Handbook on Transport Pricing and Financing

Transport financing and regional development

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1. Introduction

Transport is a key element of regional development policies. The traditional objectives that governments try to achieve with transport policies are the promotion of regional growth and the guarantee of good accessibility levels. Governments rely on transport infrastructure investment for the former and on pricing policies and regulation for the latter. More recently, sustainability has been considered as an additional objective of transport policy at regional level.

This chapter will review different issues related to the funding of transport policies from a regional perspective. The second section deals with the role of infrastructure investment as a regional policy instrument. In section 3, we review the role that accessibility can play to improve labour market results and the implications for transport policies. Section 4 is devoted to one of the core problems when financing regional infrastructures or pricing transport services: the interactions between different levels of government. We then deal with the long-debated issue of fighting poverty using transport policy instruments, before a final concluding section.

2. Transport policy in national policy agendas

The relevance of transport policy on government agendas reflects the widespread idea that improving transport infrastructures or services has a positive effect on economic development. Thus, investing in transport has usually been considered a priority by national, regional and local governments around the world.[1] Given their potential for economic growth, transport improvements are expected to contribute to reducing regional economic disparities and increasing territorial cohesion. From a policy viewpoint, providing equal access to citizens regardless of where they are located is an attractive goal. Hence, a significant amount of resources are being devoted to increasing the regions' infrastructure stock. One example is the European Union's Cohesion Fund, which has devoted 52% of its available resources during the period 2014-2020 to network infrastructure investment (in transport and energy sectors).[2]

[1] Given that major transport improvements originate from investment in infrastructure, we identify improvement with infrastructure investment. Nevertheless, the same effects can be reached by improvement in services.

[2] https://cohesiondata.ec.europa.eu/funds/cf [last accessed Feb 22nd 2022]

The positive relationship between infrastructure and growth is supported by both economic theory and empirical evidence. However, from a theoretical viewpoint a consensus has not been reached about the mechanisms underlying such relationship, while the difficulties plaguing the empirical estimations explain the wide range of results obtained in the literature.

From a theoretical perspective, the production function approach considers that physical, human and public capital are complementary factors. In this way, as infrastructure investment increases the stock of public capital, it contributes to rising productivity and, consequently, to output growth. See Calderón and Servén (2014) for a review of this analytical framework. From a different perspective, the New Economic Geography focuses on the role that transport costs play on the location of activities in a context of economies of scale under monopolistic competition and horizontal product differentiation. By reducing travel costs, transport investments improve accessibility to input and output markets. As a consequence of having access to broader markets, firms can take advantage of economies of scale, which generates agglomeration economies and results in higher productivity (Fujita et al, 1999)

Regarding the empirical evidence, a debate exists about the impact of transport infrastructure on economic development. The available literature provides results that range from almost negligible impacts to substantial positive effects. This diversity can be explained by different reasons, among which the difficulties underlying the econometric strategy stand out as the most relevant ones. First, a regression in levels between non-stationary variables may face a problem of spurious regression. Second, when estimating the impact of infrastructure on economic activity, reverse causation from the dependent variable to public investment may generate an upward bias in the estimated coefficient. If this is the case, the estimated impact of transport infrastructure on economic activity would reflect the fact that investment in infrastructure accrues to those regions with higher economic dynamism and higher potential for growth. Redding and Turner (2015) also point out the difficulties of an econometric model -usually a reduced form equation- to properly account for the complex path of impacts of transport infrastructure on growth and on the geographic distribution of economic activities. Additionally, the differences in the results can also be explained by the alternative methods used in the measurement and definitions of what constitute transport infrastructures. Traditional monetary and physical measures are only crude proxies for changes in the stock of infrastructure. A better way to approximate their impact is to rely on accessibility measures that directly reflect the changes in a locations' attraction after a reduction of transport costs. Taking the previous issues into account, recent evidence confirms that improvements in transport can foster economic development by contributing to an increase in productivity. Nonetheless, the magnitude of the impact is below the one found in earlier studies and a high level of dispersion remains (See Melo et al., 2013; Calderón and Servén, 2014; Berg et al., 2017).

