UNIVERSITÄT POTSDAM

WIRTSCHAFTS- UND SOZIALWISSENSCHAFTLICHE FAKULTÄT

VOLKSWIRTSCHAFTLICHE DISKUSSIONSBEITRÄGE

Wolfgang Wagner

Spatial Patterns of Segregation

A Simulation of the Impact of Externalities between Households

Diskussionsbeitrag Nr. 69

Potsdam 2004

Spatial Patterns of Segregation – A Simulation of the Impact of Externalities between Households

Wolfgang Wagner

University of Potsdam

Abstract

Usually, in monocentric city models, the spatial patterns of segregated ethnic groups are assumed to be ring-shaped, whereas in the 1930's Hoyt showed that empirically wedge-shaped areas predominate. In contrast to Rose-Ackerman's discussion of the influence within a ring-shaped pattern which the aversion which different households in the context of racism have, Yinger showed that, depending on the population mix, a wedge-shaped pattern may arise if it is border length which causes the spatial pattern. In this contribution, a simulation based on a monocentric city model with two or more different household groups is used to derive spatial patterns. Wedge-shaped segregation is shown to be the result of positive externalities among similar households. Differences between households only lead to ring-shaped patterns if the effect of a city center on spatial structure dominates neighborhood effects. If more than two groups of households are being considered, mixed patterns of concentric and wedge-shaped areas arise.

JEL Classification: R14
Keywords: Simulation, segregation, monocentric city

---

[0] University of Potsdam, Department of Economics and Social Sciences, Chair of Economic Theory, Karl-Marx-Str. 67, D - 14439 Potsdam, Germany, email: wwagner@rz.uni-potsdam.de

1 Introduction

Empirical observations of today's city structures show an increasing segregation by ethnic or lifestyle groups (Sassen [14]; Harth, Herlyn, Scheller [5]; Schneider, Spellerberg [16]; Wagner [18]). Such an ethnic or other non-economic segregation takes place if different household groups exist and if there are either negative externalities between households of different groups or positive externalities among households of the same group. Racism as well as the existence of social networks are particular examples of these phenomena. According to Shelling [15], such externalities lead to a dynamic process of segregation because when households choose their location, they either minimize the amount of differing households in their neighborhood or maximize those of their own group. This evolutionary process is called *tipping-process.*

The analysis of urban segregation brought about two different spatial patterns. On the one side, there is the well understood ring-shaped pattern according to Burgess's and Parks' [4] as well as Alonso's [1, 2] description of households' location choices. On the other hand, in the 1930's, Hoyt [6] empirically discovered the dominating spatial segregation pattern in American cities to be more ore less wedge-shaped. The basic difference lies in the direction of borderlines which may be either concentric, leading to ring-shaped patterns, or radial, with wedge-shaped patterns.

In the discussion of segregation caused by ethnic or other non-economic characteristics, focusing on density and pricing structure in space, the spatial pattern is usually assumed. The resulting density structure depends on the assumed reasons for segregation. In *border models,* the border itself is such a reason. Its effect on density and pricing structure at any given location decreases with distance. In *amenity models*, density and pricing structure are influenced by a neighborhood's population mix, with the effects also decreasing by distance from the respective location.

Rose-Ackerman [13] describes the effects of racism as negative externality between two different ethnic groups within a border model, assuming a ring-shaped segregation pattern as the one with the shortest border length and therefore a minimum of connection between households of the two groups. Yinger [19] shows that, depending on population mix, a wedge-shaped segregation pattern may lead to a shorter border length as well as the lower number of households along a border. Finally Loury [7] showed, that a pattern with two areas devided by a circular arc provides the shortest possible border length an least number of households at a border.

This models have in common that they analyse the optimality of given spatial patterns without explaining how these patterns will be reached by a housing market allocation. A critism is that if there are negative externalities between different households, the most efficient outcome of the models would be the existence of different cities, each with only one household group. Miyao [8] and Miyao, Shapiro and Knapp [9] showed, that cities with mixed population only occours if there is a positive effect of decline in the size of a group for households of this group. Such an effect can be agglomeration effects driven by the population mix.

With the advancing computing possibilities, the simulation of evolutionary complex systems becomes more and more important for urban modelling (Torrens and O'Sullivan [17]). Especially the use of extended cellular automata provides interesting results. Portugali et al. [12] and Portugali [11] use cellular automata models to simulate segregation processes. As driving force they stipulate that social networks may be the reason for positive externalities among households with similar demographic or ethnic characteristics. As in Shelling's [15] *tipping-process*, their system is leading to patterns with strong segregation. However, their contributions are limited in two aspects. The location choice of households is explained in a behaviouristic fashion only and the city possesses no other characteristics other than the initial distribution of the population. Thus, the size of the city is usually limited by the modelled space only. While the possibility to model externalities between households by using evolutionary approaches is shown, it is necessary to explain the size of the city in order to show the city structure endogeniously.

