Price dispersion in the housing market: the role of bargaining and search costs

Lisi, Gaetano

University of Cassino

2 October 2011

Price Dispersion in the Housing Market: The Role of Bargaining and Search Costs

Gaetano Lisi [*]

Abstract

This paper develops a matching model *à la* Pissarides (2000) in order to explain the basic facts of housing markets, most of all the variance in house prices. Price dispersion is basically due to both the *ex-ante* heterogeneity of the parties and the search costs of buyers and sellers. In fact, sellers and buyers spend time and money before concluding the deal. Furthermore, the house price is substantially determined by bargaining between the parties. These factors affect the selling price and lead to price dispersion. This simple theoretical model is able to take these distinctive features into account, thus explaining the basic facts of housing markets.

Keywords: house prices, price dispersion, bargaining power, search frictions

JEL Classification: R0, R31, R21, D40, D83

[*] Territorial Agency (Italian Tax Agency) and CreaM (Creativity and Motivations) Economic Center, University of Cassino. Email: gaetano.lisi@agenziaterritorio.it ; gaetano.lisi@unicas.it.

1. Introduction

Housing markets are characterized by a decentralized framework of exchange with important search and matching frictions. It has, in fact, been acknowledged that housing markets clear not only through price but also through the time that a buyer and a seller spend on the market. Consequently, the search and matching approach is widely used even in this type of market (see e.g., Wheaton, 1990; Albrecht *et al.*, 2007; Caplin and Leahy, 2008; Diaz and Jerez, 2009; Maury and Tripier, 2010; Genesove and Han, 2010; Lisi, 2011; Leung and Zhang, 2011). Furthermore, three basic facts have been repeatedly reported: (a) the positive correlation between housing price and trading volume (see Leung, Lau and Leong, 2002; Fisher *et al.*, 2003, among others), (b) between housing price and the time-on-the market (see Leung, Leong and Chan, 2002; Anglin et al. 2003; Merlo and Ortalo-Magne, 2004; Diaz and Jerez, 2009, among others), and (c) the existence of price dispersion. The latter is probably the most important distinctive feature of housing markets. Price dispersion (or volatility) refers to the phenomenon of selling the same product in near locations at the same time but at different prices. Although price dispersion research is more commonly found in studies of non-durable consumption goods,[1] price dispersion studies on durable and re-saleable goods such as real estate are also growing rapidly (see e.g. Read, 1991; Gabriel *et al.*, 1992; Baharad and Eden, 2004; Leung, Leong and Wong, 2006; Yiu *et al.*, 2005, 2006, 2008; and Wong *et al.*, 2006, 2007). Real estate is in fact the most important durable consumption good and one of the most important assets for most household portfolios (Leung, Leong and Wong, 2006). Since most transactions of real estate come from re-sales between individual buyers and sellers (transactions in the housing markets are in fact dominated by a second-hand market), it should not be surprising that price dispersion exists in the housing market (Leung, Leong and Wong, 2006).

According to the "housing price dispersion" literature, the variance in house prices cannot be attributed completely to the heterogeneous nature of real estate. In fact, a significant part of house price dispersion is basically due to the *ex-ante* heterogeneity of buyers and sellers (bargaining power, tastes, asymmetric information) and their sustained search costs. Indeed, sellers and buyers spend time and money (for

[1] A detailed literature review on price dispersion can be found in Baye *et al.* (2006).

advertising vacancies and making the effort to visit the greatest number of houses) before concluding the deal. Furthermore, the house price is substantially determined by bargaining between the parties. These factors affect the selling price and lead to price dispersion, since for different bargaining powers and search costs the selling price will be different.

The main aim of this paper is to develop a search and matching model *à la* Pissarides (2000) that explains the basic facts of housing markets. In particular, we develop a decentralised long-run equilibrium model with *ex-ante* heterogeneous buyers and sellers, based on both the bargaining and the costly search activity that characterises the housing market. The proposed work takes the distinctive features of the considered market into account, where the formal distinction between buyer and seller becomes very subtle. In the model, in fact, a seller can become a buyer and *vice versa*. Indeed, most houses are bought by those who already own one, and most houses are sold by those wanting to buy another house (Janssen *et al.*, 1994); indeed, buyers today are potential sellers tomorrow (Leung, Leong and Wong, 2006).

