Helsinki Center of Economic Research

Discussion Papers

Middlemen intermediate 'lemons'?

Timo Vesala
University of Helsinki, RUESG and HECER

Discussion Paper No. 88
November 2005

ISSN 1795-0562

HECER – Helsinki Center of Economic Research, P.O. Box 17 (Arkadiankatu 7), FI-00014 University of Helsinki, FINLAND, Tel +358-9-191-28780, Fax +358-9-191-28781, E-mail info-hecer@helsinki.fi, Internet www.hecer.fi

HECER
Discussion Paper No. 88

Middlemen intermediate 'lemons'?*

Abstract

We demonstrate that the coexistence of two parallel markets - an uncoordinated search market and a market with competitive middlemen - can resolve the 'lemons' problem'. Compared with the search market, middlemen facilitate efficient matching. Low quality sellers generally prefer trading via middlemen because this practice guarantees trading. Market failure is avoided if sufficiently many low quality sellers choose the middleman market. This happens if buyers' valuation for 'lemons' is high enough. We also show that allowing for subsequent trading opportunities limits the range of parameter values within which the sufficient separation may exist.

JEL Classification: D82, D83.

Keywords: Middleman, Search, Adverse selection.

Timo Vesala

Department of Economics
University of Helsinki
P.O. Box 17 (Arkadiankatu 7)
FI-00014 University of Helsinki
FINLAND

e-mail: tvesala@valt.helsinki.fi

* The author thanks *the Research Unit of Economic Structures and Growth (RUESG)* at the University of Helsinki and *the Yrjö Jahnsson Foundation* for financial support.

1 Introduction

Akerlof (1970) demonstrates in his seminal work on adverse selection that when buyers anticipate the average quality of the goods but cannot verify the quality of any particular good there may be a market failure. If the sellers' own valuation for the good is increasing with the quality, it may happen in a static setting that the Walrasian price is lower than high quality sellers' valuation for the good, so that potentially gainful trade remains unrealized and there is only market for 'lemons'.

We demonstrate that the coexistence of two parallel markets - an uncoordinated search market and an intermediated market with competitive middlemen - can resolve the 'lemons' problem'. Our result stems from the assumption that agents can obtain transaction through a middleman with greater probability than when trying to search for a potential trading partner on their own.[1] Since the low quality sellers have lower valuation for their own selling good, they value efficient trading more than the sellers of high quality goods. Akerlofian market failure is avoided if sufficiently many low quality sellers choose to trade through a middleman, so that high quality goods can be traded in the search market. A sufficient separation - and even a full separation - is possible if buyers' valuation for the low quality good is high enough. This guarantees that sufficiently many buyers are willing to enter the intermediated market, even though they rationally expect that there will be only lemons for sale.

The role of middlemen in overcoming the adverse selection problem has been recognized in some earlier contributions (e.g. Biglaiser, 1993; Li, 1998). However, these models typically emphasize middlemen as experts who possess a technology for quality testing and thereby can reveal sellers' private information. Our model demonstrates that middlemen's presence can induce separation even without any quality screening[2].

It has also been argued (e.g. Janssen and Roy, 2002; Blouin, 2003) that the Akerlofian market failure is less likely to occur in a dynamic setting. If high quality sellers wait for future trading opportunities, their relative share gradually increases, neutralizing the lemon's effect. However, we show in the dynamic extension of the model that subsequent trading opportunities limit - not extent - the range of parameter values within which the sufficient separation may occur. This is because future trading

[1] E.g. Rubinstein and Wolinsky (1987) and Gehrig (1993) draw on this idea.

[2] Garella (1989) provides an example where a middleman can successfully resolve Akerlof's impasse by randomizing the price offers to the sellers.

opportunities reduce the expected value loss from the inability to trade, so that the search market becomes a more attractive option also for the low quality sellers.

2 Static model

Assume a continuum of buyers and sellers of measure one each. The fraction of high (low) quality sellers is λ $(1-\lambda)$. High and low quality sellers value their selling goods for $h > 0$ and $l = 0$ respectively. Buyers' valuations are H and L. Buyers know the quality distribution $\{\lambda, 1-\lambda\}$ but cannot observe the quality of any particular good. The valuations are ranked as $H > h > L > l = 0$. In accordance with Akerlof (1970), we assume

$$\lambda H + (1-\lambda) L < h, \tag{1}$$

which in Walrasian setting leads to a situation where only low quality goods are traded.

