REGIONAL COSTS-OF-LIVING WITH CONGESTION AND AMENITY DIFFERENCES – AN ECONOMIC GEOGRAPHY PERSPECTIVE

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ABSTRACT

Standard models of the ´new economic geography´ predict that costs-of-living are low in the central and high in peripheral region, due to the fact that consumers in the periphery have to bear transportation cost for manufacturing varieties. In reality, however, only *some* goods are cheaper in economic centres, whereas the overall costs-of-living (including housing costs) tend to be higher. In this paper we use an analytically tractable economic geography model with an immobile housing stock, so that regional agglomeration drives up housing prices. We show that a core-periphery structure can endogenously emerge in which the core is the more expensive area in equilibrium. We also analyze the efficiency of spatial cost-of-living differences and augment the model to include an exogenous regional difference in the form of a consumption amenity.

JEL-Classification: F12, R12, R50

Keywords: economic geography, agglomeration, regional price levels

Revised version: May 2007

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1. Introduction

Regional cost-of-living disparities are becoming an increasingly important issue in economic geography and regional economics. Whereas spatial disparities in nominal earnings are reasonably well documented and understood (see e.g. Glaeser and Maré 2001, Yankow 2006), there is still a notorious shortage of stylized facts about regional price levels. This is mostly due to the fact that regional costs-of-living are typically not collected by government agencies, and hence the respective official data is simply not available. Such data would be of crucial importance, however, so that spatial disparities in nominal earnings could be adjusted for price levels in order to arrive at a geographical measure of well-being, which should be variable of fundamental interest to economic policy (Curran et al., 2006). This lack of reliable empirical data notwithstanding, casual empiricism suggests that overall costs-of-living are higher in dense urban environments and lower in remote rural areas.

Seminal models of the ´new economic geography´ (NEG) – an essential development that has deeply influenced regional science in the last one and a half decades – imply the exact opposite with respect to spatial cost-of-living differences, however. Pioneered by Krugman (1991) the NEG has shown that a combination of increasing returns, transport costs and factor mobility can lead to an asymmetric core-periphery structure of economic activity, starting from a configuration with ex-ante identical regions. The Krugman-model (as well as most other NEG-models) predicts that the overall costs-of-living are *higher* in the de-industrialized peripheral region and *lower* in the densely populated central region. The reason is that the cost-of-living index (COLI) in these models is identical to the composite price index for manufacturing goods, which is lower in the centre because competition is stiffer and because agents save on transportation costs. Land scarcity and higher prices for housing or other non-tradable goods is typically neglected, although these forces appear to be the main reason why agglomeration areas are more expensive (Tabuchi, 2001).

This issue has recently been addressed by Südekum (2006) who considers an extended version of the Krugman-model where he adds a fixed housing stock in each region that is owned by immobile landlords. The main contribution of that paper is to show that a core-periphery structure can emerge endogenously in the spirit of the original Krugman-model, but with the important difference that there is a subset of parameter constellations for which the core has higher costs-of-living. The basic intuition is that the core region has higher nominal wages and lower manufacturing prices, but higher housing prices. Higher housing costs do not compensate both "centripetal" forces, but they are substantial enough to make the core the more expensive area.[1] The main shortcoming of the paper by Südekum (2006) is that all results have to rely on numerical simulations. This is typical for many "first generation" models of the NEG, including the Krugman-approach, but in recent years alternative frameworks have appeared that resemble the original Krugman model very closely and give rise to virtually identical results while being analytically fully tractable.[2]

The contribution of the present paper is threefold. The first aim is to extend the analysis by Südekum (2006) to an analytically tractable framework. In particular, we will build on the recent model by Pflüger and Südekum (2007) which features a particularly plausible "bubble shaped" location pattern over the range of trade costs. We show that the findings by Südekum (2006) are robust in this framework: Agglomeration can occur endogenously, such that the core region is more expensive. In this paper we can present this result as a theoretical proposition, however, not as the outcome of some selective numerical simulations. This allows us, in particular, to provide clear cut comparative static results.

The second contribution is that we analyze some previously unexplored *efficiency* aspects of spatial cost-of-living differences. Apart from characterizing the decentralized market allocation we also derive the normative implications of a configuration with agglomeration and higher costs-of-living in the core. We show that agglomeration does in fact not lead to *excessively* high living costs in the centre.

Finally, the third contribution of this paper is that we address the issue of regional amenities in the context of the new economic geography. Most NEG models assume that all regions are ex-ante identical. This assumption may be seen as one of the major appeals of this literature, because agglomeration can develop *endogenously* without referring to exogenous regional differences. However, assuming identical regions is unrealistic from an empirical point of view, and it circumvents the presence of regional amenities, which is an important issue when it comes to measure regional costs-of-living in practice. Even if one can observe consumer prices for an identical basket of goods and compute a regional price deflator, the problem remains that real wage equalization need not imply utility equalization across space. Consumers may value particular regional features and thus have an implicit willingness to pay

[1] There are also other models that incorporate housing or other forms of urban costs into the NEG (e.g., Helpman 1998, Tabuchi 1998, Tabuchi/Thisse 2006, Tabuchi/Thisse/Zeng 2003). In all of these models there is a natural trade-off between agglomeration effects and higher costs-of-living in the central region. However, none of these papers has explicitly addressed the implications of agglomeration for overall regional cost-of-living indices.

[2] A compilation of these models can be found in the monograph by Baldwin et al. (2003). Credit is particularly due to Forslid/Ottaviano (2003) who have developed a tractable variant of the original Krugman-framework.

for these amenities, or – vice versa – must receive a compensating differential for certain regional dis-amenities.

There are many different forms of amenities. First, there may be consumption and production amenities, respectively affecting the location decisions of individuals and of firms. Second, amenities can be exogenous or endogenous to the spatial structure of the economy. An example of the former type would be climate or coastal location. An example of the latter type would be that individuals perceive dense urban environments as attractive (or unattractive) per se, so that changes in the spatial structure also affect the distribution of amenities. Finally, amenities may have an independent effect on value functions (e.g., nicer weather directly raises utility), or they may be related to market behavior (e.g., consumption yields higher utility in regions with nicer weather). The traditional spatial equilibrium literature (Roback 1982) has emphasized that local (dis-) amenities are typically capitalized in the prices of non-tradable goods such as land, and that they affect nominal wages in the equilibrium with an ambiguous direction depending on whether the amenity is present on the consumption or the production side. However, the general literature on the spatial equilibrium has not yet been coupled with the cumulative causation mechanisms of agglomeration that are characteristic for models of the NEG. In the NEG literature on the other hand, introducing amenities is a path not much traveled. Tabuchi and Thisse (2002) and Ludema and Wooton (2000) introduce heterogeneous preferences of individuals for particular locations (like "attachment to home"), but they do not consider genuine regional differences, and they do not derive the implications for regional price levels.

In this paper we focus on the simple case where all individuals perceive one region as inherently more attractive than the other. Unfortunately, analytical solutions are out of reach in this case with heterogeneous regions. Yet, we illustrate by means of numerical simulations how this fixed consumption amenity affects the market equilibrium allocation for different levels of trade costs, and we describe the implications for living costs. In particular, we emphasize how the exogenous amenities interact with the endogenous agglomeration and dispersion forces in this model, and we describe in what way these amenities "capitalize" in market prices.

