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Housing Market and Agglomeration of Rent-Seeking Activities: Implications for Regional Development*

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Abstract: Rent-seeking is defined as exercising privileges or expending resources in order to obtain uncompensated gain by redistributing the wealth of others without reciprocating any benefits back to society through wealth creation. This paper pioneers in analyzing the agglomeration of rent-seeking activities in geography and the corresponding impact on regional economies. First of all, we construct a theoretical model based on the standard settings in the literature of economic geography with two types of mobile workers. Each agent maximizes his/her utility, whereas the distribution of agents' type corresponds to a map of productive and rent-seeking activities. Next, conditions for the agglomeration of rent-seeking activities are characterized, which constitute partially segregated equilibria. Finally, based on a panel data analysis for the conterminous 48 states in the U.S., we examine by how much the regional per capita real GDP drops when there is an extra 1 percent increase in the rent-seeking activities in the housing market.

JEL Classification: D72, D50, O18.

Keywords: Rent Seeking; Housing Market; Regional Development.

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1 Introduction

Rent-seeking is defined as exercising privileges or expending resources in order to obtain uncompensated gain by redistributing the wealth of others without reciprocating any benefits back to society through wealth creation. In other words, rent seekers' returns come from a redistribution of wealth rather than from wealth creation (cf. Murphy, Shleifer, and Vishny, 1991). The evidence in Murphy et al. (1991) shows that countries with a higher proportion of engineering college majors (classified as productive entrepreneurs) grow faster, whereas countries with a high proportion of law concentrators (classified as rent seekers) grow slower. Baumol (1990) suggests that the rules of the game determine the relative payoffs to productive and unproductive activities for entrepreneurship and illustrates historical examples as evidence (ancient Rome, medieval China, Dark Age Europe, and the Later Middle Ages). Acemoglu (1995) shows that the existence of rent seekers creates a negative externality on productive agents and implies that relative rewards may be endogenously and malevolently determined. Rothschild and Scheuer (2011) further examine the optimal taxation under the assumption that the social planner cannot distinguish rent seekers from producers. However, the literature does not answer the question of whether a market is an endogenously rewarding mechanism good for productive activities or not, especially for housing markets that commonly present a large extent of rent-seeking activities.¹

In contrast to the literature analyzing the allocation of human capital among productive and rent-seeking occupations, this paper focuses on the allocation of houses for productive versus rent-seeking purposes (i.e., occupied by productive or rent seeking activities). Furthermore, the returns and the costs for the competing uses of houses are endogenously determined by the market. When there are rent-seeking activities in the housing market of a region, not only are some housing resources wasted with no productivity and some capital excluded from capital market, but the entry of rent-

¹Though there are also a large extent of rent-seeking activities in the financial markets, it is much harder to clearly distinguish funds invested on productive and rent-seeking purposes (especially for financial derivatives). Therefore, we choose to focus on housing markets.

seekers into the housing market yields a pecuniary externality on housing prices which affect the rewards for productive activities. In other words, rent-seekers earn profits by grabbing a portion of the producers' output in the same region, and the seizable part of producers' income is endogenously determined by the housing market in the region. The larger a region's housing price bubble is, the greater is the producers' output being transferred as rent seekers' income. Therefore, *raising housing price in a region erodes the rewards for productive businesses and promotes rent-seeking economy, which further influences the migration incentives for productive and rent-seeking activities.*

In this paper we examine several important issues. First of all, is the housing market a good rewarding system in allocating housing resources for productive activities? Secondly, can rent-seeking activities exhibit increasing returns, as claimed in Murphy, Shleifer, and Vishny (1993), with another market-relevant reason? That is, when is the pecuniary externality on housing prices in a region convexly increasing with the aggregate scale of rent-seeking activities? Thirdly, although pecuniary externalities in the literature are commonly not regarded as a loss of market efficiency, this paper shows that the pecuniary externality in the housing market may distort rewards for productive and rent-seeking activities. Finally, as claimed in Murphy et al. (1991), "in most countries, rent-seeking rewards talent more than entrepreneurship does, leading to stagnation;" however, can a region be stagnated due to the agglomeration of rent-seeking activities, rather than because people in the region choose to be rent seekers?

This paper is connected with at least two branches of the literature: discussions of rent-seeking behaviors (cf. see the original work by Tullock (1967), Krueger (1974), and Posner (1975) for the concept of rent-seeking) and analyses of sorting in economic geography (see Tiebout (1956), Benabou (1996a, 1996b), de Bartolome and Ross (2003), Hanushek and Yilmaz (2007), Bayer et al. (2004), and Peng and Wang (2005)). The literature of rent-seeking focuses on monopoly privileges (followed by the claim of Adam Smith (The Wealth of Nations, I.vii.26) that "A monopoly granted either to an individual or to a trading company has the same effect as a secret in trade or manufacturers"),

political lobbying, corruption, and the allocation of human capital. Olson (1982) regards rent-seeking through distributional coalitions as critical to economic development and especially to the decline of nations. Gelb, Knight, and Sabot's (1991) CGE model shows that fiscal expenditure on unproductive employment created by a government crowds out productive investment, which decreases output of 3.4% and retards the growth by at least 0.5%. Acemoglu and Verdier (1998) find that it may be optimal to allow some corruption and not fully enforce property rights, and so less developed economies may choose lower levels of property right enforcement and more corruption. Esteban and Ray (2006) show that both poorer economies and unequal economies display greater public misallocation on rent-seeking activities. Murphy et al. (1991) regress the rate of growth of GNP between 1970 and 1985 in 91 countries on the fractions of college students majoring in law and in engineering. They find a positive and significant effect of engineers on growth; moreover, an extra 10% increase in attorneys lowers the growth rate by around 0.3% per year.

This paper pioneers in analyzing the agglomeration of rent-seeking activities in geography and the corresponding impact on a regional economy. In addition to the importance of talents' choices for occupations, which activities most houses are occupied with should significantly affect regional aggregate output and development. This paper consists of two parts, both of which are crucial in persuading readers of our viewpoint. In Section 2, we construct a theoretical model based on the standard settings in the literature of economic geography with two types of mobile agents. Each agent maximizes his/her utility, whereas the distribution of agents' type corresponds to a map of productive versus rent-seeking activities. In Section 3, we characterize conditions for the agglomeration of rent-seeking activities, which constitute specific partially segregated equilibria. In Section 4, we examine by how much the regional per capita real GDP drops when there is an extra 1 percent increase in rent-seeking activities in the housing market. Finally, concluding remarks are summarized in Section 5.