Overall, the impacts will depend on a set of factors at the local level, among which the following stand out: the existence of a sufficient endowment of other production inputs, such as human capital and innovation capacity; the quality of the government and institutions; the productive structure of the region and its geographical characteristics; the characteristics of the project and

the type of infrastructure in which the investment takes place.[3] Regarding this last issue, returns are higher for road investments than for rail and airport investments.

Additionally, there is evidence of a gradual decrease of output elasticity with respect to the stock of infrastructure over time (Fernald, 1999). A possible interpretation is that returns on investment are high in early stages of development when infrastructures are scarce and progressively decline as the basic networks are completed (De la Fuente, 2010). However, Calderon et al. (2015), using a large cross-country dataset, find a high level of homogeneity in long-run output elasticities with respect to a set of variables such as countries' populations, their level of income or their infrastructure endowments. In a context of an aggregate production function, these authors interpret that observed cross-country variations in the marginal productivity of infrastructure are driven by the variation in the ratio of infrastructure to output. Redding and Turner (2015), in a review of the literature that analyses the impact of transportation infrastructure on the organization of economic activity, also conclude that such effects are similar across ranges of countries and levels of development. Given the previous reasoning, the returns on investment will not depend so much on the endowment of infrastructure, but on its stock relative to the level of production. Therefore, positive effects can be expected wherever the investment contributes to effectively solve accessibility or bottleneck problems.

The expected positive effects of investment in transport infrastructures have generated high levels of hope, and even enthusiasm, by governments trying to foster economic growth. However, investment and funding of transport projects are also linked to a series of potential inefficiencies and problems, so that too frequently their overall impact on the whole economy has not been as positive as initially expected. In what follows, we discuss the following issues: impacts can be merely a reallocation of economic activity; infrastructure investment does not necessarily contribute to regional convergence and efficiency losses may appear as a consequence of redistributive objectives.

The first issue is related to the geographical scope of the analysis: although a reduction in transport costs as a result of improved infrastructure can induce local positive outcomes, this may be merely the result of relocation of activities from another area. In that case, the net gain for the economy will be null. Empirically identifying whether the creation of new activities is a net increase or the result of displacement of activities from other zones has proved to be difficult and, hence, evidence is very scarce and conclusions are not definitive. Gathering the available evidence, Redding and Turner (2015) report, firstly, that for investments in within-city highways relocation of economic activity is at least as important as the generation of new one. Secondly, in the case of investments in intercity highways the primary effect seems to be to attract economic activity at the expense of more remote areas. Nevertheless, as Proost and Thisse (2019) point out, more research is needed to obtain clear-cut answers on this issue.

A second problem is that transport infrastructure investment may not effectively contribute to regional convergence, which is often regarded as a key objective from a regional perspective. The controversial issue is whether transport cost reductions result in a diffusion of economic activity to peripheral regions or, on the contrary, they reinforce the concentration of production in space. Improving accessibility between a peripheral region and a well-developed area can

[3] See, for instance Crescenzi and Rodriguez-Pose (2012)

enhance the market size advantages of the latter leading to firms relocating at it. Faini (1983) finds that the reduction of transport costs between the North and the South of Italy in the 1950s contributed to accelerate the South's deindustrialization. On the other hand, infrastructures can contribute to reducing regional disparities if they facilitate firms' relocation to developing regions with much lower input costs, improved access to markets or if, as a result of their construction, knowledge is more easily diffused and therefore contributes to reducing cost asymmetries between regions (Ottaviano, 2008). Whether the overall effect of improved transport infrastructure is to increase or decrease economic concentration will depend on both the project's characteristics and those of the economic environment (Puga, 2002).

A clear example and frequent subject of study are the effects of the EU's infrastructure policy. The EU has devoted large sums of funds to territorial development granting financial support to lagging regions with inconclusive results in terms of reduction of regional disparities. Teixeira (2006) shows that the substantial increase in investment in road transport in Portugal did not reduce regional imbalances. On the other hand, De la Fuente (2002) finds positive effects of the same policies for convergence among Spanish regions. More recently, Crescenzi and Guia (2020) report that the EU policy has achieved on the aggregate a positive effect on output and employment. However, the diversity of the results obtained suggests that its effectiveness depends on a large set of local conditions, as already pointed out. Besides, these authors show that an average positive effect at EU aggregate level can mask an uneven distribution of such effects for regions in different countries. As Fratesi and Wishlade (2017) emphasize, more research should focus on "the conditioning factors that explain where, when and how policy is effective". [4]

The third type of problems are the potential efficiency losses of infrastructure projects that can arise when they are selected on pure distributional grounds. This is the case, for example, of infrastructure investments that would have higher economic benefits in more developed areas, but instead, take place in other regions, which are selected to allocate investment funds on distributional grounds. In these instances, the output of the whole economy will increase by less than it would have otherwise increased had the investment taken place in a more developed area.

