Urbanization and Emerging Cities: Infrastructure and Housing

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Summary

Urbanization is a central challenge of our times. At its core, it is an urban development challenge that requires addressing transportation and housing in cities. Transport improvements can reduce travel times and improve the spatial reach of urban dwellers. But these improvements may be crowded out by latent demand for travel and may lead to worse congestion, pollution, and other negative externalities associated with urban traffic. To evaluate the effects of transport improvements, direct travel effects must be measured. Then, an improvement in traffic conditions somewhere may spill over to other areas. Firms and residents may also relocate, so economic growth close to a transport improvement may just result from a displacement of economic activity from other areas. Conversely, better accessibility is expected to foster agglomeration effects and increase productivity. Valuing these changes is difficult, as it requires being able to quantify many externalities such as congestion delays, scheduling gains, and greater job accessibility. Housing policies present different challenges. More fundamental policies seek to enable housing construction by offering more secure property rights, up-to-date land registries, and competent land-use planning—all complex endeavors and all necessary. Other housing policies rely on heavy government interventions to provide housing directly to large segments of the urban population. These policies often flop because governments fail to link housing provision with job accessibility and appropriate land-use planning. Housing is also an expensive asset that requires significant initial funding, while credit constraints abound in the urbanizing world. Policymakers also need to choose between small improvements to extremely low-quality informal housing, retrofitting modern housing in already-built urban areas, or urban expansion. All these options involve sharp trade-offs, subtle induced effects, and complex interactions with transport. All these effects are difficult to measure and challenging to value.

Keywords: urbanization, housing, transportation, agglomeration, place-based policies

Subjects: Economic Development, Urban, Rural, and Regional Economics

Introduction

In South and Southeast Asia and in the sub-Saharan, the share of population living in cities is growing fast. For instance, the rate of urbanization in sub-Saharan Africa is around 40%, and this figure increases by 1.4% per year (UN, 2018). This massive transition to emerging cities, undertaken by tens of millions of people annually and due to last for several decades, is an extraordinary event. Even in the more highly "urbanized" regions of the developing world, like Latin America where urbanization rates are approaching 80%, people concentrate in some location, but the cities are yet to be fully developed and built (Duranton, 2021).

Accommodating large numbers of new residents in emerging and developing cities, and improving the lot of those who live at high density but are otherwise deprived of nearly everything that one would call *urban*, is clearly an extraordinary challenge with many dimensions: transport, housing, governance, safety, education, health, amenities, and funding of local public goods, for example (for recent reviews with a broader focus, see Bryan et al., 2020; Henderson & Turner, 2020). The first two are of particular importance and form the main focus of this article. At the most basic level, cities are about housing and, from there, being able to access work, supplies, friends, and school, and more generally, to conduct errands.

Both urban housing and urban transport are policy issues. Absent transport and housing policies and under weak institutions, urban chaos ensues, with slums and dysfunctional traffic. Transport infrastructure is essentially a public good subject to many external effects affecting the residents it serves, the residents it does not serve, and even nonresidents. Urban housing is also subject to pervasive market failures, especially in urban contexts where property rights are weak, households are financially constrained, and basic utilities are often absent. Housing location choices are also subject to market failures and affect transportation outcomes. Because of their spatial nature, transportation and housing are best analyzed as place-based policies.

The Urban Context

Standard economic analysis is based on diminishing returns.[1] In an urban context, this assumption implies that economic activity will be spread more or less smoothly across space, essentially negating the existence of cities.

To think about urbanization and the development of cities, some form of increasing returns is needed. These agglomeration economies are generated by close and intense economic interaction and arise through several different mechanisms. Thick labor markets enable better matching of workers to firms' skill requirements. Better communication between firms and their customers and suppliers enables knowledge spillovers, better product design, and timely production. A larger local market enables development of a larger network or more specialized suppliers. A greater concentration of residents or workers also allows infrastructure to operate at scale. For all these interactions, physical proximity is fundamental, as it reduces the frictions created by distance.

This productivity advantage has been widely researched (see Combes & Gobillon, 2015, for a review of this literature). The apparent elasticity of wages with respect to city population is typically around 8% to 10%, but much of that relationship is driven by the sorting of more skilled individuals into larger cities. City population is also potentially endogenous, as one expects workers to move to more productive cites. Correcting for these biases leads to smaller elasticities. It is also the case that workers may learn more over time in larger cities. Overall, there is a reasonable consensus that the agglomeration elasticity with respect to city population is between 2% and 5%. That is, urban wages increase by 0.2% to 0.5% when city population increases by 10%. Most of this research is done in high-income countries, although research on developing economies indicates that benefits may be even larger (Glaeser & Xiong, 2017).

The proximity that enables agglomeration effects to occur also generates costs and limits increasing returns. More employment in a central business district increases commuting costs for workers. These costs are exacerbated by congestion—a negative externality—and other costs of close urban living. Land becomes the scarce factor, and housing consumption (floor space per household) is reduced.[2] The evidence about urban cost is less developed. Combes et al. (2019) developed an approach to urban costs grounded in consumer theory and asked what the increase in expenditure needs to be as a city grows in population, in order to keep the same utility. Using French data, they found that the elasticity of urban costs with respect to population is small but increases sharply for cities with more than a million residents.

Firms need to choose a location, and so do workers for their residence. These are major decisions with large sunk costs that involve long-lived assets. Because agglomeration effects mean that the returns to investing in a place depend on who else is there, expectations are critical. There is a first-mover problem: No one wants to move to a new place while uncertain about its future development. This first-mover problem is compounded by inertia and path dependency, as firms are unwilling to move out of existing clusters, and it is therefore hard to start new ones. Coordinating the movement of a group of firms potentially solves this problem, but coordination failures are pervasive. Thus, a planner can construct a model of a perfectly functioning new town, but there has to be a path of public and private sector investment and location decisions that lead from the initial situation of empty fields to the completed town with both residents and firms. If such a path is not in place, then development will fail. These arguments are particularly acute in a developing country. The economic environment is one of rapid change, which increases uncertainty. There are also greater frictions associated with distance, including higher travel costs.

Cities are also subject to shocks as their industries grow or decline or as the attractiveness of their location grows or declines. Adjusting to negative shocks is generally slow and painful for cities. When a country's export sector experiences a negative shock, the adjustment mechanism is currency depreciation. In turn, currency depreciation leads to a reduction in real wages and unit costs relative to trading partners. Unlike countries, however, cities cannot adjust by depreciating their currency. Instead, cities need to rely on direct factor adjustment. Unfortunately, labor is poorly mobile. In cities, part of the adjustment occurs through a depreciation of the value of fixed factors such as land, housing, and fixed productive equipment. Because they represent only a fraction of business costs, fixed factor depreciation has little leverage in bringing sectors to the point of competitiveness. Worse, depreciated fixed factors make the cost of operating and living in a city cheaper, which slows labor mobility even further. It is only as fixed factors slowly become obsolete or insalubrious that labor eventually moves out (Glaeser & Gyourko, 2005).

Increasing returns, coordination failures, and a slow adjustment to shocks combine to produce a distribution of economic activity across space, and this pattern is typically highly uneven. There is a distribution of cities and urban areas with different specialisms and of different sizes, and regions with different levels of activity and income. Three important points follow.

As a result of the forces just described, the market outcome (such as the size of cities or the number and location of clusters) is not, generally, efficient. In the urban context, private decisions to locate in a city mean that, for the marginal entrant, private benefits are equal to private costs. But external effects are ignored in this decision, so there may be net social benefits (or costs) from expanding a city according to whether the value of positive external benefits created is greater (or less) than the cost of negative ones. In particular, coordination failure means that it is hard to start new centers of activity, and therefore there may too few such centers. An important possible consequence of coordination failure is excess primacy, meaning the tendency for the largest cities in a country to be excessively large compared to those further down the urban hierarchy. The data show that this is a common feature of developing countries, compared to higher income countries both now and also when they were at comparable stages of development (Kim, 2008).

Within cities, transport and land are of paramount importance. Transport and other infrastructure underpin agglomeration effects as they make direct interactions possible and reduce the cost of distance. As discussed in "Urban Transport," transport is also subject to a range of external effects, notably congestion.

Land also matters greatly as building it up enables residents to be accommodated and firms to produce, a process called land development. As this article shows, the process is rife with externalities, and land-use decisions have lasting effects. All this implies that urban development is inherently a policy question and needs to be analyzed as such.

Policy: Quantity Change and Valuation

Investment choices are particularly stark in developing countries as constrained resources and the lumpiness of many public investments mean that, of necessity, some cities or neighborhoods will be served with roads, telecommunications, power, and other public services, before others. Informing these difficult choices with systematic ex ante appraisal of projected policies is complex because of two distinctive features of place-based policies.

Economic policy has both direct and indirect quantity effects. Direct effects arise, for example, because building a hospital will improve health outcomes. Indirect or induced effects occur when, for instance, building an arterial road will not just increase the number of journeys made but may also increase private investment as locations along the road become more attractive. Indirect effects often occur via induced private-sector investment. The first stage of policy design and appraisal is to establish these quantity effects.

The second stage is to place a value on these quantity changes. They will generally create costs and benefits, and valuation has to work out the net effect. Again, following the construction of a new arterial road, an increase in economic activity along this road may be observed, as well as an appreciation of residential land values. Much of that increase may just result from a spatial shuffling, creating investment in one place at the expense of another. Valuation has to compare

the changes in values everywhere in the city and beyond to establish whether the net effect is positive or negative. In short, valuation requires establishing both the value of a factor in its new use, and the opportunity cost of this employment.

Valuing direct effects is the stuff of standard project appraisal techniques for which well-established techniques are in place, based around cost–benefit analysis. But indirect effects depend on responses of the private sector, often including major location decisions that incur sunk costs and are long lasting. Such decisions and their economic impacts are hard to predict.

Most urban policies are focused on direct effects, such as the benefits of slum improvement or better traffic flows. However, indirect effects also matter. The success of cities in attracting investment and creating jobs has much to do with the way the city has been built—its infrastructure and connectivity, and its housing stock and consequent amenity value to urban workers.

Urban Transport

With a framework of analysis at hand, we start our investigation with urban transport.

Urban Transport Improvements: Setting the Scene

Before describing the interplay between the demand and supply of urban travel, a number of preliminary points must be made because urban travel is an unusual commodity. Urban travel is not directly consumed. People do not typically conduct errands to get a direct satisfaction from their trips. Instead, urban travel is a costly activity undertaken in order to produce, shop, or enjoy leisure. The demand for travel is often described as derived demand by transport economists.

Two important implications follow from this simple observation. First, for a given trip, the total cost of reaching our destination (and coming back) is the relevant economic cost to consider, and the total cost of a trip includes both monetary costs, such as the cost of gasoline, as well as the cost of time. In turn, this cost of time includes various elements such as the duration of the trip, the discomfort of a particular mode of transportation, traffic conditions, not leaving at our preferred time, and reliability (Small, 2012). Second, people elect to take only a small number of trips from a much broader choice set. They should thus think not only about the trips that they take but also about the entire choice set of the trips that they could take. “Accessibility,” then, is the combination of the possible destinations and the total cost of reaching these destinations. In short, accessibility measures people’s ability to go places.

Hence, it is convenient to think about the total cost of a trip as the product of its length or distance by its cost per unit of distance. The former can be referred to as proximity, and the latter as mobility (or speed if only time is considered). Although most of the focus of urban transport policy is on mobility (Duranton & Guerra, 2016), proximity is possibly more important. In

addition, accessibility and mobility need not be positively correlated. For instance, denser locations may offer slower mobility but better proximity. The latter effect could potentially be stronger so that accessibility increases with urban density despite worse mobility (Couture, 2018).

Finally, it is also worth keeping in mind that people pay for travel directly through the cost of travel but we also pay for travel indirectly through higher housing costs in residential locations with better accessibility. This interaction between housing and transport is at the heart of our understanding of land use in cities.[3] Land prices are expected to capitalize, at least partly, differences in accessibility across locations within a city.

Urban Transport Improvements: Price and Quantity Changes

In a demand and supply diagram, the simplest way to think of an urban transport improvement is to view it as a downward shift of the transport supply curve, that is, a lower cost of travel per unit of distance, all else equal.

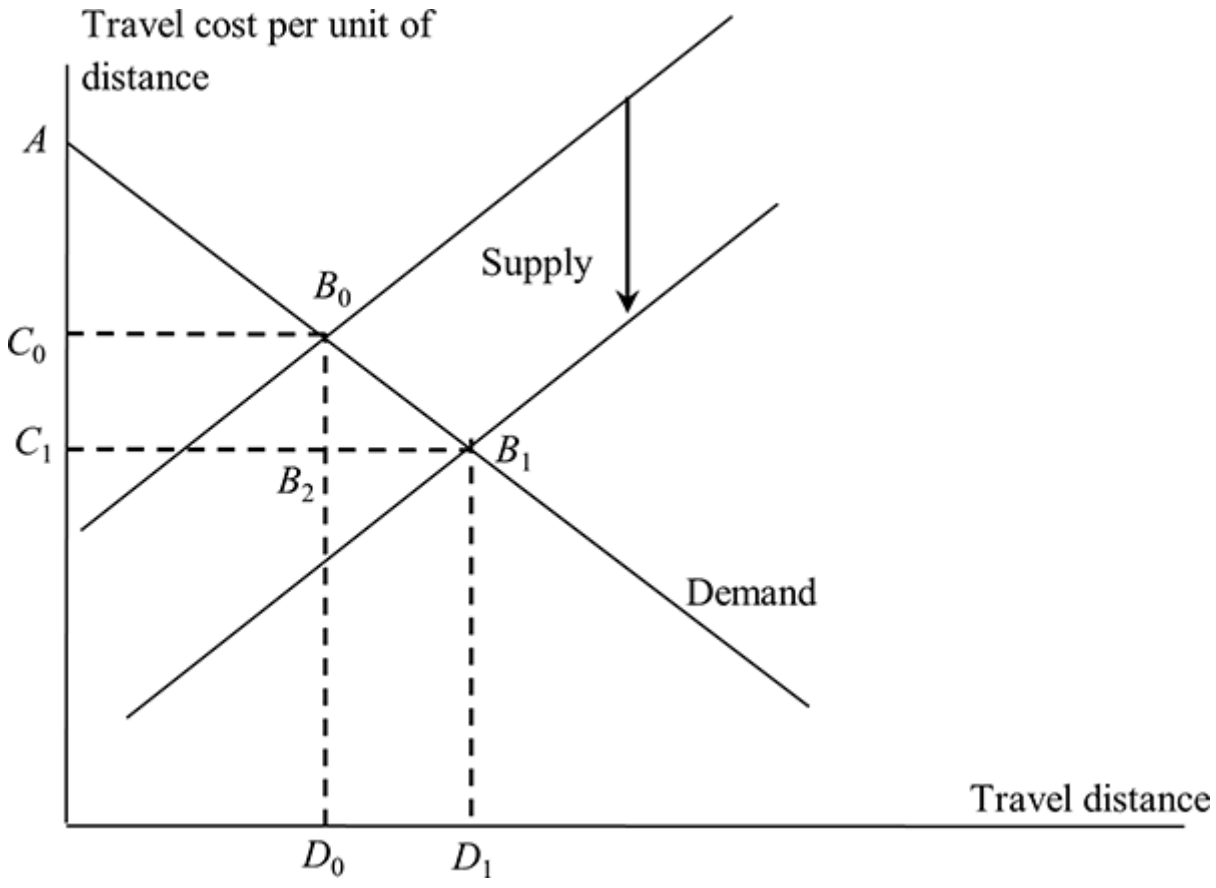

Figure 1. The supply and demand of urban travel.

This situation is represented in Figure 1. In the figure, the horizontal axis measures total distance traveled in a city, and the vertical the cost of travel per unit of distance. The demand curve represents the willingness to pay for urban travel, which we reasonably assume to be decreasing

in total distance traveled. The supply curve represents the cost of travel as a function of the total quantity of travel undertaken. It is upward sloping because of congestion. Initially, the equilibrium is at B_0 where demand and supply intersect.

The first important implication is that after a transport improvement such as the widening of a road, the supply curve shifts downward and the new equilibrium is in B_1. Importantly, this improvement leads to an increase in consumer surplus. Originally, traveler (consumer) surplus is measured by the triangle AB_0C_0. After the improvement, it is given by AB_1C_1. This increase has two components. The first is the rectangle $B_0C_0C_1B_2$, which corresponds to the reduction in travel cost for the original trips. The second is the triangle $B_0B_1B_2$, which corresponds to the surplus associated with the increased travel induced by lower travel costs. In practice, these are either new trips or longer versions of previous trips such as going to a more distant supermarket instead of the local corner store.

The second key implication is that the decline in the equilibrium cost of travel is less than the downward shift in the supply curve. As travel becomes cheaper, it induces more travel, a widely recognized phenomenon usually referred to as induced demand (Litman, 2017). As travel demand is more elastic, the surplus generated by a transport improvement falls and reaches zero for a perfectly elastic demand which crowds out any change in supply. We return to the interpretation of this seemingly paradoxical result and provide some important qualifications below after our analysis of congestion.

Before going further, it is worth pausing and asking how big the differences in the cost of urban mobility are. The international evidence provided by Akbar et al. (2022) suggests that cross-country differences in urban travel speed is large. Travel speed in Dhaka is only about a third of that observed in some midwestern and southern American metropolitan areas. Similar differences are observed by Akbar et al. (2021) among cities of India. As a result, for a roughly similar share of expenditure and a comparable amount of time devoted to transportation, we find that residents of slow cities travel only half as much or less as residents of fast cities. The economic cost of low mobility appears to be high. Given that households typically devote between 10% and 20% of their income to transport expenses and 1 to 2 hours a day per person to travel, the potential gains from better urban transport may be large.

While the framework discussed so far is a useful departure point to think about urban transport, it neglects several important dimensions. The first is that urban travel generates a number of externalities. On the negative side, congestion is the main, but by no means the only external effect associated with transport. Urban travel is also responsible for many road accidents and generates various forms of pollution, from particulates to carbon emissions, to noise. These externalities are discussed by Parry et al. (2007) who make a strong case that accidents and pollution may each be of the same magnitude as congestion in terms of social costs.

Transport improvements can also support the positive externalities associated with better access or "connectivity." Agglomeration economies are reaped when workers are closer together—employment densities in excess of 150,000 workers per km^2 in the center of major cities—and this density requires a highly effective transport infrastructure. Transport investments are therefore necessary for delivering the high productivity of economic agglomeration.

Before turning to the negative and positive external effects of urban transport we note two further points. A limitation of the simple demand and supply framework used so far is that there are several transport technologies, from walking to private cars.[4] Transport technologies affect each other in a variety of ways. More cars and heavy vehicles may discourage biking and other lighter modes of transport. Transit investments such as bus rapid transit with rights of ways will reduce the amount of roadway for other forms of transport, etc. In addition, transit often operates with increasing returns. Hence, easing travel with private vehicles can have detrimental effects on transit, etc. More generally, a cost–benefit analysis of a transport improvement must consider these interactions across transport modes.

Finally, transit improvements in a city are usually far from uniform as they often consist of small projects such as a new bus line or a new overpass or underpass at a particularly busy intersection. In a network, an improvement somewhere can generate a worsening elsewhere. For instance, a new major arterial may impede traffic on connected roads and lead overall to a worsening of total travel time.[5] This type of consideration implies that a good cost benefit analysis should model each transport improvement at a great level of detail. Unfortunately, this imposes extremely high information and modelling requirements for each project.[6]

Urban Transport: Congestion

Road congestion is a concern in all large cities, particularly large developing cities. The two simplest ways to think about congestion are following. First, congestion can be viewed as a friction which worsens with the number vehicles on the road. For security reasons, drivers want to leave a time interval of 1.5 to 2 seconds with the vehicle in front of them. As the density of vehicles on the road increases, the only way to keep this time interval is by slowing down.[7] Second, there are bottlenecks. Intersections and some particularly hard to avoid road segments, such as bridges, have a finite capacity. If vehicles at a bottleneck arrive at a rate that is higher than the rate at which they can exit, a queue will form.

While urban road congestion is extremely salient and receives a great deal of academic and popular attention, one needs to be careful not to exaggerate its importance in the developing world. Akbar and Duranton (2017) found that for a representative set of trips taken by residents of Bogota in Colombia, travel speed only varies slightly less than one to two between the fastest and slowest hours of the day even though by some measure Bogota is the most congested city in the world (Akbar et al., 2022). Looking at traffic conditions in Indian and world cities, Akbar et al. (2021, 2022) found that travel delays caused by traffic only play a minor role in explaining mobility differences between cities. For cities in the developing world, the first-order issue is slow mobility in absence of congestion.

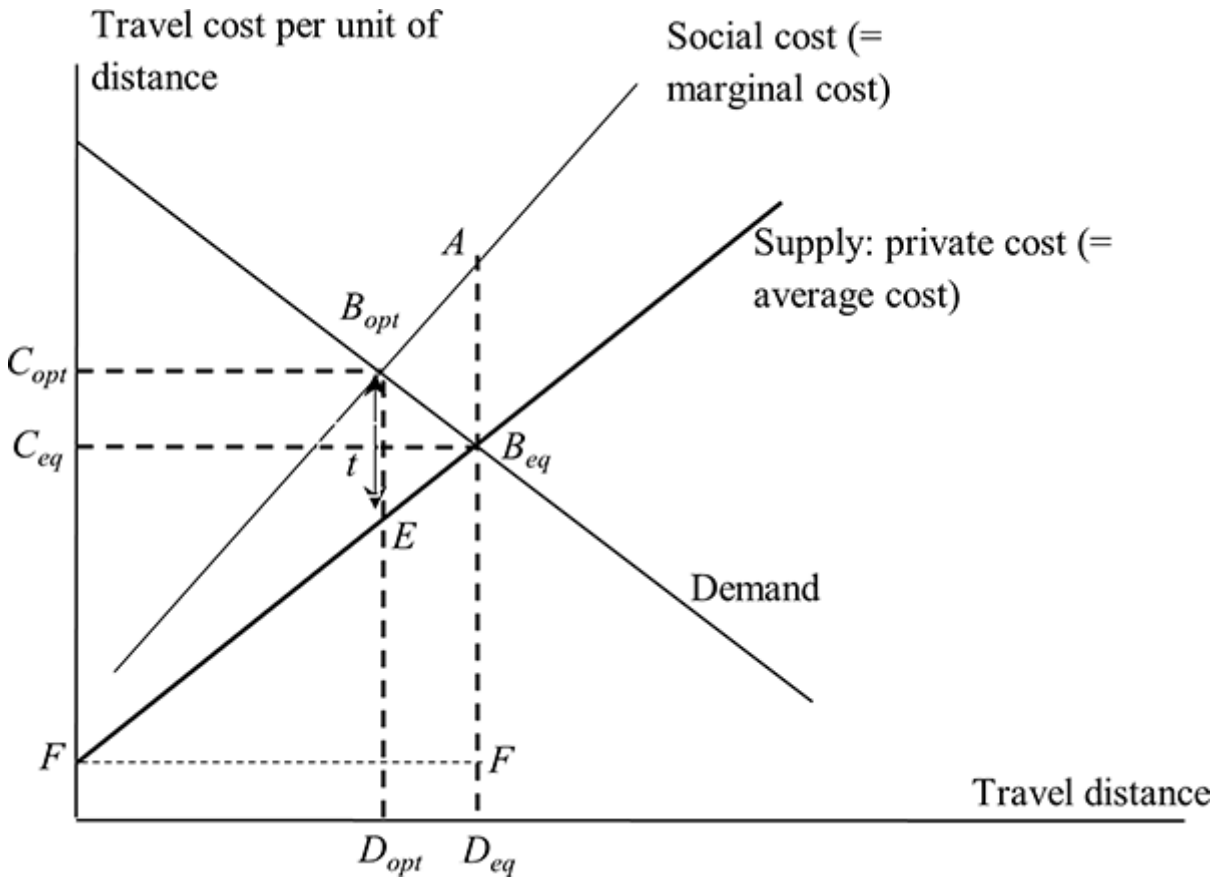

Figure 2. Congestion.

As shown by Figure 2, congestion can easily be incorporated into the framework used so far. The demand and supply curves are as in Figure 1 and the equilibrium is at B_{eq}. The supply curve reflects the private cost of travel per unit of distance, upward sloping because of congestion. However, this does not internalize the externality created by additional travel, so the full social cost is the (higher) marginal cost of travel. There is thus excess travel at B_{eq} as travelers do not pay for the full cost that their travel inflicts on society. The optimum is instead at point B_{opt}, where the marginal cost of travel intersects with the demand curve.

The optimal amount of travel is D_{opt}. For residents to be willing to travel the optimal quantity D_{opt}, they need to face a cost of travel C_{opt}. This can be achieved by taxing travelers and charging them the difference between the marginal cost of travel and the average cost, t. Without a congestion tax, excess travel at D_{eq} generates a social loss (deadweight loss) equal to the difference between the social cost of travel and the willingness to pay of travelers between the optimum and the equilibrium. In the figure, this loss is measured by the triangle $AB_{eq}B_{opt}$.[8]

Hence, the recommendation from economists regarding traffic congestion can often be summarized in one word: pricing. In practice, the easiest form of pricing is to implement a cordon around the central part of a city with a toll to be paid when crossing this cordon at certain hours of the day. Politically, this is difficult to implement since congestion pricing leads to a number of distributional conflicts, between rich residents with a high value of time and poor residents,

between suburban residents who are more reliant on cars and more central residents who are often exempt from the charge altogether, and between renters and owners as a congestion tax is likely to affect property prices. We also keep in mind that taxing congestion raises a number of implementation and enforcement issues that may be challenging for many cities in the developing world.

While direct congestion pricing may be out of reach for many developing cities, other pricing mechanisms are possible. Pricing for parking is one of them. Appropriately implemented, the pricing of parking has the added benefit of freeing up parking spots and eliminating cruising, arguably a major source of congestion in many central cities (Shoup, 2005).[9]

Beyond pricing, it is also important to keep in mind that traffic conditions are also greatly affected by driver behavior and the quality of the roadway, ranging from the absence of potholes to well-functioning traffic lights or, more advanced but still easy-to-implement devices, such as ramp-metering systems. In many parts of the developing world, the division of the roadway between moving vehicles, parked vehicles, and other users such as street sellers is not well defined or enforced. Akbar et al. (2021) find that the evolution of travel speed during the day is highly consistent with road encroachments being a major impediment to mobility in Indian cities.

The endless debates about urban congestion also tend to forget that the optimal congestion tax is conditional on the extent of the roadway. Cities with more roadway enjoy better mobility (Akbar et al., 2022). Many emerging cities where informal residential development occupies a large fraction of the land appear to have fewer roadways than equivalent cities in developed economies.

Three Further Issues About Congestion

Although Figure 2 is useful and informative, it neglects three important points about congestion.

First, there is good empirical evidence that for a given road, the supply curve is first upward sloping, as represented in Figure 2, but then eventually bends backward (Small & Verhoef, 2007). The reason is that as the number of vehicles increases, their speed keeps decreasing, and eventually the overall flow or quantity of travel declines. In the extreme, too many vehicles on a road bring it to a standstill. This phenomenon is known as hyper-congestion. The social costs associated with hyper-congestion can be extremely large. For instance, a hyper-congested highway that moves at 15 kilometers per hour could perhaps achieve the same flow at a speed of 60 kilometers per hour. In this case, 75% of the cost of travel is (deadweight) lost over and above the standard losses from congestion, as illustrated in Figure 2.

Second, studies that measure congestion at the area level find that the supply curve is much flatter than for specific roads (Akbar & Duranton, 2017). The reason is that, as major arterial roads get congested, some travelers start using alternative routes. As a result, a given area will be less congestible than a single major road. If there is enough supply of local roads, the supply curve will eventually reach a plateau and become flat as all the new traffic is directed toward uncongested local roads. The optimal congestion tax for the area is then zero. This situation may

nonetheless be deeply inefficient as the major arterial road may be hyper-congested. This situation would then call for the taxation of specific roads instead of the usual "cordon" pricing of an entire area, as encountered in London, Singapore, or Stockholm.

Third, congestion is often thought of in static terms, and the main loss is time lost in traffic. Taking a more dynamic view, is known that the demand for traffic varies a lot throughout the day. A key margin of adjustment to costly travel is rescheduling. In dynamic models of congestion, travelers face a key trade-off between arriving on time but facing a high cost of travel; and arriving at a less preferred time but enjoying a lower cost of travel. In the benchmark dynamic model of congestion developed by Arnott et al. (1993), this cost of scheduling delays represents half the total cost of congestion. This particular 50–50 split depends on the details of the assumptions made in this model, but there is little doubt that scheduling costs represent a large unobserved fraction of congestion costs. Although traffic jams are extremely salient, scheduling delays are often forgotten.

Rerouting and scheduling delays are useful to keep in mind when interpreting the phenomenon of induced traffic. It is often observed that roadway expansions quickly "fill up," and traffic conditions revert to their initial situation at peak hour. This is often interpreted as if these expansions were of no social value. This neglects the fact that the extra traffic generated substitutes for traffic on slower alternative routes or may allow travelers to travel closer to their preferred time.

Urban Transport Improvements, Economic Centers, and Land Use Changes

Although much of the discussion about the externalities of urban transport focuses on the negative, there are also positive externalities associated with better access. First, a reasonable first-order conceptualization of emerging cities is to view them as labor markets for their residents. A transport improvement in a city such as the development of a bus rapid transit system will change how residents can access jobs. In turn, this will likely change how employers and employees match. Employees may gain some bargaining power because of more job opportunities. Firms may be able to find better matches from a larger pool of workers. Transport improvements can also ease other daily errands such as going shopping. These positive externalities associated with transport improvements are arguably more important in developing countries, where the inability to travel more than a couple of kilometers by foot is a limiting factor for a large share of urban residents.

Capturing these effects can be thought about in two stages. The first is that, even if land use remains unchanged (so no new investment in jobs or housing changing the shape of the city), a transport improvement makes places closer together, in economic terms, so increases the effective size or density of a cluster of activity.

Holding land use unchanged is a simplifying assumption, particularly since land use change and transport improvements are often combined in a joint policy package. Although the main short-run effect of transport improvements is on the travel behavior of residents, in the long run

improvements will also affect the location choices of residents and firms. These changes will, of course, affect how urban transport improvements should be valued. In conjunction with this, changes in property prices are often used as a metric to evaluate urban transport improvements.

To remain concrete, consider a new bus rapid transit (BRT) line that links the center of a city to its remote periphery, such as the new BRT under construction in Beirut, Lebanon. In the short run, this project will lead to an increase in the surplus of residents through cheaper and more travel (assuming that it will indeed lower the cost of travel per unit of distance in Beirut). This project also aims to lessen the dependence on cars of local residents and rebalance travel between transport modes, and it is expected to generate a decline in the cost of congestion for the city.

Even without any land-use change, residents may re-sort within the city. More specifically, residents who depend more on public transport may choose to relocate close to the new BRT station. This re-sorting of residents leads to serious complications when assessing the value of the BRT project. Re-sorting may imply that any increase in transit trips observed with the new BRT may be just a substitution for transit trips that were taken elsewhere before, rather than residents switching from car to transit and relieving congestion. This does not imply that the project is not socially worthwhile. Residents who now have easy access to the new BRT may have previously used other forms of transit that were further from their residence, slower, and less frequent. This is a clear benefit to them, but it is not the same as a social benefit from reduced congestion.

In addition, this BRT project may lead to changes in land use, with, for instance, higher residential densities close to the new stations near the center and new residential developments toward the end of the line. Easy access to transit for an increased number of residents is of obvious value to these residents. For residents who relocate to new residential developments at the periphery, the calculation is more complicated. Their total transport cost may actually increase. These residents in newly developed peripheral areas may be willing to incur higher transport costs through longer distances because it allows them to consume more housing at a lower cost. Although these are private gains for these residents, the calculation of these gains is extremely challenging.

A new transit line may not only affect the residential “origins” of trips; it may also change the destination of trips, workplace or other. For instance, with better transport, some firms may decentralize and relocate to the periphery of the city. Retail may also relocate from the center of the city toward the periphery. This can potentially increase travel distances to access work or retail. In extreme cases, accessibility can even be reduced when the increase in distance more than offsets the reduction in travel cost per unit of distance. When measuring the value of projects, accessibility and not mobility is the relevant welfare measure, as argued above.

Because these changes in location and travel behavior are extremely hard to measure and value, a metric that would capture all these changes at once and could be used as a sufficient statistic to measure welfare changes is alluring. The change in aggregate land values is the obvious candidate here. As already mentioned, a lot of caution needs to be exerted when attempting to measure welfare through land values. A first limitation arises from imperfect mobility. For instance, the

social worth of a transport improvement in an area will not be fully reflected in land values if potential newcomers face some frictions to move into the area. To take an extreme example, if a city is closed to new residents, a transport improvement will typically lead to lower land values as the accessibility premium from more central locations declines. Alternately, local residents may restrict access to newcomers through restrictions on land use and new developments. Aggregate land value will then reflect their "monopoly power." As transport improvements affect the behavior of incumbent residents and may lead to them to impose more stringent restrictions, the change in land values will not in general reflect the social worth of the improvement.

The second limitation arises from residential heterogeneity. To take a simple example, the potential resident who values a transport improvement the most only needs to pay a little bit more than the potential resident with the second highest valuation to be able to buy the house that benefits from better access. The increase in land value thus fails to reflect the full social value of the transport improvement. The third limitation is that there might be changes in lot size or housing consumption per capita. The change in the welfare of residents should be measured by both the changes in prices of housing or land and their change in the quantity consumed. Finally, general equilibrium effects must be kept in mind. A BRT project in a secondary city in China is unlikely to change welfare in other Chinese cities. A BRT project in Beirut, the dominant city in Lebanon, will affect other Lebanese cities. Increases in land values in Beirut may be partly offset by declines in other cities. This "growth versus displacement" problem plagues the evaluation of all transport improvements.

Housing and Other Urban Infrastructure

Housing policy in developing countries often follows similar goals as in more developed economies and seeks to improve housing quality, increase the ability of residents to consume housing, and facilitate housing transaction to own or rent housing. The challenges are, of course, immensely more difficult in poor countries, where housing informality is the default choice of a large fraction of the population, where housing finance mechanisms are often primitive if not absent; and property rights are often disputed, badly registered, and poorly protected. Remember, too, that a house is not only a roof but should be considered more broadly together with a number of complementarity services and utilities such as water, sewers, and power as well as access to jobs, goods, and schools.

Quantity Effects: Fostering Supply and Demand Versus Enabling Markets

A key complication with housing policy is the vast array of instruments available to policy makers. More "fundamental" institutional policies seek to enable the housing market to work. More direct policies either provide housing on the supply side or allow residents to consume more housing through subsidies on the demand side. In between, and at an intermediate level, the provision of key infrastructure and utilities or appropriate urban planning will hopefully raise the quality of the housing being supplied.

While a huge housing shortfall cannot disappear overnight, housing stocks should be able to adjust reasonably fast to demographics and income changes, provided property markets are allowed to function. In principle, the residential construction industry should face minimal barriers to entry and be competitive while employment in the sector could potentially grow fast. Given this, the provision of a working institutional framework that allows the expression of supply and demand mechanisms to play their role seems like an attractive proposition.

Institutional reform for land and housing market is unfortunately harder than it may seem at first sight. Many complementary factors need to be in place at the same time. First, property rights need to be well defined. They are sometimes absent.[10] In some parts of the world, property rights often collide with other rights, such as those given to tenants. For land and housing markets to work, property rights also need to be tradable. This arguably requires a reasonably uniform system of rights. This condition is clearly not met in many countries where land rights are administered by customary chiefs, sometimes in a whimsical manner; many systems of right coexist uneasily; and the trade of property assets is heavily restricted within a group (Durand-Lasserve et al., 2015). In addition, land parcels need to be clearly delineated and registered through a system of cadastre and land registry. Such a system can only operate if titles are not contested and the registry is kept up to date. Although this latter condition sounds trivial, keeping land registries up to date is a struggle in most developing countries, including some of the more advanced ones. Finally, even when all those conditions are met, the land market will not work unless titles can be enforced and secured by a fair and timely judiciary system (Glaeser et al., 2016). With only a little exaggeration, one may conclude that well-functioning land and housing markets essentially require a high level of development.

The second key set of institutions needed for functional property and housing markets is a system of housing finance. Housing is not only an important good in household consumption; it is also part of an extremely large asset class. In the absence of a dedicated system of housing finance, very few households can easily pay for an asset that is typically worth several times their annual income. Renting is the obvious alternative tenure choice. It does not require households to make a large investment. At the same time, a property on the rental market still needs to be financed by someone, and this someone is also likely to need external finance. In addition, rental arrangements are subject to difficult agency issues with potential abuse on both sides. These agency problems impede the development of a rental market in countries with weak institutions. If anything, observation suggests that rental markets are often embryonic in poor countries despite the challenges faced in securing and funding property. For instance, the homeownership rate is above 80% in India, whereas it is 60% to 70% in most developed countries and even 50% or less in Germany or Switzerland.

Housing finance relies on several sets of conditions, with again extremely limited substitutions between them. The first is a system of titles and a workable market for land and properties, as already discussed. The second is a set of laws and regulations for mortgages. These regulations must protect banks from fraudulent borrowers by allowing them to control titles. Regulations must also protect borrowers from potential abuse by lenders and make sure their titles are returned when the mortgage is paid. With a mortgage, both parties enter a long-term relationship that requires some guarantees and predictability. The third set of conditions regards

the creation of funding flows that allow lenders to lend to a large number of borrowers. In turn, this requires either large, well-funded retail banks, a system of specialized banks like building societies associated with savings, or a large provident fund with an independent source of funds, such as a payroll tax.

While these more fundamental policies that allow property and housing markets to function and housing to be funded are eventually necessary at higher levels of development, they seem unlikely to fix housing consumption shortfalls in the short- to medium-run in poorer countries. As a result, these countries often turn to interventions that are more direct. Even with ill-functioning property markets, it is possible to develop a large quantity of new housing in a fairly short period of time, as evidenced by mass housing programs in Mexico, Brazil, or South Africa (Buckley et al., 2015). These programs seek to foster both supply and demand by mandating new large housing developments and by offering deep discounts for the newly constructed housing units. Other, less ambitious policies may act only on the demand side by offering subsidies for house buyers or borrowers, or only on the supply side by, for instance, building public housing directly or by offering fiscal incentives for housing investments.

Some of these policies have been successful at increasing housing quantities (though not at creating social value, as argued below). For instance, the My House, My Life program in Brazil was able to develop nearly 2 million new houses benefiting about 7 million Brazilians in about 5 years. Other countries, such as Angola, Ethiopia, and Thailand, have been far less successful at massive housing development. Their programs have often struggled to build more than tens of thousands of new housing units. The two key factors behind the ability of some of these programs to produce new houses on a massive scale appear to be (a) political prioritization and (b) the existence of provident funds to fund these constructions.

Quantity Effects: Upgrading Versus Retrofitting Versus Expansion

Before turning to the evaluation of new housing units, the other key quantity decision regards the type and location of new housing. At one extreme, urban expansion occurs through new housing built on “greenfield” suburban developments. At the other, there is re-building or upgrading in already developed areas, typically slums. Various forms of infilling construction can occur between these extremes.

We need to draw a strong distinction between rebuilding and upgrading. Retrofitting (or rebuilding) entails very significant changes to an area. Land in slums is typically highly fragmented with low-rise and low-quality housing covering most of an area. Retrofitting typically involves the destruction of the existing housing stock and very significant changes in land use with a drastic reduction in the share of land devoted to residential purpose to make room for more roadway, commercial development, public services, and recreational spaces. Upgrading involves instead more marginal interventions centered on current residents, including the provision of basic infrastructure and utilities or subsidies and technical help with housing improvements or expansions. Some policies also involve the legalization of hitherto illegal

settlements to give them titles (De Soto, 2000), which could be used for a variety of (entrepreneurial) purposes or, simply, access to utilities and public services (since being legal is often requirement to receive public services).

Distinct from retrofitting and upgrading, urban expansion is another option. Urban expansion is often frowned on as it involves new developments beyond the urban fringe. It is often disparagingly labelled as "urban sprawl" and accused of a wide variety of social ills. It is true that new suburban housing developments require complementary utility and infrastructure development in areas that are not currently serviced. This is a cost. This type of development is also arguably subject to severe market failures.

The inefficiencies associated with urban expansion are reminiscent of those described above about the existence of cities. Coordination failures are rife with urban expansion. Not knowing how and where expansion will take place makes developers reluctant to invest. This potentially leads to too few new developments. In addition, there are also many externalities at play. For instance, new suburban developments in emerging cities often take place without much consideration of their transport and congestion implications. In addition, these developments are often targeted at rich households willing to live at much lower density and are unlikely to factor in all the social costs of sub-optimally low density.

Despite the challenges, urban expansion is a pressing issue. Consider the typical case of cities that grow in population by 2% per year and where household are willing to increase their housing expenditure by 2% per year.[11] To prevent prices from increasing, this 4% annual increase in demand implies a doubling in the amount of developed floor-space of housing every 18 years.

Hence, despite its lack of popularity and the costs highlighted above, urban expansion will nonetheless need to be a big part of accommodating increasing demand for housing. The potential for large increases in housing supply from slum upgrading policies seems limited given extant construction technologies and materials being used.[12] Urban retrofitting may not be much more promising in this respect either. Much higher constructions in modernized areas do not always provide more floor space as the share of land devoted to housing is also much lower (Henderson et al., 2021). As we argue below, slum upgrading and urban retrofitting have some virtues but accommodating massive growth in demand is not one of them.

Besides its limited ability to provide a large increase in housing floor-space, urban retrofitting has other drawbacks. The first is its cost. While candidate neighborhoods for retrofitting offer potentially good accessibility and thus have valuable land, tearing down, redesigning, and rebuilding is arguably much more costly there than for greenfield development. The second main drawback of urban retrofitting is that it entails the relocation (at least temporarily) of large groups of residents.

While land in some areas seems so valuable that existing inhabitants could be re-accommodated locally after retrofitting without affecting the economic viability of such project, existing experiences are not always encouraging. For the emblematic case of the Dharavi slum in Mumbai, Iyer et al. (2009) showed that a viable re-development project supported by the municipal authorities got derailed as poorly defined property rights led to a much larger number of

claimants than expected for the projected new housing. This jeopardized the economics of the project as it was feasible to rehouse existing inhabitants in new developments one square meter for one, but not four or five for one. The other main cause behind the failure to redevelop Dharavi is that the proposed plan was opposed by the powerful local leather and dying industries, which, for obvious public health reasons, were scheduled to be relocated elsewhere after redevelopment. In many slums, there are also politically well-connected "slumlords" that benefit from slums though rents that they collect either directly from the housing that they control or from the services and utilities that they charge to residents.

Slum upgrading and legalization offer a third, seemingly more modest option. Providing titles is sometimes viewed as a magic wand for development giving previously asset-free residents collaterals that could allow them to start new businesses (De Soto, 2000). Recent academic studies of titling experiences have failed to provide evidence on this collateral aspect. They point instead at a more modest reality where titled households increase their investment in housing investment and in their children's education (Galiani & Schargrodsky, 2010) or their labor market participation (Field, 2007). Given these results, titling policies appear to be a useful tool that belongs to the broader family of slum upgrading policies together with improvement in water and sewers, and financial and technical support for housing expansions. An important downside of sum-upgrading policies is that they appear to slow down the "modernization" of the neighborhood where they take place (Harari & Wong, 2021).

Despite its costs, its adverse political economy, and the potential for social upheaval associated with the relocation of residents, urban retrofitting will eventually occur in most emerging cities. It occurred in all large cities of what is now the developed world. The question should thus not be whether slum redevelopment will take place, but when and how. In turn, this begs the issue of the articulation between urban expansion, retrofitting, and slum upgrading. It looks like slum upgrading is needed but is more of a stop-gap policy. Although slum upgrading is possibly of value, its negative effect on retrofitting needs to be factored in. Then, there are some potential complementarities between retrofitting and urban expansion. The choice here is not either/or. Both are arguably needed as existing urban boundaries will have to be pushed outward to accommodate demographic growth and the rise demand for housing in most emerging cities. At the same time, good locations that have been informally developed should not remain with highly adverse patterns of land use forever. As already mentioned, retrofitting is extremely challenging, in part because of extremely high human densities in slums. Urban expansion that allows some informal households to relocate in more formal and newly developed areas will put some relief on the demand for slums and, in turn, possibly ease their conversion.

Finally, we note that these policies need to rely on a variety of instruments. Some hard instruments such as the provision of complementary infrastructure and utilities without which new constructions would be unlikely to take place. There are also soft instruments, including zoning designations, expansion plans, etc. Both types are needed. Developers are unlikely to start building a new residential complex if it cannot be accessed and serviced with utilities. They are also unlikely to build if they do not know what to expect for the immediate surroundings of their parcel. We note that both soft and hard policy instruments also require some time consistency, as housing investments are extremely long lived and unmovable. More concretely, it is important to

plan for future roads. It is also important that this plan is credible as squatters may otherwise occupy this land and develop it informally. The durability of housing also implies that policies must get their timing right. If we take the example of providing utilities to newly developed areas, it is easy to understand that doing it too early is wasteful and may lead to an infrastructure being depreciated before it is fully used, whereas doing too late will imply costly retrofitting costs.

Valuing Increases in Housing Consumption

Many housing policies, especially on the demand side (like direct subsidies) come at a high cost. More fundamentally, these policies are also often questioned because housing is a standard private good whose consumption is both rival and excludable. Subsidizing housing when residents would prefer to consume other goods may entail a large deadweight loss.

We can distinguish several types of benefits for housing policies. First, we can think of the more fundamental policies about property rights as reducing frictions to exchange. For instance, when housing is informal it is extremely difficult to trade. This implies that residents may be stuck in housing that is extremely far from their workplace. Improving the functioning of housing and property markets can thus lead to better allocations. Although such benefits may not be salient, they are potentially large. The relative certainty offered by titles and the option to resell a property if needed also appear to foster the incentives of households to invest into their accommodation.

Second, households are generally financially constrained, particularly so in poorer countries. Although the literature on titling has failed to demonstrate that households are willing to use their property title as collateral in entrepreneurial ventures, there is overwhelming evidence that they are willing to do so to obtain a loan to purchase a house and increase their housing consumption.

Third, while housing is generally a private good, residents may not factor in health and schooling benefits from less crowded and higher quality housing. It is also the case that the provision of housing services does not result only from having a roof over one's head. It also results from complementary investments in utilities and access. Water, sewers, and roads are largely public goods and significant externalities are associated with them. There are potentially large public health externalities associated with the provision of water and sewers (Ashraf et al., 2021). Urban dwellers in emerging cities also value the pavement of their streets highly (Gonzalez-Navarro & Quintana-Domeque, 2016). The same high valuations probably hold true for many other urban utilities and public goods.

Transport and access seem to play a particularly important role in this respect. Simply put, housing without access is worth very little. The mass housing programs described above have been major failures in this respect. Although countries like Brazil, Mexico or South Africa have been able to expand their number of housing units very significantly, this has come at a large social loss. Housing units developed by these policies typically re-sell at a price well below their cost of constructions and some large developments have remained mostly empty (Buckley et al., 2015). The failures have been multiple, including the insistence of these policies to develop large

areas zoned exclusively for residential purpose without retail or any form of economic activity. The largest failure however has been perhaps the disregard of any notion of accessibility and especially of accessibility to jobs. With a fixed budget per unit, developers built new housing in areas where land could be bought essentially for free to save on costs. There are of course good reasons when land is essentially free and lack of access is usually prominent among them. Housing is place-based. This is unfortunately too often forgotten by housing policies.

Concluding Comments

At its core, urbanization is an urban development problem which first requires handling housing and transport infrastructure issues. Because of the public good nature of infrastructure and the market failures and externalities associated with the provision of both infrastructure and housing, implementing good policies is a challenge. Evaluating extant policies requires a careful analysis of the direct quantity changes induced by these policies, and even more careful analysis of their indirect effects. In some cases, indirect effects such the development of a neglected part of town for a transport project may even be the primary objective. Finally, all these changes need to be valued. Unfortunately, market prices in developing cities may not reflect economic value. With poorly defined property rights for instance, it is difficult to use changes in land values to assess the effects of new urban infrastructure.

Although the difficulties are daunting, serious evaluation of urban housing and transport policies should not be neglected. The investments at play are massive and near impossible to change after construction has taken place.

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Notes

1. This section borrows from Duranton and Venables (2021).

2. However, it is important to keep in mind that high land rents and land prices are not a real cost; they are a transfer payment from occupants of land to its owners, so do not use up real resources (e.g., as does time in commuting).

3. See Duranton and Puga (2015) for an extensive review of this literature.

4. Although an overwhelming majority of trips in the United States rely on privately-owned vehicles, rates of car ownership are still low in emerging cities. While transit is widely available in large European cities, it is still sparse and often informal in much of the developing world.

5. This extreme situation is referred to as Braess's paradox.

6. Transport models often provide a disaggregate modeling of an entire city divided into many small zones. This requires knowing about the demand for trips for the entire matrix of origins and destinations and the modeling of congestion effects on the supply side. Because much of that information is usually missing, it is generated from knowledge of the location of residents and jobs and from relationships such as a gravity pattern for commutes.

7. Related to this, minor traffic shocks such as small decrease in speed to make way for a vehicle that changes lane gets amplified in dense traffic as each vehicle needs to slow down as least as much as the vehicle in front of them.

8. The "cost of congestion" is often measured as the total delay relative to a free flow situation. In our graph, that would be the rectangle $C_{eq}B_{eq}\,FF$. Although seemingly intuitive, this measure is problematic in three respects. First, getting the equilibrium amount of traffic to flow at the speed that would be achieved in absence of traffic is a physically impossible counterfactual. Second, even if free-flow speed could be achieved, demand would not remain at D_{eq}. It would increase. Third, optimal mobility is not free-flow mobility as implicitly assumed when measuring total delay. Optimal mobility involves instead some congestion and the objective is to reach an optimal amount of congestion, not to eliminate it completely. Eliminating congestion completely also implies eliminating travel altogether.

9. Rather than price instruments, some cities use quantity restrictions, typically based on plate numbers. These are particularly popular in large cities in Latin America. The jury is still divided on the effects of these measures. Carrillo et al. (2016) find that it led to some reductions in travel in Quito. Davis (2008) finds no effect for Mexico City.

10. Among many examples, Kibera, the largest slum of Nairobi (see Henderson et al., 2021)

11. Using national accounts for a large cross-section of countries, Dasgupta et al. (2014) show that housing investment as a fraction of GDP per capita is S-shaped and takes off at about $3,000 before tapering off at around $36,000. Low-income countries invest about only half what upper-middle-income invest as a fraction of their GDP. Housing is often acknowledged to be a normal good but it appears to be a luxury good at low levels of development so that a 2% increase per year for housing expenditure at the household level is perhaps a conservative estimate in a poor but growing economy. Then, a 2% per year population growth is above what we have observed in the recent past in Latin America but seems very conservative for large African cities and some parts of Asia including India (UN, 2018).

12. The most primitive forms of housing are shacks for which building up is simply not an option. With less extreme poverty, houses made of brick can be raised by several floors without requiring full reconstruction.

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