2 Model

There are two regions ($k \in K \equiv \{x, y\}$) with the same land endowment \bar{s} . There are two types of mobile agents ($i \in N \equiv \{P, R\}$) with populations $n^P, n^R \in \mathbb{R}_{++}$, respectively. Throughout this paper, each agent's type is indexed by a superscript and location is indexed by a subscript. The (endogenous) population of i -type agents living in k is denoted by n_k^i , where $n_x^i \equiv \rho^i n^i$ and $n_y^i \equiv (1 - \rho^i) n^i$, $i \in N$, and the (exogenous) aggregate population in the model is $n \equiv n^P + n^R$. Since we focus attention on the locations of productive and non-productive activities rather than on their magnitude, participation constraints for agents are assumed always satisfied and agents cannot change their types. That is, n^P and n^R are exogenously given.²

To extract the influence of rent-seeking activities on the location choices of productive activities, we assume that two regions are symmetric and there is no commuting so that agents can work only in the region where they live, though they are allowed to migrate to the region with the highest utility in the next section. Let s_k^P, z_k^P each be the P -type agent's house size and the consumption of composite goods in region k , $k \in K$, respectively. Let p_k denote the price per unit of housing in k . Each P -type agent is a worker inelastically supplying one unit of labor whose productivity (wage) is Y_w . Denote Y_o and $Y^P \equiv Y_o + Y_w$ as the exogenous non-wage income and total income for each P -type agent, respectively (cf. Muth (1969), Fujita (1989), and Hochman and Ofek (1999)). Letting $\varphi_k^P \equiv (s_k^P, z_k^P)$, following Aidt, Daunton, and Dutta (2010) and Schlee (2013), the optimization problem for P -type agents in region k is:

$$\begin{aligned} \max_{\varphi_k^P \in \mathbb{R}_+^2} \quad & u_k^P(\varphi_k^P) = (s_k^P)^\alpha + z_k^P, \\ \text{s.t.} \quad & p_k \cdot s_k^P + z_k^P \leq Y^P, \end{aligned} \tag{1}$$

where α represents the strength of P -type agents' preference for housing. Given p_k and Y^P , we have $s_k^P(p_k, Y^P)$ and $z_k^P(p_k, Y^P)$ as optimal consumptions for each P -type

²The numbers n^P and n^R can be determined by education, institution, and social culture, which may be endogenized in future extensions.

agent in k , $k \in K$. Later, we will analyze conditions of α for the existence of different patterns of equilibria.

There are various kinds of rent-seeking activities in a realistic housing market. To simplify our analysis, it is evitable to rely on some modeling tricks. We model rent-seeking activities as non-productive brokers between the P -type agents and the absentee landlord in the same region, who raise the housing price in the region with a pecuniary externality.³ Specifically, we assume that all houses are owned by an absentee landlord in each region, denoted by A . When there are R -type agents in a region, they are always hired as brokers by the absentee landlord. Only when there is no R -type agent in the region, the absentee landlord directly trades with the P -type agents in the same region. The R -type agents work for only the absentee landlord in the same region.⁴ To have a privilege to engage in rent-seeking activities in region k , a minimal slot $s_k^R \in \mathbb{R}_{++}$ is required for every R -type agent in k . Each R -type agent resides in only one region, who is so small that he/she does not consider his/her influence on the housing prices.

When there is no rent-seeking activity in k , the equilibrium housing price in k is defined as a fundamental housing price, denoted by f_k , i.e., $f_k \equiv \{p_k \mid n_k^P \cdot s_k^P(p_k, \underline{s}, Y^P) = \bar{s}\}$, $k \in K$. When there are R -type agents in k , they exclusively occupy $n_k^R s_k^R$ houses. Thus, the equilibrium housing price in k , denoted by p_k , is raised above the fundamental housing price, i.e., $p_k > f_k$. In each region, the R -type agents collect p_k from the P -type agents per unit of housing and render f_k per housing unit to the absentee landlord in k .⁵ In other words, the absentee landlord in k earns $Y_k^A \equiv f_k \bar{s}$ for all distributions of

³Modeling rent seekers as brokers does not deny that brokers in reality may offer services like information transmission, similar to that lawyers may contribute in protecting property rights. However, to match with the definition of “rent-seeking,” we adopt a modeling strategy by assuming that brokers add no value on any product with their efforts.

⁴Similar to the Walrasian auctioneer who matches supply and demand in a market of perfect competition, the landlord in our model is absentee in that he/she is indifferent from spending his/her time and effort on transactions or not. However, to model the idea without explicit financial markets that rent-seeking activities earn profit from the difference between market and fundamental housing prices, we assume that R -type agents in a region are always hired as brokers by the absentee landlord in the same region.

⁵This setting is to reflect different rent-seeking opportunity costs in different regions (for example, interest cost) without explicitly considering extra financial markets.

agents' types.

By defining $\beta_k \equiv \frac{p_k}{f_k} \geq 1$ as the bubble scale of the housing price in k , we have that $\beta_k > 1$ if and only if $n_k^R > 0$.⁶ R -type agents earn their income from the difference between market and fundamental housing prices, $p_k - f_k = (\beta_k - 1)f_k$, which is called the bubble revenue per unit of housing. The total bubble revenue in k is equally shared by the R -type agents in the same region, whereas the rent-seeking cost for each R -type agent is $f_k s_k^R$. Given the same exogenous Y_o to each R -type agent, letting $s_k^R = s^R$, $\forall k \in K$, the optimization problem for each R -type agent in k is:⁷

$$\begin{aligned} \max_{z_k^R \in \mathbb{R}_+} \quad & u_k^R(z_k^R) = (s^R)^\gamma + z_k^R, \\ \text{s.t.} \quad & z_k^R \leq Y_k^R \equiv \frac{n_k^P}{n_k^R}(\beta_k - 1) f_k s_k^P(p_k, Y^P) - f_k s^R + Y_o, \end{aligned} \quad (2)$$

where γ represents the R -type agents' preference for housing, $0 < \gamma < \alpha$. Since s^R is exogenous, the R -type agents' object is equivalent to earning as much income as they can. Recalling that $n_x^i = \rho^i n^i$ and $n_y^i = (1 - \rho^i)n^i$, β_k and f_k are both endogenously determined by market clearing conditions and are thus functions of $(\rho^P, \rho^R) \in [0, 1] \times [0, 1]$. That is, regional bubble scales and fundamental housing prices are determined by the distribution of agents' types.

From the definition of rent seekers, the existence of the R -type agents do not contribute to the regional aggregate production. Therefore, the more the P -type agents there are in a region, the larger the regional aggregate output is.⁸ Moreover, the R -type agents in a region create a pecuniary externality in the housing market by which they transfer a portion of regional P -type agents' aggregate output into their income. The seizable part of the P -type agents' output to be transferred is determined by the

⁶In this paper, the so called bubble scale comes from the existence of rent-seeking activities, rather than from investment and expectations. The role of houses as investment assets needs future analysis.

⁷We assume that Y_o is large enough so that the total income for every R -type agent is non-negative. Moreover, fixed s^R is a common simplifying assumption and adding utilities from consuming a fixed s^R does not change our results.