The rest of this paper is structured as follows. Section 2 presents the basic model setup. In section 3 we deal with the standard case of identical regions, and in section 4 we assume that one region is inherently more attractive than the other. Section 5 concludes.

2. The model

2.1. The basic set-up

The economy is composed of two regions ($r = 1,2$) and two types of households, unskilled labour (L) and skilled labour (K). Households in-elastically supply one factor unit each, thereby earning wages W and R, respectively. All individuals have identical preferences and derive utility from an aggregate of manufactures (X), an agricultural good (A), and from housing (H). Furthermore we assume that utility is influenced by (fixed) regional amenities (ν_r). The standard case where both regions are ex ante identical amounts to a constellation with $\nu_1 = \nu_2$, but below we will also analyze the case where region 1 is the more attractive location and offers an "utility bonus" compared to region 2 ($\nu_1 > \nu_2 > 0$).

Housing is a non-traded and non-produced consumption good. The housing stocks H_1 and H_2 are assumed to be owned by absentee landlords for simplicity.[3] The agricultural good is homogeneous, traded without cost and produced perfectly competitively under constant returns with unskilled labour as the only input. This good serves as the numeráire. The manufacturing aggregate consists of a large variety of differentiated products. Each variety is produced with unskilled and skilled labour. Unskilled labour is the only variable input, and marginal costs are constant. Skilled labour enters only the fixed cost, and one skilled worker is needed to produce at all. Trade in X is inhibited by iceberg costs. Unskilled labour is assumed to be intersectorally mobile, but immobile and equally distributed across regions. Skilled workers are geographically mobile. The total endowment of skilled workers is normalized to one. The share of skilled workers who locate in region 1 is denoted by λ, so that the share in region 2 is given by ($1-\lambda$).

2.2. Preferences and demand

Households are indexed by $z = L, K$. Preferences are homogenous and characterized by

$$U_r^z = \alpha \ln C_{X,r} + \beta \ln C_{H,r} + C_{A,r} + \nu_r \qquad C_{X,r} = \left(\int_{i \in \Theta} x_{i,r}^{\frac{\sigma-1}{\sigma}} di \right)^{\frac{\sigma}{\sigma-1}} \tag{1}$$

$$\alpha > 0, \quad \beta \geq 0, \quad \sigma > 1, \quad \nu_r \geq 0$$

[3] Housing income is neutralized by this assumption. We could alternatively assume that the housing stock is equally owned by all citizens. Since the upper-tier utility is assumed to be quasi-linear in our model, this is inconsequential, because there is no feedback from income to consumption in the manufacturing sector.

where $C_{H,r}$ denotes the consumption of housing, $C_{A,r}$ is the consumption of the agricultural good, and $C_{X,r}$ is consumption of the manufacturing aggregate. The total set of manufacturing varieties is given by Θ, which has mass $N = N_1 + N_2$ where N_r is the mass of varieties from region r. Per capita consumption of a single variety is denoted by $x_{i,r}$. The parameter σ expresses the constant elasticity of substitution between any two manufacturing varieties. The budget constraint of household z in region r is given by

$$P_r C_{X,r} + p_{H,r} C_{H,r} + C_{A,r} = Y_r^z, \qquad P_r = \left[\int_{i=1}^{N_1} \left(p_{i,1r}\right)^{1-\sigma} di + \int_{i=N_1}^{N_1+N_2} \left(p_{i,2r}\right)^{1-\sigma} di \right]^{\frac{1}{1-\sigma}} \quad (2)$$

where Y_r^z denotes the household type z's income. $p_{H,r}$ denotes the price of housing, P_r is the perfect CES-price index for the manufacturing aggregate, and $p_{i,sr}$ is the consumer price for a variety i produced in region s and consumed in region r. Trade costs are assumed to be of the familiar iceberg form: From any unit that is shipped across regions, only a fraction $1/\tau$ arrives for consumption in the destination location, where $\tau \geq 1$. The consumer price of an imported variety in region r is then $\tau p_{i,s}$ where $p_{i,s}$ is producer price of that variety. Utility maximization yields the following demand functions and indirect utility, V_r^z :

$$C_{X,r} = \alpha / P_r \qquad C_{H,r} = \beta / p_{H,r} \qquad C_{A,r} = Y_{z,r} - \alpha - \beta \quad (3)$$

$$x_{i,r} = \alpha (\tau_{rs} p_{i,r})^{-\sigma} (P_r)^{\sigma-1}$$

$$V_r^z = Y_r^z - \alpha \ln P_r - \beta \ln p_{H,r} + \nu_r + \varepsilon \qquad \varepsilon \equiv [\alpha(\ln\alpha - 1) + \beta(\ln\beta - 1)] \quad (4)$$

Note that quasi-linear preferences eliminate income effects from the demand for manufacturing varieties and housing. Although questionable from an empirical point of view (income elasticities for housing are positive in reality) this assumption is quite commonly made in economic geography models and tremendously simplifies the analysis. This particular preference structure has first been used in economic geography by Pflüger (2004)

2.3. The housing market

Using equation (3), aggregate housing demand in region 1 is given by $\beta(\rho + \lambda)/p_{H,1}$, where $\rho > 0$ denotes the exogenous endowment of unskilled labour in either region (which by assumption is equally large) relative to the world population of skilled workers. In equilibrium aggregate housing demand must be equal to aggregate supply, which is assumed to be fixed and equal to $\overline{H}$ in either region. Hence, equilibrium housing prices are given by

$$p_{H,1} = \beta(\rho+\lambda)/\overline{H} \qquad\qquad p_{H,2} = \beta(\rho+1-\lambda)/\overline{H} \tag{5}$$

It follows from (5) that the housing price in region 1 increases with the share of skilled workers located in region 1, λ. The opposite is true for region 2.

2.4. Production

The agricultural good is produced under perfect competition with a unit input requirement of unskilled labour. Since this good is the numéraire, the unskilled wage rate in both regions is equal to one, $W_1 = W_2 = 1$. Each manufacturing variety is supplied by a single firm, and the number of firms in region r equals the number of skilled workers who reside in that region (i.e., $N_1 = \lambda$, $N_2 = 1-\lambda$). Market clearing for a variety produced in region 1 is expressed by $X_{i,1} = (\rho+\lambda)x_{i,1} + (\rho+1-\lambda)\tau x_{i,2}$. With wages equal to one, and the technology $L_i = X_i$, the marginal cost in this sector are also equal to one. There is a fixed cost, R_r, to compensate the skilled worker who is needed to produce at all. Profits of the representative firm in region 1, $\Pi_{i,1}$, are then given by

$$\Pi_{i,1} = (p_{i,1}-1)(\rho+\lambda)x_{i,1} + (p_{i,1}-1)(\rho+1-\lambda)\tau x_{i,2} - R_1 \tag{6}$$

