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Language and political power in the setting of a regional economic model: Application to Brussels

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Language and political power in the setting of a regional economic model: application to Brussels

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ABSTRACT

The city of Brussels has a unique position in Europe. It is not only the capital city of the European Union, it is also the capital of federal state of Belgium, of its two different language communities and of the government of the Brussels region. Independent of this, the city itself is composed of 19 communes with a (by comparison in Europe) large degree of independence from the central authority (Witte, 2003). The intertwining of different public institutions and the sheer complexity of those institutions make it difficult to identify the impact of policies performed in Brussels as well as the competences of the public actors.

The present paper treats a city, much like the city of Brussels, and its border region as an urban employment center, shared by two language groups. Both groups commute to the city center and share a space in the urban labor market. We treat the locational preference of households in and around this city, taking into account the preference of each language group for public facilities in their native language. We first derive a first-best optimum for the whole city and derive the locational equilibrium of both groups. Then we consider restrictions to the availability of public facilities for each group, dependent on political restrictions or local regional preferences.

In a last section, we consider the impact of transport infrastructure, a numeric overweight of one group and elaborate more on possible impacts of migration and agglomeration effects within the city. Innovative elements in the model are the treatment of the language groups and its implementation in the urban model. The paper treats how this can be introduced in an applied model for Brussels and gives directions for future work.

1 Introduction

The city of Brussels has a unique position in Europe. It is not only the capital city of the European Union, it is also the capital of federal state of Belgium, of the two different language communities and of the government of the Brussels region. Independent of this, the city itself is composed of 19 communes with a (by comparison in Europe) large degree of independence from the central authority (Witte, 2003). As a center for public administration and the headquarters of many national companies, the city relies heavily on commuting from the surrounding regions. One particular noteworthy aspect of the locational pattern in Brussels is that the minority French-speaking language group holds the majority in the central business district (80% of population), while the majority Dutch speaking language groups in many cases hold the majority in the regions bordering the central business district and hold a majority in the country (60%). The case is further complicated, as a large part of the French-speaking group (50%) is constituted out of immigrants from a varied number of nationalities, using (mainly) French as a lingua franca in the city center. A new dynamic is the increasing number of highly educated English speaking immigrants linked to the European establishment, which (in some regions) is replacing French as the main publicly used language.

The case of different language groups in Brussels has been a question of social and political debate and is a major source of conflict in the border regions of Brussels (Maskens A, 2008). Janssens R. (2008) notes that bilingual media is virtually non-existent in Brussels. While Dutch speaking inhabitants in the city center consult the dominantly French language media, the opposite cannot be said from the non-Dutch speakers. In contrast, Dutch speaking media does report on Brussels in a negative way, focusing on the city's high unemployment and low provision of public goods. This can contribute to a negative perception of Dutch speakers outside of the city center.

Few researchers have looked at Brussels starting from a theoretical framework, incorporating elements of urban economics, agglomeration theory and job accessibility. Thisse et al (2010) make an overview of the situation of Brussels and note that the structure of the city is not that different from many U.S cities. This relates to the predominantly poor unemployed households in the city center and high income commuters in the periphery. One possible reason is the comparatively low level of public amenities in the city center (Brueckner, Thisse and Zenou , 1999). However, a difference in amenities should not necessarily be the only reason for this type of urban configuration.

In the case of Brussels, the difference in language patterns can provide an alternative explanation, as language groups (similar to 'ethnic' group) have a preference for co-location. Even when this preference is relatively mild, this can lead to strikingly different spatial patterns (Loury, 2000). This problem may be aggravated by the noted asymmetries in information and access to media, twisting the perceptions of each group. The presence of a large French-speaking group of migrants, but with a different ethnic background may further distort the locational preferences. The artificial nature of the border of the Brussels Region, with important French speaking minorities in the Flemish border region, with limited access to public services in their own language adds to the complexity of the locational preferences.

Another possible explanation for this pattern relates to spatial matching in the city (Glaeser E., 2008, Brueckner J. (2002), Zenou (2003), Zenou (2005)). Zenou Y and Selod H. (2006) treat a problem where the structure of the city is dependent on the employment outcomes of whites and blacks. In this

model the location of whites and blacks depends on the willingness of non-conformist blacks to locate closer to whites and share job information. Zenou (2007) relates search intensity and job matching to the type of transport mode used by each ethnic group.

2 Model description

2.1 The model

2.1.1 The city and the native regions

In this model we consider Brussels as a central business district (CBD), in the sense of the classic urban economic theory (Brueckner 1987) and apply it to a case where 2 groups distinguished by cultural background and native language, share jobs in the business center and make decisions on locating within the city. We use a linear space, the metropolitan area extends from -1 to 1 . The regions to the left and right of the border are considered as native regions of each population group. Each of the native regions has its own business center, which is indicated as a suburban business district (SBD). The business centers in each native region form an alternative source of income for their residents. The whole population needs to locate along the axis, which goes from -1 to 1 . The population can work in any of the three business districts, where they get a fixed wage, depending on the particular business center they work in.