⁸Assume that the aggregate endowment nY_o is immobile and equally distributed among two regions. Though agents can consume their own Y_o interregionally with no transaction cost, they proceed either productive or rent-seeking in the region where they live.

housing market in our model, which further affects the migration incentives for both types of agents. The larger the housing price bubble in a region is, the more the P -type agents' output is turned into the revenue for rent-seeking activities. This is a simplest model for examining whether the housing market is an appropriate rewarding system in keeping and attracting productive activities for regional development.

Recalling that e is the base of the natural logarithm, i.e., $e \equiv \{\eta | \ln \eta = 1\}$, consider,

Condition I. $0 < n^R s^R < \bar{s} - n^P e^{-1}$.

Condition I avoids the possibility of one region being completely occupied by R -type agents, for it is not reasonable to have a region full of predators (R -type agents) who have no source of prey (P -type agents).⁹ Furthermore, Condition I ensures that housing prices are higher when P -type agents' preference for housing is stronger (i.e., with a larger α).¹⁰ Denoting p_k^* as the equilibrium housing price and letting $\varphi_k^{P*} \equiv (s_k^{P*}, z_k^{P*}) = (s_k^P(p_k^*, Y^P), z_k^P(p_k^*, Y^P))$, following Krugman (1991), we define the short-run equilibrium as a competitive market equilibrium for a given population distribution over the two regions. Notice that in the short run, both types of agents are immobile, whereas R -type agents consume all their income. We allow both types to move across regions in the next section.

Definition 1 (Short-Run Equilibrium)

Given $n^P, Y^P, n^R, s^R, \bar{s}$, and Condition I, for any arbitrary $(\rho^P, \rho^R) \in [0, 1] \times [0, 1]$, $(\varphi_k^{P*}, z_k^{R*}, p_k^*)_{k \in K}$ constitutes a short-run equilibrium if:

- (a) $u_k^P(\varphi_k^{P*}) \geq u_k^P(\varphi_k^P)$, for all $\varphi_k^P \in \mathbb{R}_+^2$ satisfying $p_k^* s_k^P + z_k^P \leq Y^P$, $k \in K$;
- (b) $u_k^R(\varphi_k^{R*}) = (s^R)^\gamma + z_k^{R*}$, where $z_k^{R*} \equiv \frac{n_k^P}{n_k^R}(\beta_k^* - 1)f_k^* s_k^{P*} - f_k^* s^R + Y_o$;
- (c) $\rho^P n^P s_x^{P*} + \rho^R n^R s^R = \bar{s}$,
 $(1 - \rho^P) n^P s_y^{P*} + (1 - \rho^R) n^R s^R = \bar{s}$,

⁹Without the existence of productive activity in a region, rent-seeking activities are simply Ponzi schemes, which are beyond the scope of our analysis.

¹⁰Since $\partial p_k^* / \partial \alpha = (s_k^{P*})^{\alpha-1}[\alpha \ln s_k^{P*} + 1]$, to ensure $\partial p_k^* / \partial \alpha > 0$, $\forall \alpha \in (0, 1)$, $\bar{s} - n^R s^R > n^P e^{-1}$ is needed (or $s_k^{P*} \geq 1$ is sufficient).

$$\begin{aligned}\rho^P n^P z_x^{P*} + \rho^R n^R z_x^{R*} + z_x^{A*} &= \rho^P n^P Y^P + \rho^R n^R Y_o, \\ (1 - \rho^P) n^P z_y^{P*} + (1 - \rho^R) n^R z_y^{R*} + z_y^{A*} &= (1 - \rho^P) n^P Y^P + (1 - \rho^R) n^R Y_o.\end{aligned}$$

For every distribution of agents, P -type agents choose optimal consumptions in the short-run equilibrium given that price-taking R -type agents collect housing prices for the absentee landlord, and the housing and the composite good markets in each region clear. The short-run equilibrium, by Walras' law, is determined by conditions (a), (b) and the arbitrary two equalities in (c). Proposition 1 shows that the short-run equilibrium always exists and is unique.

Proposition 1 *Under Condition I, for each $(\rho^P, \rho^R) \in [0, 1] \times [0, 1]$, there exists a unique short-run equilibrium:*

$$s_x^{P*} = \frac{\bar{s} - \rho^R n^R s^R}{\rho^P n^P}, \quad s_y^{P*} = \frac{\bar{s} - (1 - \rho^R) n^R s^R}{(1 - \rho^P) n^P}, \quad (3)$$

$$z_x^{P*} = Y^P - \alpha \left(\frac{\bar{s} - \rho^R n^R s^R}{\rho^P n^P} \right)^\alpha, \quad z_y^{P*} = Y^P - \alpha \left[\frac{\bar{s} - (1 - \rho^R) n^R s^R}{(1 - \rho^P) n^P} \right]^\alpha, \quad (4)$$

$$z_x^{R*} = \alpha \frac{(\rho^P n^P)^{1-\alpha}}{\rho^R n^R} [(\bar{s} - n^R s^R)^\alpha - \bar{s}^\alpha] + Y_o, \quad (5)$$

$$z_y^{R*} = \alpha \frac{[(1 - \rho^P) n^P]^{1-\alpha}}{(1 - \rho^R) n^R} [(\bar{s} - n^R s^R)^\alpha - \bar{s}^\alpha] + Y_o, \quad (6)$$

$$p_x^* = \alpha \left[\frac{\bar{s} - \rho^R n^R s^R}{\rho^P n^P} \right]^{\alpha-1}, \quad p_y^* = \alpha \left[\frac{\bar{s} - (1 - \rho^R) n^R s^R}{(1 - \rho^P) n^P} \right]^{\alpha-1}, \quad (7)$$

$$f_x^* = \alpha \left[\frac{\bar{s}}{\rho^P n^P} \right]^{\alpha-1}, \quad f_y^* = \alpha \left[\frac{\bar{s}}{(1 - \rho^P) n^P} \right]^{\alpha-1}, \quad (8)$$

$$\beta_x^* = \left[\frac{\bar{s}}{\bar{s} - \rho^R n^R s^R} \right]^{1-\alpha}, \quad \beta_y^* = \left[\frac{\bar{s}}{\bar{s} - (1 - \rho^R) n^R s^R} \right]^{1-\alpha}. \quad (9)$$

Proof. From the housing-market clearing condition, $s_k^{P*} = \frac{\bar{s} - n_k^R s^R}{n_k^P}$ is uniquely determined, and so are $p_k^* = \alpha \left(\frac{\bar{s} - n_k^R s^R}{\rho^P n^P} \right)^{\alpha-1}$ and $z_k^{P*} = Y^P - \alpha \left(\frac{\bar{s} - n_k^R s^R}{n_k^P} \right)^\alpha$, $k \in K$. By the definition of f_k^* , $f_k^* = \alpha \left(\frac{\bar{s}}{n_k^P} \right)^{\alpha-1}$ is unique for each $\rho^P \in [0, 1]$, and so are $\beta_k^* = p_k^* / f_k^*$ and z_k^{R*} , for each $(\rho^P, \rho^R) \in [0, 1] \times [0, 1]$. *Q.E.D.*

Intuitively, the equilibrium housing size for each P -type agent equals to the aggregate housing supply to them, net of the houses occupied by the R -type agents, divided

by the regional population of P -type agents. That is, s_k^{P*} is independent of α . Moreover, the larger α is, the more P -type agents prefer for housing. Thus, to keep P -type agents choose s_k^{P*} , the equilibrium housing price must be higher when α is larger, and so is the equilibrium fundamental housing price. We summarize the analysis of comparative statics for the equilibrium bubble scale in the short-run equilibrium as follows.