This reasoning does not imply that the returns on investment are necessarily higher in more developed regions; rather, an infrastructure investment will lead to economic benefits only for those projects that relieve pressure due to bottlenecks and/or connect strategic parts of the network. In general, these criteria are more frequently satisfied in more dynamic areas. As previously explained, what matters is the relative level of infrastructure stock to output, which can be lower in more developed regions.

The evidence of excessive redistribution in Spain, as highlighted by Solé-Oller (2010) and De la Fuente (2004), alerts about the risks of using public funds to finance pro-development policies. However, the existence of efficiency costs does not imply that infrastructure investment has to be ruled out as an instrument of regional policy. Lall et al. (2014) argue that although transport investment in existing agglomerations will generate higher economic returns than in remote

[4] On this topic see the papers included in the special issue "European Cohesion Policy in Context", Regional Studies, 51, 6, 2017.

areas, investment in rural areas is more beneficial for the poor. As usual, achieving the right balance is the challenge.

The inefficiencies observed in transport infrastructure investment cannot be disentangled from the way projects are financed. Assuming that infrastructure investment projects are welfare improving, the existence of economies of scale in their supply justifies the use of public funds. Even if economies of scale are not significant, it may be the case that for those projects provided purely on distributional grounds the total willingness to pay for the project is lower than construction costs. Hence, public funds are necessary, but given that they generate an efficiency loss derived from the marginal cost of the required tax increases, the distortionary effects of such taxation in the economy have to be accounted for in the evaluation of any project. This requires specific assessments taking into account the broader context, as the marginal cost of public funds is higher in developing countries and rises as the budget constraints become tighter. If such cost is not considered, it can lead to overcapacity. De Rus (2017) provides a discussion of the elements that need to be assessed in a proper evaluation of infrastructure investment with a special emphasis on pricing and investment decisions in a multimodal context.

The difficulties of rising funds to finance infrastructure arises as a major concern as budget constraints are tightened. In developing countries, where the lack of infrastructures can deter economic development, obtaining funds is particularly difficult. Hence, there may be a case for user financing. However, setting prices above social marginal costs will reduce demand and give rise to the corresponding welfare losses which have to be compared to the social cost of public funds. When user financing is an alternative, private involvement in the construction, financing and maintaining the infrastructure is common. If this is so, the necessary conditions for a successful private involvement need to be settled. This issue is dealt with in Chapter 16 on 'The regulation of Public-Private Partnerships'.

Finally, other inefficiencies may arise from potential political interferences in the project selection process (Knight, 2004; Kemmerling and Stephan, 2015; Burgess et al., 2015). Although they are more frequently linked to the use of public funds, the risk does not vanish when procurement is in private hands.

3. Transport infrastructure and job accessibility

The analysis of the relationship between accessibility and labour market outcomes, known as the 'spatial mismatch hypothesis', has its origin in Kain (1968), who studied the decentralization of employment in U.S. cities and showed how it led to a disconnection between residential and job locations. This was particularly problematic for Afro-Americans who continued to live in the inner city as housing market discrimination prevented them from relocating closer to the jobs. This research showed how the physical disconnection from jobs is a key factor in explaining persistent unemployment. Since then, many authors have extended the analysis looking at the effects of residential and access characteristics on labour market outcomes.

The different theoretical mechanisms that explain how disconnection from jobs results in poor labour market outcomes can be grouped into those related to the supply or the demand side (Gobillon et al., 2007). Supply-side explanations focus on job search efficiency and the impact of accessibility on reservation wages. Job search efficiency decreases with distance to jobs since information on job opportunities is lower for distant jobs. Additionally, the unemployed incur in

higher transport costs as distance increases and, accordingly, may restrict their search to accessible areas. This effect may be particularly important for those dependent on limited public transport. Accessibility also has an effect through its impact on reservation wages, as potential employees will refuse job opportunities with commuting costs that are too high in relation to their offered wage. From the demand side, the impact would be due to workers commuting long distances being less productive and having a higher rate of absenteeism, which would result in employers being less willing to hire them.