In this contribution an evolutionary simulation based on a monocentric model is used to discuss the spatial segregation patterns of two to six household groups. A city center is assumed which influences the location choice of households depending on their commuting between any location within the city and the city center. Furthermore, positive externalities within household groups are being assumed which influence their evaluation of a location according to individual preferences. As a consequence the evaluation of a location varies with the group. It is the better the more households of the same group are in the neighborhood. As a positive effect of a mixed population incomes of households are positively related to the number of households of other groups by a CES production function. In this model, the result of the allocation process is open. It is not exante that the process leads to an equilibrium. Section 2 presents the model which is solved within a simulation, closing with the allocation process used in the simulation. Section 3 shows the spatial patterns and welfare results. Section 4 summarises.

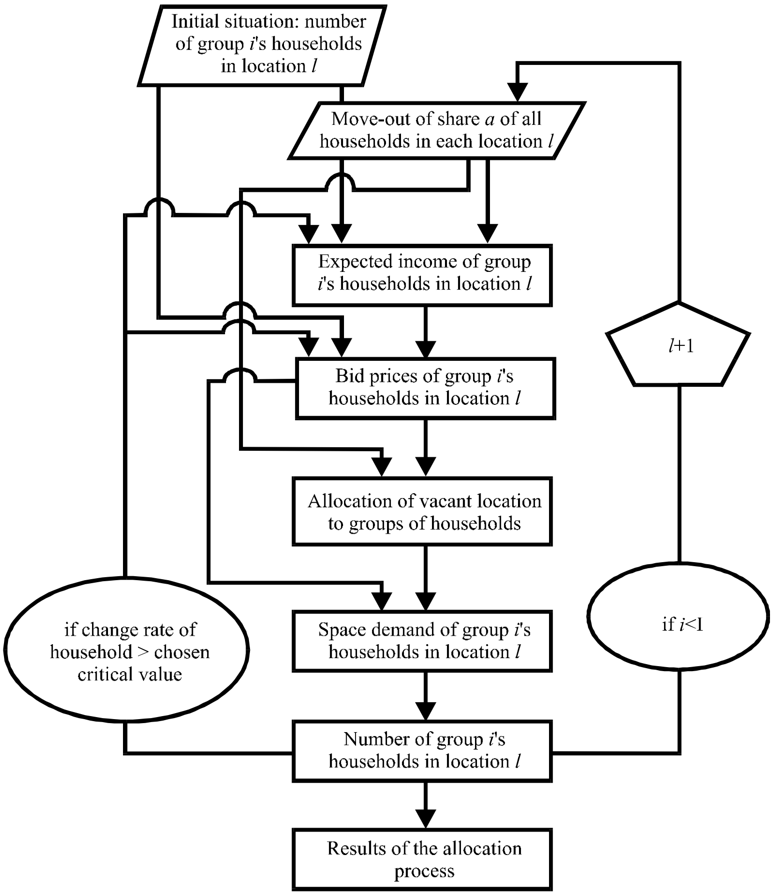

Figure 1: Allocation process

2 The Model

The model is basically an extended cellular automaton as in Batty [3]. We use an even surface which is devided into l cells. Without migration costs the population may move between cells inside the city but also from outside into the city and vice versa. The allocation is simulated as an iterative process. In each iteration a certain share of the population is leaving a cell. The vacant land will be allocated to households with the highest bids. The process may lead to an equilibrium but the result is open. It is dependent on the expectations of households regarding income and externalities (figure 1). As a result, we obtain the distribution of population on the surface, as in common cellular automata models visualized in a plot which looks quite similar to a population map.

To simulate segregation, population is divided into different groups of households. These groups can be distinguished by family structure, race, lifestyle or other non-economic characteristics. The microeconomic foundation of the simulation is a monocentric model in the *Muth* style [10, p. 37]. Accordingly households' behaviour follows a utility function including housing, consumption and commuting to the city center. Apart from these goods, we are considering the influence of externalities between different households.

Since we are using an *open city* approach, the values of living inside or outside the city have to be compared. The key question here concerns a household's evaluation of an inner-city location compared to one outside the city with given characteristics at a given price. As in other monocentric models the answer lies in a bid-price function with a form which depends on the goods considered in the utility function, usually housing and a centrally offered consumption good. In this approach however, while the consumption good is obtainable everywhere, we regard two other arguments of utility, namely a centrally provided public good and externalities between households. Inside the city households are connected to the city center by consumption of the public good, while outside the city, spatial structure is assumed to be unimportant – think of more or less independent settlers. Apart from distance to the city center the value of a location depends on the spatial distribution of other households.

We use a utility function for a location l inside the city:

$$u_{i,l} = (z_{i,l})^{\alpha_{z,i}} \, (s_{i,l})^{\alpha_{s,i}} \, (x_{i,l})^{\alpha_{x,i}} \prod_{i'=1}^{I} (n_{i,j,l})^{\alpha_{n,i,j}} \tag{1}$$

and a utility function for a location outside the city:

$$\overline{u}_{i,l,\varepsilon} = (z_{i})^{\alpha_{z,i}} \, (s_{i})^{\alpha_{s,i}} \, (x_{i})^{\alpha_{x,i}} \prod_{i'=1}^{I} (\overline{n}_{i,j})^{\alpha_{n,i,j}} \, . \tag{2}$$

The Budgetconstraints are as follows. Inside the city we have

$$\widehat{Y}_i = tr_l z_i + \psi_{i,l} s_i + p_x x_{i,j,\varepsilon}$$

while it is outside the city:

$$\widehat{Y}_i = T_l z_i + \psi_{i,l} s_i + p_x x_{i,j,\varepsilon}.$$

Here, commuting inside a city is necessary to receive a unit of a public good z for free. tr_l are commuting costs of a location with a distance r to the city center. Outside the city the public good is provided by the state and financed by a fee T per unit of public good which is a uniform delivered price.

$\widehat{Y}_i$ is the expected income of a member of group i inside the city, and $\overline{Y}_i$ is obtainable outside. The externalities caused by members of group j are $n_{i,j,l}$ inside and $\overline{n}_{i,j,l}$ outside the city. The exponents $\alpha_{z,i}$, $\alpha_{s,i}$, $\alpha_{x,i}$ and $\alpha_{n,i,j}$ are exogenous and represent preferences of a member of group i for the goods in the index.

By this we obtain as bid-price function:

$$\psi_{i,l} = p_b \left(\frac{T}{tr_l}\right)^{\frac{\alpha_{z,i}}{\alpha_{s,i}}} \left(\frac{\widehat{Y}_i}{\overline{Y}_i}\right)^{\frac{\left(\alpha_{s,i}+\alpha_{x,i}+\alpha_{z,i}\right)}{\alpha_{s,i}}} \prod_{j=1} \left(\frac{n_{i,j,l}}{\overline{n}_{i,j}}\right)^{\frac{\alpha_{n,i,j}}{\alpha_{s,i}}} . \tag{3}$$

Thus, we realize that the willingness to pay depends on the advantage of a location inside compared to one outside the city.

To specify the bid-price function, we have to calculate externalities and income. The system becomes dynamic if we assume externalities and income as dependent on the population of the city in a period ε. The first is plausible by definition of externalities. We are using a potential approach, standardizing externalities n to 1 unless there is an influence of the potential:

$$n_{i,j,l} = 1 + \sum_{l'} \left(\frac{H_{j,l}}{\exp(d_{l,l'})}\right) \tag{4}$$

with $d_{l,l'}$ being the distance between locations l and l'. The case of $\overline{n} = 1$ is used as reference for locations outside the city.

The grounds for second relationship have to be explained. There is a broad discussion on agglomeration effects generated within urban production. In the present approach, these are caused by combining members of different household groups, leading to higher productivity and income. This we represent by using a CES production function, with $H_{i,\varepsilon}$ being labour offered by members of different groups in the period ε and q_i being the quality of labour of a group:

$$Y_{i,\varepsilon} = p_x q_i^{\rho} \left(\left(\sum_i \left(q_i H_{i,\varepsilon}\right)^{\rho}\right)^{1/\rho} \left(q_i H_{i,\varepsilon}\right)^{-1} \right)^{(1-\rho)} . \tag{5}$$

To obtain an income outside the city, it is assumed that only members of the same group, perhaps only a single household, are involved in production. In this case, the income is p_x.

Since income is dependent on population, households have to build expectations regarding their income in a certain period of time. The easiest way here is to use the concept of static expectations since tests showed that adaptive expectations wouldn't lead to better fitting with the realized income and leave the results nearly unchanged.

Unfortunately, using the CES production function leads to two specific problems. Firstly, if a groups' share of the population is small, there is an extreme increase in income, and secondly, if a group disappears, the expected income becomes zero. These edge solutions can be avoided by assuming that there has to be a minimal share of one groups' population to gain information about their income. If the share of this group is larger than, say, ι, the expected income $\widehat{Y}_{i,\varepsilon}$ in period ε equals the income of the last period $\varepsilon - 1$. Otherwise it will be the average income of the whole cities' population of the last period. Income follows as:

$$\widehat{Y}_{i,\varepsilon} = \left| \begin{array}{c} \widehat{Y}_{i,\varepsilon-1} \text{ if } \frac{H_{i,\varepsilon-1}}{\sum_i H_{i,\varepsilon-1}} \geq \iota \\ \frac{\sum_i H_{i,\varepsilon-1}\widehat{Y}_{i,\varepsilon-1}}{\sum_i H_{i,\varepsilon-1}} \text{ if } \frac{H_{i,\varepsilon-1}}{\sum_i H_{i,\varepsilon-1}} < \iota \end{array} \right. . \tag{6}$$

Knowing the bid-price function and its elements, we can think about the allocation process itself. In our simulation the evolution of a city starts with the rise of a city center within a concentration of households, maybe a village, with randomly distributed households of different groups. For an allocation process it is necessary that a certain amount of locations are set free to be obtainable for new households. Assuming that households which moved in in one period move out in equal fractions within a certain time, say 10 periods, then in each period 10% of the land becomes vacant. A reason can bee seen in an exogenous distribution of changes in lifecycle or composition of households which leads to moves.

The vacant land will be distributed to households with the highest bid for a dwelling. The bids follow the bid-price function (equation 3). Thus we know the allocation of land to household groups. Knowing the realized bid price, deviding the total land of a location by the demand of land of the relevant households of that location delivers the allocation of households to locations $H_{i,l}$. This result of the housing market is the starting point for the next iteration. Again people move out and release a share of land which can be reallocated to households.

Due to the continous fluctuation of households, there is no natural end to this iteration algorythm; it must be stopped by rule. A stop rule may either be a criterium of an equilibrium or a critical number of iterations. The later becomes important in cases when the system is instable while the relative change in the number of households may be used as a criterium of equilibrium. If the change is smaller than a chosen critical rate ι in each cell, the city seems to be in equilibrium.

Within the allocation process several results are obtainable: Household numbers per cell, income of different households, production of goods, profits of firms and landlords and ultimately welfare as the total producer rent. The spatial patterns of segregation can be demonstrated by the graphical representation of a populations' distribution. Marking the cells of the simulated city in the color of the group which occupies that cell, we obtain a city map of population distribution. For different parameter specifications we should expect different results. We will examine this in the following section.

3 Results

The simulation was run on *matlab* for different parameter values and underwent an extensive sensitivity analysis. The initial parameter specification is oriented on empirical relations and on plausibility. In particular the parameters for the exponents of the utility function are based on data of household expenditures. According to the choosen utility function, the ratio of one exponent to the total of exponents shows the share of expenditures for this good or bundle of goods. The commuting costs are set according to practical reason. Within the observed cell space the commuting costs reach the cost of obtaining public goods outside the city. At this distance to the city center we are expecting the border of the city. Other parameters can be established by trial and error which is legitimate as long as we only aim at understanding the work of the system[1].

The basic calibration is done for two groups of households with similar utility functions. We can see that a monocentric model including externalities between households leads to a spatial pattern allocating half of the city space to either group (figure 2).

Varying the parameters, we realize that these results are quite sensitive. In this open city a mixed city only emerges if income is positively related to the population mix. Otherwise, as Miyao [8] and Miyao, Shapiro and Knapp [9] showed, only one group will settle within the city while the other one is being expelled.

Due to the static expectations regarding income and externalities in many cases, especially with two different groups of inhabitants, we obtain a fluctuating system without an equilibrium. The reason for this is quite obvious: if a group is very small and consequently its income is very high, this leads to high immigration into the city, thereby diminishing the size of the other group everywhere in the city. Thus, the former large group becomes the smaller one with high incomes and the process turns round. An equilibrium

---

[1] The initial parameter values are as follows: 20x20 Cells, $d_{l,l'} = 1$ for l and l' being direct neighbors, $\alpha_{x,i} = 0.3$, $\alpha_{s,i} = 0.15$, $\alpha_{z,i} = 0.1$, $\alpha_{n,i,i} = 0.0075$, $\alpha_{n,i,j} = 0$, $\rho = 0.99$, $q_i = 1$, $p_x = 0.1$, $p_b = 10$, $T = 5$, $t = 1$, $\iota = 0.001$.

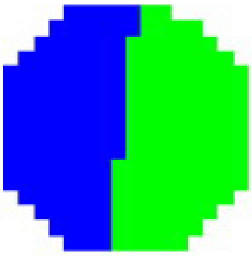

Figure 2: Results of a simulation with externalities and two groups (initial parameter values, see footnote 1)

is possible only if none of the groups becomes small enough for its members to expect extremely high income. This is the case in segregated patterns.

If we take a look at the dynamic allocation process, we can follow the development of a city from a square-shaped village with randomly distributed population. Usually we observe an instantaneous growth following the establishment of a city center. The final size of the city is quickly reached while the segregation process follows growth. Usually an equilibrium is reached between 40 and 60 periods, whereas the spatial growth needs only a few periods. Depending on the rate of moves, an iteration may be counted as a one or two years' period. Thus the equilibrium is to be understood only as a direction of the allocation process which usually will be interfered before equilibrium is reached.

Varying the parameters, we usually obtain results which are up to our expectations. As long as the parameters are symmetric for both groups, asymmetries of the spatial structure are caused by differences in the initial distribution of population only. A productivity rise as well as of positive externalities increases the city's population and size. Both aspects aim at the advantage of living in the city rather than at an outside location. On the other hand, if we raise commuting costs or the preferences for consumption goods, the size of the city decreases. If for instance there were clusters, these might cause higher externalities and lead to larger areas in the equilibrium.

With the chosen production function, however, we have no direct possibility to examine income differences between different groups. Instead we may vary the quality of labour q_i. Since the groups usually occupy areas of more or less similar size with differences being caused by distribution in the start situation only, raising one groups' quality of labour leads to a larger area occupied by this group (figure 3). Its income is lower according to the high

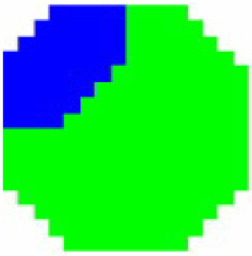

Figure 3: Results of a simulation with externalities and two groups with asymmetric quality of labour (group 1 with higher quality of labour, $q_1 = 1.005$)

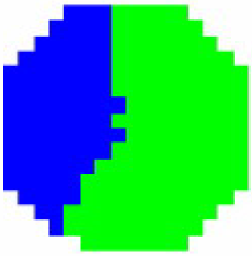

Figure 4: Results of a simulation with externalities and two groups with asymmetric preferences for consumption goods (group 1 with stronger preferences than group 2, $\alpha_{x,1} = 0.5$)

population share. Here we obtain a pattern where the smaller group obtains an area devided by a circular arc. This pattern is similar to those Loury [7] showed as the type of pattern which minimzes border length.

However, we may vary the preferences for externalities, goods or housing. In such cases, a groups' population and area are the larger the higher it evaluates locations within the city compared to locations outside (see figure 4). Here we see a more or less clearly wedge-shaped spatial pattern.

We may obtain ring-shaped patterns if we vary parameters which are responsible for the relationship to the city center, namely the exponent of the centrally offered public good in the utility function, in an asymmetric manner (see figure 5). A group with lower preferences for the centrally provided public good forms a ring-shaped area around the group with higher preferences which is located directly at the city center. The reason for this is that

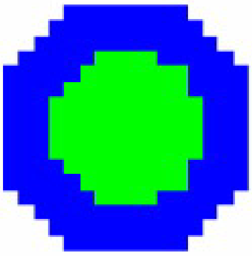

Figure 5: Results of a simulation with externalities and two groups, with asymmetric preferences for centrally offered public goods (group 1 with stronger preferences than group 2, $\alpha_{z,1} = 0.2$)

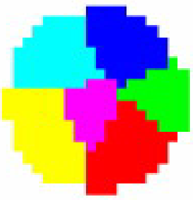

Figure 6: Results of a simulation with externalities and six groups (initial parameter values, see footnote 1)

the bid-price function of the group with lower preferences is less steep than the other. While the group is larger and its curve lower than the other, we obtain a well-known intersection of the two bid-price functions dividing the areas of the two groups (Alonso [1, 2]). In this case the effect of the city center dominates the effect of neighborhood clusters.

We may now derive our main result. The spatial pattern depends on the spatial direction of the dominating parameter. If the relationship to the city center is asymmetric for different households and dominates other parameters, ring-shaped patterns arise. If instead, neighborhood effects dominate, wedge-shaped patterns are obtained.

Finally it is possible to run the simulation with more than two groups for example with six (see figure 6). We then obtain more complex patterns than in the case with two groups. In situations with households of different groups beeing equal apart from their membership, the most frequent pattern is one with areas of several groups at the border while only one or two groups occupy the city center. The effects of changes of parameters again follow intuition. But it is quite more unlikely to obtain ring-shaped patterns than in the case with two groups.

4 Concluding Remarks

In this contribution, within a monocentric model, spatial segregation caused by positive externalities among households of a same group, such as a social network, is simulated. It is shown that both wedge and ring-shaped patterns may occur, depending on the dominating spatial parameter of a households' location choice. If the relationship to the city center dominates and varies for different groups, then ring-shaped patterns are obtainable, whereas, if neighborhood effects are stronger then wedge-shaped patterns dominate. However, if more than two groups are considered, purely ring-shaped patterns are as unlikely as are purely wedge-shaped ones. Usually one or two groups settle in the city center while the other groups occupy clustered areas at the border. The size of the city as well as of single areas is related to the relative advantage of a location within the city compared to any location outside the city.

To go further, this simulation approach may be used as a basis for analyzing more specific situations. Global parameters such as taxes are quite easy to introduce. To make the geography of the model more realistic, differences in the quality of land, even streets, rivers and so forth, might be considered. These parameters are quite interesting for use as a policy planning tool. To improve the market process it is possible to model suppliers' behaviour and the market mechanism by the use of a search algorythm.

By this simple approach, it is possible to show that the sector model by Hoyt [6] and the ring model by Burgess [4] may be unified in a monocentric model with externalities.

5 References

1. Alonso, W., A Theory of Urban Land Market, *Papers and Proceedings of the Regional Science Association*, 6, p. 149-157 (1960).

2. Alonso, W., Location and Land Use, Harvard University Press, Cambridge, MA (1964).

3. Batty, M., Urban Development on the Desktop: Simulation with the Use of Extended Cellular Automata, *Environment and Planning A*, 30,

p. 1943 - 1967 (1999).

4. Burgess, E.W. and Park, R.E.: *The City*, University of Chicago Press, Chicago, Illinois (1925).
5. Harth, A., Herlyn, U. and Scheller, G., *Segregation in ostdeutschen Städten*, Leske+Budrich, Opladen (1998).
6. Hoyt, H., *The Structure and Growth of Residential Neighborhoods in American Cities*, Government Printing Office, Washington (1939).
7. Loury, G.C.: "The Minimum-Border-Length Hypothesis Does Not Explain the Shape of Black Ghettos", *Journal of Urban Economics* (1978).
8. Miyao, T.: "Dynamic Instability of a Mixed City in the Presence of Neighborhood Externalities", *American Economic Review*, 68, S. 454-463 (1978).
9. Miyao, T., Shapiro, P. and Knapp, D. (1980): "On the Existence, Uniqueness and Stability of Spatial Equilibrium in an Open City with Externalities", *Journal of Urban Economics*, 8, S. 139-149.
10. Muth, R.F., *Cities and Housing - The Spatial Pattern of Urban Residential Land Use*, The University of Chicago Press, Chicago and London (1969).
11. Portugali, J., *Self-Organization and the City*, Springer, Berlin (2000).
12. Portugali, J., Benenson, I. and Omer, I.: Spatial Cognitive Dissonance and Sociospatial Emergence in a Self-organized City, *Environment and Planning B: Planning and Design*, 24, p. 263-285 (1997).
13. Rose-Ackermann, S., Racism and Urban Structure, *Journal of Urban Economics* 2, p. 85-103 (1975).
14. Sassen. S., *Cities in a World Economy*, Pine Forge Press, Thousand Oaks, London, New Delhi (1994).
15. Shelling, Th.C., *Micromotives and Macrobehavior*, Norton & Company, New York and London (1978).
16. Schneider, N. and Spellerberg, A., *Lebensstile, Wohnbedürfnisse und räumliche Mobilität*, Leske+Budrich, Opladen (1999).

17. Torrens, P.M. and O'Sullivan, D., Cellular automata and urban simulation: where do we go from here?, *Environment and Planning B: Planning and Design*, 28, p. 163-168 (2001).

18. Wagner, W., *Die Siedlungsstrukturen der privaten Haushalte in Potsdam,* Peter Lang Verlag, Frankfurt/Main (2001).

19. Yinger, J., Racial Prejudice and Racial Residential Segregation in an Urban Model, *Journal of Urban Economics*, 3, p. 383-396 (1976).

Bisher erschienene Diskussionsbeiträge:

Nr. 1 **Eickhof, Norbert/Martin Franke:** Die Autobahngebühr für Lastkraftwagen, 1994.

Nr. 2 **Christoph, Ingo:** Anforderungen an eine standortgerechte Verkehrspolitik in der Bundesrepublik Deutschland, 1995.

Nr. 3 **Franke, Martin:** Elektronisches Road Pricing auf den Autobahnen, 1995.

Nr. 4 **Franke, Martin:** Die Reduktion der CO_2-Emissionen durch Zertifikate?, 1995.

Nr. 5 **Eickhof, Norbert:** Marktversagen, Wettbewerbsversagen, staatliche Regulierung und wettbewerbspolitische Bereichsausnahmen, 1995.

Nr. 6 **Eickhof, Norbert:** Die Industriepolitik der Europäischen Union, 1996.

Nr. 7 **Schöler, Klaus:** Stadtentwicklung im Transformationsprozeß - Erkenntnisse aus der deutschen Entwicklung, 1996.

Nr. 8 **Hass, Dirk/Klaus Schöler:** Exportsubventionen im internationalen räumlichen Oligopol, 1996.

Nr. 9 **Schöler, Klaus:** Tariffs and Welfare in a Spatial Oligopoly, 1996.

Nr. 10 **Kreikenbaum, Dieter:** Kommunalisierung und Dezentralisierung der leitungsgebundenen Energieversorgung, 1996.

Nr. 11 **Eickhof, Norbert:** Ordnungspolitische Ausnahmeregelungen - Rechtfertigungen und Erfahrungen -, 1996.

Nr. 12 **Sanner, Helge/Klaus Schöler:** Competition, Price Discrimination and Two-Dimensional Distribution of Demand, 1997.

Nr. 13 **Schöler, Klaus:** Über die Notwendigkeit der Regionalökonomik, 1997.

Nr. 14 **Eickhof, Norbert / Dieter Kreikenbaum:** Reform des Energiewirtschaftsrechts und kommunale Bedenken, 1997.

Nr. 15 **Eickhof, Norbert:** Konsequenzen einer EU-Osterweiterung für den Gemeinsamen Markt und Anpassungserfordernisse der Gemeinschaft, 1997.

Nr. 16 **Eickhof, Norbert:** Die Forschungs- und Technologiepolitik der Bundesrepublik und der Europäischen Union - Herausforderungen, Maßnahmen und Beurteilung -, 1997.

Nr. 17 **Sanner, Helge:** Arbeitslosenversicherung, Lohnniveau und Arbeitslosigkeit, 1997.

Nr. 18 **Schöler, Klaus:** Die räumliche Trennung von Arbeit und Wohnen - Kritik einer populären Kritik -, 1997.

Nr. 19 **Strecker, Daniel:** Innovationstheorie und Forschungs- und Technologiepolitik, 1997.

Nr. 20 **Eickhof, Norbert:** Die Neuregelung des Energiewirtschaftsrechts, 1998.

Nr. 21 **Strecker, Daniel:** Neue Wachstumstheorie und Theorie der strategischen Industrie- und Handelspolitik -Fundierte Argumente für forschungs- und technologiepolitische Maßnahmen?-, 1998.

Nr. 22 **Schirmag, Toralf/Klaus Schöler:** Ökonomische Wirkungen der Universitätsbeschäftigten auf die Stadt Potsdam und das Umland, 1998.

Nr. 23 **Ksoll, Markus:** Ansätze zur Beurteilung unterschiedlicher Netzzugangs- und Durchleitungsregeln in der Elektrizitätswirtschaft, 1998.

Nr. 24 **Eickhof, Norbert/Dieter Kreikenbaum:** Die Liberalisierung der Märkte für leitungsgebundene Energien, 1998.

Nr. 25 **Eickhof, Norbert:** Die deutsche und europäische Forschungs- und Technologiepolitik aus volkswirtschaftlicher Sicht, 1998.

Nr. 26 **Sanner, Helge:** Unemployment Insurance in a General Equilibrium Framework with Firms Setting Wages, 1998.

Nr. 27 **Never, Henning:** Vielfalt, Marktversagen und öffentliche Angebote im Rundfunk, 1998.

Nr. 28 **Schöler, Klaus:** Internationaler Handel und räumliche Märkte - Handelspolitik aus Sicht der räumlichen Preistheorie -, 1999.

Nr. 29 **Strecker, Daniel:** Forschungs- und Technologiepolitik im Standortwettbewerb, 1999.

Nr. 30 **Schöler, Klaus:** Öffentliche Unternehmen aus raumwirtschaftlicher Sicht, 1999.

Nr. 31 **Schöler, Klaus:** Wohlfahrt und internationaler Handel in einem Modell der räumlichen Preistheorie, 1999.

Nr. 32 **Wagner, Wolfgang:** Vergleich von ringförmiger und sektoraler Stadtstruktur bei Nachbarschaftsexternalitäten im monozentrischen System, 1999.

Nr. 33 **Schulze, Andreas:** Die ordnungspolitische Problematik von Netzinfrastrukturen – Eine institutionenökonomische Analyse -, 1999.

Nr. 34 **Schöler, Klaus:** Regional Market Areas at the EU Border, 2000.

Nr. 35 **Eickhof, Norbert/Henning Never:** Öffentlich-rechtlicher Rundfunk zwischen Anstaltsschutz und Wettbewerb, 2000.

Nr. 36 **Eickhof, Norbert**: Öffentliche Unternehmen und das Effizienzproblem – Positive und normative Anmerkungen aus volkswirtschaftlicher Perspektive -, 2000.

Nr. 37 **Sobania, Katrin**: Von Regulierungen zu Deregulierungen – Eine Analyse aus institutionen-ökonomischer Sicht -, 2000.

Nr. 38 **Wagner, Wolfgang**: Migration in Großstädten - Folgen der europäischen Osterweiterung für mitteleuropäische Stadtstrukturen, 2000.

Nr. 39 **Schöler, Klaus:** Vertikal verbundene Märkte im Raum, 2000.

Nr. 40 **Ksoll, Markus:** Einheitliche Ortspreise im Stromnetz und Wettbewerb in der Elektrizitätswirtschaft, 2000.