In this model, price dispersion comes from two sources: first, the bargaining power of the parties, since different bargaining powers lead to different selling prices for two similar houses; second, the search costs of sellers and buyers, since the *ex-ante* heterogeneity of the parties implies different search costs and thus individuals obtain different values from a conclusive transaction. Furthermore, this theoretical model is able to explain the positive correlation between housing price and trading volume, and between housing price and the time-on-the-market.

In addition, search and matching frictions rationalize market non-clearing even in the presence of flexible prices. As a result, this model allows to overcome a major drawback of the hedonic pricing theory: the assumption of perfect competition (Quan and Quigley, 1991; Habito *et al.*, 2010; Harding *et al.*, 2003a; Harding *et al.*, 2003b; Cotteleer and Gardebroek, 2006).

The rest of the paper is organised as follows: section 2 presents the housing market matching model; while section 3 concludes.

2. The model

2.1 The hypotheses of the model

In this section, we follow the matching model developed by Lisi (2011). Since we are interested in selling price, the market of reference is the homeownership market rather than the rental market. In this way, if a contract is legally binding (as hypothesised) it is no longer possible to return to the circumstances preceding the bill of sale, unless a new and distinct contractual relationship is set up. In matching model jargon this means that the destruction rate of a specific buyer-seller match does not exist.

The economy is populated by N types of sellers (which we indicate with $i = 1,...,N$) and by M types of buyers (which we indicate with $j = 1,...,M$). "Type" refers to the economic rather than social or personal characteristics of the individual. We indicate with s^i a measure of sellers of type i and with b^j a measure of buyers of type j. Hence, we can think of $\sum s^i = S$ and $\sum b^i = B$ as measures of the stock of sellers and buyers in the economy, respectively. Sellers hold $h \geq 2$ houses of which $h-1$ are on the market, i.e. vacancies (v) are simply given by $v = (h-1) \cdot S > 0$, thus assuming a vacancy rate permanently positive (as in Wheaton, 1990). It is therefore possible that a buyer of type j can become a seller of type i, and that a seller of type i can become a buyer of type j.

The expected values of a vacant house (V) and of buying a house (H) are given by: [2]

$$rV = -a^i + q(\theta) \cdot [P - V] \quad \textbf{[1]}$$

$$rH = -e^j + g(\theta) \cdot [x - H - P] \quad \textbf{[2]}$$

where $\theta \equiv \frac{v}{B}$ is the housing market tightness from the sellers' standpoint,[3] while $q(\theta)$ and $g(\theta)$ are, respectively, the (instantaneous) probability of filling a vacant house and of finding/buying a home. The popular hypothesis of constant returns to scale in the matching function, $m = m\{v, B\}$, is adopted (see Pissarides, 2000; Petrongolo and Pissarides, 2001). Hence, the properties of these functions are straightforward: $q'(\theta) < 0$ and $g'(\theta) > 0$.[4] The terms a^i and e^j represent, respectively, the costs

[2] Time is continuous and individuals are risk neutral, live infinitely and discount the future at the rate r. As usual in matching-type models, the analysis is restricted to the stationary state.

[3] By definition, markets with frictions require positive and finite tightness, i.e. $0 < \theta < \infty$.

[4] Standard technical assumptions are assumed: $lim_{\theta \to 0} q(\theta) = lim_{\theta \to \infty} g(\theta) = \infty$, and $lim_{\theta \to 0} g(\theta) = lim_{\theta \to \infty} q(\theta) = 0$.

sustained by sellers of type i for the advertisement of vacancies and the effort (in monetary terms) made by buyers of type j to find and visit the largest possible number of houses. If a contract is stipulated, the buyer of type j gets a benefit x from the property (abandoning the home searching value) and pays the sale price P to the seller of type i (who abandons the value of finding another buyer). As in Habito *et al.* (2010), the buyer's benefit x is a positive function of housing characteristics, i.e. it does not depend on the buyer's type.

2.2 Equilibrium

The endogenous variables that are determined simultaneously at equilibrium are market tightness (θ) and sale price (P).