There have been many attempts to provide empirical evidence on the spatial mismatch hypothesis. As in other contexts, research in this area needs to deal with endogeneity issues that may be caused by simultaneity or by unobserved individual characteristics. Andersson et al. (2018) use very rich data on workers searching for jobs after mass lay-offs in different U.S. states adjacent to the Great Lakes. Their results support the spatial mismatch hypothesis: better job accessibility significantly decreases the duration of unemployment among low-medium income workers. The effect is especially important for blacks, women and older workers.

One overall conclusion that emerges from research in this area is that transport policy can improve labour market outcomes by increasing accessibility, but not any infrastructure project will do so. Moreover, positive effects can be expected from investment in private transport infrastructure, but also by improving public transport provision. This last result is important on the light of the negative externalities generated by the use of the private car and the fact that disadvantaged workers will benefit most from public transport, since they are usually more constrained to local labour market opportunities.

4. Transport prices in a hierarchy of regional governments

The optimal decisions related to the pricing of transport services and the provision of infrastructure capacity are to a large extent determined by the need to internalise the external effects of transport activities, such as congestion or environmental damages, but also by providing equity in accessibility. When transport networks are not limited to the responsibility of a single government, externalities may arise as a consequence of each authority's taxation or spending actions.

In this context, fiscal or expenditure externalities arise whenever decisions made by one government level have welfare effects on residents from another jurisdiction. Depending on the hierarchical structure of the governments involved, the externalities can be characterised as horizontal (between governments at the same level, each one responsible for a different region or country) or vertical (when there is a hierarchical relation between governments, as in a federal structure).

De Borger and Proost (2012) provide four possible cases combining the horizontal/vertical governmental structure with the fiscal/ expenditure nature of the externalities (for details, see Table 1 in Chapter 3):

- Horizontal fiscal externalities arise as taxation decisions have impacts on residents from other regions.

- Horizontal expenditure externalities imply that non-residents benefit from expenditure in other regions' transport projects, as would be the case of an infrastructure providing accessibility benefits to non-residents.

- Vertical fiscal externalities imply that tax bases overlap between different governments.

- Vertical expenditure externalities appear when spending in a type of transport project, such as for instance road infrastructure, generates additional revenues to another government.

Identifying the optimal decisions to be taken in each case in the framework of a precise analytical model is particularly difficult due to the wide range of dimensions on which certain modelling assumptions would have to be made. An assessment of the effects of pricing and investment decisions in transport networks would have to consider the structure of the network (which can be parallel, serial or a combination of both), the intensity and geographical reach of congestion and environmental externalities, the interaction between local and through-traffic, the available policy instruments (users' tolls and/or investment in additional capacity, in the simplest cases), the aims of public agents (social welfare or net revenue maximization), the kind of strategic interactions that take place between decision making agents (typically resulting in Stackelberg or Nash equilibria) and even the complexity of the organisational structure of operators sharing a network: from a simple one with atomistic users to a multi-layered one with many different agents interacting in specific ways (Verhoef, 2008; De Borger and Proost, 2012).

The problem, moreover, can be looked at from either a positive or a normative perspective. In this context, the normative question focuses on how sharing responsibilities among different governments can result in optimal outcomes, while the positive one analyses and explains potentially suboptimal outcomes emerging from a particular decision-making process or institutional mechanisms observed in public choices.

A good example of the range of different possibilities that tax exporting can take is provided by De Borger et al. (2005), who model a network with two parallel roads, each one tolled by a different government. Users are a mix of local and through traffic, and governments try to maximize the sum of local users' surplus plus toll revenues. When different tolls can be imposed to local and through traffic, tax exporting takes place in an obvious way: the toll charged to non-residents exceeds the one charged to residents. However, even if tolls are required to be equal for both user types, some kind of tax export also arises as tolls are then set above the marginal local external cost, the difference rising with the relative importance of through traffic. Finally, if only local traffic can be charged, the toll level is set below the marginal external cost generated by total traffic. This would be a subtle form of tax exporting, as it increases congestion above its optimal level and makes the use of the infrastructure less attractive for through traffic.