The wage income in the center is w_c and the wage income in each of the suburban districts is w_s and w_f . The disposable income y of each household group varies according to the distance to an employment center due to commuting costs. We assume that there is no surplus commuting and people can relocate without any moving costs. This means that along the axis we will first encounter commuters to the first SBD, then to the CBD and then again to the second SBD. The determinant for a commuter will be the disposable income, which needs to be the same for an SBD commuter and a CBD commuter on the commuting border (x or $-x$) or

This means that it will be determined by the following equations:

$$(1)$$

In principle the border between the two types of commuters is flexible and is determined by the relative difference between the wages in the CBD and SBD and the travel costs within the regions. However, given that we assume that wages and transport costs are fixed exogenously, w_c or w_s will be fixed as well. The administrative borders of the regions are determined outside of the model. These are indicated as x_1 and x_2 and relate to the native regions of V and F type of households. When locating outside of the native region, one incurs a certain disutility, which we will call cultural distance decay. These are indexed as d_1 and d_2 .

Household income is spent on consumption of housing (h) and the consumption of a numeraire good (c). Only the price of housing will change along the axis. We define a utility function $U(h, c)$, where U is defined as an amenities index. This is similar to Brueckner et al (1999).

To have a meaningful result we need that the first derivatives of the utility function are strictly positive and second derivatives are strictly negative

We assume that the household maximizes utility, subject to:

$$(2)$$

The cultural amenity index consists of 2 elements. The first element is the cultural distance decay. It is assumed that households derive some utility from being close to the border of their ethnic region. This could be argued as a preference to be close to social networks in the native regions or possibly to the presence of a specific native culture different from the metropolitan region which loses its influence with increasing distance. The second part is an index of amenities that only one of each household type gives about (for example services in the own language), but can only be consumed in the specific location. In what follows below, we will focus on the first type of amenities and return to the second type of amenities later.

$$(3)$$

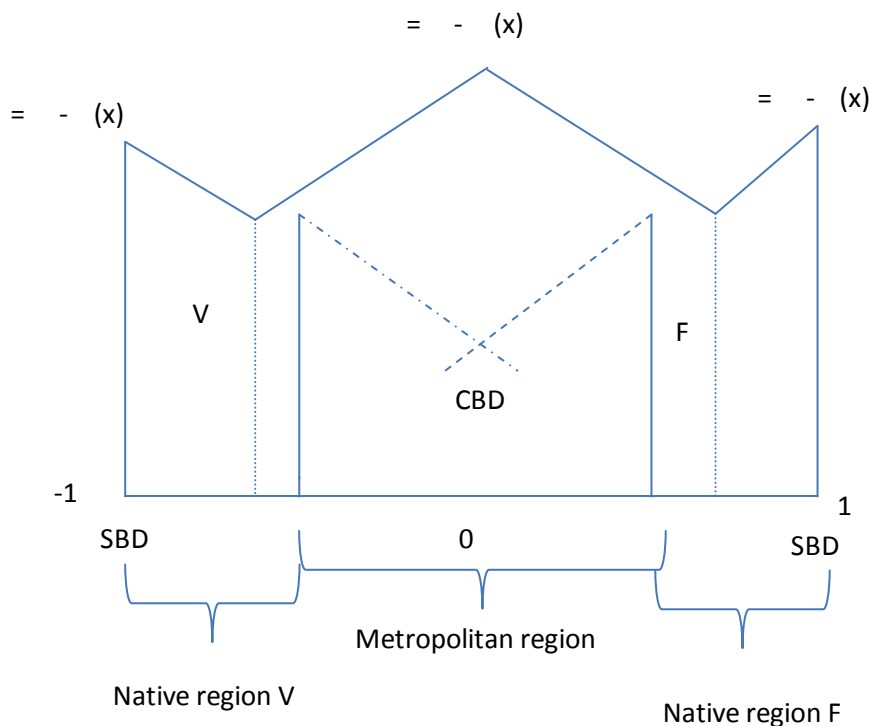


Figure 1: Schematic drawing of the city and outside regions V and F

Using the concept of spatial equilibrium, we know that that the utility of each household type should be equal in each location. This means that there should be a trade-off between the price of housing and the location, with respect to the commuting costs. Deriving the spatial equilibrium, assuming that each household type will achieve the same utility, regardless of location, we have that the derivative of the rent (p) for each of the two types of households, should be equal to (household indices are dropped).

— — — —

This means that the bid price offered by each household reveals its disposable income after subtracting commuting costs and its preference for that location. Deriving the difference in slope between the bid rent curves of both households we have that:

$$\frac{\partial R_V}{\partial x} - \frac{\partial R_F}{\partial x} = \frac{1}{\alpha} \left(\frac{\partial U_V}{\partial x} - \frac{\partial U_F}{\partial x} \right) - \frac{1}{\beta} \left(\frac{\partial U_V}{\partial x} - \frac{\partial U_F}{\partial x} \right)$$

We know that the preference for location Z goes down for type V along the axis and rises for type F. This means that at some point, F-will outbid V and vice versa.

To see this more clearly we can express the bid rents of each household in terms of disposable income, locational preference and utility or $R = \frac{1}{\alpha} (Y - \tau x) + U$. Let us consider the location where the two bid rents are equal, which we will call the (de facto¹) language border or x^* .

$$R_V(x^*) = R_F(x^*) \quad (7)$$

We will now have a look at a second condition, related to the population within the whole city. Suppose that the land supply $L(x)$ at each point of the axis is equal to one, this means that the population of each type that can reside in the whole region is equal to:

$$L(x) = 1$$

However, we know from 5), 6) and 7) that the household groups will not locate along the whole axis, as they will not be able to outbid the opposing group. In the model, the preference for location will limit each household group in its purchase of housing. If we indicate the language border as x^* we have that

$$L(x) = 1$$

Equations 7) and 9) will be the main determinants to solve the model with two household groups.

Let's start from a perfectly symmetric equilibrium. In this case we assume that the population of each region is equal, the household preferences are equal and there are no differences in transport costs or wages at the two SBD's and the border of each region is equidistant. The solution is then simple and equally symmetric. Given that that the disposable incomes and preference for housing is equal for both household types, differences in bid rent curves will be the only element to reflect a difference in locational preference between the households. As the population of each household group is equal, we can derive from 7) and 9) that the residual utility of each group is equal and x^* is located at the CBD (0).

¹ The official language border in Belgium was fixed by law in 1963, the de facto language border concerns the real location of each household group, independent of the official border. There is plenty of empirical evidence that household locations and 'street' language are not entirely in line with the official language border.

Left from the CBD $>$, thus V type will outbid the F type, to the right of the CBD the opposite happens. There will be no mixing between the 2 language groups, as each group outbids the other group depending on its locational preferences. In this set-up, the locational preference will be the only force that matters for the location of language groups within the city. The results from this model will not diverge substantially from the standard urban model, except that the housing price in the city center and its border will be lower than in the standard model, due to the negative effect of cultural distance on the preference of location. The housing price in the native regions will be higher.

2.1.2 Cultural dominance

Suppose that one culture has a stronger influence than the other. The best way to represent this in our model is to consider that τ decays at a different rate than τ' when moving away from the border of each respective region. Suppose that τ decreases at lower rate, then the bid rent of household of the V-type will go up, such that they can outbid a share of the people F currently living within the metropolitan region. Alternatively we could assume that the border of the V region is moves closer to the center than the border of F. The result is that the metropolitan region will become less attractive for people of type F. This is illustrated in Figure 2.

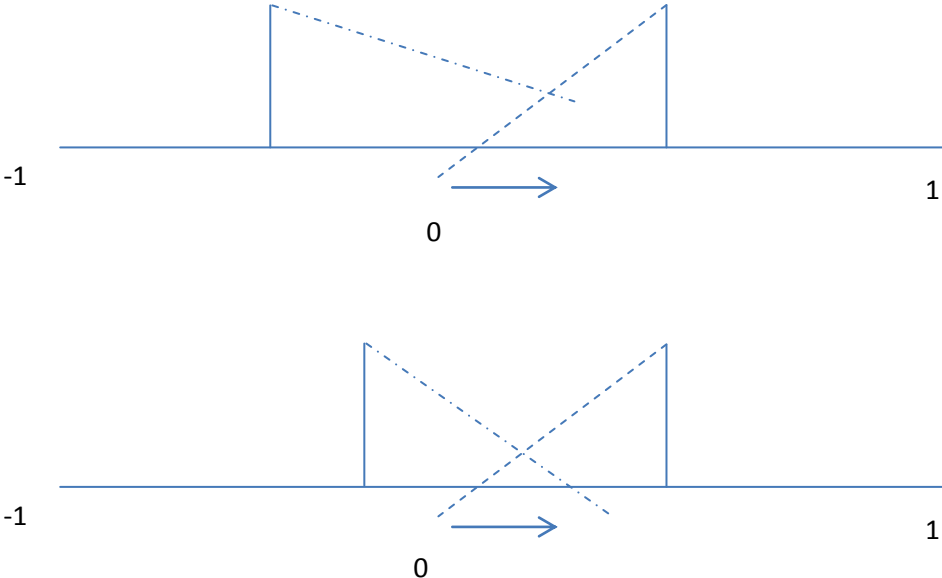


Figure 2: Illustration of a change in cultural distance decay or moving the border of region V

To derive an analytical result, we first simplify Figure 1, which has both SBD and CBD and increasing and decreasing disposable incomes due to travel costs. We will assume that the disposable income in both native regions is the same and is independent of the distance, up to the administrative border of the native region. Within the native region there is no commuting, within the metropolitan region there are only commuters to the CBD. This means that $\tau = \tau'$. There are only 2 types of employees:

1. Employees of either household type living and working in the native region
2. Employees of either household type living in the metropolitan region and working in the CBD