An analogous profit function can be derived for region 2. Imposing the Chamberlinian large group assumption, each producer perceives an elasticity of demand equal to σ in both markets. Producers engage in mill pricing, and profit maximizing prices $\overline{p}$ are constant mark-ups over marginal costs

$$\overline{p} \equiv p_{i,1} = p_{i,2} = \sigma/(\sigma-1) > 1 \tag{7}$$

The skilled wage adjusts so as to ensure zero profits. Using the market clearing condition, firm scale $X_{i,r}$ and fixed costs R_1 are related in the following way: $X_{i,r} = R_r(\sigma-1)$. For a given allocation of skilled workers between the two regions, λ, the wages accruing to skilled workers in the two regions, R_1 and R_2, can be determined by imposing the condition of zero profits on (6), together with the demand functions (3), the price level (2), and firm's optimal prices (7) (and the analogous conditions for region 2). This gives

$$R_1 = \frac{\alpha}{\sigma}\left[\frac{\rho+\lambda}{\lambda+(1-\lambda)\phi}+\frac{\phi(\rho+1-\lambda)}{\phi\lambda+(1-\lambda)}\right] \qquad R_2 = \frac{\alpha}{\sigma}\left[\frac{\phi(\rho+\lambda)}{\lambda+(1-\lambda)\phi}+\frac{\rho+1-\lambda}{\phi\lambda+(1-\lambda)}\right] \tag{8}$$

where $0 \le \phi \equiv \tau^{1-\sigma} \le 1$ is a parameter that captures the freeness of trade, which is inversely related to trade costs.

2.5. Indirect utility, costs-of-living, and short-run market equilibrium

With skilled wages determined by (8), all other endogenous variables can be derived straightforwardly. The X-sector employs $N_r X_{i,r} = N_r R_r(\sigma-1)$ units of unskilled labour which we assume to be smaller than ρ in order to ensure that both sectors are active after trade, implying the parameter restriction $\alpha < \rho\sigma/(2\rho+1)(\sigma-1)$. Substituting (7) in (2), the CES-price levels for manufactured goods in the two regions can be derived as

$$P_1 = \overline{p}\left[\lambda+(1-\lambda)\phi\right]^{\frac{1}{1-\sigma}} \qquad P_2 = \overline{p}\left[\lambda\phi+(1-\lambda)\right]^{\frac{1}{1-\sigma}} \tag{9}$$

Finally, using (5), (8) and (9) in (4) indirect utility for a mobile skilled worker in region r=1,2 is as follows

$$V_1^K = \frac{\alpha}{\sigma}\left[\frac{\rho+\lambda}{\lambda+(1-\lambda)\phi}+\frac{\phi(\rho+1-\lambda)}{\phi\lambda+1-\lambda}\right]-\frac{\alpha}{1-\sigma}\cdot\ln\left[\lambda+(1-\lambda)\phi\right]-\beta\cdot\ln\left[\lambda+\rho\right]+v_1+\tilde{\varepsilon}$$

$$V_2^K = \frac{\alpha}{\sigma}\left[\frac{\rho+1-\lambda}{\phi\lambda+1-\lambda}+\frac{\phi(\rho+\lambda)}{\lambda+\phi(1-\lambda)}\right]-\frac{\alpha}{1-\sigma}\cdot\ln\left[\phi\lambda+1-\lambda\right]-\beta\cdot\ln\left[1-\lambda+\rho\right]+v_2+\tilde{\varepsilon} \tag{10}$$

where $\tilde{\varepsilon} \equiv \varepsilon-\alpha\cdot\ln[p]+\beta\cdot\ln[H]$ is a constant. The equilibrium spatial structure is determined by the location choice of skilled workers who will base their decision on these indirect utility levels, which include the skilled wages, the (manufacturing and housing) prices in the two regions, and the regional amenities.

The main focus of this paper is to ask what this spatial equilibrium implies for regional costs-of-living. In the Krugman-model with a Cobb-Douglas upper tier utility function, i.e. with a particular form of homothetic preferences, there is a natural "price deflator" as expenditure on the single goods are constant income shares (see Deaton and Muellbauer 1986, ch. 7). This cost-of-living index number is at the root of Südekum's (2006) analysis. Furthermore, demand for housing and manufacturing in that framework exhibit positive income elasticity, hence there is a feedback from agglomeration on prices via the income channel. The present framework is different, because preferences are *not* homothetic. However, since all income effects are channeled into the agricultural sector where the "law of one price" holds, it is also possible to construct a scalar cost-of-living measure. Note that every agent's expenditure on housing and on the CES-aggregate of manufactures is simply given by a constant (β and a, respectively). Therefore we can think of

$$COL_r = \alpha \cdot \ln\left(P_r\right) + \beta \cdot \ln\left(p_{H,r}\right) \tag{11}$$

as a precise costs-of-living index for region r that correctly measures the impact of consumer prices on utility. The *difference* in costs-of-living across regions, therefore, reads as

$$\Delta COL \equiv COL_1 - COL_2 = \frac{\alpha}{\sigma - 1} \cdot \ln\left(\frac{\phi\lambda + 1 - \lambda}{\lambda + \phi(1-\lambda)}\right) + \beta \cdot \ln\left(\frac{\lambda + \rho}{1 - \lambda + \rho}\right) \tag{12}$$

Note that the regional amenity levels ν_1 and ν_2 do not directly influence costs-of-living in the two regions. However, we will describe in section 4 how amenity differences across regions affect prices and living costs indirectly via their influence on the equilibrium spatial structure of the economy.

3. Identical regions: Equilibrium, social optimum, and costs-of-living

In this section we derive the spatial equilibrium allocation and the optimal spatial structure that a benevolent social planner would choose for the case of identical regions with equal amenities ($\nu_1 = \nu_2 \geq 0$). This is the standard assumption that is usually made in the NEG. The analysis closely follows Pflüger and Südekum (2007) at first, and it establishes the welfare properties of agglomeration. Afterwards we derive the implications of agglomeration for regional costs-of-living. That part follows the analysis by Südekum (2006), and extends it to the fully analytically tractable framework that is presented in this paper. Furthermore we analyze the efficiency aspects of regional living cost differences, an issue that has not yet been addressed in the literature.

3.1. Market equilibrium and social optimum

Using (10), the utility differential $\Delta V^K \equiv V_1^K - V_2^K = (R_1 - R_2) - \alpha \ln(P_1/P_2) - \beta \ln(p_{H,1}/p_{H,2})$, can be expressed for general trade costs in the following way

$$\Delta V^K = \alpha \left[\frac{(1-\phi)}{\sigma} \left(\frac{\rho+\lambda}{\lambda+(1-\lambda)\phi} - \frac{\rho+(1-\lambda)}{\phi\lambda+(1-\lambda)} \right) + \frac{1}{\sigma-1} \ln \left(\frac{\lambda+\phi(1-\lambda)}{\lambda\phi+(1-\lambda)} \right) - \gamma \ln \left(\frac{\rho+\lambda}{\rho+(1-\lambda)} \right) \right] \qquad (13)$$

where $\gamma \equiv \beta/\alpha \geq 0$ is a measure of the importance of housing relative to manufacturing expenditure. Amenities drop out of eq. (13) because of the assumption that $v_1 = v_2$.