In the case of a network with a serial structure, if no externalities are generated across jurisdictions the problem of setting tolls is equivalent to that of double marginalisation by concatenated monopolies in vertical markets. Tax externalities arise as travel takes place across borders, making it possible for governments to engage in tax exporting. One example is provided by international air travel, which is subject to airport charges set by different regulators. Benoot et al. (2013) show how non-cooperative behaviour by regulators results in too high airport charges, this being a potentially more important distortion than the one due to imperfect competition. Another example of tax exporting is provided by Levinson (2001), who finds that

reliance on tolls by US States is directly related to the magnitude of demand for transport originating in other states.

One area of interest to study tax competition in transport economics are the fuel taxes imposed by governments, which can be used to attract demand from neighbouring jurisdictions. Rietveld and van Woudenberg (2005) analyse the determinants of differences for diesel and gasoline taxes in a sample of 100 countries, but they find evidence of tax competition only in the case of small European countries, which charge lower taxes than their larger neighbours. Decker and Wohar (2007) and Nelson (2002) find no evidence of competition between US states when setting fuel taxes.

A particularly interesting case where tax exporting may arise in transport is that of congestion charging schemes that limit access to urban centres. From a political economy perspective, De Borger and Russo (2018) model a city surrounded by a region whose residents differ by income, location and ability to access the city by private or public transport.[5] One key result of this model is that support for road pricing depends on the use given to revenues, as well as on the geographical distribution of residents. When most people live outside the city and revenues are distributed uniformly across the whole population, the acceptable charge will be inefficiently low. However, as a higher share of toll revenues are devoted to subsidising public transport, the chosen toll level increases and tends to its optimal level. Empirical evidence on road pricing acceptability shows the difficulties that arise in obtaining support from suburban residents. In the case of Edinburgh, in 2005 the City council proposed a system based on two cordon tolls, with no charges for driving without crossing the cordons. Although revenues would be earmarked for improving the transport system and shared with neighbouring councils in proportion to the origins of paying trips (Laird et al., 2007), those councils considered that the cordon design unfairly favoured City residents and the proposal was rejected in a referendum. Stockholm provides another example of the different views held by city and suburban residents. There, after a one-year trial implementation, a road pricing scheme was approved in 2007 in a local referendum organised by the City of Stockholm and around half of the neighbouring municipalities that constitute the County of Stockholm. While a majority of voters in the city supported the scheme, those in the neighbouring municipalities mostly voted against it (Borjesson et al., 2012).

The literature on tax competition shows that governments can benefit from tax exporting practices on private car users, such as tolling through traffic or collecting fuel taxes from non-residents. However, in the case of public transport services, which are most frequently provided at a loss, the results can be different. Hörcher et al. (2020) assess the effects of different institutional arrangements to provide public transport to suburban commuters who access the city centre. Although the service is assumed not to be available to urban residents, they indirectly benefit from its existence as it reduces car congestion and provides for higher levels of urban employment, which contributes to productivity improvements by means of agglomeration economies, resulting in higher wages. The authors show that, compared to the optimal provision levels of a federal welfare-maximizing government, both the regional and the urban governments would prefer to provide public transport at higher fares and lower quality

[5] See Chapter 7, on the political economy of road pricing.

levels, as they only consider the interests of their local residents and need to keep costs under control.

Low Emission Zones (LEZ) provide an example of horizontal expenditure externalities. These are typically urban areas to which access by high polluting vehicles is restricted. They can be a source of externalities since their effects are potentially felt beyond their borders. Such effects can be positive, as they may induce the substitution of polluting vehicles, or negative, if the LEZ simply diverts traffic and pollution to the surrounding areas. In an assessment of the impact of LEZs in German cities, Wolff (2014) shows that the negative impacts have been negligible, while the impacts in terms of purchasing lower emitting vehicles are felt beyond their borders. Börjesson et al. (2021) assess the welfare impacts of a proposed LEZ in Stockholm and observe that the costs imposed on light vehicle users outweigh the benefits, in the form of health benefits from air quality improvements.