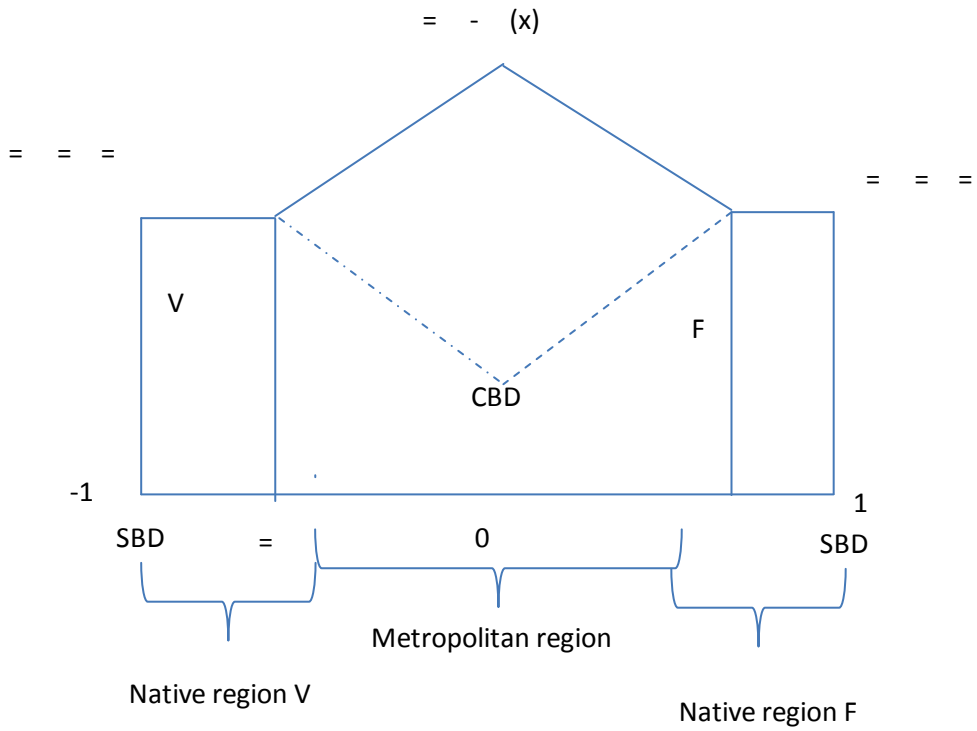


Figure 3: Simplified case of figure 1 with constant income in native regions and commuting limited to metropolitan region

We will now use a specific utility function to show the possible solutions of this model.

$$(10)$$

We chose this utility function, as it results in bid prices with an exponential component, which are relatively easy to integrate. The general solution for the bid rent, derived from utility maximization and spatial equilibrium is equal to:

$$b = \frac{w}{\alpha} - \beta x$$

Using 8) and 9) and our simplified set-up of the model, using linear transportation costs and using that $\beta > 0$ and $\alpha > 0$ with $\beta < \alpha$ and normalizing transport costs as $\beta = \alpha$

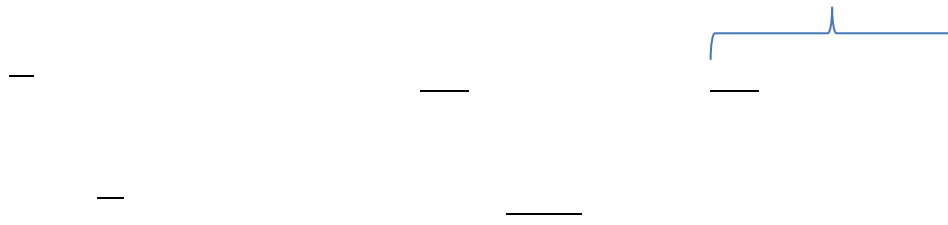
We derive that the population of type V must be equal to:

$$P_V = \frac{w}{\alpha} - \beta x$$

Population native region
Population of type v in city

Or with $\beta > 0$ and $\alpha > 0$

Population living right to CBD



We can derive the location of the language border directly from condition 7):



From 15) we see that there is a clear linear relationship between the utility differences, the cultural distance decay and the language border. The language border moves towards the group with the lowest cultural distance decay and the highest utility. It is important to remark that 15) is a result at the envelope of the optimization problem. Such that it is only correct when both and are optimal.

We can use Figure 4 to gain understanding in the mechanisms of the model. Let us suppose that we start from a symmetric city, which experiences a shock in cultural distance decay of group V.