The customary long-term equilibrium condition, namely the "zero-profit" or "free-entry" condition, normally used in the matching models (see Pissarides, 2000) yields the first key relationship of the model, in which market tensions are a positive function of price. In fact, using the condition $V = 0$ in [1], we obtain:

$$\frac{a^i}{P} = q(\theta) \Rightarrow q(\theta)^{-1} \cdot a^i = P \qquad \textbf{[3]}$$

with $\frac{\partial \theta}{\partial P} > 0$ since $q'(\theta) < 0$. In short, if the price increases, more sellers will stand in the market; hence, it will be more difficult to fill the vacant houses. Consequently, fewer vacancies will be on the market.

The free-entry condition also implies a trade-off between the housing price and the speed of sales for the sellers. In fact, with an arrival rate of $q(\theta)$, the expected time-on-the-market is $q(\theta)^{-1}$. As a result, from [3] there is a positive correlation between housing prices and the time on the market (as pointed by Leung, Leong and Chan, 2002; Anglin et al. 2003; Merlo and Ortalo-Magne, 2004; Diaz and Jerez, 2009).

The (generalised) Nash bargaining solution, usually used for decentralised markets, allows the sale price P to be obtained through the optimal subdivision of surplus (S) deriving from a successful match: [5]

$$S = \underbrace{(P - V)}_{capital\ \ gain\ of\ seller} + \underbrace{(x - H - P)}_{capital\ \ gain\ of\ buyer}$$

[5] Entering into a contractual agreement obviously implies that $S > 0$, i.e. $x > H$, $\forall \theta$. This realistic condition ensures that the price is positive.

$$\Rightarrow S = x - H \quad \textbf{[4]}$$

The price is obtained by solving the following optimisation condition:

$$P = argmax\left\{(P-V)^{\gamma^i} \cdot (x-H-P)^{1-\gamma^i}\right\}$$

$$\Rightarrow P = \frac{\gamma^i}{(1-\gamma^i)} \cdot (x-H-P)$$

where γ^i is the bargaining power of sellers of type i. Knowing that $(x-H-P) = \frac{(1-\gamma^i)}{\gamma^i} \cdot P$, eventually we get:

$$P = \gamma^i \cdot (x-H) \Rightarrow P = \frac{\gamma^i \cdot (rx + e^j)}{r + g(\theta) \cdot (1-\gamma^i)} \quad \textbf{[5]}$$

Equation [5] is none other than the hedonic price function of the model. In fact, the selling price depends positively on the buyer's benefit x, which in turn depends positively on the housing characteristics.

Since $g'(\theta) > 0$, as market tensions increase, the sale price decreases; hence, we obtain the second key relationship of the model: $\frac{\partial P}{\partial \theta} < 0$. In short, if the tightness increases, the effect of the well-know congestion externalities on the demand side (see Pissarides, 2000) will lower the selling price.

Finally, it is straightforward to obtain from [3] that when P tends to zero (infinity), θ tends to zero (infinity), as $q(\theta)$ tends to infinity (zero). Consequently, given the negative slope of [5] and the fact that price is always positive, only one long term equilibrium deriving from the intersection of the two curves exists in the model (see point A in *Figure* 1).

========== *Figure 1 about here (now at the end)* ==========

2.3 Comparative statics and price dispersion

From [5], the selling price crucially depends on the bargaining power of the seller. In fact,

$\gamma^i \to 0 \Rightarrow P = 0$, and $\gamma^i \to 1 \Rightarrow P = x + \frac{e^j}{r}$

since the price can never be negative or null, we assume that $0 < \gamma^i \leq 1$.

Furthermore, the selling price also depends on the search costs of buyers and sellers. In particular, from [5] it is straightforward to obtain that an increase in the search effort of buyers (e^j) increases the selling price. This is an intuitive result. However, a partially counter-intuitive result regards the effect of advertising vacancies on the selling price. In fact, an increase in a^i decreases market tightness, which in turn increases the selling price (see *Figure 2*). In short, an increase in the seller's search cost also leads to an increase in the selling price.

========== *Figure 2 about here (now at the end)* ==========

Intuitively, the trading volume for a given period is given by the matching rate (Leung and Zhang, 2011). Although in this simple model the search costs of buyers and sellers are exogenous, it is straightforward to include them in the matching function, i.e. $m = m\{a^i, v; e^j, B\}$. An increase in the search effort (advertising vacancies) will increase the matching rate, since the probability of finding a home (of filling a vacant house) will be higher. As a result, the model could also explain the positive relationship between housing price and trading volume, since an increase in the search costs of buyers and sellers increases the selling price. This is in line with the empirical works of Fisher *et al.* (2003) and Leung, Lau and Leong (2002).