In the long run, skilled workers move across regions in response to utility differences, and the adjustment process over time is governed as usual by the differential equation

$$d\lambda/dt \equiv \dot{\lambda} = (\Delta V^K) \cdot \lambda \cdot (1-\lambda) \qquad (14)$$

A symmetric allocation of the mobile factor, $\lambda = 1/2$, is always a long-run equilibrium in this model, which – however – is not necessarily stable due to the well known "centripetal forces" that operate in NEG models.[4] Whether the symmetrical equilibrium is stable or unstable can be analyzed by evaluating the sign of

$$\left. \frac{\partial \Delta V^K}{\partial \lambda} \right|_{\lambda=1/2} = 4\alpha \left[\frac{(1-\phi)\left[\sigma(3\phi+1) - 2\phi - 2\rho(1-\phi)(\sigma-1)\right]}{\sigma(\sigma-1)(1+\phi)^2} - \frac{\gamma}{2\rho+1} \right] \qquad (15)$$

If (15) is negative (positive), symmetry is stable (unstable) equilibrium. Provided symmetry is unstable, the model might then exhibit stable equilibria with partial agglomeration (such that $\Delta V^K = 0$ and $1/2 < \lambda \leq 1$ or $0 \leq \lambda \leq 1/2$), or full agglomeration in one of the two regions (such that $\Delta V^K > 0$ and $\lambda = 1$ or $\Delta V^K < 0$ and $\lambda = 0$).

The behavior of the utility difference for different values of λ and ϕ is illustrated in figure 1 (left column, panels A1-A5). The thick solid line represents the function ΔV^K as given in eq. (13). For low levels of trade freeness (panel A1) the symmetrical configuration $\lambda = 1/2$ is the only stable long-run equilibrium. As trade freeness rises, the symmetrical equilibrium becomes unstable but two stable equilibria with partial agglomeration arise (panel A2). In the next phase, where trade integration has risen even further, full agglomeration of all mobile

[4] The single agglomeration and dispersion forces are analytically disentangled and economically explained in Pflüger and Südekum (2007, App. A).

workers in one region is the stable equilibrium (panel A3). Due to the presence of the housing congestion force, however, there is then a gradual re-dispersion process in the course of trade integration, because the agglomeration forces get weaker as transport costs lose their importance and the housing scarcity becomes the dominating location force (see Helpman 1998 or Pflüger and Südekum 2007). As a consequence, the economy moves back to partial agglomeration (panel A4) and finally to symmetry (panel A5) as trade integration continues.

[Figure 1 about here]

The critical levels of trade freeness at which symmetry first becomes an unstable equilibrium (the "market break point" ϕ_b^M), and the level of ϕ at which symmetry re-emerges as the unique stable equilibrium (the "market re-dispersion point" ϕ_r^M) can be obtained by setting (15) equal to zero and then solving for ϕ. This yields

$$\phi_b^M = \frac{(\sigma-1)\left[(2\rho+1)^2-\gamma\sigma\right]-(2\rho+1)\sqrt{1+4\sigma(\sigma-1)\left[1-\gamma(\sigma-1)\right]}}{(\sigma-1)\left[(2\rho+1)^2+\gamma\sigma\right]+(2\rho+1)(2\sigma-1)} \tag{16}$$

$$\phi_r^M = \frac{(\sigma-1)\left[(2\rho+1)^2-\gamma\sigma\right]+(2\rho+1)\sqrt{1+4\sigma(\sigma-1)\left[1-\gamma(\sigma-1)\right]}}{(\sigma-1)\left[(2\rho+1)^2+\gamma\sigma\right]+(2\rho+1)(2\sigma-1)} \tag{17}$$

In order to obtain meaningful solutions $0 \le \phi_b^M < \phi_r^M \le 1$, we impose two parameter restrictions. First, $1-\gamma(\sigma-1)>0$ is sufficient to obtain a real root in (16) and (17). In economic terms, this requires that the degree of increasing returns to scale is strong (i.e. σ low) relative to the importance of the housing sector in the expenditures of consumers (γ). This puts an upper bound on the housing congestion force. Second, we rule out that the agglomerative forces become so strong that the symmetric equilibrium is unstable even at infinite trade costs. It is sufficient to require $\sigma/(\sigma-1)<2\rho$ for this 'no black hole-condition' to be fulfilled. Hence, scale economies must not be too strong (σ not too low) relative to the dispersive force given by the relative stock of immobile workers (ρ).

A different and commonly used way to summarize the long-run spatial equilibria of this model is the bifurcation diagram. In this model the bifurcation pattern has an intuitive "bubble shape" as illustrated by the solid line in figure 2. Starting from a symmetrical equilibrium at low levels of ϕ there is a gradual agglomeration and re-dispersion process, until the economy moves back to symmetry as $\phi \to 1$.

[Figure 2 about here]

3.2. The optimal spatial structure

The main contribution of Pflüger and Südekum (2007) is to compare this market allocation with the socially optimal spatial structure that would be chosen by a benevolent social planner. It has to be acknowledged that there are several sources of inefficiency in this model. First, firms in the manufacturing sector have market power. Prices exceed marginal costs, and consumption is too low from a social perspective. Second, the spatial distribution of the manufacturing sector in the long-run market equilibrium is the result of the migration decision of independently acting skilled workers. A skilled worker faced with the decision whether to migrate or not, does not take into account the effects of her decision on prices, which affect the welfare of all other agents. It is well-established that these pecuniary externalities, though inconsequential from a welfare point of view under perfect competition, do matter with imperfect competition (e.g. Laffont 1987; Ottaviano and Thisse 2001). The socially optimal allocation may, therefore, differ from the equilibrium structure. Importantly, Pflüger and Südekum (2007) prove that first- and second-best optimal spatial structure coincide in the present model, i.e. the planner makes the same choice of λ no matter if she can impose marginal cost pricing, or if she takes market prices as given.

The optimal spatial structure can be derived by maximizing the aggregate social welfare function with respect to the parameter λ that summarizes the geographical structure of the economy. Since preferences are assumed to be characterized by a quasi-linear utility function in our framework, all agents have marginal utility of income equal to one, and income redistributions do not affect aggregate welfare. Hence, it is reasonable to postulate a utilitarian social welfare function. With indirect utilities given by (4), and using market prices (5), (8), and (9), the (second best) social welfare function is given by

$$\Omega(\lambda) = \left[\lambda V_1^K + (1-\lambda) V_2^K + \rho\left(V_1^L + V_2^L\right)\right] \tag{18}$$

$$= \alpha\left[\frac{1}{\sigma-1}\ln\left(\frac{\left(\lambda+(1-\lambda)\phi\right)^{\lambda+\rho}}{\left(\phi\lambda+(1-\lambda)\right)^{-(1-\lambda+\rho)}}\right) - \gamma\ln\left(\frac{(\rho+\lambda)^{\lambda+\rho}}{(\rho+1-\lambda)^{-(1-\lambda+\rho)}}\right)\right] + \xi$$

The first term and the second term in square brackets show how λ affects welfare through manufacturing price indices and through housing prices, respectively. The parameter ξ is an unimportant positive constant collecting exogenous parameters.

It is possible to show that the optimal spatial structure also has a "bubble-shape", i.e. the planner also chooses symmetry as the unique welfare maximizing structure if trade freeness is sufficiently low or high. There is, however, a critical level of trade freeness (the "social break point" ϕ_b^S) at which symmetry ceases to be optimal, and where the planner starts to allow partial agglomeration. As ϕ continues to increase the planner chooses full agglomeration, then gradually moves back to partial agglomeration and finally – again – to symmetry. The critical level of ϕ at which symmetry re-emerges as the social optimum is labeled the "social re-dispersion point", ϕ_r^S .

These critical levels of trade freeness for the planner allocation can be computed from (18). It turns out that $\partial\Omega/\partial\lambda$ is always equal zero at $\lambda = 1/2$, but symmetry can be a welfare maximum or a minimum. We thus have to evaluate the second order partial derivative of Ω with respect to λ at $\lambda = 1/2$:

$$\left.\frac{\partial^2\Omega}{\partial\lambda^2}\right|_{\lambda=1/2} = 4\alpha\left[\frac{(1-\phi)\left[(3\phi+1)-2\rho(1-\phi)\right]}{(\sigma-1)(1+\phi)^2} - \frac{\gamma}{2\rho+1}\right] \tag{19}$$

Setting (19) equal to zero, and solving for ϕ yields the following two solutions:

$$\phi_b^S = \frac{(2\rho+1)\left[(2\rho+1)-2\sqrt{1-\gamma(\sigma-1)}\right]-\gamma(\sigma-1)}{(2\rho+1)(2\rho+3)+\gamma(\sigma-1)} \tag{20}$$

$$\phi_r^S = \frac{(2\rho+1)\left[(2\rho+1)+2\sqrt{1-\gamma(\sigma-1)}\right]-\gamma(\sigma-1)}{(2\rho+1)(2\rho+3)+\gamma(\sigma-1)} \tag{21}$$

The "social break point" and the "social re-dispersion point" fall in the relevant range between zero and one under the previously imposed parameter restrictions. The comparison of the critical levels of ϕ for the market allocation (eqs. 16 and 17), and for the planner allocation (eqs. 20 and 21) leads to the following important result:

Proposition 1 (Pflüger and Südekum 2007)

(i) The market break point is strictly lower than the social break point ($\phi_b^M < \phi_b^S$), and

(ii) The market redispersion point is equal or lower (strictly lower for $\gamma > 0$) than the social redispersion point ($\phi_r^M \leq \phi_r^S$).

This proposition implies that the market leads to over-agglomeration for low levels of trade freeness, and it yields under-agglomeration for high levels of trade freeness. At very high, very low, and intermediate levels the market equilibrium and the optimum coincide qualitatively. This result is illustrated above in figure 2, which superimposes the bifurcation diagrams of the market and of the social planner. Solid lines represent the equilibrium spatial structure of the economy, and broken ones the optimal spatial structure. From the point of view of public policy, proposition 1 implies that a pro-dispersive regional policy is warranted from an efficiency perspective for low levels of trade freeness only, whereas for higher levels of ϕ the market even delivers "too little" agglomeration and dispersive regional policy can not be justified from aggregate welfare maximization. For the present paper, this welfare analysis is a useful background, because it allows us to address the efficiency of regional costs-of-living differences, to which we turn now.

3.3. Agglomeration and (the efficiency of) regional cost-of-living differences

In the previous two subsections we have shown for which levels of trade freeness agglomeration occurs as market equilibrium, and for which it is efficient. In this subsection we derive the implications for regional cost-of-living differences. The main question of the analysis is whether the central region, provided agglomeration exists, has higher or lower costs-of-living than the peripheral region. It is clear that manufacturing prices will be lower in the core, because all manufacturing production is concentrated there in the case of full agglomeration, and no trade costs for manufacturing varieties need to be paid. However, housing is more expensive because the housing stock is assumed to be equally large in both regions. A priori it is unclear which price difference dominates overall costs-of-living.

This is also illustrated in figure 1 above (left column, panels A1-A5). Assume without loss of generality that region 1 is the central region where agglomeration would occur (i.e., concentrate on the part of the figures where $1/2 \leq \lambda \leq 1$). The thin solid line depicts the housing price difference. This curve is always monotonously upward sloping, i.e., residents of region 1 would always pay a higher equilibrium housing price when $\lambda > 1/2$. Since housing demand exhibits no income effects in this model and overall housing expenditure is fixed, this implies that residents of the agglomeration region purchase a smaller lot size than residents of the peripheral region, which seems to be in line with the stylized empirical fact that housing units are smaller in cities. Whether the *overall* costs-of-living, depicted by the broken line in the figures A1-A5, are higher or lower in the agglomeration region 1 depends on the level of trade openness. For low levels of ϕ the advantage of lower manufacturing prices in the agglomerated region is substantial and outweighs the higher housing prices. This can be seen in the panels A1-A3 where the thin broken line is downward sloping, indicating that overall costs-of-living in region 1 would be lower in case of agglomeration. Yet, when trade becomes sufficiently free the higher housing prices are more important for overall costs-of-living. Panel A4 illustrates a scenario where the equilibrium location pattern exhibits partial agglomeration (in region 1), and where the central region is subject to higher living costs.

We can derive an analytical expression for the cost-of-living difference by using eq. (12). Starting with the case of full agglomeration ($\lambda = 1$), eq. (12) becomes:

$$\Delta COL\left(\lambda = 1\right) = \alpha\left(\frac{Ln\phi}{\sigma - 1} + \gamma \cdot \ln\left(\frac{1+\rho}{\rho}\right)\right) \tag{22}$$

If ΔCOL is larger (smaller) than zero, the core is more expensive (cheaper) than the periphery. The borderline case where centre and periphery have equal living costs can be found by setting (22) equal to zero and then solving for ϕ. This yields a critical level of ϕ:

$$\phi_{COL} = \left(1 + 1/\rho\right)^{\gamma(1-\sigma)} \tag{23}$$

The core region 1 has lower costs-of-living than region 2 when $\phi < \phi_{COL}$ and higher costs-of-living when $\phi > \phi_{COL}$. It is clear that costs-of-living are lower in the core, the lower the degree of trade freeness is, because the imports of the de-industrialized periphery are then more expensive. Furthermore, we can use (23) to establish the following comparative statics:

Proposition 2

The parameter range of ϕ for which the core has lower costs-of-living than the periphery is larger (i.e. ϕ_{COL} is larger), (i) the lower is the weight of housing expenditure γ, (ii) the larger is the relative size of the population of immobile workers ρ, and (iii) the stronger are the increasing returns to scale (the lower is σ).

The disadvantage of the core is the higher price for housing. The lower is the weight of housing expenditure, γ, the more likely is it that the industrial centre is the cheaper area. Second, the smaller is the population of mobile workers the smaller are the differences in housing costs between centre and periphery, and the easier will the core be cheaper. Finally, the stronger are the increasing returns to scale, the more pronounced are the differences in manufacturing prices between centre and periphery due to the size of the mark-up.