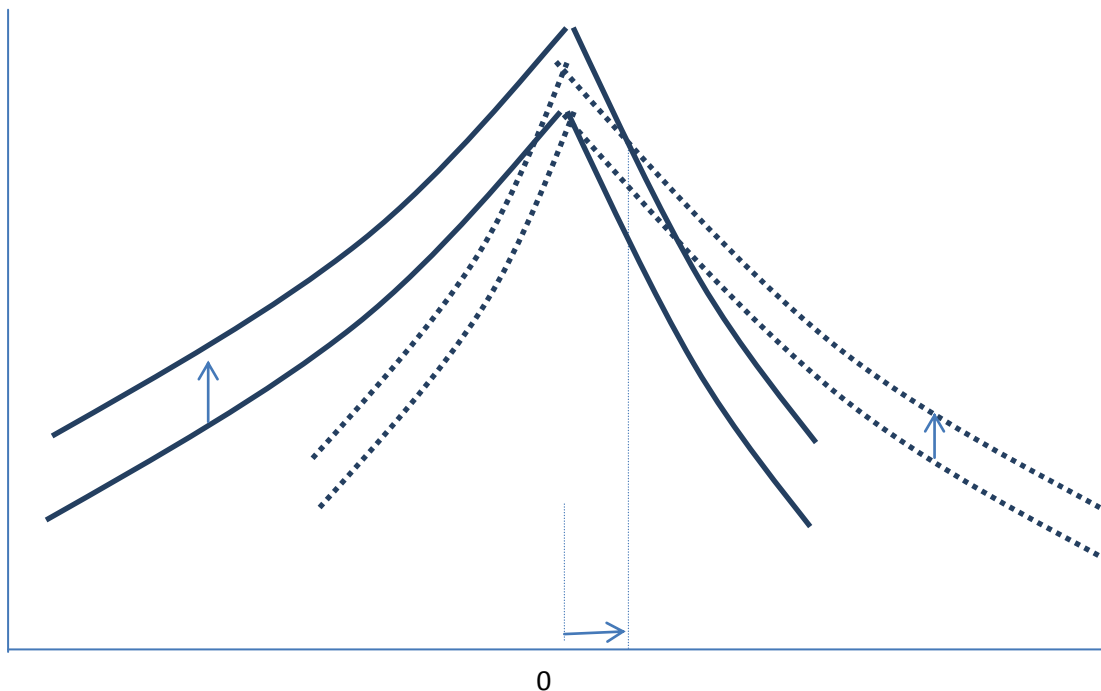


Figure 4: Schematic drawing of symmetric city before and after a culture shock

We assume that the total populations of group V and F do not change. We focus on the metropolitan region, which goes from to . We suppose a reduction in the parameter. Looking at 15), we see that the language border moves right. From 13) we see that a decrease in and an increase in , raises the second part of the equation (the population that can be held in the metropolitan

region). The metropolitan region will experience an inflow of V type consumers, who will outbid a share of F type consumers. F-type consumers move out of the metropolitan region, which creates housing pressure on the native region of F. Thus as a second order effect, the bid rents of the F type consumers will go up as well.

We can also verify this in equation 14), given that the population V does not change, the utility has to go up. In 14) we see that moving the language border right, decreases the second term of the population equation, such that θ decreases. Eventually θ will go up and θ down until the language border is at θ . The rents paid by V-types in the metropolitan region go up to a stronger degree than the rents paid by F-types.

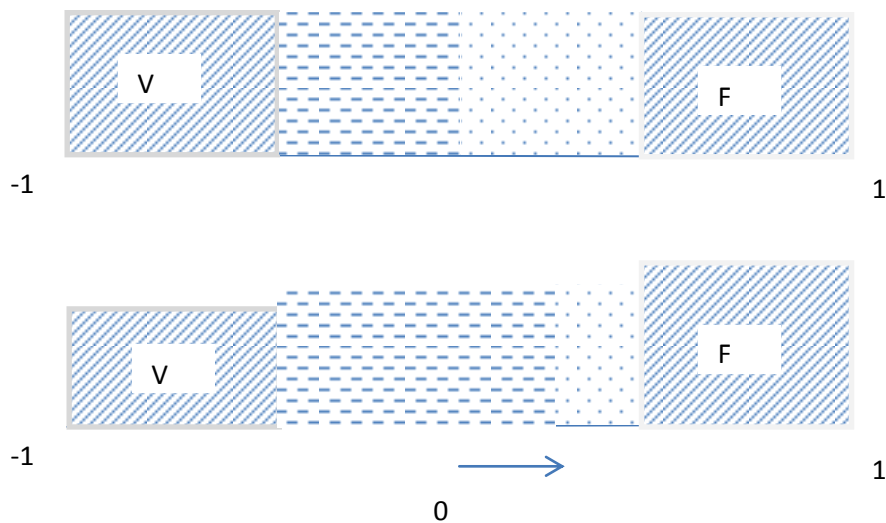


Figure 5: Schematic drawing of population in symmetric city and city with a higher cultural influence of group V

What would be the impact if θ becomes significantly larger than θ ? Looking at 13), we see that θ will need to go down, so the language border moves right. In 14) this decreases the second part of the equation, which means that θ will go up. Again the language border will move to the right until it is at θ and both 13) and 14) are satisfied.

2.1.3 Change in transport costs from the CBD

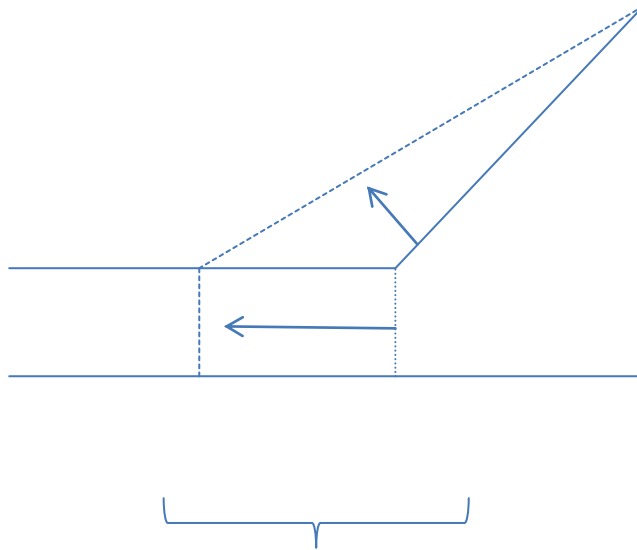
Let us start from the set-up of Figure 3 again and add the additional complexity of a shock in transportation costs from the CBD. We distinguish θ and θ which are respectively the costs left and right of the CBD. We use Figure 6 to explain this in more detail, focusing on region V. This figure would be similar for region F.

Following Figure 3, we assume that the border of the region is initially at the same location as the commuting line. The disposable income for employment in the native region is equal to θ as there are no commuting costs. A shock in the transport costs from CBD to the native region will have 2 complementary effects.

1. A share of the population in V will switch work and commute to the CBD instead, earning a higher income than before
2. The commuting line will move from to and no longer be identical to the border of the native region.

