes that were specifically designed to be targeted to low-income individuals. We begin with the subsidy introduced in Bogota in 2014.

2.1 Description of the subsidy

Much like many other cities in Latin America or other parts of the world, in Bogota, Colombia, certain categories of users pay a lower transit fare. These include the elderly (over 62 years of age) and

[1] Informality is defined as those workers who either do not contribute to social security or those who own unincorporated enterprises whose activities cannot be separated between financial results of productive activities and that of its owner's. According to the International Labour Organization 38.2% of employment is informal in Brazil (ILOSTAT Database, 2022).

disabled citizens. Since these categorical subsidies are not particularly novel, in this paper we focus on the means-tested transit subsidy introduced in 2014.[2] [3]

The decree introducing the scheme (*Decreto Distrital 603 de 2013*) established a 40% fare subsidy for 21 trips per month. To qualify for the benefit, an individual must be at least 16 years of age, must not receive another transit subsidy (e.g., elderly, or disabled fare subsidy), must not have made fraudulent use of any prior benefit in the system and must be registered in the SISBEN social security database with a score between 0 and 40 points. The SISBEN database is the administrative instrument used in Colombia to target social benefits.[4]

Since 2014, the subsidy scheme has undergone several changes in the parameters determining eligibility, the number of rides subsidized per month and the discount level per ride. The first change occurred with the implementation of the subsidy in March 2014, when the 40% discount was increased to 48.6% in the case of zonal services and off-peak trunk services.[5] Other changes are documented in Table 1.

It can be seen from the table that in November 2014 the fare discount increased to 50% in peak trunk services and to 60% in off-peak trunk and all zonal services. The number of rides with a discount also increased from 21 to 40. In February 2016, the peak/off-peak fare was eliminated for trunk services and the subsidy remained at 50% of the new fare.

Budgetary restrictions forced a reduction in benefits starting in April 2017, with a reduction in the full fare discount (to 25% in Trunk services and 27.5% in zonal services) and a decrease in the number of rides to be subsidized (from 40 to 30 per month). Another important change at this time, was that the cutoff SISBEN score to qualify for the subsidy was reduced to 30.56. These benefit reductions were due to the rising financial cost of the subsidy as the take-up of the scheme increased after its introduction.

In February 2018 the percentage reduction over the full fare was reduced slightly for zonal trips to 25%. This discount level remained in place until February 2020. In March of that year fares were increased but concessionary fares remained constant, so the effective discount increased to 28% both for trunk as well as zonal services.

[2] However, it should be noted that unlike many other experiences, the fare discount benefiting the elderly in Bogota has a quantitative limit of 30 trips per month. This can only be implemented if there is a personalized smart card technology capable of counting the number of trips made by each beneficiary. In Colombia there is also a nationwide transit subsidy for employees in the formal sector who earn below two minimum wages. This is an unconditional monetary transfer which is perceived as an increase in the wages rather than a transport subsidy and will thus be ignored in what follows.

[3] For a recount of the studies, design options and decisions leading to the implementation of the scheme see Rodriguez and Peralta-Quiros (2016).

[4] In the case of Bogota, the system is administered by the District Planning Secretariat (*Secretaría Distrital de Planificación*). This institution undertakes surveys at a household's dwelling which is then compared to administrative records by the Planning Ministry (*Departamento Nacional de Planificación*) to classify a household according to its income and standard of living levels. Until 2021, the classification was based on a score from 0 to 100, with a lower score indicating a poorer household. Beginning in 2021, the introduction of SISBEN IV changed each household's classification into four groups A-B-C-D with A being extremely poor and B moderately poor. Since this change is not relevant for the time frame of the analysis of this paper, we will continue to refer to a household's numeric score in the older SISBEN system. See http://www.sdp.gov.co/gestion-estudios-estrategicos/sisben. Last accessed November 16th, 2021.

[5] In Bogota, trunk services are those using the BRT infrastructure of Transmilenio, while zonal services are local, feeder and non-trunk services of the system that operate in mixed traffic conditions. There is a small charge of COP$200 for transfers to or from a trunk service to a zonal service.

Table 1: Evolution of full fares, concessionary fares, number of trips subsidized per month and the SISBEN cutoff point to qualify for the subsidy, Bogota

Service	From	To	Normal Fare (COP$)		Discounted fare (COP$)		Number of rides per month	Maximum cutoff SISBEN score
			Peak	Off-peak	Peak	Off-peak		
Trunk	Mar-14	Oct-14	1,700	1,400	1,020	720	21	40.00
	Nov-14	Jan-16	1,800	1,500	900	600	40	40.00
	Feb-16	Mar-17	2,000		1,000		40	40.00
	Apr-17	Jan-18	2,200		1,650		30	30.56
	Feb-18	Jan-19	2,300		1,725		30	30.56
	Feb-19	Feb-20	2,400		1,800		30	30.56
	Mar-20	now	2,500		1,800		30	30.56
Zonal	Mar-14	Oct-14	1,400		720		21	40.00
	Nov-14	Jan-16	1,500		600		40	40.00
	Feb-16	Mar-17	1,700		700		40	40.00
	Apr-17	Jan-18	2,000		1,450		30	30.56
	Feb-18	Jan-19	2,100		1,575		30	30.56
	Feb-19	Feb-20	2,200		1,650		30	30.56
	Mar-20	now	2,300		1,650		30	30.56

Source: Veeduría Distrital (2018) from 2014 to 2018. Updated using information from www.transmilenio.gov.co. Trunk services are those using the BRT infrastructure of Transmilenio, while zonal services are local, feeder and non-trunk services of the system that operate in mixed traffic conditions. There is a COP$200 (US$0.07[6]) charge for transfers between trunk and zonal services. The SISBEN cutoff score is the maximum score that an individual must have in the welfare evaluation system to qualify for the benefit. A smaller score implies a lower socioeconomic level of the individual. The average exchange rate for this period (March 2014 to March 2020) was 2,891 COP$ per US$.

[6] Value obtained using the average exchange rate for the period.

To implement the subsidy a prerequisite was to have a smartcard payment technology that could keep count of the number of trips made by each beneficiary. This was possible in Bogota since prior transit reforms (Transmilenio in 2000 and SITP in 2012) had introduced an electronic payment card throughout the transit system. This card, called *Tullave* (literally "your key") allows for personalization; that is, registers the user's personal information (name and identification number).[7] This capability is key to discourage fraudulent use of the subsidy.

To obtain the benefit, an individual can verify if they are eligible by consulting the webpage https://sisben.tullaveplus.gov.co/. If they are eligible, they must visit any *Personalization Point*[8] of the system, present their identification card, pay the COP$6,000 (US$1.62[9]) cost and will then receive a personalized *Tullave Sisben* card. Once an individual has the card, they can charge it with money at any charging point of the system and start using it to travel. The card will automatically discount the subsidized fare for each trip from the user's card balance, up to the maximum number of subsidized trips per month. After this limit, the full fare will be charged.

Table 2 presents the aggregate number of paying trips in Bogota (*validaciones*), the total number of paying trips using a *Tullave Sisben* card and the maximum aggregate cost of the subsidy.[10] The table shows that the number of *Tullave Sisben* card validations increased from 1.5% of all validations in 2014 to 11.2% in 2016.[11] The financial cost of the scheme also rose rapidly during this period, from US$4.7 million to US$40.2 million. Since the financial deficit of the transit system is funded by transfers from the Bogota city government, the cost of the subsidy is ultimately paid for by the city as lower fare revenues must be compensated by higher transfers.

The rising use of the benefit and the financial cost of the scheme explain the changes introduced in 2017 described above. First, the SISBEN cutoff point to qualify for the benefit was lowered from 40 to 30.56. Second, the number of total rides per month with a discount was lowered from 40 to 30. Third, the discount over the full fare was lowered from 50% or more to close to 25%. These changes had an immediate effect on the aggregate financial cost of the subsidy, falling by 46.2% between 2016 and 2017.

[7] In the case of the elderly transit subsidies, beneficiaries must have *Tullave* with the individual's photograph. Not so for the means-tested subsidy.
[8] These are offices throughout the city where individuals can obtain a personalized card. At the time of writing there were 37 personalization offices throughout Bogota. See www.tullave.gov.co for more information.
[9] Value obtained using the 2020 exchange rate.
[10] The figure for the cost of the subsidy is an estimate of the maximum budgetary cost of the scheme. These figures were estimated using the difference between the concessionary and full fare times the total number *Tullave Sisben* card validations. Since some *Tullave Sisben* validations may include trips above the monthly limit that pay the full fare, these estimates probably overstate somewhat the true budgetary cost of the scheme.
[11] As of October 2016, there were 485,092 users with SISBEN, out of the 1,377,708 eligible residents registered in December 2016. Around 54.6% of users have between 16-30 SISBEN points, and 36.4% have between 31-40 points the rest are below 16 (Alcaldia Mayor de Bogota, 2017). The beneficiaries represent approximately 5% of the residents in the city.

Table 2: Evolution of total validations, those using a Tullave Sisben card and the maximum yearly financial cost of the scheme

Year	*Total validations*	*Validations using Tullave Sisben cards*	*% of Tullave Sisben card validations over the total*	*Maximum cost of the subsidy (millions of COP$)*	*Maximum cost of the subsidy (millions of US$)*
2014	809,567,451	12,429,443	1.5%	9,513.9	4.70
2015	996,510,104	76,249,360	7.7%	68,624.4	25.01
2016	1,104,902,200	123,485,279	11.2%	122,706.8	40.21
2017	1,044,026,011	91,154,452	8.7%	65,989.2	22.35
2018	1,073,784,187	n.a.	n.a.	n.a.	n.a.
2019	1,137,503,815	n.a.	n.a.	n.a.	n.a.
2020	574,038,601	n.a.	n.a.	n.a.	n.a.

Source: Veeduría Distrital (2018) and https://datosabiertos.bogota.gov.co/dataset/validaciones-tarjeta-tullave-sitp. The last column was estimated using the number of validations with *Tullave Sisben* card together with information on the discount of concessionary fares over full fares. Since some validations could have been for trips above the limit of subsidized trips per month, these figures may overstate actual budgetary costs of the scheme. The last column was calculated using the average exchange rate for the US$ to the COP$ of each year.