Proposition 2 *Under Condition I, for each $(\rho^P, \rho^R) \in (0, 1) \times (0, 1)$, we have that β_x^* (β_y^*) is monotonically increasing (decreasing) with ρ^R . Moreover, β_k^* is a convex function of the number of R -type agents in k , $k \in K$.*

Proof. Given $(\rho^P, \rho^R) \in (0, 1) \times (0, 1)$, since Ψ_k is independent of ρ^R , it can be checked that

$$\frac{\partial \beta_x^*}{\partial \rho^R} = \frac{(1 - \alpha)n^R s^R}{\bar{s}} \left(1 - \frac{\rho^R n^R s^R}{\bar{s}}\right)^{\alpha-2} > 0, \quad (10)$$

$$\frac{\partial \beta_y^*}{\partial \rho^R} = -\frac{(1 - \alpha)n^R s^R}{\bar{s}} \left[1 - \frac{(1 - \rho^R)n^R s^R}{\bar{s}}\right]^{\alpha-2} < 0. \quad (11)$$

Moreover, we have:

$$\frac{\partial^2 \beta_x^*}{\partial (\rho^R)^2} = (1 - \alpha)(2 - \alpha) \left(1 - \frac{\rho^R n^R s^R}{\bar{s}}\right)^{\alpha-3} \left(\frac{n^R s^R}{\bar{s}}\right)^2 > 0, \quad (12)$$

$$\frac{\partial^2 \beta_y^*}{\partial (\rho^R)^2} = (1 - \alpha)(2 - \alpha) \left[1 - \frac{\rho^R n^R s^R}{\bar{s}}\right]^{\alpha-3} \left(\frac{n^R s^R}{\bar{s}}\right)^2 > 0. \quad (13)$$

That is, β_k^* is a convex function of ρ^R , and thus, a convex function of n_k^R . *Q.E.D.*

According to Proposition 2, given n^R , the relationship between β_k^* and n_k^R is depicted in Figure 1. Fixed $\rho^P \in (0, 1)$, since the fundamental housing price in each region is independent of the distribution of R -type agents, and the pecuniary externality on housing prices is convexly increasing with the number of R -type agents, the bubble revenue per unit of housing for rent seekers exhibits increasing returns to scale. This presents one of centripetal forces for the agglomeration of rent seekers. Though Murphy et al. (1993) discuss three mechanisms with which the rent-seeking activities exhibit increasing returns; however, rare literature endogenize the degree of increasing returns

from a market mechanism. Our model illustrates how the market can yield increasing returns to rent seekers. The other centripetal force comes from the increase in P -type agents' marginal valuation for housing since their housing size is smaller when there are more R -type agents in the region. However, there is one centrifugal force against the above two centripetal forces: the total bubble revenue in one region must be shared by a larger population of rent seekers, so each rent seeker may get a smaller bubble revenue eventually.

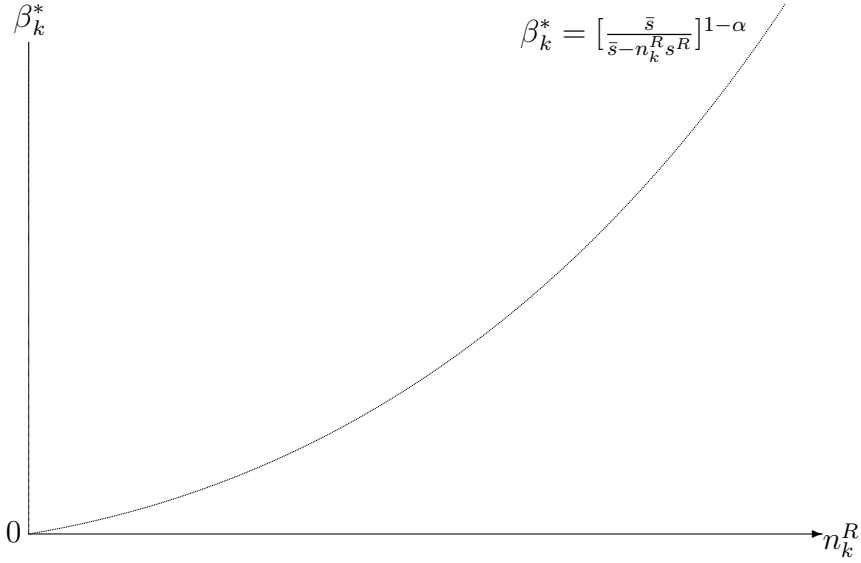


Figure 1: The relationship between the bubble scale and the number of rent seekers in region k , $k \in K$.

For a given distribution of agents, substituting equilibrium consumptions into the utility functions yields

$$u_k^{P*} = (s_k^{P*})^\alpha + z_k^{P*}, \quad (14)$$

$$u_k^{R*} = (s^R)^\gamma + z_k^{R*}. \quad (15)$$

The equilibrium locations of i -type agents are determined by the difference in the utility levels achieved by residing in the two regions, i.e., $u_x^{i*} - u_y^{i*}$, $i \in N$. The sign of the difference in the utility levels is summarized in Lemma 1.

Lemma 1 *Under Condition I, given $(\rho^P, \rho^R) \in [0, 1] \times [0, 1]$,*

$$\begin{aligned}
u_x^{P*} &\begin{matrix} \geq \\ \leq \end{matrix} u_y^{P*} \text{ if and only if} \\
\rho^{P*} &\begin{matrix} \leq \\ \geq \end{matrix} \frac{\bar{s} - \rho^R n^R s^R}{2\bar{s} - n^R s^R}; \\
u_x^{R*} &\begin{matrix} \geq \\ \leq \end{matrix} u_y^{R*} \text{ if and only if } \rho^{P*} \begin{matrix} \leq \\ \geq \end{matrix} \Phi \equiv \left[\frac{\rho^R}{1 - \rho^R} \cdot \frac{\bar{s}^\alpha - (\bar{s} - \rho^R n^R s^R)^\alpha}{\bar{s}^\alpha - [\bar{s} - (1 - \rho^R) n^R s^R]^\alpha} \right]^{\frac{1}{1-\alpha}}.
\end{aligned}$$

In the next section, we discuss the equilibrium distribution of types when they are free to choose their optimal locations.