5. Transport funding and urban and rural poverty

A controversial topic in transport economics is whether subsidies should be used to increase transport affordability to low-income groups. It could be argued that transport affordability is part of a wider problem of poverty and, as such, it should be addressed through income transfers funded with general taxation. Nonetheless, due to the significant limitations faced by first-best policies, it is a reality that transport is not affordable to all income groups. Therefore, subsidies need to be considered.[6] Making transport available to low-income groups can improve their opportunities in the labour market but also their opportunities in terms of access to education and healthcare. Such effects can result, not only in individual welfare gains, but also in higher economic development by increasing human capital and labour productivity. Moreover, it is often the case that efficient prices are not pro-poor with the corresponding implications on income distribution. Subsidies for equity reasons are present all over the world, but they are more common in developed and rich countries, although the lack of transport affordability is more acute in low income countries. This may be because subsidies are costly and taxation is politically difficult to implement (Berg et al., 2017).

Equity subsidies are used in both urban and rural contexts. Although it is not always the case, given that public transport use decreases with the level of income, subsidies favour low-and-medium income groups. In rural areas the problem is the lack of sufficient demand to guarantee commercially viable services. Given that governments deem that transport accessibility has to be guaranteed, the services' operators may receive support under different forms, such as direct subsidies, tax breaks, preferential loans or cross-subsidization from other profitable services.

Given a certain level of government preferences for equity,[7] the distributional impact of subsidies will depend on who actually benefits -to whom the subsidy is targeted- and on who pays – how is the subsidy funded. In what follows we review which are the main options to

[6] For a more in-depth analysis of affordability in Latin America see Chapter 22.

[7] Basso and Silva (2014) show that if distributional concerns are sufficiently high, optimal transit subsidization becomes an imperfect means to achieve equity objectives.

channel the subsidies and the most common sources of revenue used, together with the corresponding implications on redistribution and efficiency.

Essentially, there are two policy instruments to channel subsidies: subsidising operators providing transport services (supply-side subsidies) and subsidising specific groups of passengers (demand-side subsidies).

Subsidising public transport operators for redistributive reasons is justified on the assumption that the poor use public transport more intensively than the rich. This is usually the case in cities in developed countries where it is common for public transport to absorb a higher share of household expenditures as the level of income decreases. However, the correlation between public transport use and income is far from being perfect, as sometimes the subsidies accrue more than proportionally to well-off people. This problem is more severe for developing countries where the relationship follows an inverted U-shape curve: very low-income household spend less in transport than low-or middle-income ones because for them transport is not affordable and walking is their predominant mode (Serebrisky et al., 2009).

Available evidence suggests that in cities in more developed countries supply-side subsidies have progressive or mildly-progressive impacts, whereas evidence from poorer countries indicates that there is scope for policies to be redesigned so as to make the poorest better-off. Venter et al. (2018) analyse the equity impacts of Bus Rapid Transit (BRT) systems in Africa, Asia and Latin America, and conclude that although they offer significant benefits for poorer segments of population, benefits are often skewed towards medium-income users. This result is explained mainly by their insufficient spatial coverage and inappropriate fare policies. The Transmilenio BRT system implemented in Bogotá is particularly interesting as it extended its coverage of trunk services into peripheral low-income areas so that it provided equal access to the local population. However, according to Teunissen el al. (2015), lack of affordability remained an issue for poor groups.

Widespread evidence of undesired redistributive effects are subsidies granted to expensive rail or metro investments. It is often the case that these transport modes are used by relatively high-income groups. Examples can be found in Mexico City (Serebrisky et al., 2009); Santiago and Buenos Aires (Gwilliam, 2017); Oslo (Fearnley and Aarhaug, 2019) and in US cities (Taylor and Morris, 2015), among others.

Subsidies can be more effective if they are targeted at beneficiaries (demand-side subsidies), as they can be made available to specific groups (senior citizens, students, unemployed) or linked to some income variable. Recent literature surveyed by Gandelman et al. (2019) suggests that equity policy can be improved by moving to demand-side narrowly targeted subsidies. Smart card technology makes it easier to differentiate fares according to income groups, specific locations or trip categories. Although the most common cases are those based on individual categories, it is increasingly frequent to use some kind of means-tested instrument to select the potential beneficiaries. Examples can be found both in urban and interurban contexts, as explained in what follows.