Focusing now on the case of partial agglomeration ($1/2 < \lambda < 1$), we can derive the regional cost-of-living difference by setting eq. (12) equal to zero and solving for ϕ. We obtain the following generalized critical trade freeness level at which costs-of-living in core and periphery are exactly identical:

$$\tilde{\phi}_{COL} = \frac{\lambda\left(\frac{\lambda+\rho}{1-\lambda+\rho}\right)^{\gamma} - (1-\lambda)\left(\frac{\lambda+\rho}{1-\lambda+\rho}\right)^{\gamma\sigma}}{\lambda\left(\frac{\lambda+\rho}{1-\lambda+\rho}\right)^{\gamma\sigma} - (1-\lambda)\left(\frac{\lambda+\rho}{1-\lambda+\rho}\right)^{\gamma}}$$

Considering a scenario with any given value of $1/2 < \lambda < 1$, so that partial agglomeration in region 1 obtains, this region is the more expensive area if $\phi > \tilde{\phi}_{COL}$ and the cheaper area if $\phi < \tilde{\phi}_{COL}$. One can show that $\tilde{\phi}_{COL}$ reduces to the expression ϕ_{COL} in eq. (23) with $\lambda = 1$, and that $\tilde{\phi}_{COL} > \phi_{COL}$ for all values $1/2 < \lambda < 1$. I.e., the parameter range where region 1 has higher costs-of-living is larger with full than with partial agglomeration. The basic intuition and the comparative statics from the full agglomeration case carries over to the case with partial agglomeration, hence we will not deal with this analytically less tractable case from now on.

Comparing the critical level (23) with (16), (17), (20) and (21), it is possible to derive the following unambiguous ranking of thresholds,

$$\phi_b^M < \phi_b^S < \phi_{COL} < \phi_r^M < \phi_r^S , \tag{24}$$

which immediately implies the following result:

Proposition 3

The industrial core has lower overall costs-of-living than the peripheral region in the parameter range $\phi_b^M < \phi < \phi_{COL}$ *, and higher costs-of-living in the range* $\phi_{COL} < \phi < \phi_r^M$.

This proposition generalizes the main result by Südekum (2006) that a core-periphery structure with full agglomeration can emerge endogenously as market equilibrium, such that the centre is the more expensive region. The seminal Krugman-model is incapable of reproducing this stylized fact, because it abstracts from housing scarcity. This feature is needed, however, for higher living costs in the centre. Of course, partial agglomeration is then also consistent with higher overall costs-of-living in the larger region.

The threshold ranking in eq. (24) also implies another result which is useful for thinking about the efficiency aspects of regional cost-of-living differences. To be sure, the planner maximizes the sum of individual *utility* levels. Although living costs are an important part of utility, the planner is not concerned with living costs directly when choosing the (second best) optimal spatial structure. Since the planner takes market prices as given, however, we can study the *implications* of the planner's choice of λ for the costs-of-living in the two regions. We have shown above that agglomeration is a priori consistent with both, higher or lower living costs in the agglomerated region. Thus, it is conceivable that for a given level of ϕ the market allocation might lead to excessively high living costs in the centre. I.e., a priori the possibility exists that the market implies agglomeration with higher living costs, whereas the planner would choose a configuration with agglomeration but lower living costs in the larger region. However, the next proposition establishes that this possibility is not relevant in this model:

Proposition 4

(i) Agglomeration with higher costs-of-living in the central region is efficient in the parameter range $\phi_{COL} < \phi < \phi_r^S$, (ii) the market allocation never generates excessively high costs-of-living in the core.

In the parameter range $\phi_{COL} < \phi < \phi_r^S$ the planner would precisely choose a spatial structure where all manufacturing activity is concentrated in the core, and where the core is the more expensive area. In that sense, this outcome is efficient. Furthermore, note that there are only two ranges of ϕ where equilibrium and optimum differ qualitatively, namely $\phi_b^M < \phi < \phi_b^S$ and $\phi_r^M < \phi < \phi_r^S$. In the initial phase of inefficient over-agglomeration the transition from symmetry to the core-periphery structure is such that the core maintains lower overall costs-of-living. The planner, in contrast, would still keep the economy dispersed, which would imply equal costs-of-living in both areas. In this sense, costs-of-living in the core are "too low" rather than "too high". Only after trade freeness has risen further to ϕ_{COL} will the core become the more expensive area. On that level of trade freeness, however, agglomeration is already efficient. In the later phase of inefficient under-agglomeration the core-periphery structure (with higher central costs-of-living) breaks down "too early", i.e. the planner would prefer to have agglomeration with an expensive core and a cheap peripheral area. We therefore do not find a parameter range with *excessively* high costs-of-living in the central region. Put differently, in this model we do not find a constellation such that (i) the planner would choose less agglomeration than in the market allocation, and (ii) the centre is more expensive in the market allocation. In that sense we do not find a constellation with "excessively high" living costs in the central region.

The normative results provided in the propositions 1 and 4 hinge – of course – crucially on the assumed functional form of the social welfare function, the utilitarian one. Deriving more general normative results based on the less controversial Pareto-criterion is not possible, however, because the different groups in this economy are affected differently from agglomeration in region 1.[5] Given that overall costs-of-living would increase in the core, immobile workers will see their real wages falling because they do not earn a nominal wage premium. This implies that it is not beneficial for everybody if his or her region of residence becomes an industrial agglomeration area. Conversely, immobile residents of the peripheral region will be better off in this constellation since housing prices and overall costs-of-living decrease in region 2. Exactly opposite considerations apply when agglomeration gives rise to lower living costs in the agglomeration region. By postulating a utilitarian social welfare function we envision a planner who compromises on the interest of the different groups.

4. Amenity differences

In this section we introduce exogenous regional differences by assuming that region 1 is inherently more attractive than region 2 due to higher amenities ($v_1 > v_2$). We describe how this affects the equilibrium market allocation and the regional costs-of-living.[6] In doing we emphasize how regional amenities that capitalize in market prices interact with the cumulative causation mechanisms that are characteristic for models of the new economic geography.

[5] On that point, see also Charlot et al. (2005) who show that a Pareto-ranking of different spatial structures is out of reach in standard economic geography models.

[6] In this section we concentrate on the positive part of the model and do no longer analyze the welfare implications of agglomeration.

The utility difference that governs the location decision of mobile skilled workers, eq. (13), must now be augmented with the amenity difference $\Delta \nu \equiv (\nu_1 - \nu_2)$:

$$\Delta V^K = \alpha \left[\frac{(1-\phi)}{\sigma} \left(\frac{\rho+\lambda}{\lambda+(1-\lambda)\phi} - \frac{\rho+(1-\lambda)}{\phi\lambda+(1-\lambda)} \right) + \frac{1}{\sigma-1} \ln\left(\frac{\lambda+\phi(1-\lambda)}{\lambda\phi+(1-\lambda)} \right) - \gamma \ln\left(\frac{\rho+\lambda}{\rho+(1-\lambda)} \right) \right] + \Delta \nu \quad (24)$$

The symmetrical configuration is, thus, no longer an equilibrium, but $\Delta V^K = \Delta \nu > 0$ at $\lambda = 1/2$ if $\nu_1 > \nu_2$. The long-run equilibria λ^* of this augmented model are implicitly entailed in eq. (24). Unfortunately, we cannot obtain closed-form solutions for the equilibrium spatial structure $\lambda^*(\phi, \Delta\nu, \cdot)$. For solving this model we have to resort again to numerical simulations and to qualitative descriptions of the model's properties. Still we can make use of the fact that the exogenous term $\Delta \nu$ simply shifts up the utility difference ΔV^K at any value of λ, and that the local properties of ΔV^K at $\lambda = 1/2$ for different values of ϕ are still the same as in the case of identical regions. The shape of the utility differential ΔV^K therefore depends crucially on the level of trade freeness ϕ, and it is useful to consider a trade integration process where ϕ steadily rises from zero to one.