2.2. Evaluation of the subsidy scheme

Guzman and Oviedo (2018) simulate the impact of the subsidy scheme by analyzing its potential effect on job accessibility in Bogota. They compare the accessibility of a pre-subsidy scenario (2011) to a post-subsidy scenario (2015) if all the poorest individuals in the SISBEN database take up the benefit. Accessibility is measured as the inverse of the total travel cost in public transport from an individual's residential location to a location where job offerings are available.[12] The total accessibility index of an individual is the weighted sum of the accessibility of an individual's residential location to all other areas of the city, where the weights are the total number of jobs in each area of the city. Their results indicate that the subsidy would potentially increase accessibility in the periphery of the city, where there is a high concentration of low-income households. The simulations were undertaken assuming that all SISBEN classified in group 1, the poorest households, take-up the subsidy.

The analysis by Guzman and Oviedo (2018) is confirmed by the results of Veeduría Distrital (2018). In this last study, a detailed analysis of each smartcard used in the system was undertaken to infer the spatial and economic impact of the subsidy in March, September, and October of 2017. The analysis was based on the *Unidad de Planificación Zonal* (Zonal Planning Units, or UPZ by its Spanish acronym), a finer geographic classification than that of locality.[13] First, the residential UPZ of each card holder was inferred using the most frequently used bus stop during a month. The idea being that the most frequently used stop will be the one closer to the card holder's residential location.[14] Then

[12] The total travel cost from each origin area is multiplied by a cost sensitivity parameter to reflect differences in behavioral effects of changes in travel cost across different areas of the city. These parameters were calibrated using travel behavior data.
[13] Bogota is divided into 117 UPZ. See https://bogota.gov.co/mi-ciudad/salud/que-es-una-upz.
[14] For this comparison, only cards that exhibited between 20 and 100 trips per month were used. When there was a tie in the frequency of use by stop for a given card, the location of the earliest trips during the day was used to infer the user's residential location.

the total number of subsidized trips, as a proportion of all trips, can be calculated for each UPZ. The same can be done for the number of *Tullave Sisben* cards over the total number of *Tullave* cards in each UPZ.

Comparing the above ratios to average income per capita in each UPZ indicates that in the lowest income areas the proportion of subsidized cards and trips were highest. This is an indication that the subsidy scheme is well targeted to low-income individuals.[15] These were mainly locations in the periphery to the south of the city and some areas to the north.

On the other hand, the reported number of users in October 2016 was 485,092 (Alcaldia Mayor de Bogota, 2017). Users of the benefit represent approximately 5% of the residents in the city. The SISBEN database for the third quarter of 2016 indicates that there were 697,432 individuals in Bogota between 18 and 59 years of age and with a score of 40 or less.[16] Although not perfect, the error of exclusion (approximately 30%) does not seem to be particularly high based on this data for 2016.

In sum, the available evidence suggests that Bogota´s targeted transit subsidy is progressive. More research is required to estimate the exact distributive properties of the subsidy considering the changes introduced in 2017.

As for other impacts of the subsidy, Rodríguez, et al. (2016) analyze the travel behavior and labor market outcomes of those benefiting from the scheme. They find that individuals with the subsidy increased their monthly trips by 56% (about 8 additional trips per month and 2 transfers) compared to non-beneficiaries. Interestingly, the overall expenditure on transport of subsidy recipients did not change, suggesting that many low-income individuals have a repressed demand for travel due to financial limitations. Once fares are lower, they increase frequency of travel rather than save on transport expenditure.[17]

As for labor market outcomes, they find that the subsidy increased hourly earnings of informal workers. As Rodríguez, et al. (2016) point out, this result is evidence for the complementarity between mobility and access to better labor market opportunities for informal workers.

Since the funding of the scheme is through the city's budget and the benefit is not conditioned on any labor market outcome (employment in the formal or informal sector) it is unlikely that this subsidy generates significant general equilibrium effects in the labor market.

3. The case of Buenos Aires

The original scheme was introduced in December 2012 in Buenos Aires, as a policy reaction to fare hikes for bus and train services (ASAP and CIPPEC, 2014).

[15] It is also interesting to note that Veeduría Distrital (2018) estimates that 170,000 people lost the benefit from the change in the SISBEN score from 40 to 30.56 in April 2017, a fall of 36.2% in the total number of beneficiaries.
[16] The SISBEN data base can be obtained from https://anda.dnp.gov.co/index.php/catalog/98. The database only has ranges for age, so it was not possible to calculate the exact number of eligible individuals between the ages of 16 and 62 so the figure of total eligible individuals is underestimated for this reason. However, the disabled and older students are included in the figure presented which would imply an over estimation of eligible individuals.
[17] It also implies a price elasticity of travel demand equal to -1 for this group of passengers.

3.1 Description of the subsidy

Transit subsidies in Buenos Aires have traditionally taken the form of supply side transfers to operators. These subsidies amounted to US$2,944 million in 2015 and have questionable distributive properties (Bondorevsky and Estupiñan, 2018). They may also generate negative incentives for productive efficiency. However, in 2012 a differential fare system was introduced. Analogous to the case of Bogota, it provides discounted fares to eligible individuals. These include pensioners, war veterans, domestic service workers, the disabled and individuals receiving some type of tax and welfare benefit. It is this last eligibility criteria that makes this scheme a means-tested subsidy.[18] They include vulnerable individuals who participate in community jobs program (*Monotributista Social* from Law 26,565 of 2010) or who receive one of several labor, pensions, or other social security benefits.[19]

The discount was originally 50% of the full fare in rail and bus services (which were already subsidized due to the supply side subsidies). It was reduced to 40% in 2013 but later raised to 55% in 2016 (Rivas, et al., 2020). In 2016 the eligibility criteria were also expanded to include more social programs (Lakner, et al., 2016). The number of beneficiaries has also increased through time to compensate for rising fares. In 2018 there were 2.3 million beneficiaries in the metropolitan area of Buenos Aires (Dominguez, et al., 2020).

The benefit is implemented using the *SUBE* smartcard electronic payment technology that was introduced in public transport services in 2013 and allowed for fare integration among modes. Users must register their SUBE card first (either online or at a SUBE office). Once registered, if they are eligible, they must then go to an automatic terminal that are available throughout the city and charge their cards with the transit subsidy.[20]

3.2 Evaluation of the subsidy scheme

Lakner, et al. (2016) use household expenditure survey data (ENGHo) from the year 2012/2013 to estimate the distributional impact of the transport subsidy considering the eligibility criteria as of 2014. They assume that all potential beneficiaries enroll in the program and is thus a best-case scenario in terms of the take-up rate of the subsidy.

The results indicate that the transit subsidy is not particularly pro-poor. The share of covered individuals is relatively constant across all deciles of the household income distribution. This is so whether the deciles of the income distribution are calculated nationally (using all surveyed households) or only those households in the Metropolitan Area of Buenos Aires (AMBA). In both cases, over 50% of individuals in the first four deciles of the income distribution do not receive the

[18] Students are also subsidized. However, unlike experiences in other parts of the world, the benefit is limited to 50 free trips per month, during weekdays in the academic year between 5 AM and 12 PM and up to 4 trips per day (see https://www.argentino.com.ar/tramites/como-tramitar-el-boleto-estudiantil-gratuito, last accessed November 22, 2021). As in the case of Bogota, to implement such a quantitative limit on benefits and time of use, the use of an electronic smartcard is required. Further below we describe the payment technology used throughout Argentina.

[19] These include: *Asignación Universal por Hijo*, *Asignación por Embarazo*, *Programa de Jóvenes con Más y Mejor trabajo*, *Seguro por desempleo*, *Seguro de Capacitación y Empleo*, *Programa Promover Igualdad de Oportunidades*, *Programa PROGRESA*, *Programa "Potenciar Trabajo"*, and *Pensiones No Contributivas*. See https://www.argentina.gob.ar/servicio/solicitar-la-tarifa-social-en-la-tarjeta-sube. Last accessed November 22, 2021.

[20] See https://www.argentina.gob.ar/servicio/solicitar-la-tarifa-social-en-la-tarjeta-sube.

benefit, suggesting very high errors of inclusion. Likewise, many individuals in the top deciles of the income distribution receive the benefit.

Lakner, et al. (2016) attribute the lack of progressivity in this subsidy to the inclusion of all retirees as eligible for the benefit, something that may not be good means-tested criteria in the case of Argentina. However, they simulate that if recipients of the *Programa Hogar* are included as beneficiaries, then the distributive incidence of the subsidy improves substantially.[21] In 2016 the eligibility criteria was expanded to include other social programs but to date the *Programa Hogar* has not been included. Therefore, it is an open question whether the changes introduced in 2016 improved the distributive incidence of this subsidy.

As for mobility impacts, the only information available is provided by IADB (2021). It analyzed the travel patterns of women with and without the subsidy in Buenos Aires. The results are presented in Table 3 that shows that women that pay the concessionary fare make more daily trips in public transport, use the bus mode more intensely and ride earlier in the morning compared to women who pay the full fare.

Table 3: Average transit trip characteristics for women with and without subsidy in Buenos Aires according to SUBE card use

		Subsidized fare	*Full fare*	*Difference*
Trips per day	Average per card	4.196	3.508	0.687 ***
Mode (proportion of total)	Bus	0.890	0.748	0.142 ***
	Metro	0.000	0.139	-0.139 ***
	Train	0.110	0.114	-0.004 ***
Trip time (proportion of total)	0-6 AM	0.105	0.072	0.033 ***
	7-10 AM	0.252	0.260	-0.008 ***
	11 AM to 3 PM	0.290	0.303	-0.013 ***
	4-7 PM	0.273	0.278	-0.005 ***
	8 -12 PM	0.080	0.087	-0.006 ***

Source: IADB (2021). *** indicates a statistically significant difference in the average across both groups at a 1% confidence level.

However, from the table it is not possible to infer a causal effect of the subsidy on travel patterns. For example, it is reasonable to expect poorer women to use more public transport and have access to the subsidized fare without any causal relationship between these two variables.

In sum, for the case of Buenos Aires, the distributive impact of the subsidy is unclear since the effect of changes introduced since 2016 have not be evaluated. Future research should attempt update the incidence analysis undertaken earlier.