Finally, we consider two similar houses, *Y* and *Z*, which give the same benefit: $x^Y = x^Z$. In this case, price dispersion in the model comes from:

a) The bargaining power of sellers (γ^i): different bargaining powers lead to different selling price;
b) The search costs of sellers (a^i) and buyers (e^j): in fact, since matching occurs between a seller of type i and a buyer of type j, different pairs lead to different search costs, which in turn imply different selling prices.

The key determinant of price dispersion is in fact the heterogeneity in buyers and sellers incorporated in the formula of selling price. The housing price dispersion exists as long as the heterogeneous search costs enter the pricing formula, no matter how the prices are determined (Leung and Zhang, 2011).[6]

2.4 Closing the model

[6] Vukina and Zheng (2010) find a very strong empirical support for the theoretical prediction that bargaining with search costs explains price dispersion in the agricultural market.

In order to close the model in a very simple manner, we normalise the population in the housing market to the unit, i.e. $1 = S + B$. As a result, using the definitions of equilibrium tightness ($\theta = \theta^*$) and vacancies, we obtain the stock of sellers, buyers, and the "natural" vacancy rate:

$$S = \frac{\theta^*}{h - 1 + \theta^*} \quad \textbf{[6]}$$

$$B = \frac{h-1}{h - 1 + \theta^*} \quad \textbf{[7]}$$

$$v = \frac{(h-1)\cdot\theta^*}{h - 1 + \theta^*} \quad \textbf{[8]}$$

The "natural" vacancy rate is the optimal share of houses for sale on the market that prevails in long term equilibrium at which sellers make no economic profits (Arnott and Igarashi, 2000; McDonald, 2000).

3. Conclusions

This paper develops a matching model *à la* Pissarides (2000) in order to explain the basic facts of housing markets, most of all the variance in house prices. Price dispersion is basically due to both the *ex-ante* heterogeneity of the parties (bargaining power, tastes, asymmetric information) and the search costs of buyers and sellers. In fact, sellers and buyers spend time and money (for advertising vacancies and making the effort to visit the greatest number of house) before concluding the deal. Furthermore, the house price is substantially determined by a deal between the parties. These factors affect the selling price and lead to price dispersion. This simple theoretical model is able to take these distinctive features into account, thus explaining the basic facts of housing markets.

References

Albrecht, James, Anderson Axel, Eric Smith, and Susan Vroman (2007), "Opportunistic Matching in the Housing Market", *International Economic Review,* 48(2), 641-664.

Anglin, Paul M., Ronald Rutherford and Thomas M. Springer (2003), "The Trade-off Between the Selling Price of Residential Properties and Time-on-the-Market: The Impact of Price Setting", *Journal of Real Estate Finance and Economics*, 26(1), 95-111.

Arnott, Richard, and Masahiro Igarashi (2000), "Rent Control, Mismatch Costs and Search Efficiency", *Regional Science and Urban Economics*, 30(3), 249-288.

Baharad, Eyal, and Benjamin Eden, (2004), "Price Rigidity and Price Dispersion: Evidence from Micro Data", *Review of Economic Dynamics,* 7(3), 613-641.

Baye, Michael, John Morgan, and Patrick Scholten (2006), "Information, Search, and Price Dispersion", in *Handbook on Economics and Information Systems*, (T. Hendershott, ed.), Elsevier Press, Amsterdam.

Caplin, Andrew, and John Leahy (2008), "Trading Frictions and House Price Dynamics", NBER Working Paper, w14605.

Cotteleer, Geerte, and Cornelis Gardebroek (2006), "Bargaining and market power in a GIS-based hedonic pricing model of the agricultural land market", *American Agricultural Economics Association*, 21255 (2006 Annual meeting, July 23-26, Long Beach, CA).

Díaz, Antonia, and Belén Jerez (2009), "House Prices, Sales and Time on the Market: A Search-Theoretic Framework", Working Paper 09-25 Economic Series, Departamento de Economía, Universidad Carlos III de Madrid.

Fisher, Jeffrey, Dean Gatzlaff, David Geltner, and Donald Haurin (2003), "Controlling for the Impact of Variable Liquidity in Commercial Real Estate Price Indices," *Real Estate Economics*, 31(2), 269-303.