Figure 1 illustrates the effects of an exogenous advantage of region 1 on the equilibrium spatial structure in this model. The left column represents the benchmark case of identical regions, whereas the right column (panels B1-B5) represents the respective case with a small "utility bonus" $\Delta \nu > 0$ for region 1(the case where $\Delta \nu < 0$ would be analogous).

Consider at first the case of very low trade freeness (panels A1, B1). Symmetry would be the unique spatial equilibrium with identical regions, because the endogenous dispersion forces (housing congestion and in particular the competition effect) dominate the agglomeration forces (supply and demand linkage) for such low levels of ϕ. The amenity difference shifts up the curve ΔV^K by $\Delta \nu > 0$ at $\lambda = 1/2$, so that symmetry is no longer an equilibrium, but initial migration into region 1 is triggered. The curve ΔV^K is monotonously downward sloping over the range of λ, i.e., the utility advantage of region 1 shrinks as skilled workers enter the region. The reason is the following: Migration drives up housing prices, but drives down manufacturing prices and overall costs-of-living in region 1. Hence, living cost considerations would push for ever more immigration. Still, the concentration of mobile workers does not yet become self-reinforcing at this level of ϕ, because the so-called "competition effect" is the dominating location force. Nominal wages for skilled workers decrease sharply as more skilled workers enter, and thus migration comes to a halt at some interior equilibrium with partial agglomeration, where the different agglomeration and dispersion forces just balance each other.[7] The figure also shows in what sense there is "capitalization" of amenities: The induced agglomeration in region 1 drives up local housing prices, as can be seen by the thin solid curve in panel B1. Skilled workers located in region 1 are implicitly willing to pay for these amenities and the higher housing prices in form of lower nominal wages. Still, the overall costs-of-living are lower in that region due to the supply linkage that is associated with transport costs in the manufacturing sector. In other words, comparing the case with and without exogenous differences, the amenities imply some agglomeration that would otherwise not have occurred. That additional concentration has some endogenous advantages (lower manufacturing prices in the centre), but it capitalizes in higher housing prices and lower nominal wages.

At a higher level of trade freeness, we would observe partial agglomeration even with identical regions (see panel A2). The exogenous amenity magnifies this difference in the direction of the advantaged region (see panel B2). The share of skilled workers located in region 1 is larger with $\Delta\nu > 0$ than with $\Delta\nu = 0$. Again, this additional migration towards region 1 capitalizes in higher housing prices, and it must also lead to lower nominal wages for skilled workers. This is so, because overall costs-of-living are still lower in the agglomerated region in this constellation, but migration does not yet become self-reinforcing. Hence, the competition effect must be sufficiently strong to balance the consolidated effect of all other location forces in the spatial equilibrium.

In the third line of figure 1 we depict constellations where the concentration of skilled workers actually becomes self-reinforcing. In the case with identical regions (panel A3) it is entirely indeterminate which region will become the centre. The symmetrical constellation is an unstable short-run equilibrium, and full agglomeration will occur in that location where the first "migration impulse" occurs. Introducing the regional asymmetry $\Delta\nu > 0$ gives some direction as to which region will become the centre. As can be seen in panel B3, there is now an unstable short-run equilibrium at some level $0 < \lambda < 1/2$. Thus, starting from $\lambda = 1/2$ which is no longer an equilibrium, all skilled workers will end up in the advantaged region 1. Note, however, that there is no capitalization of amenities as before: There would have been full concentration anyway, and the amenity does not increase the level of agglomeration in

[7] What is quite interesting in this constellation is that a small exogenous regional difference gives rise to a quite large regional asymmetry ex post. In this numerical constellation $\Delta\nu$ is assumed to be only 0.02, but region 1 ends up with roughly 70% of the mobile workforce in the long-run equilibrium.

region 1 as it has been the case in the first and second line of figure 1.[8] Hence, when the economy ends up in the corner equilibrium there is just one effect of the amenity difference, namely that workers in region 1 are even better off with $\Delta\nu > 0$ than with $\Delta\nu = 0$. Being in a corner-equilibrium, however, this utility bonus does not push for more migration.

In panels A3 and B3, the concentration leads to higher housing prices but to lower overall costs-of-living in region 1. That latter feature, however, changes as ϕ rises even further to exceed the critical level ϕ_{COL} (which is equal to 0.8235 in the depicted numerical constellation). From proposition 3 we know that there are constellations with full agglomeration but *higher* costs-of-living in the centre. This constellation, which is not explicitly graphically illustrated, would amount to a picture that is similar to panels A3 and B3, but where the broken line is upward sloping instead of downward sloping. For these cases where agglomeration implies higher costs-of-living it is then clear that the motive for spatial concentration of skilled workers is entirely due to higher nominal wages in the centre. That is, from a certain level of ϕ onwards the competition effect is dominated by the demand linkage, making nominal wages for skilled workers in region 1 an increasing function of the number of skilled workers locating in that region (see also Pflüger and Südekum, 2007 on that point). A final observation that is worth mentioning is that even with $\Delta\nu > 0$, the disadvantaged region 2 could also be sustained as the agglomeration centre. Suppose an initial constellation exists where λ is close to zero. Due to the endogenous agglomeration forces no skilled worker has an incentive to move to region 1, even if that region offers a fixed utility bonus. In effect, agglomeration is maintained in region 2 although it would be more efficient to have agglomeration in region 1 to exploit the exogenous amenity.

In the next line, panels A4 and B4, trade integration has come to a point where the economy is already in the phase of industrial re-dispersion, but the agglomeration forces are still sufficiently strong to imply some degree of partial agglomeration. A principal difference between this type of partial agglomeration and the other case depicted in panels A2, B2 is that costs-of-living are now *higher* in the larger region, because manufacturing prices are becoming increasingly similar as ϕ rises. This can be seen most clearly by noting that the broken line is now upward sloping and runs above the horizontal axis if $\lambda > 1/2$. Intuitively, the mix of concentration and dispersion forces that is underlying this type of partial agglomeration is now somewhat different as in panels A2, B2. The dominant agglomeration force is now the higher nominal wage in the centre (the demand linkage), whereas before it

[8] The amenity difference just makes it more likely that region 1 will be the centre.

has been the lower manufacturing price index (the supply linkage). The main opponent is now the housing congestion force, whereas before it has been the competition effect. As before, we find that the exogenous amenity difference $\Delta\nu > 0$ in panel B4 magnifies the degree of agglomeration. Thereby it leads to higher housing prices than it would have been the case otherwise. I.e., amenities “capitalize” again since we are no longer in corner equilibrium.