4. The case of Brazil

[21] *Programa Hogar* is an energy subsidy for poor households unconnected to the natural gas network. It is a monthly monetary transfer to help pay for a 10 kg. gas cylinder.

4.1 Description of the subsidy

Vale Transporte was introduced in 1985 through a national law (Law Nº 7,418 of 1985 and regulated by the Decree Nº 95,247 of 1987).[22] Formal sector employers must provide workers with transit vouchers for work related trips to and from their residence. In exchange, they can deduct up to 6% from worker's wages. This last feature is what makes this scheme a targeted subsidy (Gwilliam, 2017). Only workers who earn low wages and whose commuting transport expenditures is more than 6% of earnings will receive vouchers worth more than their wage deduction. Although voluntary, these workers should be interested in taking-up the benefit. Those with higher wages will be indifferent since their commuting expenditure, if lower than 6% of earnings, will be exactly offset by the wage reduction.[23]

The employer must provide an employee with vouchers for the full trip to and from work.[24] If the most convenient transit trip of a worker implies more than one segment with different operators and fares in each, then the vouchers must cover each segment. Consequently, employees who live further away receive a higher benefit. The benefit applies to all urban public transport modes as well as to intermunicipal or interstate transport that have the characteristics of urban services.

If the cost of the transit vouchers for a particular worker is higher than the wage deduction limit of 6%, then it is the employer who must pay the difference. However, since this net excess expenditure on *Vale Transporte* vouchers is tax deductible, about one third of the net cost is funded by the government in the form of lower tax revenues.[25] The cost (above the wage deduction) may be substantial. Gwilliam (2017) reports that in the second income quintile, individuals benefit to the amount of 30% of their incomes, much higher than the 6% deduction. Individuals in the first income quintile, however, do not benefit much since they are either self-employed, informal sector workers or unemployed. In 2019, *Vale Transporte* trips in the Sao Paulo transit system represented 30.3% of total passengers and 14% of total revenues.[26]

In practice, the scheme works as follows. At the beginning of each month, firms purchase vouchers from a syndicate of transit companies, a clearing house operated by the government or a private bank that acts as a "selling agency" (Gwilliam, 2017). The vouchers are then transferred to workers who then can use them to pay for their trips. The transit companies later exchange the *Vale Transporte* vouchers received from passengers for cash from the selling agency. Depending on the city, the benefit can take the form of tickets, tokens, or electronic credits in transit systems with smartcard payment technology.

One of the unintended consequences of the scheme is that an active black market for vouchers emerged. Gwilliam (2017) reports that in the year 2000 about 25% of recipients sold their vouchers

[22] According to Vasconcellos (2018), the subsidy was introduced after a decade of protests (backed by unions and progressive elements of the Catholic Church) against fare increases.

[23] This last type of worker could opt to receive *Vale Transporte* vouchers anyway if they so wish. However, this is unlikely since the price of the vouchers sold to employers is somewhat higher than the price individual passengers would have to pay (see further below on how employers purchase vouchers). Therefore, the wage deduction would be larger than their commuting expenditure without *Vale Transporte*.

[24] An employer is exempt from providing *Vale Transporte* vouchers to its employees if it operates or hires its own transport for workers to and from their residence. If this transport covers only part of a worker's full trip, the employer must provide vouchers for the segments that the worker must ride in public transport.

[25] The excess expenditure on *Vale Transporte* tickets made by a company cannot reduce tax liabilities by more than 10% in each period. Any expenditure above this limit can be used to reduce tax liabilities in the next two periods. This cap may reduce the proportion of the subsidy (net of the workers' earnings deduction) that is funded by the government in the form of lower tax revenues.

[26] *Planilla_de_custos_1577365324.xls*.

in the black market rather than using them. Presumably this would not be possible if non-transferable individual smartcards are used to distribute benefits as in the experience of Bogota and Buenos Aires discussed above.

4.2 Evaluation of the scheme

There could be several general equilibrium effects of the subsidy. Firms may increase their prices to compensate for the expenditure on the scheme, equilibrium wages for low skilled formal sector wages may fall or firms may discriminate by not hiring workers who reside far away from the companies' premise. Also, if the minimum wage is binding, then the effects may be higher unemployment for low-skilled workers who search for formal sector jobs, an effect reminiscent of Harris and Todaro (1970).[27]

We will examine some of these general equilibrium effects further below. However, we will start by estimating the distributional incidence of the subsidy assuming there are no compensating equilibrium changes in the labor market.

4.3 Imputing the subsidy benefit

The Brazilian household survey -PNAD- reports the monetary gross earnings[28] including all monetary subsidies. We assume that gross labor income for workers who take-up the *Vale Transporte* scheme includes the value of the transport vouchers net of the wage reduction.[29] The reported labor earnings for a formal sector worker would then be:

$$\bar{W}_i = max[M_i, M_i(1 - 0.06) + \theta_i \cdot S_{ic(i)}] \qquad (1)$$

where $\bar{W}_i$ stands for the gross labor income as reported in the PNAD; M_i represents the monetary gross labor earnings received by the worker before the *Vale Transporte* benefit and costs; θ_i is a parameter that equals one for full-time workers and less than one for part-time workers (equal to hours worked relative to a full-time work schedule); and $S_{ic(i)}$ represents the transit commuting expenditure required by worker *i* in her/his city of residence *c(i)*. This last parameter is equal to the monetary value of transport vouchers given by employers to their full-time workers.[30] This equation assumes that all workers that stand to benefit from the scheme take-up the subsidy.[31]

However, M_i is not observed in PNAD surveys but can be deduced from reported earnings through the following expression:

[27] An employer paid transit subsidy experiment in Vancouver, Canada, led to an increase in transit ridership (Hall, et al., 2021). We do not consider the impact of the *Vale Transporte* scheme on transit ridership in this paper.
[28] The income after contributions to social security but before income taxes.
[29] Further below we discuss the implications if this assumption does not hold, and gross labor earnings are registered before the effects of the *Vale Transporte* scheme are considered.
[30] We ignore the possibility that vouchers are sold to employers at a higher price than the fare paid directly by passengers.
[31] This implies that our distributional assessment undertaken further below is a best-case scenario considering full take-up of the benefit.

$$M_i = min\left[\bar{W}_i, \frac{\bar{W}_i - \theta_i \cdot S_{ic(i)}}{1 - 0.06}\right] \quad (2)$$

Equivalently, the worker will take the subsidy as long as:

$$\bar{W}_i \leq \frac{\theta_i \cdot S_{ic(i)}}{0.06} \quad (2)$$

This means that a formal sector worker will take the subsidy if her/his wage is below 16.67 times the commuting cost -multiplied by the proportion of full-time work the individual undertakes-.

The net monetary amount of the benefit received by worker *i* in city *c* is then:

$$B_i = \frac{1}{(1 - 0.06)} \cdot Max[\theta_i \cdot S_{ic(i)} - 0.06 \cdot \bar{W}_i, 0] \cdot I(i = eligible) \quad (3)$$

where I is an indicator function that takes the value of one if the worker is in formal sector employment and zero otherwise.[32]

In our empirical application we do not have information on individual worker's commuting expenditure and so $S_{ic(i)}$ is replaced by the average transit expenditure estimated for each city as explained further below. This may overestimate the benefit to those workers residing close to their employment and underestimate it for those residing very far away. However, since distance-based transit fares are uncommon in Latin America and many cities in Brazil have integrated public transport systems where transfers between services do not pay a full additional fare, using average city transit expenditure should not significantly bias our results.

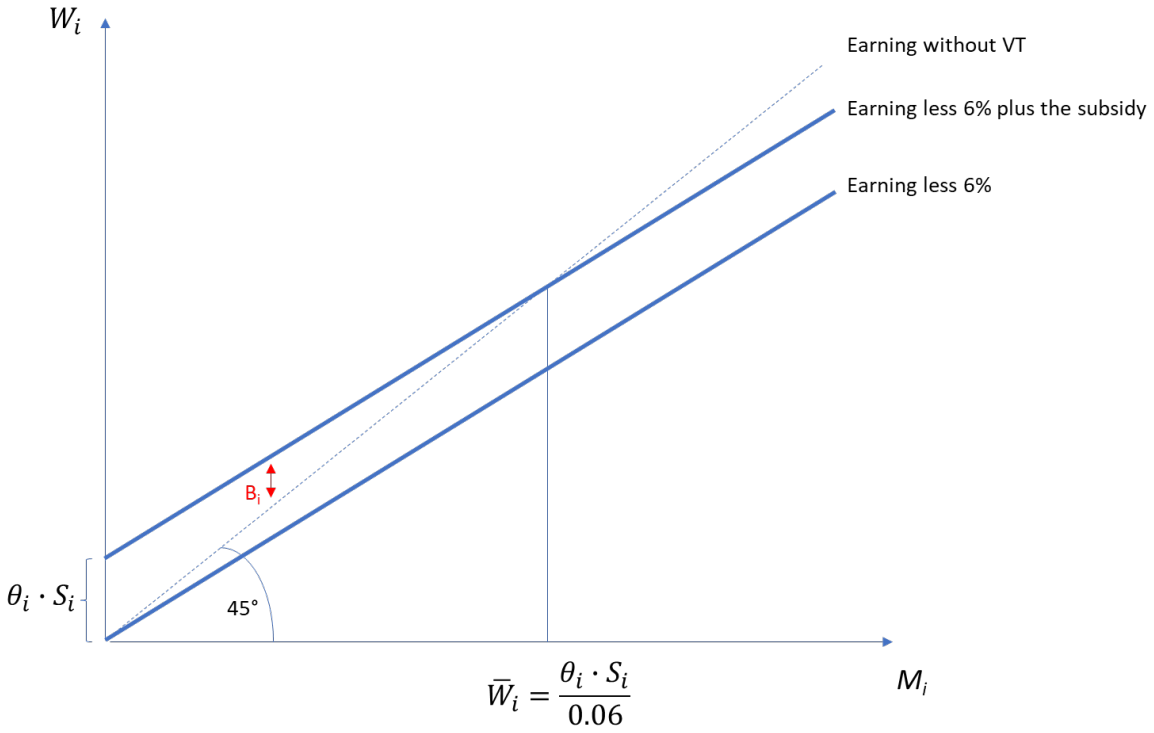
The above derivations can be clarified with Figure 1. In this figure gross labor earnings before the subsidy are measured in the horizontal axis while the post subsidy earnings in the vertical axis. The 45-degree line represents the case where the *Vale Transporte* Scheme does not exist, ex-ante and ex-post earnings are the same. The right blue line represents labor earnings less 6% of the worker paid share of the transit costs. As can be seen this 6% is higher in absolute terms the higher are ex-ante labor earnings. To this we add the subsidy benefit equal to $\theta_i \cdot S_{c(i)}$ to obtain ex-post labor earnings represented by the left blue line.

Earnings after taking up the subsidy will only increase if ex-ante earnings are below $\frac{\theta_i \cdot S_{c(i)}}{0.06}$. Only workers who meet this last condition will be interested in taking up the benefit. Higher income workers would be neutral with respect to the scheme.[33]

[32] If the survey registers gross earnings before the effects of the *Vale Transporte* scheme, then condition (3) is unchanged and the monetary benefit of the scheme to each worker is the same as (4) except that it does not have the leading fraction.
[33] If the benefit is below 6% of earnings, then the employer will reduce earnings by less than 6%, just enough to fund the travel vouchers. Thus, for higher earning workers their ex-ante and ex-post earnings will be the same whether they take up the scheme or not.

For those that take-up the subsidy, the net benefit will be the difference between their ex-post and their ex-ante earnings, represented by the red distance in the figure. Note that this net benefit increases as labor earnings are lower. Thus, the lower the worker's wage rate, the higher the net benefit of the program, at least for formal sector workers. As incomes rise the net benefit is reduced until it disappears altogether.

Figure 1: Labor earnings before and after applying effects of the *Vale Transporte* scheme



Source: Own elaboration.

4.4 Data

We use individual level data for 26 metropolitan areas of Brazil taken from the 2020 PNAD household survey. This survey is statistically representative for these metropolitan areas. We use the data for the first quarter of that year to avoid any distortions due to the Covid pandemic.

The data was trimmed eliminating households with incomes in the lowest and highest 5% percentile by income per capita in each city. Specifically, percentiles were constructed in per capita household income in each city, and individuals belonging to bottom and top 5% were excluded from the database. This eliminates individuals from zero income households.[34]

For commuting expenditure, we use data from Expatistan for 2021. This is a crowdsourced platform that registers harmonized cost of living information for different countries and cities around the world.

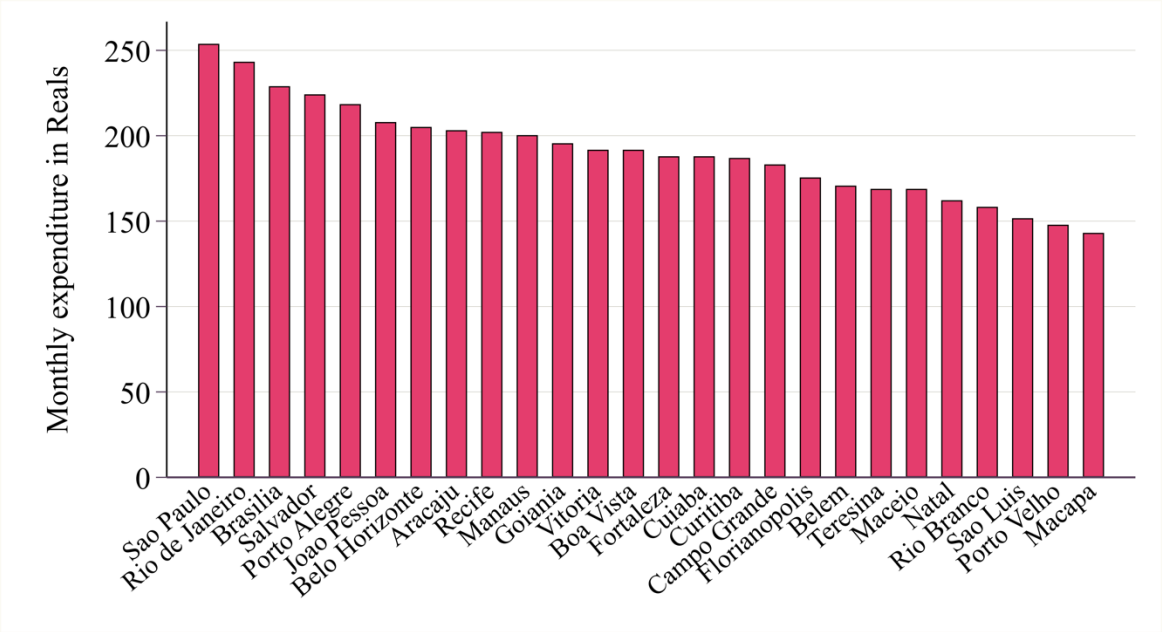
[34] Excluded observations in the bottom 5% percentile are for the most part (99.4%) not employed and 0.6% are employed but in informal work.

For this research, we use the public transport data, which indicates the average value spent in public transportation by residents of different cities in Brazil.

The transit commuting expenditure was deflated using the country's inflation rate between 2020 and 2021. Notice that this probably implies an underestimation of the subsidy benefit, since during the pandemic transport fares where usually not readjusted and nominal fares in 2021 were for the most part equal to 2020 nominal fares. Further below we present robustness checks to see the impact of different assumptions regarding the average transit expenditure in each city.

We estimated the value of the subsidy for formal sector workers according to the average expenditure in the 26 metropolitan areas of Brazil (see Figure 2). Notice that this value is presented as for full-time workers -for part-time workers it is a proportion θ of this value-. As stated above, we assume a best-case scenario where all formal sector workers who benefit from the subsidy take-up the benefit.

Figure 2: Average transit commuting expenditure for a full-time worker by metropolitan area

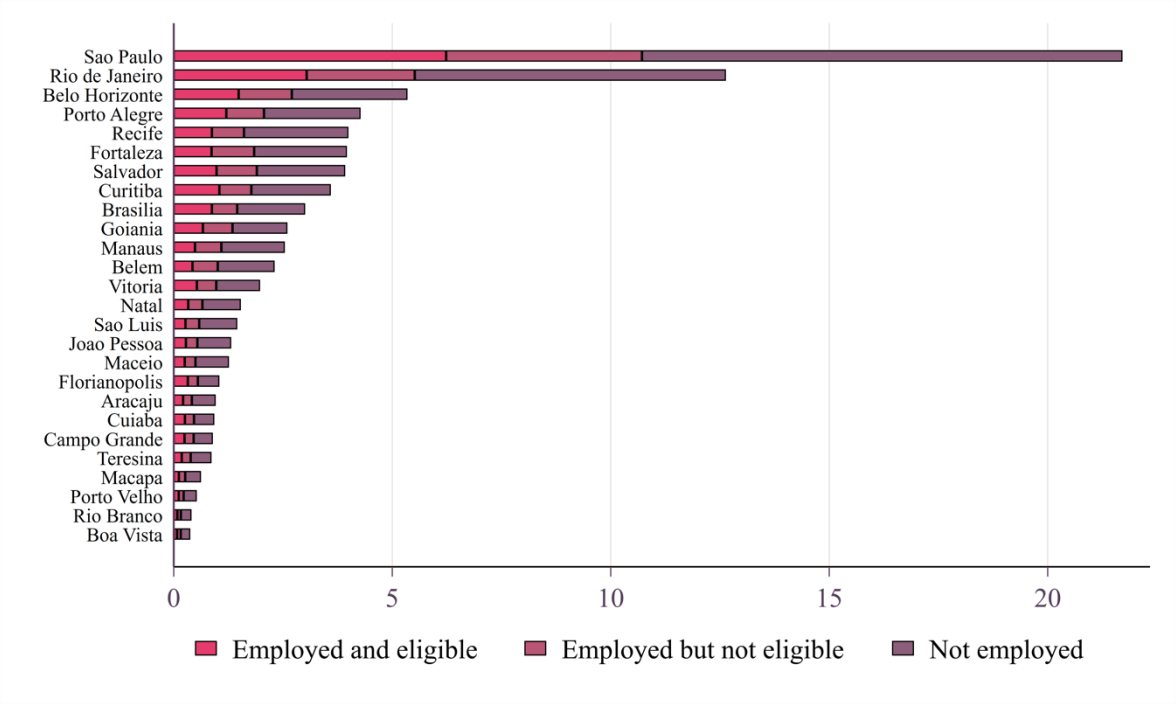


Source: Own elaboration using data from Expatistan and WDI.

The criteria for an employee to be *eligible* to receive the subsidy was defined as all workers that are employees[35] in a formal job and work at least 15 hours a week. Based on this in criteria, Figure 3 presents the distribution of the population in each of the 26 metropolitan areas. Note that not all individuals that are in the category *Employed and eligible* necessarily take-up the transport subsidy, since it will only be rationale if the gross wage is below 16.67 times the value of the subsidy (see equation (3)). According to our estimates, 26% of the Brazilian population in these metropolitan areas are eligible to receive the subsidy, e.g., 21.4 million people. This represents 55% of employed individuals. Florianópolis is the metropolitan area with the largest share of eligible population with 31% of the total population, while Brasilia accounts for the largest share among the employed (60%).

[35] Specifically, this refers to an employee of a company. Meaning that owners and the self-employed are not eligible.

