LAND RENT, TRANSPORT POLICIES AND BUILDING CONSTRAINTS

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ABSTRACT

The paper adds a policy variable seldom found in the mainstream literature that focuses generally on land rent generated by transport costs: building constraints, that are by themselves generators of rent. These three variables (transport costs, land rent and building constraints) do obviously interact in very complex way. We try some radical simplification that seems to show a certain number of distributive, and related policy consequences, far from obvious: in particular a) the possible meaning of urban sprawl as an “escape from rent” (with trade-offs between rent and transport costs) and b) the role of “dispersed” (i.e. car-driven) accessibility against concentrated (i.e. public transport driven) solutions, at least in some circumstances.
The tools employed are also, at this stage of the research, quite simple (linear graphic relations), in order to state some initial finding. But this is a start-up approach, with a range of theoretical and empirical researches to follow.

Keywords: land rent, transport infrastructure, building constraints, sprawl, transport policies

INTRODUCTION

This paper discusses some relevant strategies of growth control in a hypothetical territory, articulated through the relationship between land rent, transport costs and building constraints.
The aim of the paper is to try to show, through some simplifications, the effects of the change of one factor over others and, in general, on the territory and on community.
The core parameter is land rent, that is possible to explain as income that a land owner receives from his land thanks to two conditions: first the possible scarcity of the resource “land” (assumed here as land where it is possible to build on) and, second, its accessibility (Alonso, 1964).

Scarcity is linked also to the distribution in space of building constraints, i.e. to the level of zoning of the territory (Groves, J. R. and E. Helland. 2002). According with Helsley and Strange, governments in all country adopt policies designed to influence the spatial distribution of population. Several studies[1] show the influence of a spatial restrictive control on land rent and, as consequence, on land value. Zoning is a system of land-use regulation. It is a practice of designating the permitted uses of land, based on zones which separate one set of land uses from another (Levine, J. and A. Inam and R. Werbel and G.W. Torng. 2002). One task of planners is to set clearly in which portion of territory it is possible to build. This implies a range of building constraints; these constraints make land "scarce" and, as a consequence, create differential rent, therefore building land obtains an extra-remuneration (Camagni R., 1993, p. 184).
In this setting, "zoning" has an influence on land rent. Land rent in turn is linked to the role of the public administrator, also through the location of new transport infrastructure (which improves accessibility).
The accessibility of land depends on the infrastructure level in that area (Van Wee, B. And K. Maat. 2004) and, in this paper, on the distance between each point on the territory with the central place (Central Business District CBD). The accessibility is measured by the costs of transport to connect the different points (Wingo, L. 1961).
Land rent is linked to transport infrastructure[2]: where once transport infrastructure is built, the level of rent of the building in the nearly area is raised, without any effort for the land owners.
Rent is obviously influenced by many other factors (the attractiveness of the area number and type of services and urban quality), but here we limit ourselves to accessibility and scarcity (as defined above).
The paper starts from these considerations between land rent and scarcity (i. e. building constraints) and lands rent and accessibility (i.e. transport costs) to investigate, through the help of some economical graphical, the behaviour of each factor compared to modification of the basic assumptions (reporting a real situation).
The end result will be a series of final considerations about existing and future policies.

Basic assumptions

Land rent in this paper is assumed only as the part of prices of goods and services that can be explained only by the location of the related activity, and assumed to be due only to accessibility and to building constraints (differential rent). This differential rent is initially

[1] The strong evidence is clearly visible in the Urban Growth Boundary (UGB) to effects urban development patterns in some area in USA. UGB is a legal boundary separating urbanizable land from rural land, according to contain urban sprawl, minimize public services costs and protect natural resources and open space (Song Y., Knaap G. J., 2004). It could notice that, in the entire place interested of boundaries, the cost of housing in urban areas has increased significantly. The symbolic case of Portland in Oregon has shown an increment in a lot prices more than doubled in five years, far from the forecast of public agency (they estimated an increment of only 20%) (Staley S. R. and G. C. S. Mildner, 1999).