Traders face two options: They can either search for a trading partner or go to an intermediated market with active middlemen. The search market is characterized by matching frictions and markets do not typically clear. The middleman market, however, features perfect matching in a sense that each trader has a frictionless access to any middleman and can always locate a vacant trading partner.

Since $l < h$, the opportunity cost of *not* transacting is higher for the low quality sellers. They may thus prefer trading in the middleman market because this practice guarantees trading. Hence, the high quality sellers can only trade in the search market, while the low quality sellers and all buyers may play mixed strategies between the search market and the middleman market with the respective probability distributions $\{a, 1-a\}$ and $\{b, 1-b\}$. We first conjecture 'sufficient separation' and then verify under which parameter values such an equilibrium is feasible.

2.1 Search market

Matching between buyers and sellers in the search market is governed by the 'urn-ball' process.[3] Buyers are 'balls' who come up to sellers ('urns'). The number of buyers (sellers) in the search market is $x = b$ $(y = \lambda + a(1-\lambda))$. For tractability, we assume large markets, so that the number of buyers a seller expects can be approximated with a Poisson distribution with parameter $x/y \equiv \phi$. The probability that n buyers

[3] E.g. Butters (1977) and Hall (1979).

approach a particular seller then yields $(\phi^n/n!)\, e^{-\phi}$. [4] Since some sellers may not meet any buyers while some sellers meet several competing buyers, some agents remain unmatched.

The expected utility of a buyer entering the search market is denoted by B^s. The corresponding utilities of high and low quality sellers are denoted by S_h^s and S_l^s respectively. Prices are determined as a bidding game where buyers can observe how many other buyers are bidding for the same good. With probability $e^{-\phi}$, only one buyer approaches the seller and he bids p_1. Since we are looking for an equilibrium where all seller types trade, p_1 must equal h which is the high quality seller's valuation for his own good. With probability $1 - e^{-\phi}$, there are at least two bidders competing for the same good. The bidders raise their price offers until driven to they just break-even; i.e. the highest bid $p_{\geq 2}$ equals $\xi H + (1-\xi)\, L$, where $\xi = \lambda/\left(\lambda + a\,(1-\lambda)\right)$ denotes the expected fraction of high quality sellers in the search market. Buyer's expected utility is thus given by

$$B^s = e^{-\phi}\left(\xi H + (1-\xi)\, L - h\right). \tag{2}$$

Sellers are left without any contacts with probability $e^{-\phi}$, in which case they do not earn any rents. A single buyer shows up with probability $\phi e^{-\phi}$ and both seller types receive the price $p_1 = h$. At least two buyers come by with probability $1-(1+\phi)\, e^{-\phi}$ and the high and low quality sellers earn $p_{\geq 2} - h$ and $p_{\geq 2} - l = p_{\geq 2}$ respectively. The expected utilities for the high and low quality sellers thus yield respectively

$$S_h^s = \left(1-(1+\phi)\, e^{-\phi}\right)\left(\xi H + (1-\xi)\, L - h\right), \tag{3}$$

$$S_l^s = \phi e^{-\phi} h + \left(1-(1+\phi)\, e^{-\phi}\right)\left(\xi H + (1-\xi)\, L\right). \tag{4}$$

2.2 Intermediated market

In the intermediated market, competitive middlemen pairwise match buyers and sellers. For simplicity, we assume that middlemen face zero costs in operating intermediation, so that the 'intermediation fee' is zero and the bid and ask prices boil down to a single market price p_m. The price p_m is determined by the market clearing condition; i.e. p_m is the price that induces an equal number of buyers and sellers to enter the middleman market.

[4] For a detailed derivation, see e.g. Lu and McAfee (1996).