Gabriel, Stuart A., Shack-Marquez, Janice, and William L. Wascher (1992), "Regional House Price Dispersion and Interregional Migration", *Journal of Housing Economics*, 2(3), 235-256.

Genesove, David, and Lu Han (2010), "Search and Matching in the Housing Market", CEPR Discussion Papers, n. 7777.

Habito, Cielito F., Michael O. Santos, and Andres G. Victorio (2010), "A Game-Theoretic Approach to Hedonic Housing Prices", *International Journal of Human and Social Sciences*, 5(6), 377-380.

Harding, John P., John R. Knight, e C. F. Sirmans (2003b), "Estimating Bargaining Effects in Hedonic Models: Evidence from the Housing Market", *Real Estate Economics*, 31(4), 601-622.

Harding, John P., Stuart S. Rosenthal, e C. F. Sirmans (2003a), "Estimating Bargaining Power in the Market for Existing Homes", *Review of Economics and Statistics*, 85(1), 178-188.

Janssen, Jos**,** Bert Kruijt, and Barrie Needham (1994), "The Honeycomb Cycle in Real Estate", *Journal of Real Estate Research*, 9(2), 237-252.

Leung, Charles Ka Yui, and Zhang, Jun (2011), "Fire Sales in Housing Market: Is the House-searching Process similar to a Theme Park Visit ?", MPRA Paper, 29127.

Leung, Charles Ka Yui, Garion C. K. Lau, and Youngman C. F. Leong (2002), "Testing alternative theories of the property price-trading volume correlation", *Journal of Real Estate Research*, 23(3), 253-264.

Leung, Charles Ka Yui, Youngman Chun Fai Leong, and Ida Yin Sze Chan (2002), "Time-On-the-Market: Why Isn't Price Enough? *International Real Estate Review*, 5(1), 91-115.

Leung, Charles, Youngman Leong, and Siu Wong (2006), "Housing Price Dispersion: An Empirical Investigation", *The Journal of Real Estate Finance and Economics*, 32(3), 357-385.

Lisi, Gaetano (2011), "The Hedonic Price Function in a Matching Model of Housing Market", *Economics Bulletin*, 31(3), 2347-2355.

Maury, Tristan-Pierre, and Fabien Tripier (2010), "Strategies for Search on the Housing Market and their Implications for Price Dispersion", Working Papers hal-00480484, HAL.

McDonald, John F. (2000), "Rent, Vacancy and Equilibrium in Real Estate Markets", *Journal of Real Estate Practice and Education*, 3(1), 55-69.

Merlo, Antonio, and Francois Ortalo-Magne (2004), "Bargaining over Residential Real Estate: Evidence from England", *Journal of Urban Economics*, 56(2), 192-216.

Petrongolo, Barbara, and Christopher A. Pissarides (2001), "Looking into the Black Box: A Survey of the Matching Function", *Journal of Economic Literature*, 39(2), 390-431.

Pissarides, Christopher A. (2000), *Equilibrium Unemployment Theory* (2nd edition), MIT Press Books.

Quan, Daniel C., and John M. Quigley (1991), "Price Formation and the Appraisal Function in Real Estate Markets", *Journal of Real Estate Finance and Economics*, 4(2), 127-146.

Read, Colin (1991), "A Price Dispersion Equilibrium in a Spatially Differentiated Housing Market with Search Cost", *American Real Estate and Urban Economics Association Journal*, 19(4), 532-547.

Vukina, Tomislav and Xiaoyong Zheng (2010), "Search, and Price Dispersion: Evidence from the Live Hogs Market", *Agricultural and Resource Economics Review*, 39(3), 534–546.

Wheaton, William C. (1990), "Vacancy, Search, and Prices in a Housing Market Matching Model", *Journal of Political Economy*, 98(6), 1270-1292.

Wong, S., C. Yiu, and K. Chau (2007), "Volatility Transmission in the Real Estate Spot and Forward Markets", *Journal of Real Estate Finance and Economics*, 35(3), 281-293..

Wong, S., C. Yiu, M. Tse, K. Chau (2006), "Do the Forward Sales of Real Estate Stabilize Spot Prices ?", *Journal of Real Estate Finance and Economics*, 32(3), 289-304.