Brazil's "Vale Transporte" (VT) is a programme which was made compulsory to all companies in 1987, with the objective of incentivising commuting by public transport. Employees receive a monthly transport voucher for the work-trip, for which employers are entitled to deduct 6% of

the worker's earnings. An interesting feature of this system is that employees can opt out, and since higher income earnings have the incentive to do so as 6% of their salary will be more than their commuting costs, the policy effectively targets low-income workers. The system is basically progressive, though the very poorest, self-employed, or employed in the informal sector do not receive the subsidy (Gwilliam, 2017).

A relevant example of means-tested subsidy is the pro-poor public transport system implemented in Bogotá aimed at solving the problem of lack of affordability mentioned above in relation to Transmilenio. As fares for public transport are designed to cover all operating costs, they become too expensive for poor citizens. In 2014, the local government introduced a pro-poor public transport subsidy with potential beneficiaries targeted according to a scoring scheme. Guzman and Oviedo (2018) show that the subsidy, which is delivered through a personalised smart card providing beneficiaries with a discount ranging from 50% to 60%, is progressive.

A specific type of demand subsidies are those targeted at residents in isolated or remote areas. Such support can complement the imposition of public service obligations programmes on the transport operators, which are common in many countries. This case illustrates that demand-side subsidies can also generate distortions. Focusing on the air transport subsidies addressed at island residents in France, Greece, Italy, Spain and Portugal, Fageda et al. (2017) find that prices in routes where only island residents benefit from subsidies are higher than those where subsidies do not discriminate between residents and non-residents (such as the ones that apply to connections to Sardinia from the Italian mainland outside the summer season). However, the market distortions depend on the intensity of competition in the market and the specific design of the subsidy. Valido et al. (2014) compare the impact of 'ad valorem' versus unit subsidies in a context in which airlines exert market power. They show that the impact of each design type depends on the proportion of passengers who benefit from the subsidy and their relative willingness to pay for the trip. Using data from the Canary Islands market, they conclude that a unit based subsidy would increase welfare more than the existing 'ad valorem' one.

Any analysis of the impact of subsidies also needs to take into account the revenue sources used to fund them, among which the most common is general taxation. In this case, the net redistributive effect will depend on the degree of progressivity of the tax system. In developing countries tax systems tends to be regressive, which reinforces the undesired negative effects of supply-side subsidies. Additionally, the assessment of the subsidy has to account for the efficiency loss derived from raising additional taxes, as discussed in Section 1. For an in-depth discussion of equity issues see Chapter 6.

Given increasingly tighter budget constraints, transport authorities have been forced to draw from alternative taxation sources. Among them, financing public transport using congestion toll revenues has become an attractive option for those regions where such tolls exist. There is some research on the efficiency and equity consequences of using toll revenues to reduce labour income tax that compares it with using revenues to subsidise public transport. Mayeres (2001) assesses the changes in welfare and equity from alternative transport policies simulating the conditions of urban areas in Belgium (where no congestion pricing exists) and she shows that it will always be preferable to use congestion toll revenues to reduce labour income tax than to

increase public transport subsidies. This result is explained by the high distortionary costs of taxes on the economy.

However, the deadweight loss from labour taxes can be partially counterbalanced by the reduction in commuting costs which in turn might increase the supply of labour. Some models have considered the labour market effects of congestion with inconclusive results. Parry and Bento (2001) conclude that public transport subsidies incentivise labour supply and reduce the deadweight loss of labour taxes, but using congestion toll revenues to provide more public transport subsidies is less efficient than directly lowering the labour tax. On the contrary, under different assumptions, De Borger and Wuyts (2009) and Tikoudis et al. (2015) show that recycling congestion tax revenues to subsidise public transport can be more efficient than using them to compensate reductions in labour taxes. It seems, therefore, that the final effect will be context-specific and will depend, among other factors, on (i) how substitute transport modes are priced, (ii) the effect of subsidies on congestion and (iii) the wage elasticity of labour supply.

A second mechanism of alternative taxes to pay for public transport costs is a payroll tax levied on salaries. One relevant example is the French *Versement Mobilité* (previously named *Versement Transport*), which consists of a local payroll tax levied on companies with 11 or more employees, whose revenue is directed to local transport authorities and used to finance public transport. As a payroll tax it might reduce total employment with the consequent efficiency loss and a probable regressive effect. However, such effect can be counterbalanced if better public transport enlarges the size of the labour market and encourages employment creation. In any case, the net redistributive effects are unclear. It has to be pointed out that this tax on labour is used to finance both working and non-working trips.