[2] This relationship between land rent and a transport cost is clearer when a new transport infrastructure is built: it increases the mobility level of the area and so its accessibility. This aspect enhances the real estate price (accessibility is a component to establish the real estate price) that raise the level of land rent. The new rent can be transferred on to the price of house and building and, in turn, of goods and services.

related to the price of land, and in turn to housing and buildings in general, and finally to the prices of goods and services.
There is a single place (CBD) where there are economies of scale and agglomeration; all the productive activities and all the services are localized there. In the CBD there are building constraints, i.e. a fixed residential capacity. This is a rather standard assumption, and an indispensable one for the following elaborations.
Inhabitants have an income available for the sum of land rent R(d) and transport costs T(d) equal to:

$$R(d) + T(d) = I$$

where d is the distance from CBD. Both land rent and transport costs depend of time variable, and in this paper we analyze the relationship between these two factors in time.
Land rent R(d) is approximated as a decreasing linear function of distance and we analyze its behaviour with respect to transport costs T(d). For simplicity we call R(d) only R.
We assume that transport cost T(d), that we call only T for simplicity, is an increasing linear function of distance, and so:

$$T(d) = T = t \times d$$

The demand is assumed rigid (if not, surplus issues arise, as we see later).
Residences are located in the CBD up to capacity, and the rest of the population is distributed along an "indifference transport axis" where there are building constraints, up to a point Q, where land rent cannot exist, given the limit of available income I. In fact, further than Q, transport cost alone is higher than the sum of transport and rent in all the other points, and indifference is no more possible (by the way, if capacity in CBD is not saturated, rent will decrease attracting more people from the transport axis, up to cost equilibrium, see point 4). This, in the very first scheme.
Inhabitants are assumed as fixed (N), and choose their localization minimizing the sum of transport costs T and land rent costs R. This assumption is later relaxed in one example.
Initial distribution of residence is indifferent, due to the assumed identity of total costs in CBD and along the transport axis (equilibrium exists only if total costs are equal; given transport costs, rent is a strictly derived cost).
An improvement of the transport system obviously leads to a decrease of transport cost (we assume that its main content is time cost, but it can actually have any dimension).

CASES

In a theoretical territory with a single CBD (where are located economies of scale and agglomeration) and a suburb Q, the different combination of the level of transport costs and of the relevant building constraints can generate a set of different situations. For each of these situations we will show the results in term of the benefits for the commuters and for social surplus in general (losses or gains).
It is possible to identify four significant cases, besides the base case. The choice of the cases is intended to provide sufficient variations to give hints for some critical policy aspects.

Table 1. Composition of different cases

	CBD	**Q**	**t**
Base	constraints	constraints	constant
Case 1	constraints	constraints	decrease
Case 2	constraints	no constraints	decrease
Case 3	no constraints	not existing	not existing
Case 4 (growing population)	constraints	constraints	decrease

The first three cases are static because population is assumed fixed in time. The last case foresees an increment of population, and a consequent expansion of the city.

Base case

As stated above, in the CBD there are building constraints, (and zero transport costs, or anyway negligible if compared to commuting cost).
Along the axis and (up to Q and beyond) there are building constraints.
Unit transport costs from CBD to Q is constant, equal to $t \times d$. At Q:

$$t \times d = T(d) = T = I.$$

In the base instance there is an equilibrium between land rent R, transport costs T and income

$$R + T = I$$

Q is a point where land rent can only be R = 0, since T = I. Its distance from the CBD will determine the level of rent in CBD (no one will locate farther than Q because total costs will rise, since $t \times d$ will become higher than I).
If building constraints are abolished in any point different from Q on the transport axis, rent there will become zero by definition, and the total cost will be lower than anywhere else up to Q. This is not an equilibrium situation, and therefore cannot be a stable one.