Point 1 and 2 signify that we now have 3 types of employees from each household type:

1. People living and working in their native region
2. People living in the native region, but working in the CBD
3. People living in the metropolitan region and working in the CBD



New commuters from region V to center

Figure 6: A shock in the transport costs from the CBD to the native region

What will equations 13), 14) and 15) look like with a shock in the transport costs and the additional commuters from the native region to the CBD? We give the answer below, indicating the transport costs left and right from the CBD with and and with the additional assumption that .

Equation 15) does not change when adding transport costs, because we assume that both household groups have the same disposable income after commuting. Only cultural preferences and differences in utility will move the language border.

—
—
—

The first terms between the brackets in 16) and 17) represents the population living in the native region and commuting to the CBD. The second term represents the people in the native region commuting to the CBD. The last terms represents the population in the metropolitan region². It is important to realize that in this model, the location of the commuting border within the native region follows from the disposable income after commuting and not from the size of the population or the cultural distance decay. This is shown in equation 18).

If the transport costs from the CBD towards one of the native regions change, say a reduction in t_1 , this will have several effects. r_1 will move outward from the center, increasing the share of CBD commuters in the native region. The utility u_1 will adjust upward, as the population N_1 remains the same. This moves r_1 to the left, which will increase the utility u_1 via the last term of equation 16). Eventually r_1 moves to the region with the higher utility and the lower transport costs.

Reducing the transport costs towards one of the native regions has an opposite effect compared to reducing the cultural distance decay. Reducing the transport costs reduces the tension on the land market of the metropolitan region and motivates a return to the native region. This in turn allows a shift in the household composition of the metropolitan region.

The effect of uniform change in transport costs ($t_1 = t_2$) is straightforward. This will move CBD-commuters from the metropolitan region towards the native regions. If the city is symmetric (all other parameters equal), the difference in utility between the household groups V and F remains constant. We can deduce from 16), 17) and 15) that r_1 will then be equal to the CBD.

2.1.4 Changes in income and transport costs in the native region

From our model descriptions above, we can deduce the impact of making changes in other parameters. For example, an increase in the income of one of the native regions (say Y_1) will move the commuting line r_1 towards the CBD and increase the amount of workers living in the native region, this follows from 18).

The impact on the metropolitan region will be similar to the case above when treating a decrease in transport costs. The language border r_1 will move the left, following that the increase in

Going back to Figure 1, we see that there is one effect we have left untreated: A change in the within region transport costs to the SBD. We will not show the complete derivation as the result is similar to 16) and 17), but we will discuss the implications in the Figure 7 below, focusing on the bid rents of

² This part of the population will all commute to the CBD in this set-up.

household type V. We show the bid rents for household type V, before and after the increase in intraregional transport cost. We can distinguish 3 effects.

1. With an increase in the within region transport cost in region V, household utility of type V will fall, increasing the bid rents towards the SBD and CBD alike.
2. The commuting line will shift outwards, as commuting to the CBD becomes relatively more interesting. This is somewhat similar to the situation in Figure 6.
3. As the rents go up in region V, this also puts more pressure on the metropolitan region. Households of type V, will outbid a part of the type F households in the center.

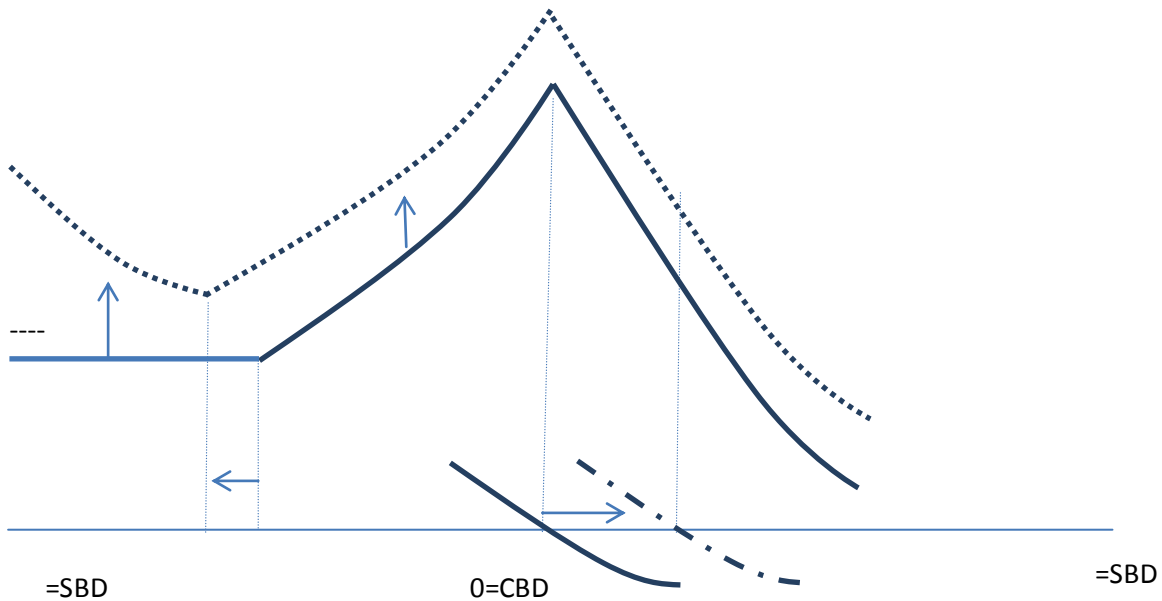


Figure 7: An increase in the within region transport costs of the region V

2.2 Cultural change

2.2.1 Cultural change in the standard model – switching sides

Above, we have assumed that the populations of and would remain constant. There is however one important difference between a population that is separated by cultural customs and dominant use of a language than by racial appearance. In the long term it is possible that the some part of the population will adopt elements of the opposing culture or even more likely, use a different dominant language. A change in racial appearance however, is much more difficult to imagine³.

Let us first assume that there are no impediments on long term for a person to change from V to F or vice versa. From 13) and 14)⁴ we can derive that any reduction in the population will increase the utility of that population group and oppositely. If we assume that the total population within the whole system is fixed, such that and we assume that people switch from one group to

³It is possible to oppose this assumption as through social mixing and intermarriage in the populations, differences in racial appearance and other characteristics distinct for one or the other race may decline. While these socio-biological changes in population are fascinating, we will not consider them in detail here.

⁴ Or alternatively from the more complicated expressions in 16) and 17)

another as long as the utility of the other group is larger, then eventually differences in utility will disappear or

Looking at our expression for the location of the language border in 15), we see that the only parameters which have a long term influence on the equilibrium location of the language border are the borders of the native regions and the cultural distance decay parameters. In fact, it is the population pressure of the opposing group (having a lower utility) that keeps in check. When the population can change 'sides', this will cause a strong outward shift of on long term.

Let's oppose this with a change in transport costs. Suppose that the transport costs towards the SBD of group V () decrease. As was deduced in 16) and 17) this leads to a strong increase in utility for group V and a small increase in utility of group F. On short term, will strongly shift inward towards the native region of V. However, given that the utility is larger, people from F will switch sides to V until on long term will establish itself again in its original position, with a lower population F and a higher population V.

2.2.2 Endogenous change in cultural distance decay

Let's make one small, but important change to the model. Make the cultural distance decay a function of the population of each group. Let us suppose that the distance decay is a function of the total population or . Let us also assume that the derivative of to is negative, meaning that any increase in the total population leads to a decrease in the cultural distance decay.

We'll take a relatively simple function such as the one in (17)

—

Now, when we consider an infinitesimal change from to keeping N fixed and normalizing the initial population to 1, we have that

The second derivative of these functions will be positive. This means that we assume that any change in the original population reduces the cultural distance decay, but that the effect of this impact reduces with a larger population.

With endogenous changes in cultural distance decay, the model becomes too complex for a full analytical derivation. However, we can say something about the types of solutions we will get.

Deriving from 15), we know that will be at:

—————

This means that will move while goes up and oppositely.

Given that U and V are functions of x and y and that λ , we can imagine an iterative procedure to solve the model. This type of solution can easily be programmed in any statistical or mathematical program.

1. Determine initial value for x
2. Solve the model maximizing the residual utility, keeping y constant
3. With the new value for x , determine new values for y
4. Solve the model again, keeping x constant
5. Update x with x_{new}
6. ...
7. Repeat until the model converges

Convergence will follow as the derivate for population and cultural distance decay is positive $\lambda > 0$ and the second derivative $\lambda < 0$, while

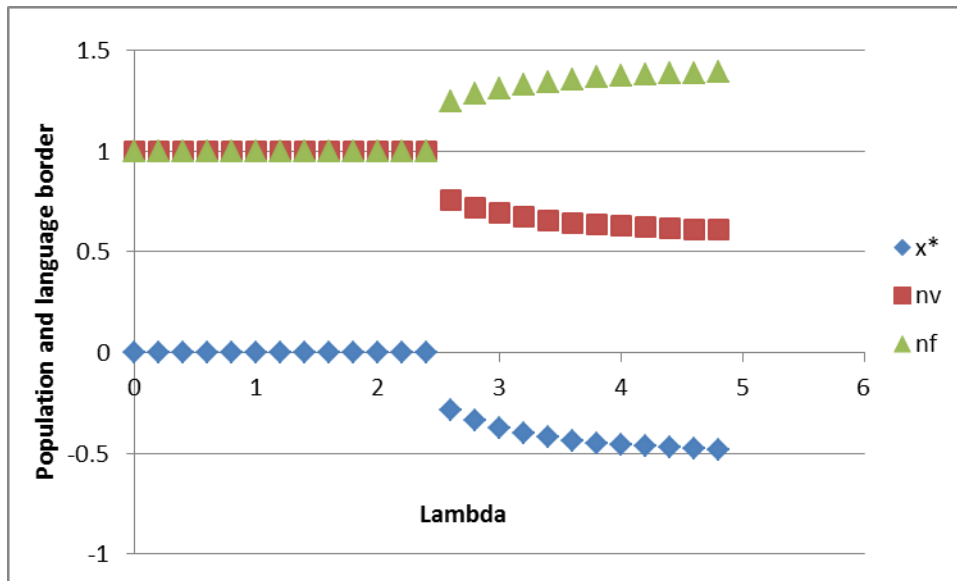
The type of solutions we will get, depend strongly on the parameter λ , which determines the strength of how population impacts on cultural distance decay. We can start from a symmetrical city, with equal population sizes and all other exogenous parameters equal. Can small disturbances in the population lead to a big divergence of populations, such as claimed by Loury (2000)?