A third alternative to fund loss-making services is to cross-subsidise them with revenues obtained from commercially profitable ones. Cross-subsidies are a mechanism used to support transport routes considered to be of general interest. Consumers of profitable services end up paying prices above their long-run marginal cost in order to sustain the losses of unprofitable ones. Compared to the marginal cost pricing alternative, such pricing policy does not increase overall welfare (Beato, 2002), even if it pursues a redistributive aim in regional terms.

Until 1997, Norway allowed airlines connecting remote regions to operate as monopolies and apply cross-subsidies to the different routes (Fageda et al., 2018), a system similar to the one that is currently applied by Spanish intercity buses. The four maritime cargo companies allowed to serve the Azores Islands also operate cross-subsidies, as did Greek ferry operators which until 2015 levied a 3% surcharge to fares of profitable routes in order to cover the losses of non-profitable ones (ITF, 2021).

A particular form of cross-subsidy is the use of a flat fare scheme, which increases accessibility for those users located at the outskirts of the cities. With such system, short trips pay a price higher than their operating cost, whereas long distance trips receive a subsidy.[8] Over and above the welfare losses for those travelling short distances, flat fares can incentivise suburbanization

[8] However, when time costs are taken into account, the effects of a flat fare are not so clear-cut. For instance, consider a bus route that gets more crowded as it approaches the city centre, increasing the time costs for all bus users. In this case, it may be efficient to set a higher fare for short trips in order to discourage them (we thank Andrés Gómez-Lobo for raising this issue).

and excess commuting. The final redistributive effects will depend on the location of the population and the pattern of travel by income groups.

Another mechanism to fund transport services is known as 'value capture', which consists of transferring to the transport system part of the increases in property market values that arise as an area becomes more accessible (Yang et al., 2019). Earmarking such property taxes as public transport subsidies is relatively common in North American cities, where its implementation subject to voter's approval makes it explicit that the alternative is to use general tax revenues (Ubbels et al., 2001). A variant of this idea is to apply development levies when new areas are being developed, so that they contribute to fund the transport services that will be demanded by the new users. Value capture is discussed with more detail in Section 3 of Chapter 15 of the *Handbook*.

6. Conclusions

Transport policies contribute to several dimensions of regional development, among which three stand out. First, by improving network connectivity, less developed areas may attract new investment and economic growth. Second, better transport accessibility can have significant labour market effects for disadvantaged groups and, at the same time, contribute to improve their accessibility to education and healthcare. And third, it should be borne in mind that besides providing accessibility, transport should also be affordable. Therefore, subsidies directly granted to targeted groups can be defended both on efficiency and on distributional grounds.

However, the effectiveness of transport policies cannot be taken for granted. Too frequently the results of transport policies are far from what was expected. Resources devoted to the promotion of lagging areas may yield businesses relocation or concentration of activities in the most prosperous ones. The final results depend greatly on local factors and specific project characteristics. In the case of subsidies, a correct design of their transfer mechanisms is crucial to limit inefficiency costs. All the distortions generated by policy interventions should be included at the project evaluation stage.

The opportunity cost of public funds to finance transport projects or subsidies increases as budget constraints are tightened. Besides, the use of public funds may create the opportunity for political or interest groups interferences in the project selection. As a result, there may be overinvestment or selection of projects that favour other aims than efficiency or distributional goals. No simple solution exists for this problem, although earmarking revenues (such as congestion tolls) can be an alternative under some circumstances. Charging users is another option, but it will reduce demand and, consequently, it translates into a welfare loss. The different alternatives need to be assessed on a case-by-case basis.

An additional problem arises as more than one government level is involved in the design and execution of transport policy. Tax competition and tax exporting become relevant issues when transport infrastructure has to be priced or financed by different governments. The fact that transport networks are increasingly integrated and used by residents and firms from different jurisdictions shows the need to coordinate policies at a broader level.

Economic principles should guide transport policy decisions within a broad enough framework that considers all the trade-offs between costs and benefits. However, this requires an institutional design with the right incentives to guarantee an independent and rigorous evaluation.

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