Figure 3: Distribution of population in the 26 metropolitan areas of Brazil

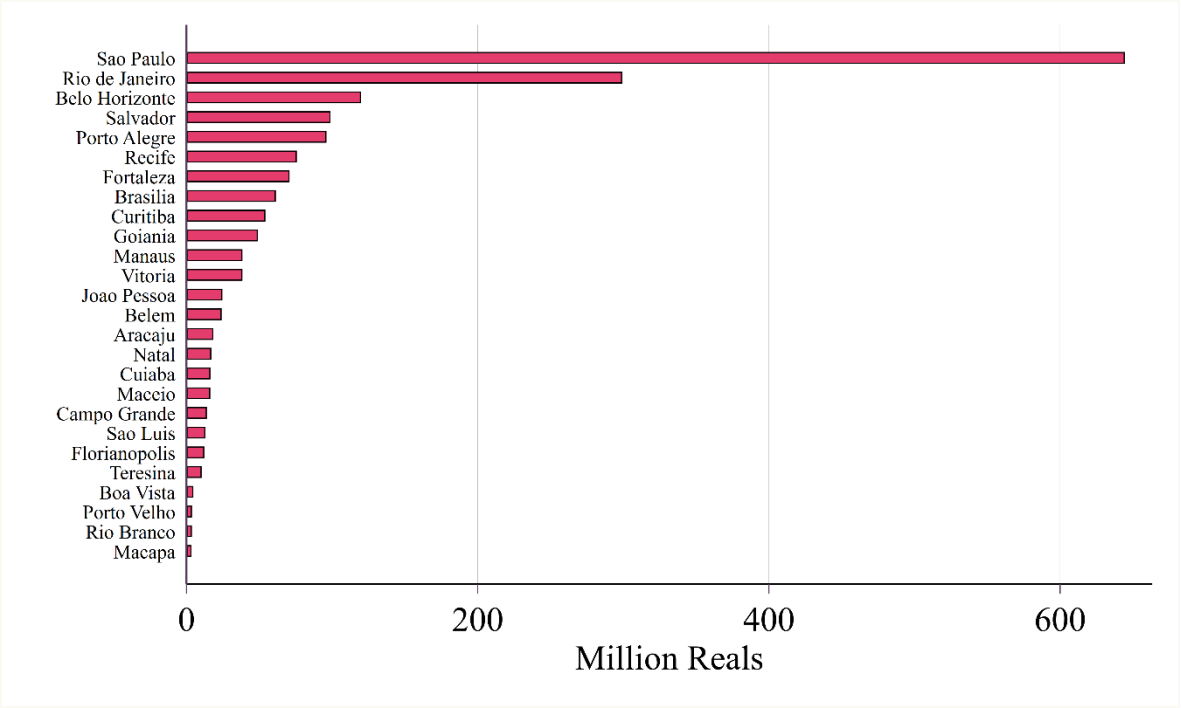


Source: Own elaboration using data from PNAD

We estimate that out of the 21.4 million individuals eligible for the program, those with sufficiently low income to obtain a positive benefit amount to 16 million workers in the 26 metropolitan areas. The subsidy amount was imputed for each of these observations using equation (4) above. In the aggregate, the subsidy -net of the part paid by workers- in these cities amounted to 1.8 billion Reals (US$410 million) a month, which annually represents 0.3% of national GDP.[36] Sao Paulo and Rio de Janeiro account for 943 million reals in subsidies, which is more than half the total amount for the 26 metropolitan areas (Figure 4).

[36] The subsidy value in dollars was calculated using the average exchange rate of the first quarter of 2020 (IMF, IFS Statistics, 2022).

Figure 4: Aggregate subsidy (million Reals)



Source: Own elaboration using data from PNAD. The average exchange rate in the first quarter of 2020 was 4.46 Reals equals per US$.

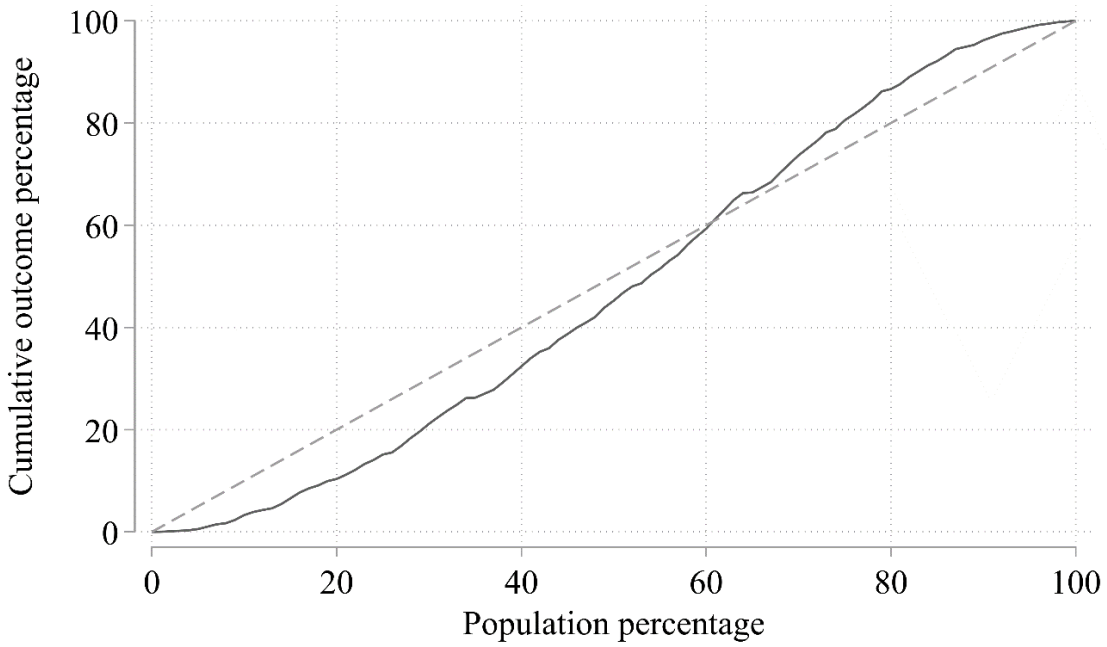
4.5 Distributive incidence results

Figure 5 presents the Lorenz curve of the subsidy aggregating over the 26 metropolitan areas. It presents the cumulative percentage of the total subsidy amount given to households across different percentiles of the income distribution.[37] The bottom 30 percent of workers receive a less than proportional part of the subsidy, but the slope of the function increases significantly afterwards, overtaking the 45 degrees dashed line at the 60th percentile.

Similarly, Figure 6 presents the Lorenz curve for each metropolitan area. The 26 metro areas have been grouped by size into 5 groups. Among all cities, Florianopolis shows the most notable results in terms of progressivity, where the Lorenz curve quickly overtakes the 45 degrees line, suggesting a better focused subsidy. On the other hand, Manaus and Arcaju present the most discouraging results as the subsidy benefits mostly those with higher purchasing power. This difference is related to the proportion of formal work among the employed population and the distribution of labor earnings in the different cities.

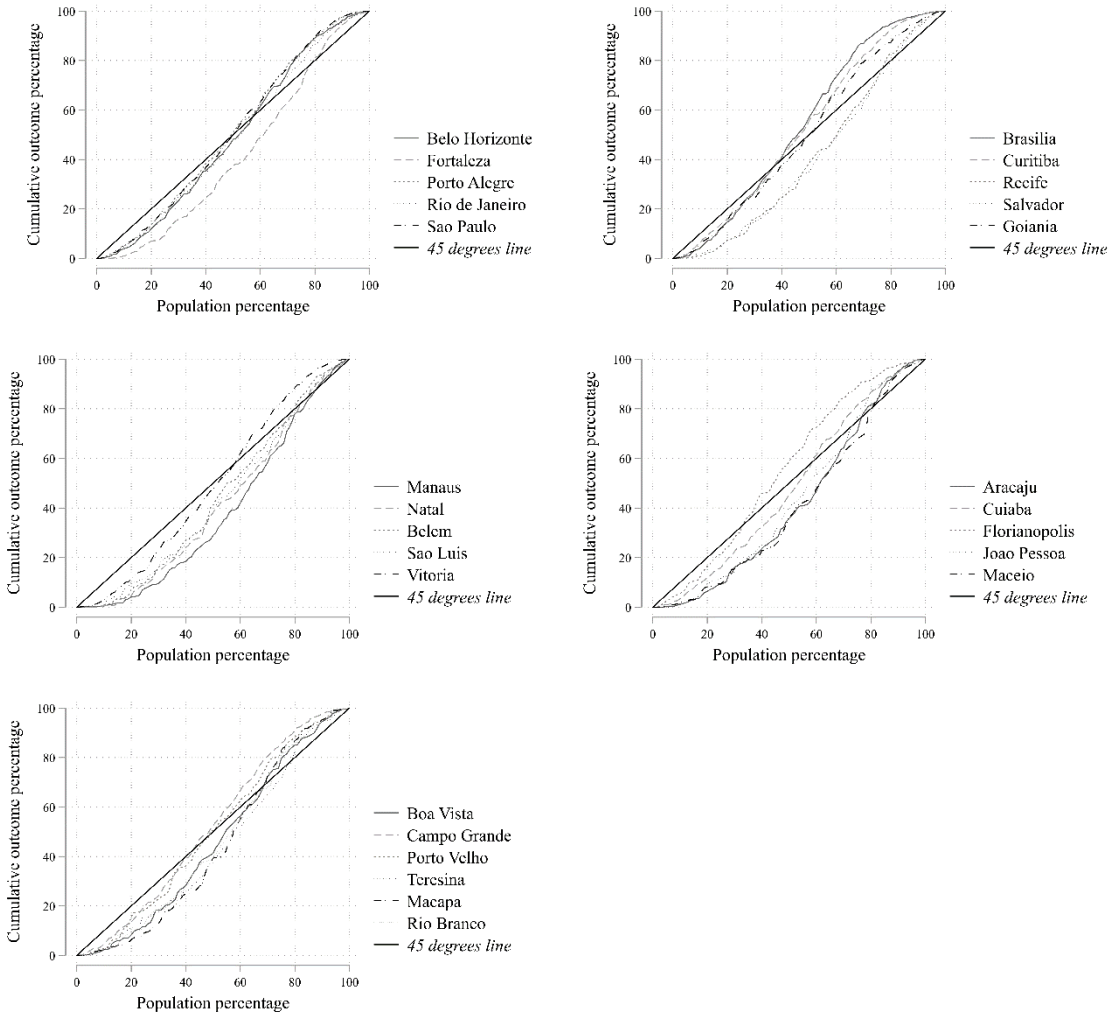
[37] The percentiles of the income distribution were constructed using household per capita incomes.