3 Equilibrium Characterization

The equilibrium distribution of agents can be summarized as follows:

$$\begin{aligned}
n_x^P &= \rho^P n^P, \\
n_y^P &= (1 - \rho^P) n^P, \\
n_x^R &= \rho^R n^R, \\
n_y^R &= (1 - \rho^R) n^R.
\end{aligned}$$

It is obvious that there always exists a symmetric equilibrium, though it may be not stable. However, under Conditions I, we are more interested in the existence of partially segregated equilibria.

3.1 Pattern I: $\rho^P = \frac{1}{2}$ and $\rho^R = \frac{1}{2}$

The equilibrium of Pattern I is a symmetric equilibrium. That is, each type of agents is equally distributed across two regions, as depicted in Figure 1.

Given $(\rho^P, \rho^R) = (\frac{1}{2}, \frac{1}{2})$, two regions are symmetric, so the same type of agents achieve the same utility from residing in x and y . Therefore, there always exists an equilibrium of Pattern I. Moreover, the symmetric equilibrium is always stable.

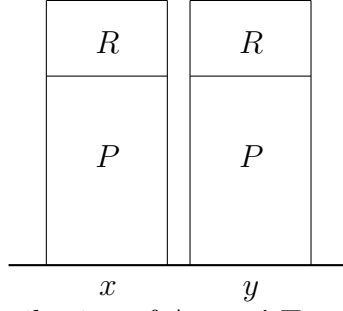


Figure 2: Distribution of Agents' Type in Pattern I.

Proposition 3 *Under Condition I, there is a stable symmetric equilibrium.*

Proof. It can be checked that at $(\rho^P, \rho^R) = (\frac{1}{2}, \frac{1}{2})$, $\frac{\partial u_x^{P*} - u_y^{P*}}{\partial \rho^P} < 0$, and $\frac{\partial u_x^{R*} - u_y^{R*}}{\partial \rho^R} < 0$, which completes the proof for the statement. *Q.E.D.*

Given $(\rho^P, \rho^R) = (\frac{1}{2}, \frac{1}{2})$ around, on the one hand, producers have no incentive to live in any region with a higher housing price but with the same of a smaller size of houses. That is, given $\rho^R = \frac{1}{2}$, producers can never agglomerate in any region. On the other hand, the increasing returns to scale on the bubble revenue is not large enough to pull rent seekers to agglomerate in one region. Therefore, given $\rho^P = \frac{1}{2}$, rent seekers do not tend to agglomerate in any region, either. There is always a stable symmetric equilibrium.

3.2 Pattern II: $\rho^R = 1$ or $\rho^R = 0$

In Pattern II, $\rho^P = 1$ ($\rho^P = 0$) indicates that all R -type agents reside in region x (y). When $\rho^P = 1$ ($\rho^P = 0$), we have $n_x^R = n^R$ and $n_y^R = 0$ ($n_x^R = 0$ and $n_y^R = n^R$), as depicted in Figure 2.

In equilibrium, R -type agents must achieve a higher indirect utility by residing in one of regions, whereas P -type agents are indifferent from residing in x and y . Given $\rho^R = 1$, $u_x^{P*} = u_y^{P*}$ yields $\rho^{P*} < \frac{1}{2}$. Denoting $\Psi(\alpha) \equiv \alpha^{-1}[(\frac{\bar{s}}{\bar{s} - \rho^R n^R \bar{s}^R})^\alpha - 1]$, consider,

Condition II. $\Psi(\alpha) < \frac{n^R \bar{s}^R}{\bar{s} - n^R \bar{s}^R}$.

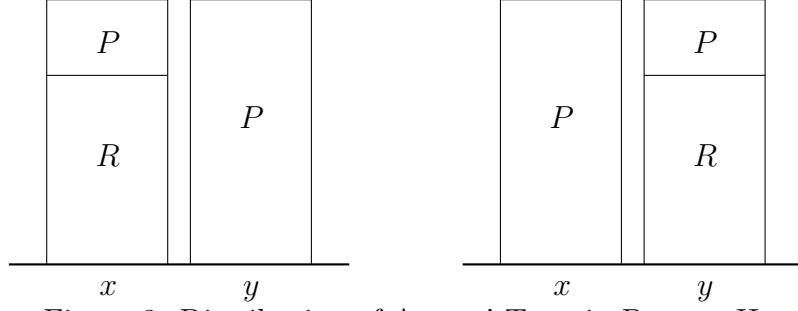


Figure 3: Distribution of Agents' Type in Pattern II.

Notice that s^R represents the minimal housing size of proceeding rent-seeking activities. In Theorem 1, we show that Conditions I and Condition II constitute a sufficient condition for the existence of partially segregated equilibria where R -type agents agglomerate in one of two regions.

Theorem 1 *Under Condition I and Condition II, there is a stable partially segregated equilibrium where R -type agents agglomerate in one of the regions and P -type agents reside in both regions. Furthermore, in the region where R -type agents agglomerate, there are fewer P -type agents than those in the other region (i.e., $\rho^{R*} = 1$ implies $\rho^{P*} < 1/2$, whereas $\rho^{R*} = 0$ implies $\rho^{P*} > 1/2$).*

Proof. Without loss of generality, consider the partially segregated equilibrium with $\rho^{R*} = 1$, i.e., $n_x^{R*} = n^R$ and $n_y^{R*} = 0$. From $u_x^{P*} = u_y^{P*}$, we have $\rho^{P*} < \frac{1}{2}$ and $\frac{\partial u_x^{P*} - u_y^{P*}}{\partial \rho^P} < 0$. That is, given $\rho^R = 1$, P -type agents converge to $\rho^P = \rho^{P*}$ after perturbations.

For R -type agents, we need to check that $\lim_{\rho^R \rightarrow 1} (z_x^{R*} - z_y^{R*}) > 0$ given $\rho^P = \rho^{P*}$, which implies that:

$$\frac{n_s^{R*}}{\bar{s} - n_s^{R*}} > \frac{(\frac{\bar{s}}{\bar{s} - n_s^{R*}})^\alpha - 1}{\alpha}. \quad (16)$$

When considering the other equilibrium with $\rho^{R*} = 0$, i.e., $n_x^{R*} = 0$ and $n_y^{R*} = n^R$, we need to check $\lim_{\rho^R \rightarrow 0} (z_x^{R*} - z_y^{R*}) < 0$ which implies the same inequality. Therefore,

the proof for the statement is completed. *Q.E.D.*

Notice that given n^R , s^R , and \bar{s} , the smaller α is, the lower $\Psi(\alpha)$ is, and thus, R -type agents are more likely to agglomerate. Intuitively, when P -type agents enjoy less from housing consumption, the fundamental and the market housing prices are both decreased. On the one hand, when α decreases, from equations (1) and (2), producers' preference for housing is closer to that of rent seekers. On the other hand, a decrease in α lowers price elasticity of producers' demand for housing.¹¹ Hence, producers' demand for housing tends to be more inflexible against rising housing prices. Accordingly, with a smaller α , rent seekers are easier to indirectly exploit producers through the housing market, and have a stronger incentive to agglomerate in one specific region.