We illustrate the impact of λ on the equilibrium city in **Error! Reference source not found.**, which is the result of a numerical simulation with following parameters

While λ in **Error! Reference source not found.**, such that λ and λ are also small, then small imbalances in the population will not have a large effect on the city. The city will remain close to the symmetric equilibrium. To understand this, we have to take into account that the impact of population on λ is secondary.

If λ in **Error! Reference source not found.** we see a bifurcation point. Any small change in λ will lead to a large increase in λ , again leading to a big rise in λ and so on, until a new balance has been reached. This means that λ has an obvious non-linear effect on the balance of population and cultures in this model city.

Figure 8: Impact of Lambda on equilibrium population and location in the city



2.3 Overview of impacts of exogenous parameters on model variables

Table 1: Overview of impact of changes in exogenous parameters on model variables (short term)

Parameters (-)								
	+	-	+	-	+	+	0	0
	+	+	-	-	-	-	0	0
t	+	+	0	-	-	-	+	+
	++	+	-	--	-	--	+	0
	++	+	-	--	-	-	-	0
	--	-	+	--	+	++	+	0
	-	-	0	+	+	--	-	-

In Table 1 we make an overview of the impact of several exogenous parameters (the cultural distance decay, population, the transport costs and the income in the SBD or CBD) on the model variables. We consider only a decrease in the exogenous parameters of the V-type household. The parameters indicate the price of housing in the SBD of the respective native region. An increase in is a shift towards region F (right), a decrease a shift towards V (left), parameters are expressed in absolute value.

Table 2: Overview of impact of changes in exogenous parameters on model variables (long term)

Parameters (-)								
	+	-	+	-	-	-	0	0
t	0	0	0	-	-	-	+	+
	+	-	0	-	-	-	+	0
	+	-	0	-	-	-	-	0
	-	+	0	-	+	+	+	0
	0	0	0	+	+	--	-	-

In Table 2 we give an overview of long term impacts of the changes in exogenous parameters of the model on the main variables. The utilities are now replaced by changes in population . The results in Table 2 with respect to prices in each native region and the formation of prices in the CBD will be similar to the standard model.

2.4 Political opposition to cultural change

We have assumed that there are no long term hindrances for the population to switch sides and change from V to F or oppositely. We'll take the example of the use of a dominant language. We assume that V and F household groups are perfectly indistinguishable by appearance and are identified only by what language they speak.

Suppose that each household group is represented by a political party that defends the 'rights' of its own people. These political parties are active on the local level and federal level and care about the size of the total population and the utility of the population. In fact, these regionalist parties will attempt to avoid a reduction of their own group within the overall population, by maximizing the utility of their own group with respect to the others.

From the model, we can imagine several ways on how politicians may react on cultural pressure from the other group:

1. Increasing the 'transition costs' to switch from a type V, to a type F household or vice versa. Instead of having τ_{VF} we may have $\tau_{VF} + c$, where c is some fixed transition cost.
2. 'Pushing borders': it is imaginable that politicians feeling the pressure from the other group, attempt to move the border of their own native region closer to the CBD.
3. 'Manipulating public services for one type of households', in the benefit of the other. This can be translated to a reduction of the cultural amenity index α_V for one type of household or alternatively increase the amenities for the other household type.
4. An 'access ban', which would not allow people from the opposing type to settle in a specific location (this is probably the most obstructive and least democratic policy).

Each of these policies of one thing in common: they lead to a reduction in the welfare of society, compared to the standard urban equilibrium. Measured in housing prices, both central (CBD), peripheral housing prices or both central and peripheral housing prices will be too high, reflecting additional costs imposed by specific cultural preferences.

3 Conclusion

This paper contains a model on the level of the city, starting from a standard set-up of a linear city with one Central Business District (CBD) and 2 Suburban Business Districts (SBD). Two household groups with opposing cultural preferences settle in this city, bidding and outbidding each other for housing in the city. We assume complete segregation between the two groups, but population pressure and attractiveness of the CBD and native SBD employment will lead to shifts in the 'de facto' border between the two types of consumers. Starting from our model of opposing groups we can derive a number of short term and long term mechanisms that shift the balance between the households and affect the long term equilibrium.

The first and most obvious observation is that an attachment to the native region and culture will counteract agglomeration effects. Compared to the standard urban model, city density and housing prices in the metropolitan region will be lower. Housing prices in the native regions will be higher. If there are returns to scale effects in the CBD, this type of opposition between cultures will create a negative externality.

The second, less obvious observation is that the transport system plays an important role in the balance between the two groups. We have seen that an improvement in the transport system in the native region or its connection to the CBD, reduces the pressure of one group on the metropolitan region, increasing the dominance of the opposing group in the center.

The last and most critical observation is that on longer term, people may switch to using another language, if the benefit of using that language outweighs the cost. The main long term determinant for this in our model was the cultural pressure from the opposing group. Politicians inclined to preserve the use of the native tongue have access to a number of methods to stop or slow down any change in the main native tongue. We have identified 4 strategies: 1) increasing the transition cost to switch sides, 2) attempting to move the border of the native region, closer to the metropolitan region 3) overproviding and/or underproviding public services for one household group, 4) limiting or even denying access of the opposing group to certain locations.

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