Yiu, C. Y., C. S. Tam, and P. Y. Lee (2006), "Volume-Related Heteroskedasticity and Liquidity Premium in Hedonic Pricing Model", *Journal of Property Research*, 23(1), 39-51.

Yiu, C. Y., Hui, E. C. M., and S. K. Wong (2005), "Lead-lag relationship between the Real Estate Spot and Forward Contract Markets", *Journal of Real Estate Portfolio Management,* 11(3), 253-262.

Yiu, C. Y., K. F. Man, and S. K. Wong (2008), "Trading Volume and Price Dispersion in Housing Markets", *Journal of Property Research*, 25(3), 203-219.

Figures

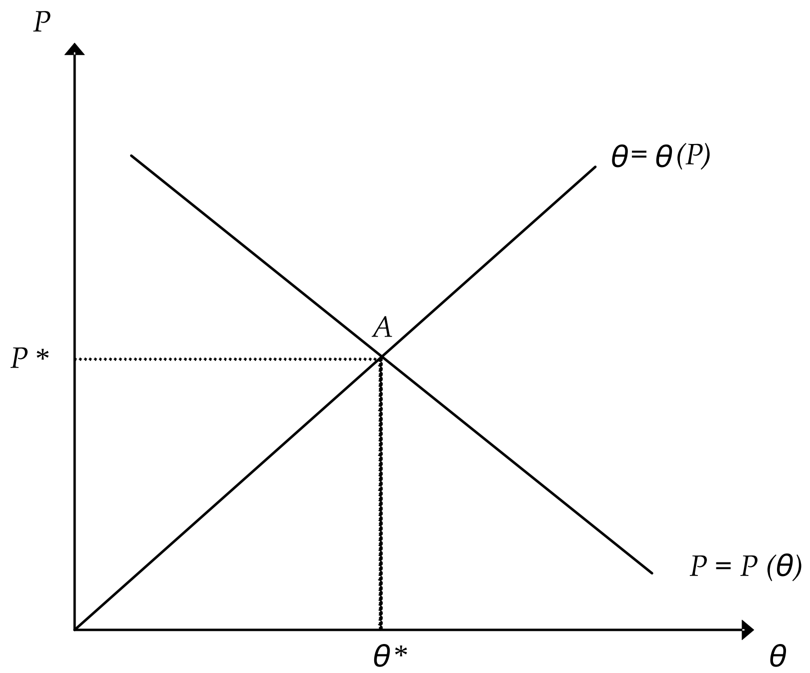

Figure 1. Equilibrium

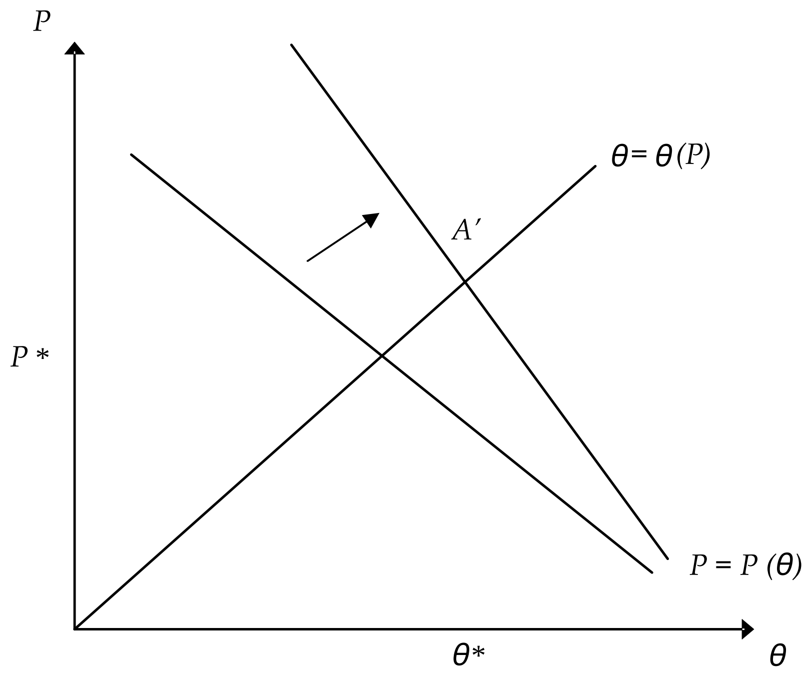

Figure 2. Increase in the search costs of sellers (advertising vacancies)