Finally, in panels A5 and B5, trade costs have almost vanished. As a result, manufacturing prices and nominal wages are almost identical across regions and the spatial structure of the economy is almost completely determined by the housing congestion force. Hence, with identical regions symmetry must be the unique stable equilibrium (see panel A5). Assuming that region 1 is inherently more attractive (as in panel B5) introduces another reason for concentration that is not present in panel A5.[9] This amenity increases the observed degree of agglomeration, and this additional concentration capitalizes in higher housing prices and overall costs-of-living, but it still leads to slightly higher nominal wages in the centre.

4. Conclusion

In this paper we have dealt with an empirically questionable implication of most NEG-models, namely that the core region has lower overall costs-of-living. Although *some* goods are cheaper in the core, particularly locally produced manufacturing varieties for which no trade costs need to be paid, the *overall* costs-of-living (including housing costs) tend to be higher in reality. That most NEG models, including the seminal paper by Krugman (1991), imply the exact opposite is an artifact of the assumption that housing scarcity or some other form of agglomeration cost is absent.

In this paper we have build on the recent NEG model by Pflüger and Südekum (2007). In common with Krugman (1991), agglomeration can develop endogenously in that model, but the location has a very intuitive “bubble shape” with the possibility of stable partial agglomeration. We study the implications of agglomeration for overall costs-of-living in this framework, and show that a core-periphery pattern can develop endogenously in which the agglomeration region has higher costs-of-living. This result is driven by the fact that lower prices for manufacturing varieties in the centre cannot make up for the higher housing prices.

[9] An interesting observation is that the spatial equilibrium becomes extremely sensitive to exogenous differences if trade freeness is high. In the numerical simulations we have chosen $\Delta\nu = 0.02$ in panel B1-B3, but we have used a smaller amenity $\Delta\nu = 0.0082$ in panels B4 and B5. The reason is that the larger amenity difference $\Delta\nu = 0.02$ would have implies full agglomeration in region 1 in both constellations.

Our results agree with those by Südekum (2006), who has studied costs-of-living in the setting of the original Krugman-model augmented with a fixed housing sector. In contrast to Südekum (2006) we are able to provide all results analytically in this paper, whereas he has to refer to selective numerical simulations. We also address the *efficiency* aspects of regional cost-of-living differences. Although some groups will clearly lose from agglomeration if housing prices are driven up, the global welfare analysis reveals that costs-of-living in the core are not excessively high. In contrast, we rather find the possibility that a configuration with agglomeration and higher central costs-of-living breaks down too early.

Finally we have augmented this model with a regional amenity difference. This exogenous consumption amenity tends to increase the degree of agglomeration in the advantaged region, and in the case where full concentration would have prevailed anyway, the amenities tend to impose a direction which region is going to become the centre. If amenities increase agglomeration, this always capitalizes in higher housing prices. This is reminiscent of the classical result described in Roback (1982). However, since we have assumed a consumption amenity, classical spatial equilibrium theory would also tend to suggest that amenities should capitalize in lower nominal wages in the advantaged region as well. This is not necessarily true in this new economic geography model, however. We have shown that the consumption amenity can come with higher or lower nominal wages in the advantaged region, depending on the level of trade freeness, because the manufacturing prices are another fundamental endogenous part of the location decision of mobile skilled workers.

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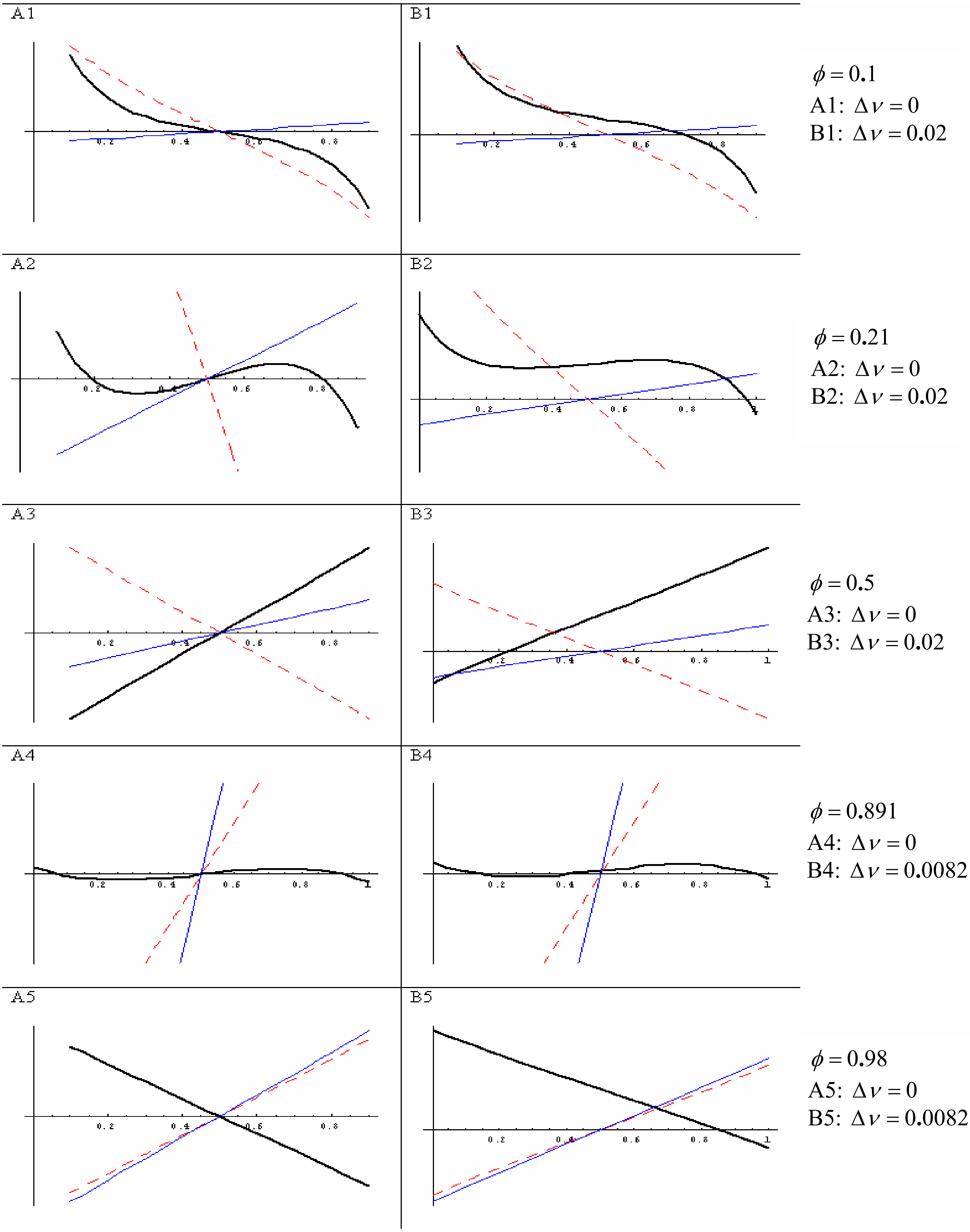
Figure 1: Utility and price differentials



- indicated by solid black line: indirect utility difference
- indicated by dashed red line: cost-of-living difference
- indicated by solid blue line: housing price difference

parameter values: ρ=1, γ = 0.07, α = 0.3, σ = 5
$\rightarrow \phi_{COL} = 0.8235$

Figure 2: Market equilibrium and optimal spatial structure