Figure 5: Lorenz curve for net subsidy distribution at the national level



Source: Own elaboration using data from PNAD

Figure 6: Lorenz curve for net subsidy distribution by metropolitan area



Source: Own elaboration using data from PNAD

Another way to express the previous information is using the **Ω** indicator of the targeting property of a subsidy proposed by Coady et al. (2004) and Komives et al. (2005):

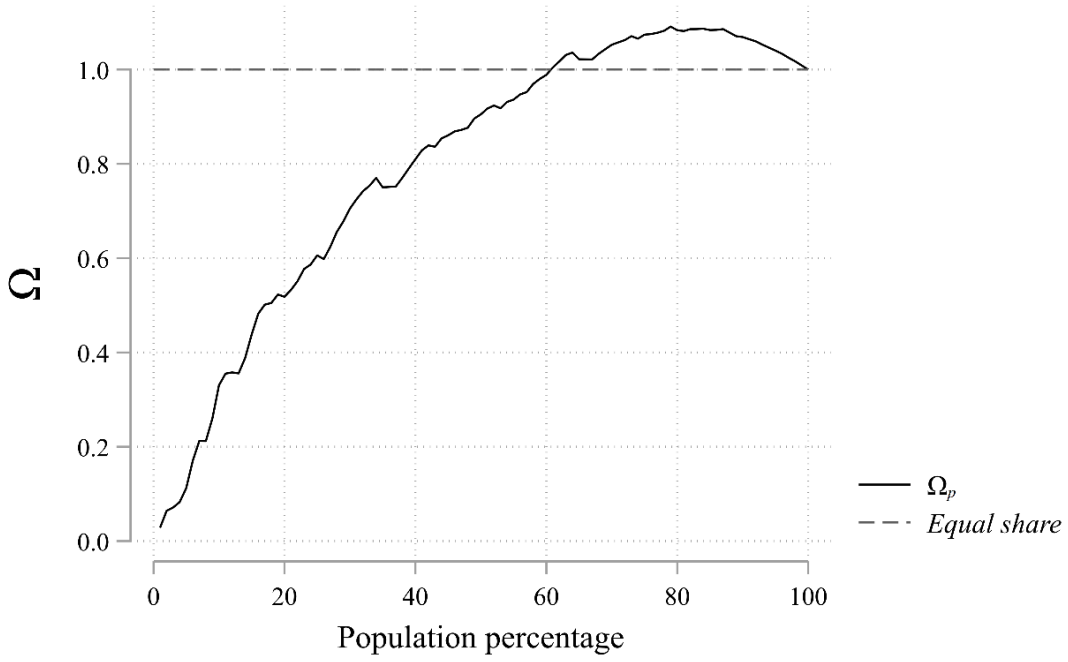
$$\Omega_p = \frac{\frac{S_p}{S_h}}{\frac{P}{H}}$$

Where subscripts p and h stand for percentile of targeted households and the grand total of households; P and H, the number of individuals in each of these two groups; and S_p represents the accumulated subsidy received by the targeted population (percentile p) while S_h represents the total amount of the subsidy. This means that Ω_p is the share of the subsidy received by the target population as a share of this group in the total population.[38] If for a given p this indicator is less than one, then it implies that the share of the subsidy accruing to the target population is less than proportional to the share of this group in the population, an indication of regressivity in the targeting of the benefit. If it is greater than 1 then it is progressive (and more so the higher above 1 is this indicator) in the sense that the target population receives a share of benefits above its share in the population.

The Ω index can be read directly from the Lorenz curves of Figure 5 and 6. It will be equal to the tangent of the slope of the ray from the origin to the point on the Lorenz curve for the p percentile. It will be less than one if the Lorenz curve is below the 45° line and greater than 1 if the opposite is true.

Figure 7 graphs the Ω indicator for all possible values of p for the combined 26 metropolitan areas. For example, if we define the target population as the first two quintiles of the income distribution (40% of poorest households) then this indicator is less than 1 implying that the subsidy is regressive. Only if the target population is defined as 60% of individuals with lowest incomes does the targeting property become somewhat progressive.

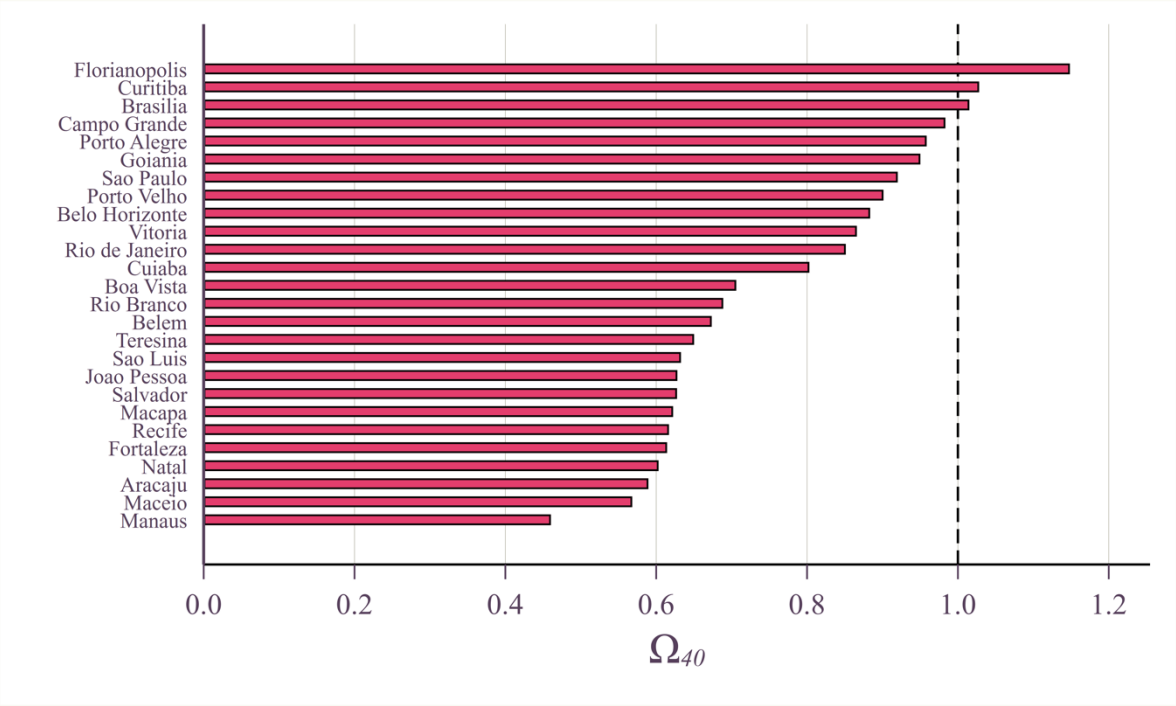
Figure 7: Omega national level



Source: Own elaboration using data from PNAD

Figure 8, on the other hand, presents the Ω indicator for each metropolitan area assuming a target population of individuals belonging to households in the lowest 40% of the income distribution. Only three cities present a value over 1.0 -Florianopolis, Curitiba, and Brasilia-, meaning that most of the cities give a lower share of the subsidy to the bottom 4 deciles of the income distribution compared to higher income groups. Manaus is the metropolitan area with the lowest coefficient presenting a value of 0.46.

Figure 8: Omega coefficient by metropolitan area ($p = 40\%$)

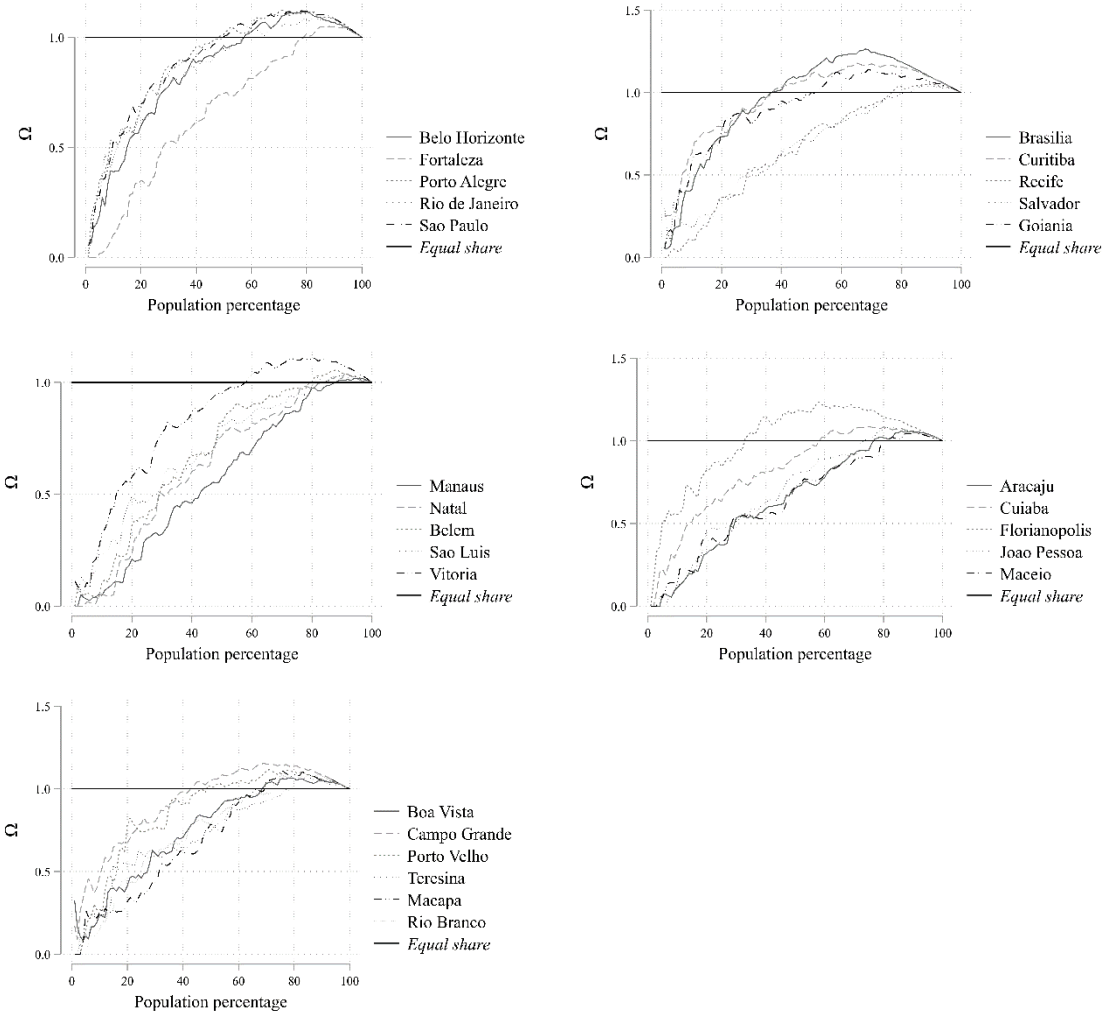


Source: Own elaboration using data from PNAD

To further describe how the subsidy is distributed among the population, Figure 9 presents the Ω index for every metropolitan area -the cities have been grouped by size as in Figure 6- for the whole range of possible target groups in the population.

Figure 10 in turn presents yet another way to summarize the information of Figure 5 and 6, the Gini coefficient of the distribution of subsidy benefits.[39] This coefficient has a range between (-1, 1) with a value of -1 indicating that the bottom percentile received 100% of the subsidy. The lower the coefficient, the more progressive is the distribution of the subsidy as poorer households receive a higher amount of the benefit. Florianopolis is the city with the best figures relative to the progressivity of the subsidy.

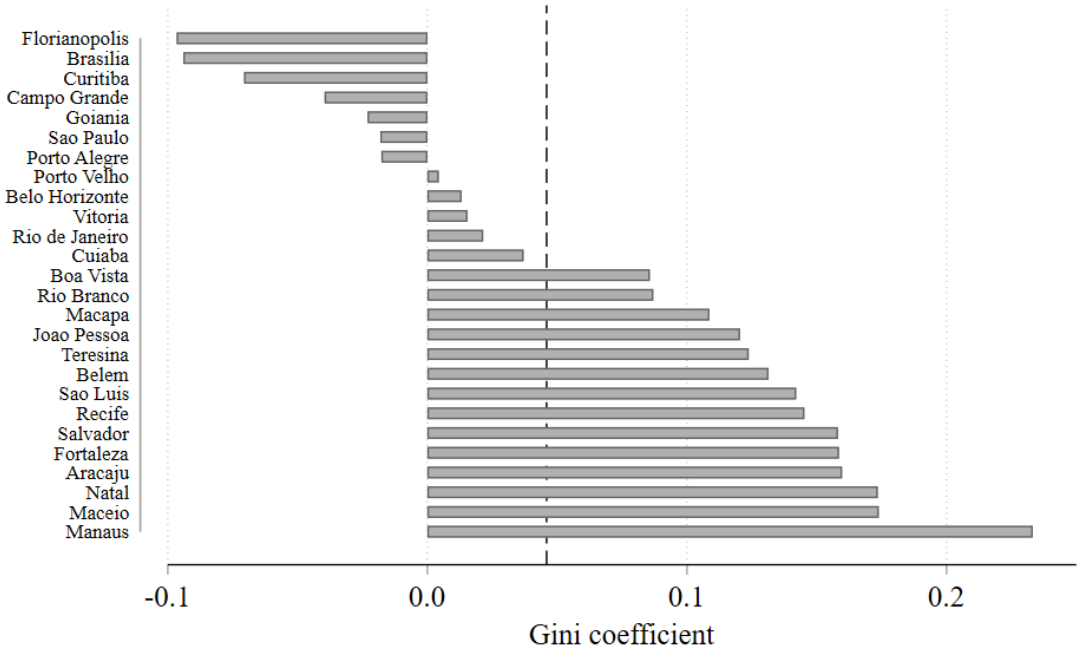
Figure 9: Omega by metropolitan area



Source: Own elaboration using data from PNAD

[39] The figure only shows a limited scale in the horizontal axis (from -0.1 to 0.25) to clearly see the value of the Gini coefficient for each city.

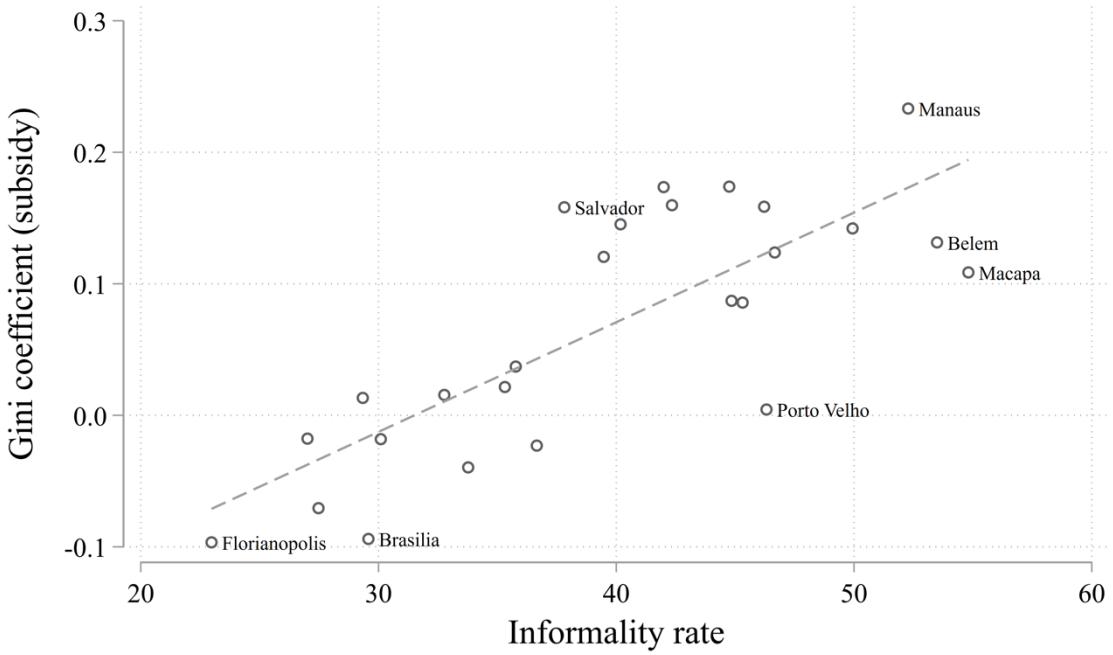
Figure 10: Gini coefficient of the subsidy



Source: Own elaboration using data from PNAD. Dotted line is the average across all metropolitan areas.

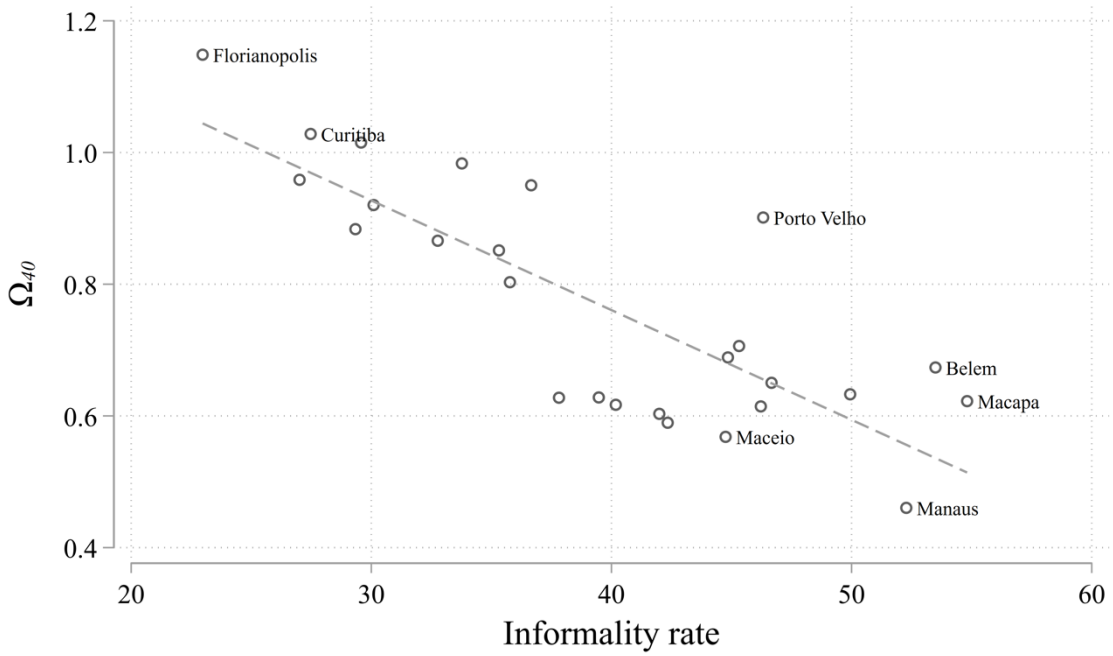
Figure 5 and 6, the Ω index and the Gini coefficients all imply that the *Vale Transporte* scheme is not well targeted in general. It tends to benefit more middle to high-middle income households. This is in the scenario we have simulated where all workers who stand to gain from the scheme take-up the benefit. The main reason for our result is that there is a high proportion of informal workers among lower income households. Figure 11 presents this relation between informality and the Gini coefficient of each city, whit the dotted line showing the linear regression between these two variables. Notably, the $R^2 = 0.62$ for this linear regression, and the slope is positive and strongly significant to a 1% confidence level, suggesting that informality tends to explain particularly well the lack of progressiveness of the subsidy. In turn, Figure 12 presents the relationship between informality and the Ω_{40} indicator with a slightly higher correlation ($R^2 = 0.66$) than in the case of the Gini coefficient.

Figure 11: Gini coefficient of the subsidy incidence and informality rate



Source: Own elaboration using data from PNAD and Expatistan.