Since agents trade with certainty and since buyers rationally expect that there will only be lemons for sale, the expected utilities for buyers and sellers obtain respectively

$$B^m = L - p_m, \tag{5}$$

$$S^m = p_m. \tag{6}$$

2.3 Equilibrium analysis

Market clearing in the middleman market implies that also the number of buyers and sellers in the search market must equal; i.e. $x = y$ so that $\phi = 1$. Moreover, mixed strategies require that $S^m = S_l^s$ and $B^m = B^s$, which with $\phi = 1$ yield

$$p_m = \frac{h}{e} + \left(1 - \frac{2}{e}\right)(\xi H + (1-\xi) L), \tag{7}$$

$$L - p_m = \frac{(\xi H + (1-\xi) L - h)}{e}. \tag{8}$$

Using (7) and (8), the two endogenous equilibrium variables, the price p_m^* and the proportion of high quality sellers in the search market ξ^*[5], are given by

$$p_m^* = \frac{e-2}{e-1} L - \frac{h}{e} \text{ and } \xi^* = \frac{L}{(e-1)(H-L)}. \tag{9}$$

In order for the pair $\{p_m^*, \xi^*\}$ to establish an equilibrium, it must hold that each trader earns non-negative rents. Since $S_l^s > S_h^s$, the relevant individual rationality conditions are $S_h^s \geq 0$ and $B^s = B^m \geq 0$. Both of these conditions are satisfied if

$$\xi^* \geq \frac{h}{H-L} \Leftrightarrow L \geq \frac{e-1}{e} h \equiv \bar{L}^{ss}.$$

If $L \geq \bar{L}^{ss}$, a sufficient separation will occur; i.e. a sufficiently large fraction of the low quality sellers chooses to trade in the intermediated market, so that a market failure in the search market can be avoided. The intuition is that the transferable rent $L - l = L$ has to be sufficiently large in order to have enough demand for lemons in the intermediated market.

A full separation requires that $S^m > S_l^s$, so that $\xi^* = 1$. $S^m > S_l^s$ holds if

$$L \geq \frac{e-1}{e} H \equiv \bar{L}^{fs}. \tag{10}$$

[5]Note that ξ^* determines the equilibrium price $p_{\geq 2}^*$, as well as the equilibrium probabilities a^* and b^* with which the low quality sellers and buyers choose the search market.

The condition $L \geq \bar{L}^{fs}$ can be consistent with the ranking $L < h$ if $h > [(e-1)/e]\,H$. In other words, the transferable rent $H - h$ available in the search market under full separation has to be low enough to secure sufficient demand for 'lemons' in the intermediated markets.

3 Dynamic extension

Assume now an infinite horizon economy, where the unmatched agents face unlimited possibilities to trade in the future. The agents discount future cash flows with the common discount factor $\delta < 1$. The value of remaining unmatched in the search market is $\delta B^s$for a buyer and δS_h^s (δS_l^s) for a high (low) quality seller. In the transaction, the loss of this value has to be compensated. This means that p_1 must equal $h + \delta S_h^s$ and $p_{\geq 2}$ satisfies $\xi H + (1-\xi) L - p_{\geq 2} = \delta B^s$, so that the life time utilities available in the search market obtain[6]

$$\begin{aligned}
B^s &= e^{-\phi}\left(\xi H + (1-\xi) L - h - \delta S_h^s\right) + \left(1 - e^{-\phi}\right)\delta B^s, \\
S_h^s &= e^{-\phi}\delta S_h^s + \phi e^{-\phi}\delta S_h^s + \left(1 - (1+\phi) e^{-\phi}\right)\left(\xi H + (1-\xi) L - h - \delta B^s\right), \\
S_l^s &= e^{-\phi}\delta S_l^s + \phi e^{-\phi}\left(\delta S_h^s + h\right) + \left(1 - (1+\phi) e^{-\phi}\right)\left(\xi H + (1-\xi) L - \delta B^s\right).
\end{aligned}$$

A steady state requires that the number of agents who transact and exit equals the number of newborn agents. Since the number of unmatched buyers and sellers from the previous period must be the same and since the number of new buyers and sellers equals by assumption, market clearing in the middleman market again implies that the steady state ratio between buyers and sellers in the search market must equal unity; i.e. $\phi = 1$. Thus,

$$B^s = \frac{1}{e-\delta}\left(\xi H + (1-\xi) L - h\right), \tag{11}$$

$$S_h^s = \frac{e-2}{e-\delta}\left(\xi H + (1-\xi) L - h\right), \tag{12}$$

$$S_l^s = \frac{e-2}{e-\delta}\left(\xi H + (1-\xi) L\right) + \frac{h}{e-\delta}. \tag{13}$$

Since the life time utilities available in the middleman market are still given by (5) and (6), the indifference conditions $S^m = S_l^s$ and $B^m = B^s$ imply

$$p_m^* = \frac{e-2}{e-1} L - \frac{h}{e-\delta} \text{ and } \xi^* = \frac{(1-\delta) L}{(e-1)(H-L)},$$

[6] It is easy to check that these equations equal eq. (2)-(4) with $\delta = 0$.

so that

$$\bar{L}^{ss} = \frac{e-1}{e-\delta}h \text{ and } \bar{L}^{fs} = \frac{e-1}{e-\delta}h.$$

$\bar{L}^{ss}$ and $\bar{L}^{fs}$ are both increasing in δ. Higher δ means that the agents have greater valuation for future trading opportunities, so that the value loss resulting from the potential inability to transact in the search market is reduced. As a result, the search market becomes a more attractive option also for the low quality sellers. Greater patience thus limits the range of parameter values within which a steady state equilibrium with sufficient separation exists - an observation that contradicts with the commonly held view (e.g. Janssen and Roy, 2002; Blouin, 2003) that a dynamic perspective is likely to mitigate the lemons' problem.

However, since the high quality sellers trade on average less frequently than the low quality sellers, their steady state share, say Λ, among all sellers is greater than in the static case. Λ can be shown to yield[7]

$$\Lambda = \frac{e\xi^*\lambda}{(e-1)\,\xi^* + \lambda} > \lambda.$$

If this number is sufficiently large, the lemon's problem might not emerge even though the sufficient separation induced by the trading via middlemen would not be feasible.

Appendix

Let Y denote the steady state 'stock' of sellers in the search market. Since the number of sellers trading in the middleman market equals $(1-a)(1-\lambda)$ in each period, we have

$$\Lambda = \frac{\xi^* Y}{Y + (1-a)(1-\lambda)},$$

Steady state requires that the 'inflow' and 'outflow' of each seller type must balance in the search market, i.e., given that ϕ mus equal unity,

$$\frac{e-1}{e}\xi^* Y = \lambda \text{ and } \frac{e-1}{e}\left(1-\xi^*\right) Y = a(1-\lambda).$$

These steady state conditions directly imply

$$Y = \frac{e\lambda}{(e-1)\,\xi^*} \text{ and } a = \frac{\lambda}{1-\lambda}\frac{1-\xi^*}{\xi^*},$$

so that

$$\Lambda = \frac{e\xi^*\lambda}{(e-1)\,\xi^* + \lambda}.$$

[7] See Appendix for detailed derivation.

References

Akerlof, G. A. (1970): "The Market for 'Lemons': Qualitative Uncertainty and the Market Mechanism," *Quarterly Journal of Economics*, 84, 488–500.

Biglaiser, G. (1993): "Middlemen as Experts," *RAND Journal of Economics*, 24, 212–223.

Blouin, M. R. (2003): "Equilibrium in a Decentralized Market with Adverse Selection," *Economic Theory*, 22, 245–262.

Butters, G. R. (1977): "Equilibrium Distributions on Sales and Advertising Prices," *Review of Economic Studies*, 44, 465–491.

Garella, P. (1989): "Adverse Selection and the Middleman," *Economica*, 56, 395–399.

Gehrig, T. (1993): "Intermediation in Search Markets," *Journal of Economics and Management Strategy*, 2, 97–120.

Hall, R. E. (1979): "A Theory of the Natural Unemployment Rate and the Duration of Employment," *Journal of Monetary Economics*, 5, 153–169.

Janssen, M. C. W., and S. Roy (2002): "Dynamic Trading in a Durable Good Market with Asymmetric Information," *International Economic Review*, 43, 257–281.

Li, Y. (1998): "Middlemen and Private Information," *Journal of Monetary Economics*, 42, 131–159.

Lu, X., and R. P. McAfee (1996): "The Evolutionary Stability of Auctions over Bargaining," *Games and Economic Behavior*, 15, 228–254.

Rubinstein, A., and A. