

WELFARE ANALYSIS OF REGULATING THE INFORMAL TRANSPORT SECTOR IN RIO DE JANEIRO

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RESUMO

Diferentes políticas têm sido propostas para gerenciar a recente expansão do transporte informal no Brasil. Este trabalho visa avaliar o impacto de um conjunto específico de políticas, em relação aos usuários do sistema informal. Um corredor de transportes no Rio de Janeiro operando serviços informais foi utilizado como estudo de caso e um conjunto de onze possíveis políticas com abordagens diferenciadas foram testadas. Os benefícios gerados aos usuários desses sistemas e a distribuição dos mesmos entre grupos de diferentes faixas de renda foram determinados. Observou-se que a legalização do setor informal produz poucos benefícios a esses usuários e que novos investimentos nesse sistema provavelmente não seriam eficientes. Maiores benefícios poderiam ser gerados como resultado da adoção de políticas voltadas à introdução de melhorias nos sistemas de transporte público de maior capacidade como trem e ônibus (entre 100 a 200 dólares por ano por usuário). Políticas que induzam maior competitividade no setor de transportes (ônibus, trens e vans), poderiam também gerar benefícios aos usuários, porém, na ordem de 100 dólares por usuário por ano.

ABSTRACT

A variety of policies are being proposed to manage the recent uncontrolled growth of the informal transport sector in Brazil. This study seeks to understand how proposed policies impact users of these informal systems. A corridor in Rio de Janeiro experiencing informal activity was used as a case study and eleven candidate policies, covering a range of approaches, were evaluated. Benefits to all users and the distribution of those benefits across income groups were calculated. Legalizing the informal sector was found to benefit users only slightly and further investments in the sector are probably inefficient. Users benefited most from improvements in formal mass transit modes, on the order of 100 to 200 dollars per commuter per year. Policies which foster a competitive environment for the delivery of all services (buses, trains and vans) also benefit users, on the order of 100 dollars per commuter per year.

1. INTRODUCTION

During the past decade, in dozens of cities across Brazil, rising unemployment, worsening public transit services, and rising public transit fares have combined to set off an explosion of informal public transit activity using small vans and minibuses. Today, tens of thousands of Brazilians have turned to providing public transit services as a means of livelihood. The poor, already subjected to agonizingly long commutes in crowded buses and trains, have largely embraced the new options. The highly ordered, concentrated and regulated public transit sector in Brazil, for decades the focus of national industrial development policy, could not contrast more with the small artisan-style operators entering the long-time monopolized and guarded public transit markets.

Policies are being proposed to come to grips with what has been uncontrolled growth of this sector. Thus far, discussions and proposals have focused on the supply side effects of these policies – effects on traffic congestion and traffic operations, the financial state of the formal transit service suppliers, as well as ideological discussions concerning the proper role of informality in the urban economy. Not much attention has been given, however, to the effects of proposed policies on the consumers of transit services. Consumers of informal transit services are often in precarious economic situations, traveling long distances from outlying residences to low wage jobs, or are transit dependent with poor access to jobs and services. This study seeks to understand and quantify the benefits accruing to users from the various policies proposed to address the problem. The key questions to be investigated are: Will the

process of regulation drastically affect the welfare of users of these transport modes? And, how do each in a range of policy options affect the welfare of users, and which, are the most beneficial?

2. BACKGROUND

2.1 Rise of Informal Transportation in Brazil

Until the 1930s, most cities in Brazil relied heavily on privately run streetcars, with buses running on peripheral routes (Dourado, 1994). By the 1950s, bus services expanded greatly and were provided by small operators. A fall in demand combined with the oil-price shocks in the 1970s led to a period of crisis for the bus industry. In response to this crisis national policy began promoting an increase in the size and strength of the bus companies. Mergers of smaller transit companies were encouraged. The combination of these various forces resulted in heavy concentration in the bus industry. This power further increased the firms' ability to rival public agencies for control of the regulatory process (Santos, 1999).

The current "wave" of informal paratransit activity in Brazil began around 1994. It is having profound effects on the ridership levels of the formal transport systems in many cities. By the beginning of 2000, about 70% of cities with populations exceeding 300,000 were experiencing some informal transportation activities. Some particular corridors might be even more heavily impacted, and numerous were witness to the complete failure and bankruptcy of the formal operators. These new systems include vans, "moto-táxis" and "kombis". "Vans," the focus of this work, typically seat 8 to 12 seated passengers and are used for both neighborhood circulation and suburb to center "line haul" services. These routes either compete directly with formal bus or rail routes, might serve areas previously underserved by transit, or behave as feeder services to other formal modes.

2.2 Proposed Policy Responses

Several older informal systems in Brazil have undergone and survived regulation decades ago. Similar policy responses to the current wave of informal activity are being discussed. This section will review some of these recommendations.

The NTU / ANTP (1997) presented responses to the illegal van activities that vary between acceptance, recognition, prohibition, and regulating the incorporation of the van services into the formal transport system. Prohibition would involve ticketing and the issuing of fines or even the confiscation of vehicles. Regulation would involve issuing service concessions to the private operators. These could also include relegating vans to act as feeder services to the bus and train system to avoid direct competition. Additional ideas included relaxing some of the "cost inducing" regulations (e.g. safety or labor rules) on the formal system in order to increase its competitiveness in the changing market. Supporting the bus mode with dedicated rights of way and better modal integration and terminals were also proposed to make the buses more competitive in the market. ANTP (2001) makes a firm stand against any deregulation and legalization of vans, and believes principally that bus firms can and should respond to van competition through offering better services and more service levels. Their concessions should be changed to allow bus firms to offer varying services, vehicle sizes, and more flexibility.

To the bus sector, vans are a threat to their substantial power and wealth and their orderly collection of monopoly rents from citizens and governments and they are opposed to legalization of van service of any type which might compete directly with the bus or rail services. Most academics, while citing safety, emissions and congestion problems from using

smaller vehicles for line haul services, support the legalization of the system (Balassiano, 1998; Torres, A., 1998; Cervero, 2000).

The CNT/CNTT (1999) stated that regulating the informal operators must come within a larger reorganization of all of the modes. The modes must be complementary and not directly competitive, respect traditional standards both for users and workers, and must receive appropriate attention, support and resources from the transportation agencies. Bus fares are a significant point of contention to the CNT. They cite the need for greater transparency in the fare calculations and cost reporting, for better stimulation of efficiency via the terms of the concessions – something we will look at in this analysis.

3. METHODOLOGY

The central analytical part of this work is to estimate the economic effects on users' of regulating the informal operators. This calculation involves two main steps: 1. Statistically model the users' discrete choice process, revealing the utility function of the users and 2. Using the utility function, calculate the change in welfare (benefit) over the status quo for each proposed policy.

In the microeconomic measure of the consumers' choice, well-being derived from their income and the qualities and prices of goods available to them in the marketplace. Policies which change the characteristics of the transportation choices result in welfare changes, or "benefits," for the users. Consumers of transportation derive satisfaction, or "utility" from each of the transportation choices available to them. The specification and estimation of a discrete choice model for application to the modal choice problem is a standard procedure for determining the relationship between attributes of modes and mode choices. In order to calibrate the choice model, extensive survey data was needed in the Rio de Janeiro corridor. The specifics of the case study survey are described in section 4.

The "compensating variation" (*CV*) is an estimate of welfare change resulting from a change in the choices available to a consumer and is the most appropriate measure to use in this study. The *CV* measures the change in the monetary wealth of an individual when there is a change in their economic state, such as induced by a policy, but when their utility is held constant to its original level. It asks: how much a consumer would have to pay after a policy change to remain at the same utility level, or how much money they would have to receive after a policy change to remain at the same level (Haneman, 1985). The *CV* was derived for a discrete choice demand situation where it computes the change in the "expected utility," in units of "utils" of a consumer before and after the implementation of a policy (Small et al., 1981). Dividing by the marginal utility of money, λ , converts "utils" into units of money.

The changes in benefits are to be calculated at a point 6 months after the implementation of a policy. 6 months was used because it was presumed that it was just long enough for travel behavior to change, but not long enough for residential or job locations to change. An additional important assumption being made here is that total demand is fixed.

4. RIO DE JANEIRO CASE STUDY

Many of the most important and interesting aspects of informal transportation are exemplified in the city of Rio de Janeiro, and a case study in Rio de Janeiro will be used for this policy analysis. In this section, some general descriptions of informal operations in Rio are presented, with the specifics of the case study corridor in the next section.

In Rio de Janeiro, bus industry concentration is especially pronounced and results in harmful

monopolistic behavior (Santos et al., 1999). The bus fleet in the metropolitan area contains around 11,000 vehicles, carrying around 8 million bus trips per day. While service is satisfactory, according to several studies of the industry bus fares are higher by about 80% than they should be according to the rules of the concessions and the actual costs experienced by the bus firms (Ferraz et al., 1992; Orrico Filho, 1999). Detailed estimates indicate that fares are inflated through liberally calculated cost items like depreciation and vehicles' residual values, general overcapitalization, and the blatant misrepresentation of ridership, vehicle mileage and maintenance costs (Ferraz et al., 1992; Orrico Filho, 1999). The power of the bus firms' organization allows these practices to continue unchecked and any attempts to question this process would be met with strong opposition. These inflated fares will become important in later discussions.

The suburban rail system in Rio de Janeiro is fairly extensive, with about 250 km of tracks on 4 lines radiating out into the northern suburbs, called the Baixada Fluminense, and western Rio de Janeiro from downtown (see Figure 1). For years in disrepair and mismanaged, it suffered from a huge loss in ridership, down to only 350,000 boardings per day from around 1.2 million in the mid-eighties (Neto, 1998). The subway consists of 35 km of tracks on two lines and offers excellent and fast service.

The unregulated, illegal "vans" generally serve the poorer northern suburbs of the Rio de Janeiro metropolitan area, called the Baixada Fluminense, though there are some van routes serving the outlying rich neighborhoods in the south zone. Total van ridership in the metropolitan region is about 150,000 trips per day, compared with 8 million trips by bus, and 350,000 each for suburban rail and metro. There are roughly 30 different long distance van routes in the metropolitan region (Almeida Júnior et al., 1999).

In order to study policy responses to the phenomena of informal transit growth, the corridor between the northern suburbs of the city of Rio de Janeiro, called the Baixada Fluminense, and the central business district was chosen. The Baixada Fluminense of Rio de Janeiro is, in effect, one expansive residential area containing roughly 2.7 million people in an area of 1300 square kilometers. The development is concentrated along the rail corridors. The Baixada suffers from high rates of unemployment and poverty. Car ownership rates are less than 5%, and there is a high dependency on public transport. Four suburban heavy rail lines serve parts of the Baixada, though about half of the population uses the bus. An estimate of the modal split for travel between the Baixada and the center city is 5% auto/taxi, 5% van, 55% bus and 35% suburban rail.

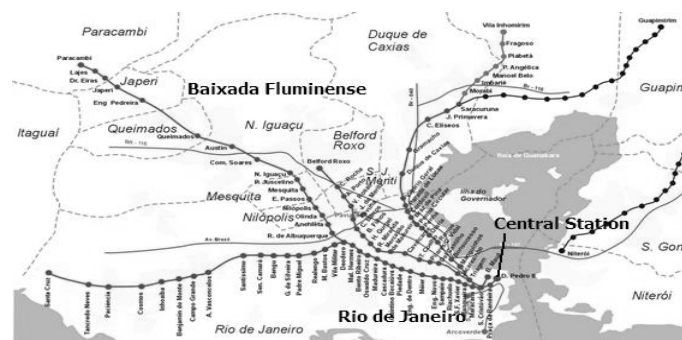


Figure 1. The suburban rail system linking Central Station and the Baixada Fluminense.
Source: Supervia (2003)

From the Baixada, the downtown-bound buses and trains connect to the downtown transit terminal, called "Central Station". Central Station is the largest transit terminal in the city,

serving about 1 million passenger trips (inbound plus outbound) per day. Buses make line-haul type trips starting with circulation in the various neighborhoods in the Baixada. Fares are based on distance, and are typically between 2 and 3 Reais (\$1.00 to \$1.50). Free entry is allowed for students, elderly, and the Vale-Transporte tickets are redeemed as well. Suburban trains offer good services throughout the Baixada from Central Station. Peak hour headways are about 10 minutes, but are 20 to 30 minutes in the off peak. Travel times to the outermost neighborhoods can be over 90 minutes. Fares are flat at 80 centavos (40 cents) and free entry is allowed for students, elderly, and the Vale-Transporte tickets are redeemed as well.

The informal services in the Baixada Fluminense consist of late model Korean and Japanese 9 or 10 passenger minivans or “vans” that generally duplicate the long bus routes connecting the Baixada to the Central Station. These routes include some pick up and drop off circulation within the neighborhood and then enter the main arterials on their way to downtown. The fares are distance based, and similar to those of buses, typically between 2 and 3 Reais (\$1.00 to \$1.50). However, no free entry is offered to elderly or student riders, and Vale-Transporte transit coupons are redeemed at about 80% of their face value. This effectively widens the difference between the van fares and the other modes.

To conduct the field research and surveys, trips were made to Rio de Janeiro in July of 2000, October of 2000, July of 2001, and February of 2003. Trips were made to gather background data and literature concerning the corridor and the informal and formal systems. Small-group interviews were held with van riders, drivers and van cooperative leaders. Operational characteristics of the vans were gathered through a review of the literature, field research and interviews with drivers and van leaders, transit operators, and academics familiar with the case corridor. A total of 640 short interviews were conducted with riders of vans, trains and buses passing randomly through the Central Station. The final choice model, because of missing data, is calibrated using 433 of the interviews.

5. THE POLICIES

A review of both academic and popular media and interviews with policy makers, academics and industry insiders helped to construct the following eleven policy “scenarios.” These scenarios address the corridor’s transportation system directly and do not seek to manage demand or other exogenous factors such as fuel prices or employment or residential location. The magnitude of policies’ effects on modal characteristics depends on the behavior of the transportation system, the response of transportation suppliers to policy and price changes, and the response of users to changes in the characteristics of the transportation system. The following sections describe each policy.

5.0 Status Quo (Do Nothing)

The status quo is the “base” against which all of the eleven policy scenarios are compared. It’s the “do-nothing” scenario and is presumed to be the state of the do-nothing case at the time policy effects are being analyzed, which is 6 months after “time zero”. It is assumed that demand for vans would remain steady during the 6-month period.

5.1 Weak (Some ticketing), “Restrict 1”

The vans are illegally providing transit services without a permit, and the means are already in place to enforce those rules. A weak restriction of the vans could be carried out with the placement of a small group of traffic police or military police in areas around the outlets or inlets to the Central Station terminals. Stopping and ticketing vans would result in a slight decline in Van use, because of the threat of delays. Common knowledge that vans are being targeted for ticketing would probably reduce demand for the vans.

5.2 Medium (Heavy ticketing, policing at bus stops), “Restrict 2”

Heavier enforcement of restrictions would send the van operations even more underground. This would probably result in a closing of the terminals closest to the Central Station. More circuitous routes combined with the greater likelihood of being stopped would increase travel times, and lower the attractiveness of the mode. Bus firms, in reaction to the increased police action, and in keeping with their rhetoric about the detrimental effects of the vans on their operations, would probably lower the rate of fare increase.

5.3 Strong (Removing all vans from circulation via police action), “Restrict 3”

Complete restriction of van operation would require extensive police action, over a period of several months. Bus firms would probably not apply for any rate increases within the time frame considered in this analysis, and the same fare reduction used in Scenario 2 was used.

5.4 Change specific terms of Bus Concessions to lower operating costs, “Change Bus Concession”

DETRO, the state transportation regulatory body is charged with issuing operating concessions to firms, defining fares, inspecting and licensing vehicles and drivers and managing all intermunicipal transportation, including the travel between the Central Station and the municipalities of the Baixada. These operating concessions are long term, on the order of 20 years. Changing their terms to lower bus operating costs would be very controversial, but it is often cited in the literature as an important option for discussion (NTU / ANTP, 1997; ANTP, 2000). Lowering labor restrictions, safety and fitness specifications for vehicles, among other things, would help lower production costs. We would assume these savings would result in a lowering of bus fares, and concomitantly, van fares.

5.5 Restrict Vale-Transporte transit coupon use to buses and trains, “Change VT”

The Vale-Transporte ticket is currently just a small piece of paper with graphics similar to any currency and a computer printed number and barcode stating its value. It is redeemable through a variety of means, and anyone can sell or trade the ticket for nearly its face value in cash at numerous street markets. The vans accept VT tickets at slightly less than their face value, and modeled in this analysis as 80% of the value of the VT ticket the employee received. Technologically changing the VT ticket to make it impossible to redeem illegally would be a way to decrease van use by forcing ticket receivers to use the formal modes, or forfeit the money.

5.6 Bus System Improvement, “Improve Bus”

This would be a major public works undertaking with the goal of increasing bus travel speeds, comfort, and adding new niches like express or executive class services. The project might include the construction of exclusive bus lanes and flyovers to access the downtown terminal, special feeder concessions, new route and service configurations, or a new management approach to the system. Upgrading the bus system could have a substantial effect on demand and welfare. Because of the “many-to-one” nature of the morning inbound commute to the central business district, major bottlenecks occur as traffic enters the city. The afternoon peak in the outbound direction is much less congested after traffic gets out onto the network of highways in the Baixada Fluminense. Exclusive bus lanes could greatly reduce travel time in the morning, but only marginally in the afternoon.

5.7 Train system improvement - “Improve Train”

Similar to Policy 6, and at heavy public expense, upgrading the train system could also have substantial effect on demand and welfare. A new control or power system, purchasing more

cars and engines, adding express limited stop trains, and purchasing faster vehicles could all lower travel times and increase the system's competitiveness with the bus, especially during the peak hour. An improvement in image, cleanliness and its reputation for safety and comfort might improve ridership beyond what the time savings might predict.

5.8 Legalize the Vans, "Legalize"

The next 3 policies affect the operating costs of the van firms. Van operator's revenues just cover short run marginal costs, with little discernable revenues for long term investments to sustain the business. The reasons for this can only be speculated, but are most likely the van operators' desire to match bus fares. Among the largest impacts regulation would have are the costs faced by van operators and owners. Legalizing and regulating van activity means that participating operators are subject to the same requirements for business taxes, licensing, social security fees, insurance, etc. that other formal transit operators are. For the work, these costs were estimated from data gathered by Araújo (2001) and sample data in the bus fare cost tables (Ministério dos Transportes, 1996) though there is not enough room to present these here. Recognizing the vans and lifting their illegal status could bring additional riders to the system who previously avoided the mode for reasons of legality. The estimated share of their total monthly fines due solely to their illegal status was about 2.5 cents per boarding. It is doubtful the operators would pass these small savings along to consumers.

5.9 Regulation (Following Decreto 25.955) - "Regulate"

A proposal in the state assembly to regulate the vans, called Decree 25.955, is the best model available for the regulatory scenario (Governo do Estado do Rio de Janeiro, 2000). This policy response would restrict van entry, enforce a set of rules concerning vehicle type, age, fitness, licensing for drivers and vehicles, insurance, acceptance of Vale-Transporte coupons and honoring free entry for the school aged and elderly.

5.10 Regulation and additional Support - "Regulate + Invest"

This policy extends Number 9 to include additional public investments to improve the van service. New terminals, better route integration and planning, and more attention to the vans as a part of the larger system could add even more capacity and ridership. This might include commitments from the Baixada municipalities to improve van terminals, signage and coordinated routes and timetables to improve integration into the larger system.

5.11 Competitive Case, "Prices = Long Run Marginal Costs"

In this scenario, a regime of competitive tendering for concessions, by route, is implemented. Barriers to entry are lowered, and information about potential costs, risks, etc are good enough to make the bus and van sectors very contestable. The essential effect here is that the resulting fares are at the estimated long-run marginal costs. These costs include operating costs plus vehicle depreciation and an allowance for other fixed costs, such as driver training, insurance, etc. According to the literature concerning the inflation of bus fares mentioned earlier, actual long-run marginal costs for the buses are equal to about 60% of current fares. For vans, the work of Araújo (2001) was used to estimate that long-run marginal costs for formal van operations would be about 18 cents higher per boarding.

6. RESULTS

Results are expressed in terms of net benefits for the entire commuter group, as well as by subgroup. Costs are then subtracted from benefits for the entire commuter group to get a net benefit. Benefits for subgroups of riders based on income is also presented to understand how benefits are distributed across the riders.

Table 1 summarizes the net benefits for the population of commuters during one year. This is presented in terms of benefits “per boarding,” (\$/boarding) and a total summed benefit over an entire year of commuting for the entire commuter population (M\$/year). Estimates of costs are also provided, which include the costs of constructing infrastructure in those cases, or administering a new policy or regulation. Safety costs are an important issue for several of the policy scenarios studied here. Very little was found regarding the accident or fatality rates of the van services and these issues will only be treated superficially where they apply. For details on all of these assumptions and estimations please consult Golub (2003).

Table 1: Net benefits and costs for the policy scenarios.

Policy	Benefit (\$/boarding)	Benefit (M\$/year)	Cost (M\$/year) ^a	Net Benefit (M\$/year)
1. Restrict 1	-0.02	-5	0.01	-5
2. Restrict 2	-0.11	-33	0.1	-33
3. Restrict 3	-0.16	-47	0.003	-47
4. Change Bus Concession	0.05	14	Safety!	14 – Safety!
5. Change VT	-0.01	-2	5	-7
6. Improve Bus	0.38	115	30 (total = 250M\$)	85
7. Improve Train	0.24	72	30 (total = 250M\$)	42
8. Legalize	0.01	3	Safety	2 – Safety
9. Regulate	0.02	6 + Safety	0.22	6 + Safety
10. Regulate + Invest	0.03	8 + Safety	12 (total = 100M\$)	-4 + Safety
11. Prices = LRMC	0.18	54 + Safety	0.22	54 + Safety

a. Costs for infrastructure projects are annualized over 20 years.

Net benefits don’t give any information about the differences in benefits between different portions of the commuting population. To understand the distribution of benefits across the population, the calculations were done separately for 6 income groups. In this discussion, the values of the utility changes from the policies will be compared in units of “utils.” The first three policies, Restrict 1, Restrict 2 and Restrict 3, and the fifth policy, “Change VT”, have negative net benefits. Figure 2a shows their benefit distributions in units of utils.

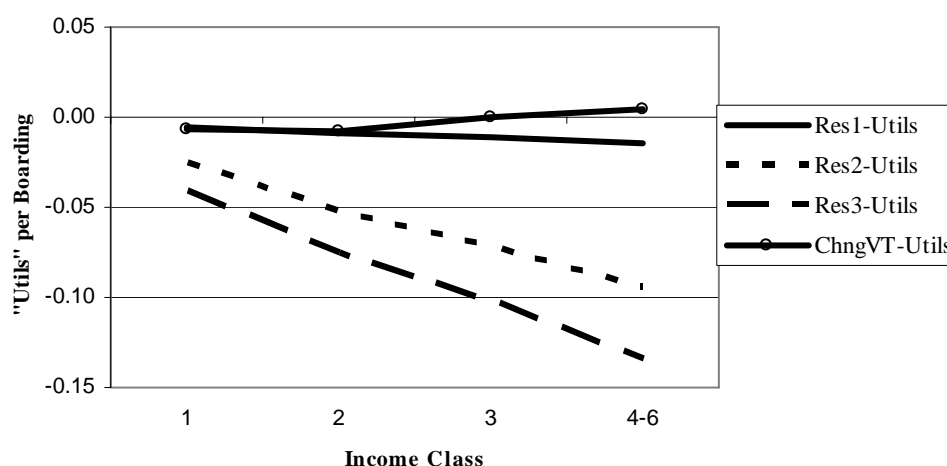


Figure 2a: Distribution of benefits for policies with negative net benefits.

The other seven scenarios result in positive net benefits and their benefit distributions are shown below in Figure 2b.

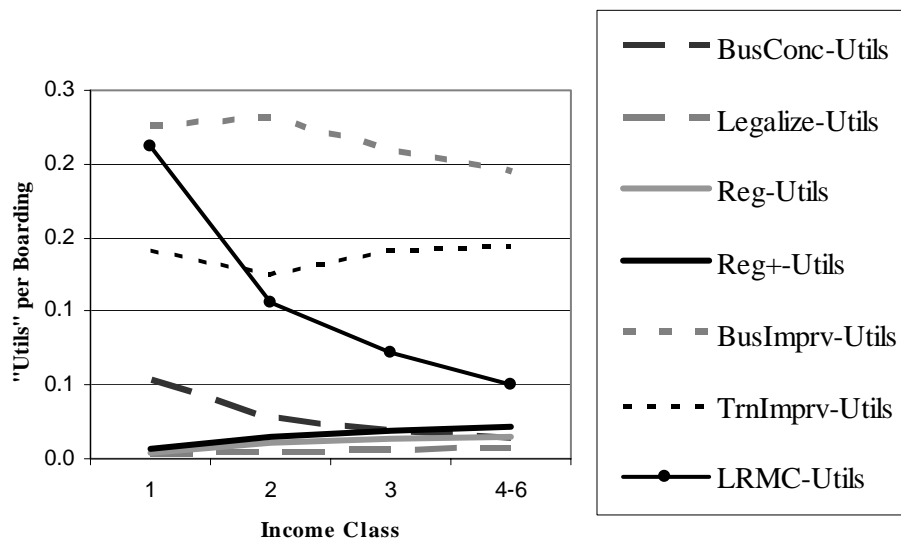


Figure 2b: Distribution of benefits for policies with positive net benefits.

7. DISCUSSION

Net benefits are the measure of economic efficiency of a policy – the more public benefits surpass public costs, the more “efficient” a policy is in creating welfare. (Note that we are not including any producer costs). The best choice from a set of mutually exclusive policies with no budget constraint is the one that creates the most positive net benefits.

The first three policies, “Restrict 1, 2 and 3” reduce the utility of the van mode. For these scenarios, the slight savings in bus travel times from reduced van congestion doesn’t add enough utility for the overall benefits to be positive. The distribution of benefits in utils for “Restrict 1” is fairly flat, showing that everyone is harmed fairly evenly by the policy. It should be noted that a small fraction, around 5%, of each income class takes vans, so policies reducing its utility harm each group fairly evenly. “Restrict 2” and “Restrict 3” force bus fares down slightly which exaggerates the differences in losses between the richer and poorer groups. Lowering fares helps the poor more than the rich because of the poor’s higher marginal utility of money, so the poor end up suffering less than the rich. Effectively, the poor lose less by these policies than the rich. The fifth policy, “Change VT”, also shown in Figure 2a hurts the poor more than the rich because it effectively raises van fares. The bus travel time savings resulting from slightly lowered van use does not offset the loss for the poor because their value of time is too low. For higher income groups with higher values of time, this trade off of higher fares for time savings results in a slight benefit.

The sixth and seventh policies, “Improve Bus” and “Improve Train”, shown in Figure 2b, result in huge net benefits resulting mainly from the fact that they improve the truly “mass transit” modes used by large shares of the population. Even small changes made to the mass modes can have large economic benefits. The rich benefit slightly more for the improvement in train, as they are more likely to take the train, while the poor benefit slightly more by improvements to the bus, because they have higher bus ridership.

The fourth policy, “Change Bus Concession” (BusConc), shown in Figure 2b, results in a positive net benefit, and effectively lowers fares in exchange for lowered safety and vehicle fitness regulations. The poor are more fare sensitive and appear to benefit the most from the fare reduction in units of utils. The rich do not gain as much utility from the fare reduction.

The eighth policy, “Legalize,” also shown in Figure 2b, creates benefits purely from removing

the stigma of the illegal status and adding additional demand for the service. The ninth and tenth policies, “Regulate” and “Regulate + Invest”, also shown in Figure 2b, create benefits even though van prices are assumed to rise slightly in response to the additional costs of formalized operation. The increases in the “immeasurable” attractiveness outbalanced the fare increases, though just barely for the poorest group. For the rich, increases in levels of service, which are included in the “immeasurable attractiveness” are highly valuable. This means that the richer groups receive slightly greater benefits. It is evident that investing in van services is not efficient, as benefits don’t exceed costs (scenario “Regulate + Invest”).

Finally, the theoretically competitive “Prices = LRMC” scenario, where prices of buses are lower, while those of vans are higher, results in benefits highly skewed in favor of the poor. The poor have the highest marginal utility of money, and greatly win with reductions in fares, combined with the fact that the fare reductions are on the bus mode, the mode most used by the poor. On the other hand, the rise in van fares hurts the rich who choose the van disproportionately. The rich do gain slightly as there are some time savings as mode share shifts slightly from the vans to the buses and trains which the rich value highly. This scenario illustrates how sensitive the poor are to reductions in fare. The net benefit also rivals the two investment scenarios, illustrating the magnitude of welfare loss the population is currently experiencing under the bus cartel.

It should be restated that the benefit model is only as accurate as its inputs. The sensitivity of the benefit estimate to the overall accuracy of the estimated inputs, like an estimated change in travel time, is large. It is hoped that these estimates were the best that can be made given the resources and time available. Understanding these uncertainties leads us to recognize that only several conclusions can be made with high confidence. The first is that heavy restriction of the vans (Restrict 2, Restrict 3) leads to losses in consumer benefits. A second conclusion is that both of the investments in the mass transit modes, “Improve Bus” and “Improve Train”, and the competitive scenario “Price = LRMC” create economic benefits greatly surpassing those of any of the other policies. Third, regulating vans shows a greater net benefit than either legalizing (Legalize) or regulating and investing (“Regulate + Invest”) do. Finally, “Change VT”, “Restrict 1” and “Legalize” show net benefits that are probably not significantly different from zero.

8. CONCLUSIONS

It was the goal of this study to look at the effects of the regulatory options on users. A demand-side approach was taken, combining original survey work with consumer surplus calculations adapted to the users’ discrete choice processes. Eleven policy interventions were converted into impacts on the market and demand, and the consumer surpluses resulting from these eleven scenarios were calculated.

With respect to the vans, regulating vans appears to be the most effective treatment and brings net benefits to the population. The distribution of these benefits is extremely regressive, like the bus and train investments, but given that few public funds would be spent on these policies, there are only slight distributional problems. Legalization brings with it additional van demand with no safety regulations, exposing even more of the population to the risks of the informal mode. Investment in vans brings no net benefit according to the results of the calculations. Other policies appeared to benefit users much more, however. Users were seen to benefit most from improvements in the mass modes of train and buses, on the order of 50 to 100 million dollars per year, or about 100 to 200 dollars per commuter. Finally, creating a competitive environment for the delivery of both van and formal bus services would benefit users, on the order of 50 million dollars per year, or about 100 dollars per commuter.

From a users' viewpoint, regulation of informality, eradication of monopoly in the formal sector, along with improvements in the service levels of the mass modes hold potential to bring substantial gains. The difficult questions are how to achieve these scenarios in practice. Competitive bidding for services can prevent the growth of monopoly in both the van and bus sectors and help to attain fair pricing in the sectors. The bidding can be combined with the entry regulations for van services, addressing some of the labor, tax and safety issues. Improvements in service levels can involve extensive use of infrastructure, which serves additionally an important form of regulation. This is especially important in Brazil where the "threat" of encroachment by informal operators is high. Infrastructure, such as busways, physically segregate services and give buses a great advantage in the marketplace.

Together, these three approaches: concessions, regulation of vans, and investments in the formal modes synergistically reinforce each other. Regulation of vans insures that marginal costs are higher, which prevents the further uncontrolled growth of the sector based on fare competition in the street, while formalization of the sector lowers perceived risks and can induce better investments on the part of operators. Investments in infrastructure for formal modes lower costs and risks to formal operators. These two processes: higher van fares, and physical segregation, increase confidence in the markets could contribute to the push towards contestable markets for bus operations. That is: the regulation of van operations, with concomitant higher van fares along with better infrastructure for formal buses to eliminate in-road competition with vans, might boost confidence enough to open discussions of competitive concessions for bus operations. Further protection from competition in the market would give more security to bus operators, removing risk from the operations sphere and placing it in the new sphere of competitive tendering. Considering the effects uncontrolled entry of informal operators has had on the market, the bus operators might be persuaded to give up some rent opportunity in exchange for this new form of security.

Based on the research presented here, policy directions should prioritize the mass modes over the informal operators in this corridor, while attempting to instill competition and regulation in both the informal vans and formal bus sector. Monopoly operations are more costly and detrimental to users than informality, and working on these problems together could yield a more sustainable solution. In this way, informality has opened up the question of users' welfare and has at the least, brought other important issues like the losses from monopoly to light.

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