Figure 12: Ω_{40} indicator of the subsidy incidence and informality rate



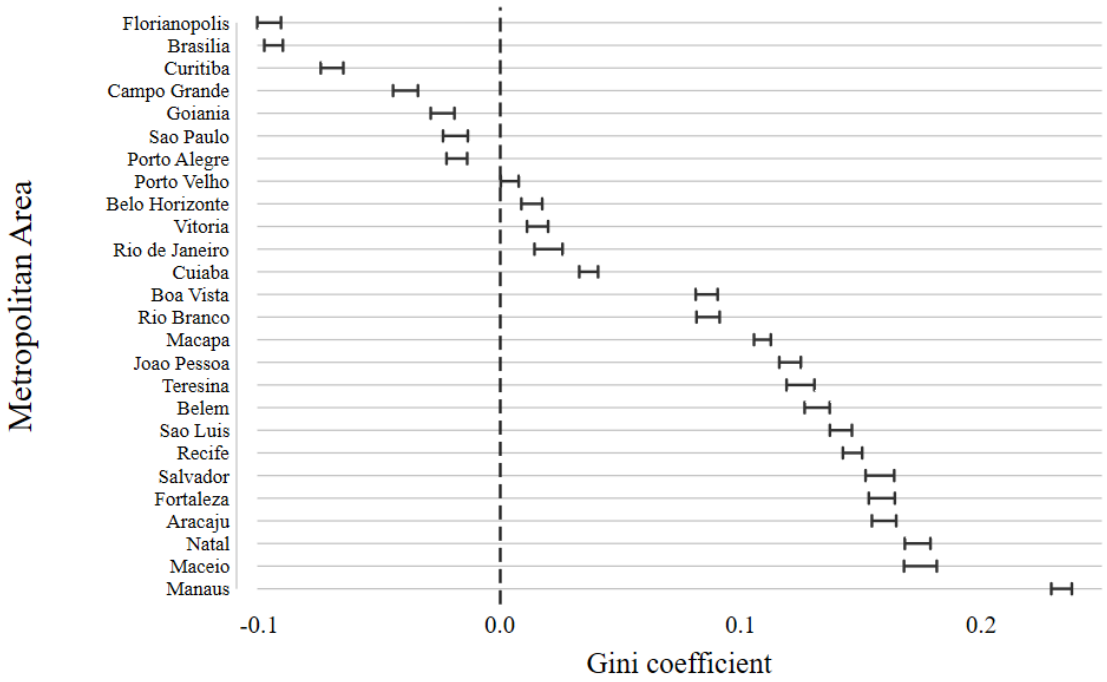
Source: Own elaboration using data from PNAD and Expatistan.

4.6 Sensitivity analysis

In this section we present a sensitivity check of the results of a reduction/increase in the average transit commuting cost in each city shown in Figure 2. Figure 13 presents the range for the Gini coefficient of a reduction/increase of the average transit commuting cost by 10%. The lower point in each interval corresponds to a 10% increase in the average expenditure shown in Figure 2, while the higher point of each interval represents the results of 10% reduction in this expenditure.

Figure 13 reveals that our qualitative results shown earlier do not change with variations in the average transit expenditure. However, it must be borne in mind that we use the average transit expenditure in each city. If this expenditure is correlated with distance and poorer households live predominantly in the outskirts and must travel longer distances, then our results may underestimate the progressivity of the scheme. However, as discussed above, most cities have flat transit fares with respect to distance and thus average expenditure may be uncorrelated with travel distance and our results are still valid. This is an empirical matter that should be addressed by future research.

Figure 13: Gini coefficient of the subsidy (considering an increase/reduction of the average transit expenditure in each city by 10%)



Source: Own elaboration using data from PNAD.

4.7 Labor market impacts

The above results assumes that employers pay the net subsidy without considering any equilibrium market effects. This is unrealistic considering that the net subsidy that firms must pay represents 0.3% of national GDP.

The scheme may generate various market equilibrium changes. First, firms may increase the sales price charged for their goods and services as the *Vale Transporte* scheme amounts to an increase in labor costs. Second, firms in the formal sector may lower their demand for low skilled labor. In turn this may decrease formal sector wages for lower wage earners. If formal sector wages cannot decrease (due, for example, to a minimum wage binding constraint) then this may generate higher unemployment among lower income workers or incentivize their migration to the informal sector.

With the data at hand, we can explore whether there is evidence for an equilibrium effect on wages. For this purpose, we estimate nearest neighbor regressions based on a Propensity Score Matching (PSM) on the log hourly wages between formal and informal sector workers. Furthermore, we undertake this regression analysis using several subsamples of the data to see if there are different results according to labor earnings. The subsamples are presented in Table 4 and are based on the relative labor earnings with respect to the wage cutoff that determines a positive subsidy amount.

Table 4: Threshold of the sampling used in models

Sample selection	Threshold
Baseline	Whole sample
Sample 1	100 – 110% wage cut-off point
Sample 2	90 – 100 % wage cut-off point
Sample 3	70 – 90 % wage cut-off point
Sample 4	50 – 70 % wage cut-off point
Sample 5	Below minimum wage

Source: Own elaboration.

Table 5 presents the regression results. The covariates to determine the matching score in every model were: experience; experience squared; years of education; gender; economic sector; and city of residence. The dependent variable used in the model is the wage per hour -the first row of the ATET coefficient indicates that the wage used included the subsidy, whereas the second row excluded the subsidy-. Being *eligible* for the transport subsidy has a positive and significant effect on hourly wages in all samples.

The results are suggestive. If we consider workers that are above but close to the wage threshold, we see that wages before the subsidy are higher in the formal sector than in the informal sector. However, our results show that the formal wage premium is U shaped according to the expected wage rate. This is consistent with prior expectations if the *Vale Transporte* scheme does have a compensating effect on equilibrium formal sector wages. The lower the wage rate the stronger the compensating effect on equilibrium wages since the subsidy is higher for low-income workers, thus lowering the formality wage premium. However, for very low wage earners the minimum wage restriction kicks-in and the formal sector wage premium is higher once again.

Table 5: Nearest neighbor regression results (log hourly wages)

	Baseline	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5
ATET (*eligible*)						
Wage after subsidy	0.14***	0.06***	0.09***	0.06***	0.05***	0.17***
Wage before subsidy	0.07***	0.06***	0.08***	0.04***	0.00***	0.01***
Observations	30,152,106	859,073	919,215	2,890,646	4,912,246	9,095,816
Min neighbors	9	14	11	15	11	9
Max neighbors	86,298	3,861	4,749	7,637	11,908	19,978
Min requested	3	3	3	3	3	3

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

Source: Own elaboration.

Our PSM estimator of wage differences between *eligible* and *not eligible workers* depends on the assumption that eligibility, conditional on the observables that determine the propensity score, is random. This may not be realistic since there may be unobservable characteristics that determine whether a given worker finds formal employment or not. However, our results show that the formal wage premium decreases with a lower expected wage rate. This is consistent with prior expectations if the *Vale Transporte* scheme does have a compensating effect on equilibrium formal sector wages. The lower the wage rate the stronger the compensating effect on equilibrium wages since the subsidy is higher for low-income workers, thus lowering the formality wage premium. However, for very low wage earners the minimum wage restriction kicks-in and the formal sector wage premium is higher once again.

Therefore, we can tentatively say that there is evidence that the *Vale Transporte* scheme does generate some compensating effects on equilibrium wages in the formal sector. If this is so, then any distributive effects of the scheme will be more neutral than what was estimated above.

5. Conclusions

In this paper we have reviewed several experiences with means-tested transport subsidies in Latin America. In two of those cases (Bogota and Buenos Aires) there is an explicit targeting mechanism based on several indicators from the general welfare system. Another feature is that benefits are funded through the general budget of each of these cities. They are both examples of subsidies that aim to reach the neediest individuals given a limited fiscal budget. Available evidence, at least for the case of Bogota, suggests these programs have been successful in helping poorer individuals increase their use of public transport.

The case of Buenos Aires also indicates that if the criteria used to determine eligibility are not progressive or are too generous (such as giving the benefits to all retirees irrespective of wealth or

income) then the subsidy will be poorly distributed. The targeting properties of a means-tested subsidy are only as good as the targeting instrument used to determine eligibility.

An interesting feature of the subsidy in Bogota and Buenos Aires is the use of smartcard technology to distribute resources to eligible individuals. Personalized travelcards can be credited with the monetary subsidy, thus reducing the chance of fraud or the use of these resources to purchase other goods and services.

We also analyze the *Vale Transporte* scheme in Brazil. Unlike the case of Buenos Aires and Bogota, this is a national subsidy program, formally paid by employers. Also, it is not an explicitly targeted benefit. However, due to the administrative rules of the scheme, only lower wage earners benefit from this program and thus it is indirectly targeted. In other words, the design of the scheme makes this a targeted subsidy whereby only the lowest income workers self-select into the program. One important drawback of the Brazilian scheme is that this subsidy only benefits formal sector workers. In a country with an important informal labor market, this last feature may imply that the distributive incidence of benefits is regressive.

To test this last proposition, we use PNAD household surveys for 26 metropolitan areas of Brazil, impute the subsidy benefit to eligible individuals and estimate the distributive incidence of the benefit. To the best of our knowledge, this is the first attempt to estimate the distributive incidence of this transit subsidy.

We find that the *Vale Transporte* scheme has negative distributive impacts on average. In some cities, particularly the larger ones, the subsidy has a slightly progressive impact measured by the Gini coefficient. However, if we define the target population as individuals belonging to 40% of lowest income households in each city, this group receives a lower share of the subsidy benefit compared to higher income households. The exceptions are three cities: Florianópolis, Curitiba and Brasilia. These are also three out of the five cities with the lowest share of informal employment to total employment, pointing to the main cause of the poor targeting properties of this subsidy, namely the exclusion of informal sector workers from the scheme.

We also present evidence that there may be a compensating equilibrium wage adjustment in the formal labor market because of the subsidy. That is, firms may pay a lower gross wage (and workers may be willing to accept a lower wage) given that eligible workers will increase net earnings due to the subsidy. This effect should not affect higher wage earners who do not benefit from the scheme but should be stronger for lower wage earners who do benefit from the scheme. Once the minimum wage restriction is active then the pressure to lower wages has no effect on observed formal sector wages (however, this may generate greater unemployment or more informality in this group of workers, something we do not test). We find evidence that the formal wage premium is U shaped with respect to labor income, which is consistent with the argument just presented. Our evidence is tentative, and more research is warranted on the potential labor equilibrium market effects of the *Vale Transporte* scheme.

Finally, a word on the social benefits of transit subsidies. Direct monetary transfers may not be a good substitute for transit subsidies if the aim of the policy is to increase transport use by low-income individuals. This may be the case if policymakers are interested lowering access hurdles to educational, health and labor market opportunities. Franklin (2017), for example, shows that lower transit fares for the low-income individuals increases job search and employment outcomes (higher employment and in better quality jobs). The subsidy schemes in Buenos Aires and Bogota would

contribute to this effect, but not the *Vale Transporte* scheme in Brazil. In this last case, the subsidy materializes after an individual has found a formal job, so it should not affect job search activity.

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