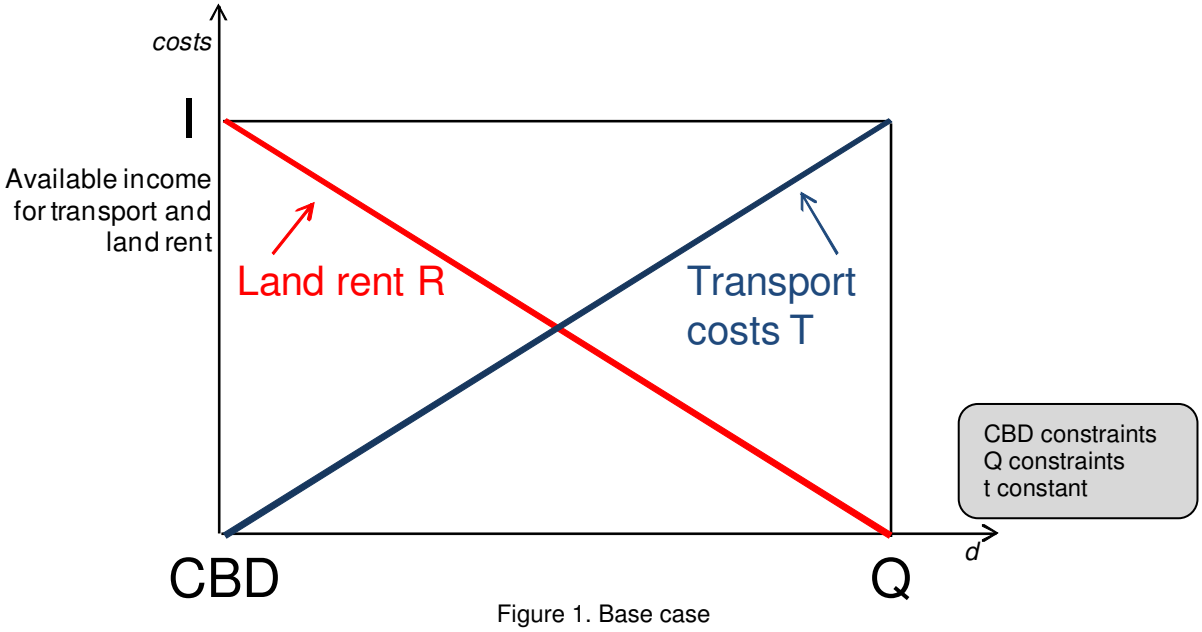

Figure 1. Base case

Case 1-a

Short period

We assume the same assumptions of the base case, concerning the building constraint in the CBD and along the transport axis.
But in this case the perceived transport costs t×d decreases (due for example to new transport investment or a variation of tariffs, etc.).
In the short period, this implies a reduction of total expenditure in Q (R + t×d < I), and in general also along the transport axis the total cost will be lower than in the CBD.
Neither this can be a situation of equilibrium, because the total level of I is different among CBD and Q.

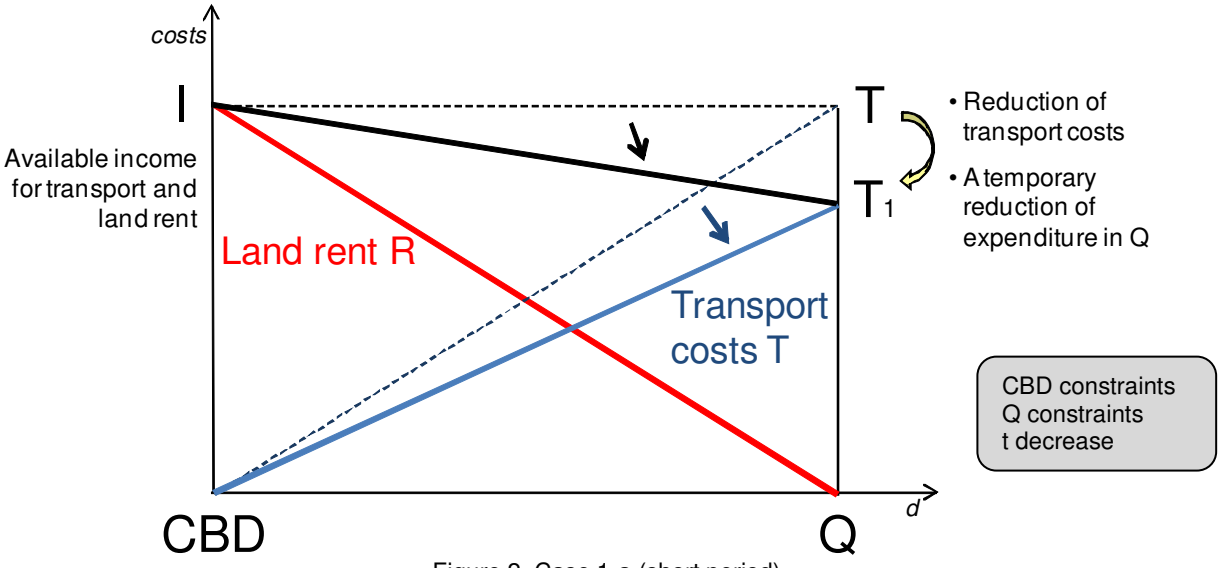

Figure 2. Case 1-a (short period)

Long period

In the long run, rent will reset itself up to restore equilibrium. With building constraints in Q, the temporary benefit of transport costs reduction is captured by land rent. The level of total expenditure of commuters does not change. If they decide to locate further away from Q, the total residential demand (density) in the CBD and on the transport axis will decrease, lowering in proportion the rent level, and therefore re-incentivating commuters to locate at a lower distance from the CBD, if N remains constant.