Nr. 41 **Sanner, Helge:** Regional Unemployment Insurance, 2001.

Nr. 42 **Schöler, Klaus:** Zweistufige Märkte bei zweidimensionaler räumlicher Verteilung der Nachfrage, 2001.

Nr. 43 **Isele, Kathrin:** Institutioneller Wettbewerb und neoklassische Modelle, 2001.

Nr. 44 **Sanner, Helge:** Bargaining Structure and Regional Unemployment Insurance, 2001.

Nr. 45 **Sanner, Helge:** Endogenous Unemployment Insurance and Regionalisation, 2001.

Nr. 46 **Ksoll, Markus:** Spatial vs. Non-Spatial Network Pricing in Deregulated Electricity Supply, 2001.

Nr. 47 **Ksoll, Markus/Klaus Schöler:** Alternative Organisation zweistufiger Strommärkte – Ein räumliches Marktmodell bei zweidimensionaler Verteilung der Nachfrage, 2001.

Nr. 48 **Kneis Gert/Klaus Schöler**: Zur Begründung der linearen Nachfragefunktion in der Haushaltstheorie, 2002.

Nr. 49 **Westerhoff, Horst-Dieter:** Die Zukunft der Gemeinsamen Agrarpolitik angesichts der EU-Erweiterung, 2002.

Nr. 50 **Wagner, Wolfgang:** Subventionsabbau um jeden Preis? Wohlfahrtswirkungen von Subventionen im Transportsektor, 2002.

Nr. 51 **Isele, Kathrin:** Fusionskontrolle im Standortwettbewerb, 2003.

Nr. 52 **Eickhof, Norbert:** Globalisierung institutioneller Wettbewerb und nationale Wirtschaftspolitik, 2003.

Nr. 53 **Schulze, Andreas:** Liberalisierung und Re-Regulierung von Netzindustrien – Ordnungs-politisches Paradoxon oder wettbewerbsökonomische Notwendigkeit? –, 2003.

Nr. 54 **Schöler, Klaus/Wolfgang Wagner**: Freizeitbewertung und städtische Bevölkerungsverteilung – Theoretische und empirische Ergebnisse –, 2003.

Nr. 55 **Sanner, Helge**: Imperfect Goods and Labor Markets, and the Union Wage Gap, 2003.

Nr. 56 **Sanner, Helge**: Imperfect Goods and Labor Markets, Regulation, and Spillover Effects, 2003.

Nr. 57 **Holzer, Verena L**: Überblick über die Energiepolitik der Europäischen Union, 2003.

Nr. 58 **Westerhoff, Horst-Dieter:** Hightech und Infrastruktur – Die Entwicklung der Geoinformationsbranche -, 2003.

Nr. 59 **Wagner, Wolfgang:** Simulation von sozialer Segregation im monozentrischen Stadtsystem, 2003.

Nr. 60 **Wagner, Wolfgang:** Mietpreisbindung für Wohnungen und ihre Wirkung auf die soziale Segregation., 2003.

Nr. 61 **Eickhof, Norbert**: Freiwillige Selbstverpflichtungen aus wirtschaftswissenschaftlicher Sicht, 2003.

Nr. 62 **Merkert, Rico:** Die Liberalisierung des schwedischen Eisenbahnwesens – Ein Beispiel vertikaler Trennung von Netz und Transportbetrieb, 2003.

Nr. 63 **Holzer, Verena L.**: Ecological Objectives and the Energy Sector – the German Renewable Energies Act and the European Emissions Trading System -, 2004.

Nr. 64 **Schulze, Andreas:** Alternative Liberalisierungsansätze in Netzindustrien, 2004.

Nr. 65 **Do, Truong Giang:** Tariffs and export subsidies in a spatial economic model, 2004.

Nr. 66 **Wagner, Wolfgang**: Der räumliche Wohnungsmarkt als lokales Mehrproduktmonopol, 2004.

Nr. 67 **Sanner, Helge**: Economy vs. History: What Does Actually Determine the Distribution of Firms' Locations in Cities?, 2004.

Nr. 68 **Schulze, Andreas:** Liberalisierungen in Netzindustrien aus polit-ökonomischer Sicht – Eine positive Analyse der Interessenbedingtheit von Privatisierungen und Marktöffnungen am Beispiel netzgebundener Wirtschaftsbereiche –, 2004.

Nr. 69 **Wagner, Wolfgang**: Spatial Patterns of Segregation .A Simulation of the Impact of Externalities between Households, 2004.

Nr. 70 **Wagner, Wolfgang**: Optimal Spatial Patterns of Two, Three and Four Segregated Household Groups in a Monocentric City, 2004.

Nr. 71 **Wagner, Wolfgang**: A Simulation of Segregation in Cities and its Application for the Analysis of Rent Control, 2004.