For the authority of a region, Theorem 1 implies a serious problem since there are fewer productive activities in the region where rent-seeking activities agglomerate. If the regional authority cares about regional aggregate output, reducing rent-seeking activities in the region helps in attracting productive activities and improving regional prosperity.

4 Empirical Studies

4.1 Descriptive Statistics for the Home Vacancy Rate

It is hard to track the locations and movements of rent-seeking activities. Although houses that are transacted within 1 or 2 years are commonly regarded as rent-seeking properties, it is not easy to collect such ideal data. However, the extent of rent-seeking activities in the housing market in a region can be approximated by the regional home vacancy rate since it is hard to imagine vacant houses being involved in productive activities. In this case, when there are rent-seeking activities migrating into the housing market in a region, the regional home vacancy rate is raised. So our theory implies that a higher home vacancy rate yields a lower per capita GDP of the region *in the following*

¹¹In our model, the price elasticity of producers' demand for housing is $1/(1 - \alpha)$.

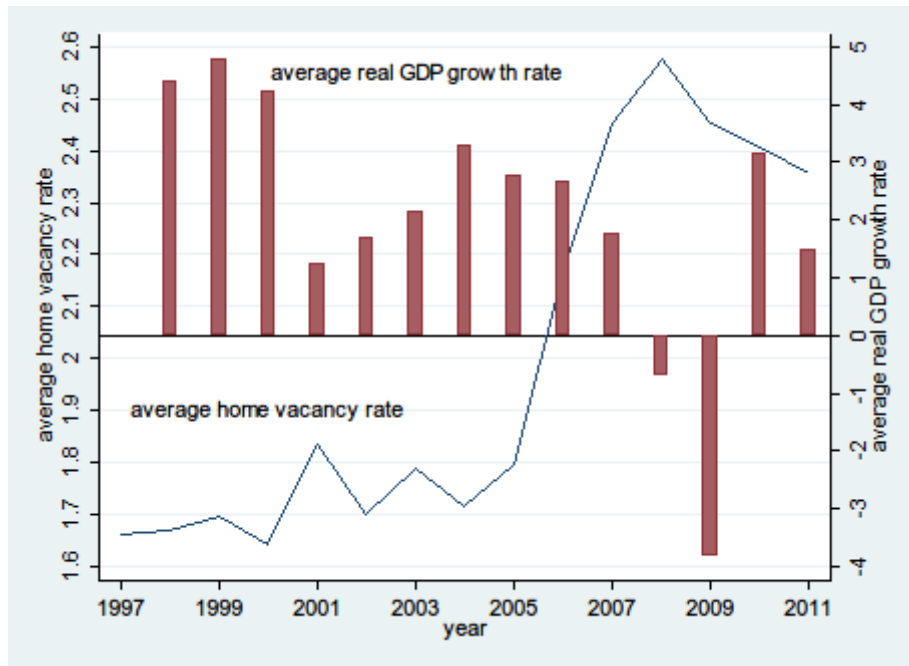
years.

Our panel data set consists of home vacancy rates ($x_{k,t}$) and per capita real GDP ($y_{k,t}$ millions of chained 2005 U.S. dollars) for the conterminous 48 states in the U.S. covering the period 1997 to 2011, $k \in K \equiv \{1, 2, \dots, 48\}$, $t \in T \equiv \{1997, 1998, \dots, 2011\}$.¹² Time series of the average home vacancy rate among the 48 states are:

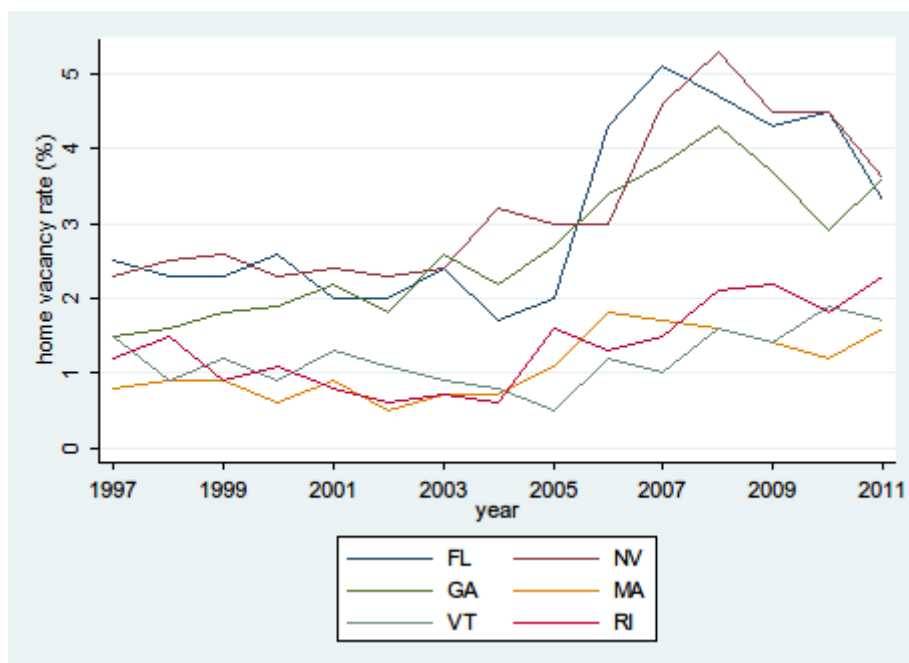
Year	1997	1998	1999	2000	2001	2002	2003	2004
Average	1.660	1.671	1.696	1.644	1.835	1.702	1.788	1.715
Year	2005	2006	2007	2008	2009	2010	2011	
Average	1.796	2.173	2.454	2.577	2.452	2.406	2.356	

In most years, the average home vacancy rate moves in the opposite direction to the movement of the average per capita real GDP growth rate for the 48 states, as shown in the following figure. Specifically, a sharp increase in the average home vacancy rate from 2006 to 2008 is accompanied with a sharp decrease in the average per capita real GDP growth rate from 2007 to 2009. This observation implies that in average there is a lag of 1 to 2 years around for the negative influence of the home vacancy rate on the per capita real GDP.