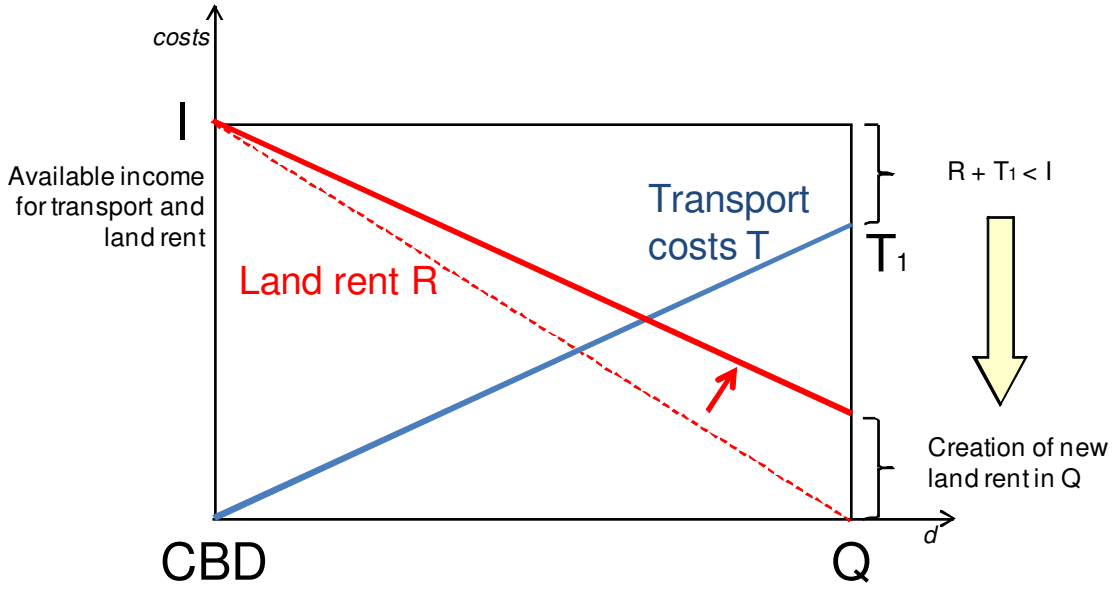

Figure 3. Case 1-b (long period)

From a distributive point of view, the situation of the commuters does not change. All the new benefits generated by the reduction in transport cost, are captured from new land rent in Q. In this way all the benefits generated by an improvement in the transport system (which reduces travel costs) go to the landowners and not to commuters (who were the direct subjects of improvement).

Case 2-a

Short period

Let's assume now that there are building constraints along the transport axis, but they are removed in Q. Also in this case, transport unit costs are assumed to decrease linearly.
In a short period, this reduction of transport costs entails a temporary reduction of total expenditure in along the transport axis.
This can't be a situation of equilibrium, but the results will be different than in the previous case.

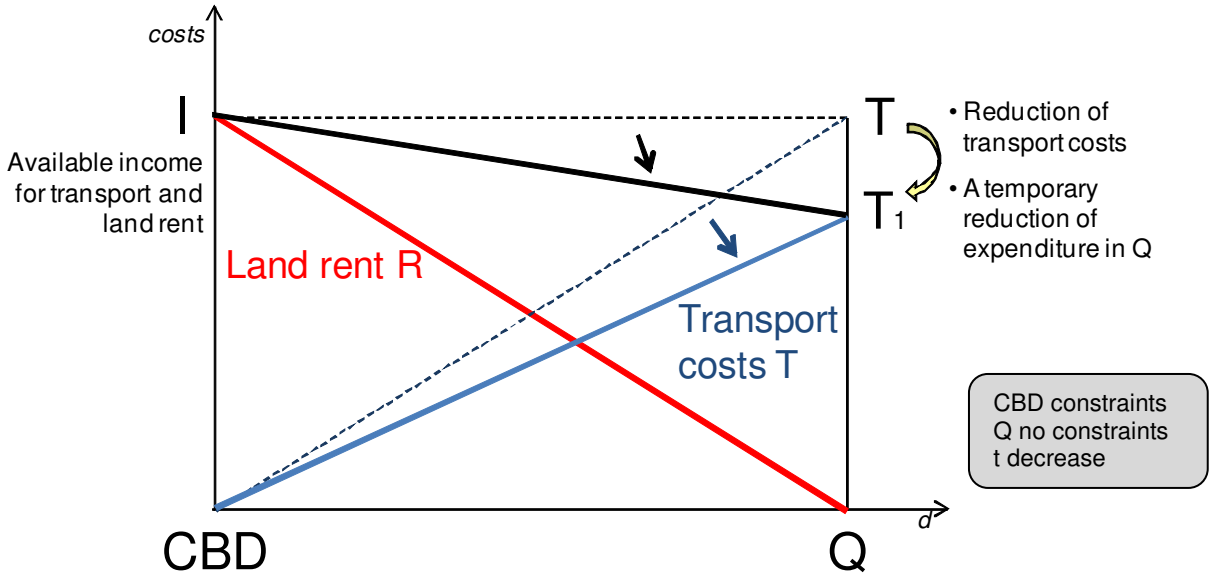

Figure 4. Case 2-a (short period)

Long period

Actually, without building constraints in Q, some inhabitants along the transport axis and in the CBD will transfer in Q, thanks to lower transport costs. According to the initial assumption of constant population, if some individuals move from the CBD to Q, there will be a reduction of demand in the CBD. In due, time the lower demand in the CBD will generate a reduction of land rent (without considering the waiting times).
The distribution of people will go on until a new equilibrium is reached. Eventually, land rent will be lowered everywhere along the axis and up to the CBD.

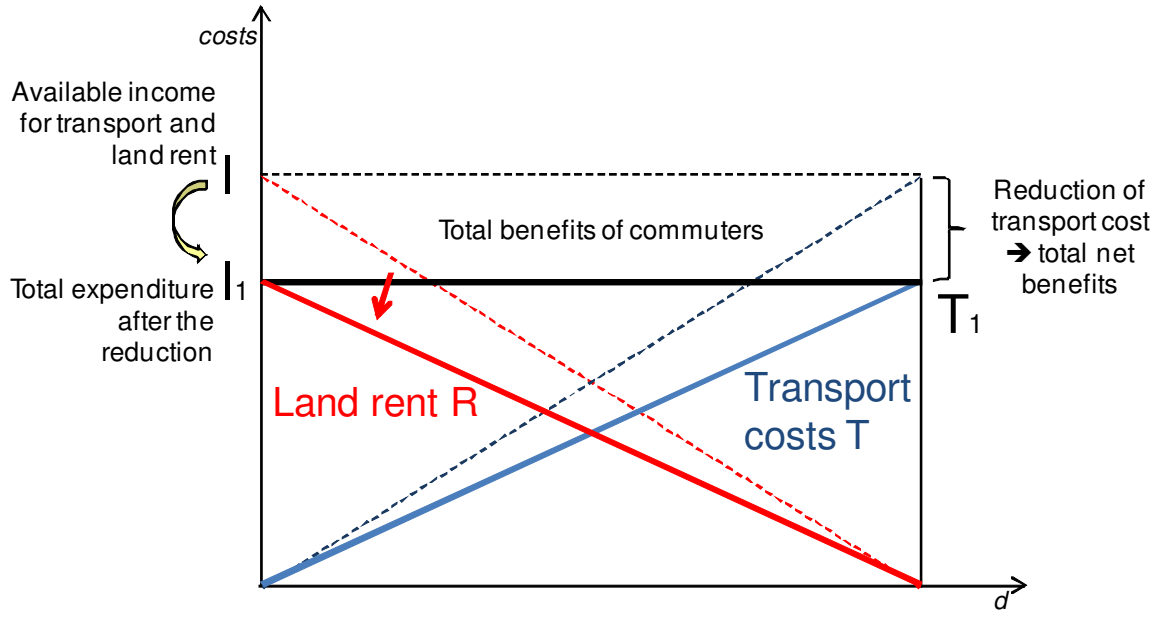

Figure 5. Case 2-b (long period)

All the commuters will benefit, because their total expenditures are reduced (part of this benefit comes from the reduction of transport costs and part from a reduction in land rent). In the CBD, the level of land rent is reduced, and in Q the transport cost needed to commute is reduced as well.
In this case there will be a displacement of inhabitants from CBD to Q, causing new housing demand (Bruegmann, R. 2007) and, as consequence, new land consumption for housing development, rising the sprawl phenomenon. According with several studies[3], we are aware that land consumption should not remain totally uncontrolled. We only demonstrate that there are social benefits resulting from the reduction of building constraints in Q.