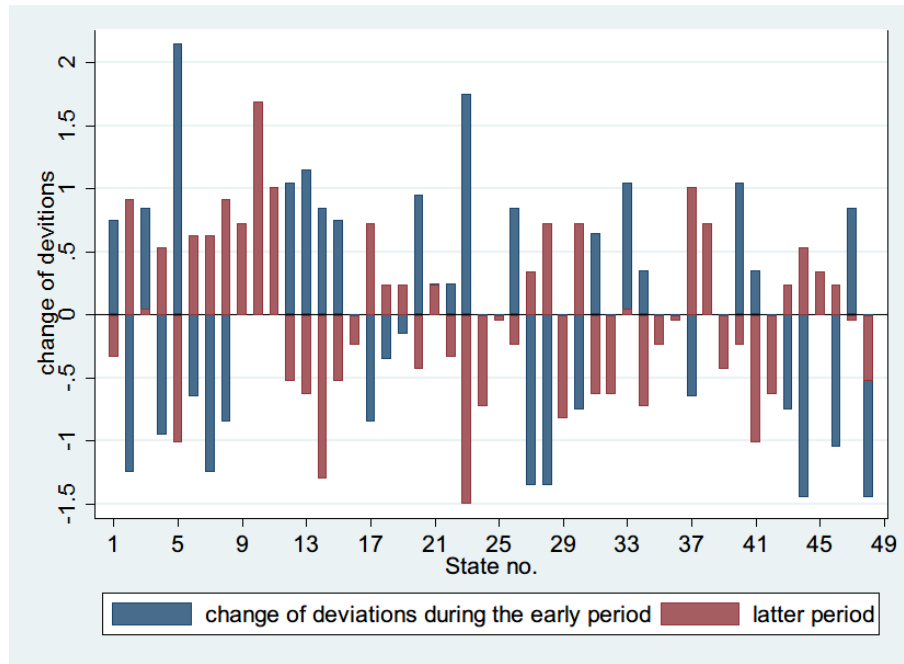
¹²The data of home vacancy rates is collected from Federal Reserve Bank of St. Louis, whereas the data of real GDP and population for the conterminous 48 states comes from United States Census Bureau.



For the cross-state differences, the highest average home vacancy rate among the 15 years (1997–2001) appears in Florida (3.2%), Nevada (3.1%), and Georgia (2.7%), whereas the lowest average home vacancy rate in this period happens in Massachusetts (1.1%), Vermont (1.2%), and Rhode Island (1.3%), as shown in the following figure. There is a large variability in the values of home vacancy rate among the 48 states.



Denote \bar{x}_t as the mean of the home vacancy rate for the 48 states in year t , $t \in T$. Dividing the whole period of data into two equal-length periods, in the following figure each blue line presents $(x_{k,2004} - \bar{x}_{2004}) - (x_{k,1997} - \bar{x}_{1997})$ for one state $k \in K$, whereas each red line presents $(x_{k,2011} - \bar{x}_{2011}) - (x_{k,2004} - \bar{x}_{2004})$ for the same state. It is obvious that in most states (specifically, 30 out of the 48 states), an increase (decrease) in the deviation from the mean of the home vacancy rate in the early period is followed by a decrease (increase) in the deviation of the home vacancy rate in the latter period. Thus, the correlation coefficient between these two series is negative (-0.496). This observation indicates that home vacancy rates are highly migrant across the 48 states, which implies that there are extra stories hidden in the home vacancy rates in addition to the market conflict viewpoint.



Finally, the descriptive statistics for the pooled data of home vacancy rate is summarized in the following table.

Home Vacancy Rate	
Mean	2.00
Median	1.90
25th percentile	1.50
75th percentile	2.40

4.2 Human Capital, Home Vacancy, and Regional GDP

In addition to the home vacancy rate and the real GDP, we also collect the percentage of completed Bachelor's degree or higher for the 48 conterminous states for the period 1997 to 2007, which is commonly used as an index for human capital (cf. Berry and Glaeser, 2005; Abel and Gabe, 2011).¹³ Since there is a subprime mortgage crisis in the first quarter of 2007, the period of our analysis is chosen from 1997 to 2006 to avoid abnormal increases in the home vacancy rate. Therefore, when a regression on both home vacancy and human capital is estimated, we use only the data of home vacancy rate at $t \in T' \equiv \{1997, 1998, \dots, 2006\}$.

To rule out the influence of rent-seeking activities moving to those regions with high per capita GDP and following the spirit in Murphy et al. (1991), we estimate regressions of the per capita real GDP on both the τ -year lag Bachelor's percentage and the τ -year lag home vacancy rate, $1 \leq \tau \leq 9$. Denoting Model $A\tau$ and $B\tau$ as the linear regression models containing at most τ -year lag regressors with and without time-specific dummy variables, respectively. Our panel data analysis results are summarized in Table 1 and Table 2.

First, since the time-specific effect of business cycles is rarely uncorrelated with the explanatory variables, we use time dummies rather than time-specific random effect, together with cross-state fixed effects and random effects as shown in Table 1. Notice that all coefficients of the home vacancy rates are negative. Moreover, coefficients of

¹³The data of the percentage of completed Bachelor's degree or higher for the conterminous 48 states comes from United States Census Bureau.

the home vacancy rates in Models A1 and A2 are statistically significant at the 95% confidence level. The Hausman (1978) specification test is employed to test whether the unobservable individual-country effects are uncorrelated with the exogenous variables or not. The Hausman's specification test rejects the random effects models in Models A1, A2, and A3 for the inconsistency due to the correlation between the regressors and the random terms.

Furthermore, the result of joint tests for all the home vacancy rates included in Models A1~A4 shows that the home vacancy rates are significant in explaining the difference in the per capita real GDP across 48 states. Especially, the time dummies are significant in Models A1~A4 with state-specific fixed effects, whereas Table 3 illustrates the significance of time dummies in Model A4. That is, ignoring the time dummies may yield inconsistent estimates. Even when the time dummies are removed, as summarized in Table 2, all the regression coefficients of the home vacancy rates which are still negative, which qualitatively confirms the results in the aforementioned models with time dummies. The result of joint tests in Models B1~B4 implies that the claim of the home vacancy rates having negative influence on the per capita real GDP is robust.

Finally, when there is 1% increase in the home vacancy rate, the per capita real GDP after 3 years will decrease by roughly -0.281; in contrast, when there is a 1% loss in the human capital rate, there is at most a -0.089 decrease in the per capita real GDP after 2 years. Therefore, the hurt from an extra increase in the home vacancy rate cannot be smaller than a loss in human capital in the region.

5 Conclusion

In Acemoglu (1995) the existence of rent seekers creates a negative externality on productive agents and implies that relative rewards may be endogenously and malevolently determined. However, the question of whether the market (e.g., the housing market) can yield the appropriate relative rewards for productive activities and further repel rent-seeking activities out of the region is not answered yet. This paper develops a

personal-characteristic-based optimization framework to characterize the conditions for the agglomeration of rent-seeking activities, which is one of the sources for regional stagnation.

This paper supports the claim in Murphy et al. (1993) that rent-seeking activities exhibit increasing returns, though with a different reason: when the pecuniary externality on housing prices is convexly increasing with the aggregate scale of rent-seeking activities in the region, rent-seeking activities exhibit increasing returns to scale. Therefore, in contrast to the literature regarding pecuniary externalities as being innocent in market efficiency, this paper finds that the pecuniary externality in the housing market may distort the reward structure for productive activities and hurt efficiency.