Case 3 (trivial)

Just in order to clarify the tenets of the analysis and with the usual simplifications, let's assume that in the CBD there are no longer building constraints. In this extreme case, no one is interested in living outside the CBD: rent there has disappeared, while for any point external to the CBD there is a transport cost.
The entire city will collapse in the CBD, in a form that it is possible to call "an oversize skyscraper".

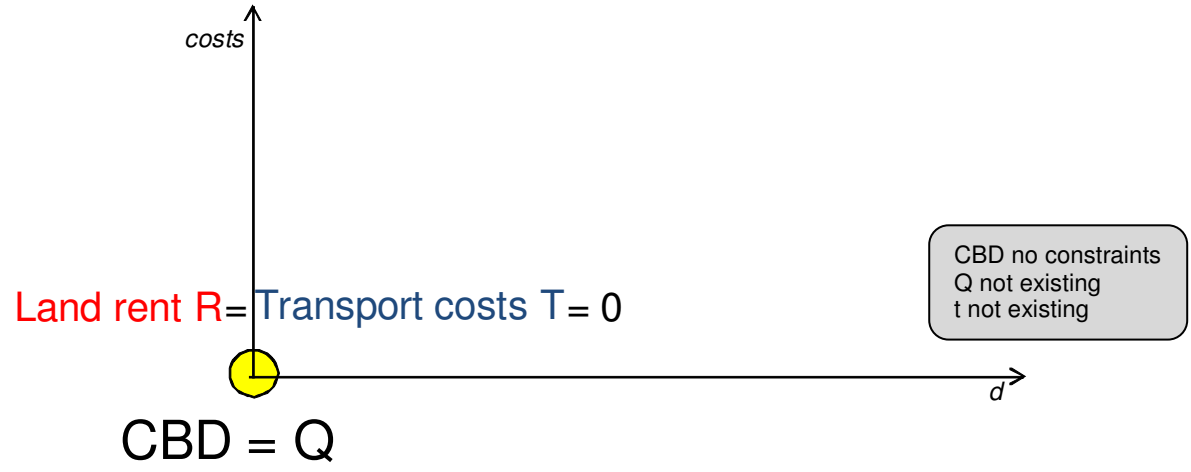

Figure 6. Case 3 (trivial)

This is a totally unrealistic assumption, but if it we consider a city of limited dimensions (N not too large), and a very high allowed density allowed (i.e. no building constraints), this scheme will at the same time eliminate both land rent (i.e. the scarcity price of housing), and any relevant transport cost (and the possible related externalities).

Case 4 (growing population)

In this case, we assume, as in the case 1 seen before, that building constraints both in the CBD and along the transport axis will remain in place, transport cost will decrease (due to

[3] European Commission. (2005).; Geerlings, H. and D. Stead (2003).; Mayer, C. J. and C. T. Somerville (2000).; Webber, C. and G. Athey (2007).

investments etc.), but the population N is no longer fixed (while the relevant available income I remains constant).

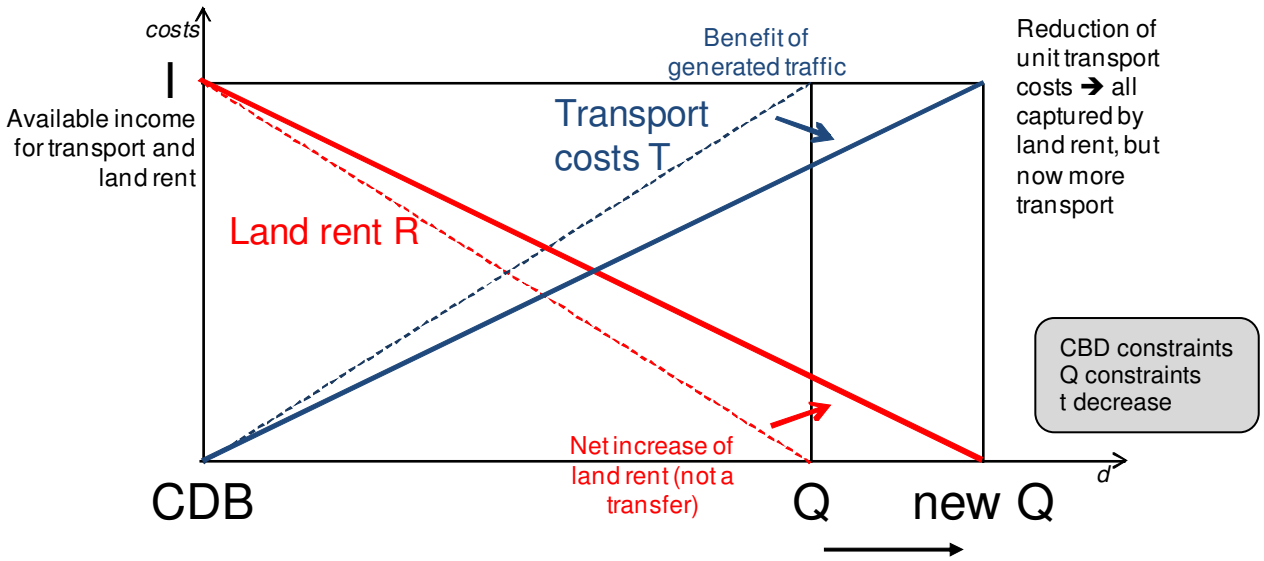

Figure 7. Case 4 (growing population)

This is a simplification of a dynamic situation, in which there is growing population, since the reduction in transport cost makes possible to have further residential locations along the transport axis, that are in equilibrium.
The new population will reach equilibrium in a "new Q" (since any increase in demand elsewhere will increase land rent, and therefore raise the total costs above I). This allows the formation of new land rent, which is not a transfer but a net increase.
In the former Q the amount of transport cost will decrease against a rising of land rent.

SOME POLICY CONCLUSIONS

At this level of approximation, it is possible formulate some conclusions.
First of all, when building constraints are lowered in the CBD, there are positive impacts on income distribution, but also on transport costs (and on the environmental ones). In fact, more people will dwell in the CBD. From the territorial point of view, the effects of a location near the city centre leading to a dense urban development. According with recent European guidelines and key recommendations of urban growth, the achievement of the compact city is also desirable to reduce land consumption. If demand is elastic, there are also efficiency gains, as by definition there are economic benefits stemming from any reduction of constraints.
Second, the realistic contexts to take into account are obviously someway intermediate ones between the cases one and three. In particular, within a standard urban "circular" scheme, it is indeed likely that building constraints tend to be relaxed in more external and less dense areas.
There are no doubts that policy recommendations have to favour the case n. 2, *coeteris paribus*. As seen, eliminating building constraints as close as possible to the CBD will

generate net benefits (in terms of transport cost reduction, "captured" in this case by the commuters), and distributive benefits from the reduction of land rent.
It may be assumed that these benefits could be a pure transfer from land owners to commuters (who travel daily between Q and CBD), since they will gain by a reduced transport cost with a progressive content in terms of income distribution. This assumption is possible because these two social groups are assumed as non-coincident and, on average, land owners have higher incomes than commuters[4].

The paper has shown that removing building constraints in Q involves social benefits in general because of decreasing in the level of expenditure (for the same of rent and transport cost) and in particular for commuters thanks to lower transport costs.
Some consideration on the removal of building constraints has to be made. Urban planning was born in order to regulate land use and land consumption.
We are aware of the importance of protecting the territory, and that some places must to be excluded from development. The sprawl phenomenon is actually growing, and can become a problem particularly if the land consumed is irreplaceable.
With this paper we are trying to show the negative effects of "over-planning" on social welfare. Over-planning, while reducing land consumption, creates more benefits for landowners, potentially worsening income distribution.
Increasing the value of houses in the CBD that follows is the main course of the gradual relocation of the population to outlying areas where houses are less expensive, i.e. spatial dispersion is the result of a trade-off between rent and transport costs.
Taking into consideration this factor may guide future urban policies and perhaps could lead to some revisions of those in place.

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[4] If house property by the commuters is widespread, the distributive impact of this transfer is someway more blurry, but it remains progressive for new buildings (for the intergenerational issue that young people are less able to buy a new home) and for the CBD (the owners of building areas or of activities localized here, very likely belong to social groups much better off than the average commuter, even if he/she is a house owner).

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