Finally, this paper shows that an increase in the current home vacancy rate lowers the per capita real GDP in the next 1 to 3 years. Furthermore, when there is 1% increase in the home vacancy rate, the per capita real GDP after 3 years will decrease by roughly -0.281; in contrast, when there is a 1% loss in the human capital rate, there is at most a -0.089 decrease in the per capita real GDP after 2 years. Therefore, the hurt from an extra increase in the home vacancy rate cannot be smaller than a loss in human capital in the region.

For future extensions, in the current model quality of houses is assumed to be the same in different regions. Introducing local (regional) public goods as an ingredient for raising housing quality can help to answer whether providing a better infrastructure attracts the agglomeration of rent-seeking or productive activities. However, as analyzed in Appelbaum and Katz (1987), government as a rent setters, who indirectly determine the rent through the provision of local public goods and the housing market, may not be altruistic and may bargain with rent seekers in sharing the yielded rent. This consideration complexes the analysis and needs further clarifications. Moreover, concept of an optimal configuration of public facilities is not easy to be well-defined in the Pareto sense. As warned in Berliant, Peng, and Wang (2006), central optimization by a government is in fact a mix of equilibrium and optimality concepts. Accordingly,

this direction keeps to be a challenge.

Table 1. Linear Regression Models with Time-Specific Dummy Variables in Fixed and Random Effect Models
Per capita real GDP and Home vacancy rate in U.S., 1997 – 2006

	Model A1			Model A2			Model A3			Model A4		
Human Capital (t-1)	0.818 (0.000)	0.063 (0.080)	0.093 (0.010)	0.207 (0.273)	0.016 (0.670)	0.039 (0.313)	0.189 (0.359)	0.000 (0.996)	0.027 (0.480)	0.101 (0.669)	0.014 (0.733)	0.048 (0.247)
Vacancy Rate (t-1)	-0.296 (0.552)	-0.833 (0.000)	-0.844 (0.000)	-0.717 (0.352)	-0.549 (0.000)	-0.569 (0.000)	-0.649 (0.429)	-0.499 (0.000)	-0.518 (0.000)	-0.886 (0.319)	-0.510 (0.001)	-0.533 (0.001)
Human Capital (t-2)				0.635 (0.001)	0.089 (0.021)	0.112 (0.004)	0.172 (0.504)	0.065 (0.103)	0.080 (0.047)	0.291 (0.289)	0.071 (0.087)	0.096 (0.023)
Vacancy Rate (t-2)				0.160 (0.836)	-0.474 (0.001)	-0.72 (0.001)	-0.877 (0.363)	-0.264 (0.082)	-0.280 (0.070)	-0.744 (0.479)	-0.145 (0.362)	-0.167 (0.309)
Human Capital (t-3)							0.511 (0.014)	0.048 (0.206)	0.076 (0.047)	0.081 (0.770)	0.036 (0.398)	0.060 (0.159)
Vacancy Rate (t-3)							0.971 (0.243)	-0.373 (0.010)	-0.363 (0.014)	-0.471 (0.656)	-0.281 (0.084)	-0.303 (0.071)
Human Capital (t-4)										0.416 (0.074)	0.031 (0.432)	0.062 (0.118)
Vacancy Rate (t-4)										1.606 (0.077)	-0.238 (0.112)	-0.206 (0.179)
Hausman Test		214.18 (0.000)	214.18 (0.000)		44.08 (0.000)	44.08 (0.000)		31.28 (0.002)	31.28 (0.002)		21.32 (0.067)	21.32 (0.067)
Number of Sample	432	432	432	384	384	384	336	336	336	288	288	288
Type of Estimation	pooled ols	fixed effect	random effect	pooled ols	fixed effect	random effect	pooled ols	fixed effect	random effect	pooled ols	fixed effect	random effect

Note: Dependent variable is per capita GDP in real terms.

The numbers under the coefficients are the corresponding *p*-values for the usual two-sided alternative hypothesis.

Table 2. Linear Regression Models without Time-Specific Dummy Variables
Per capita real GDP and Home vacancy rate in U.S., 1997 – 2006

	Model B1			Model B2			Model B3			Model B4		
	0.818 (0.000)	0.598 (0.000)	0.609 (0.000)	0.207 (0.273)	0.403 (0.000)	0.408 (0.000)	0.189 (0.359)	0.338 (0.000)	0.340 (0.000)	0.101 (0.669)	0.268 (0.000)	0.267 (0.000)
Vacancy Rate (t-1)	-0.296 (0.552)	-0.662 (0.000)	-0.668 (0.000)	-0.717 (0.352)	-0.340 (0.083)	-0.339 (0.083)	-0.649 (0.429)	-0.036 (0.854)	-0.028 (0.886)	-0.886 (0.319)	-0.010 (0.959)	0.026 (0.892)
Human Capital (t-2)				0.635 (0.001)	0.262 (0.000)	0.267 (0.000)	0.172 (0.504)	0.238 (0.000)	0.238 (0.000)	0.291 (0.289)	0.211 (0.000)	0.208 (0.000)
Vacancy Rate (t-2)				0.160 (0.836)	-0.572 (0.004)	-0.579 (0.003)	-0.877 (0.363)	-0.385 (0.061)	-0.388 (0.058)	-0.744 (0.479)	-0.177 (0.400)	-0.169 (0.422)
Human Capital (t-3)							0.511 (0.014)	0.242 (0.000)	0.243 (0.000)	0.081 (0.770)	0.262 (0.000)	0.259 (0.000)
Vacancy Rate (t-3)							0.971 (0.243)	-0.523 (0.006)	-0.525 (0.006)	-0.471 (0.656)	-0.301 (0.141)	-0.298 (0.146)
Human Capital (t-4)										0.416 (0.074)	0.234 (0.000)	0.229 (0.000)
Vacancy Rate (t-4)										1.606 (0.077)	-0.494 (0.012)	-0.491 (0.012)
Hausman Test		1.93 (0.380)	1.93 (0.380)		0.94 (0.919)	0.94 (0.919)		N/A*	N/A*		0.10 (1.000)	0.10 (1.000)
Number of Sample	432	432	432	384	384	384	336	336	336	288	288	288
Type of Estimation	pooled ols	fixed effect	random effect	pooled ols	fixed effect	random effect	pooled ols	fixed effect	random effect	pooled ols	fixed effect	random effect

Note: Dependent variable is per capita GDP in real terms.

The numbers under the coefficients are the corresponding *p*-values for the usual two-sided alternative hypothesis.

* Model B3 fails to meet the asymptotic assumptions of the Hausman test.

Table 3. P -values for time dummies in Models B4

	Coefficient	t	$P > t $
Time dummy for 2001	-2.934	-12.12	0.000
Time dummy for 2002	-2.564	-12.15	0.000
Time dummy for 2003	-2.034	-10.83	0.000
Time dummy for 2004	-1.144	-6.73	0.000
Time dummy for 2005	-0.585	-3.61	0.000
Time dummy for 2006 (reference year)			

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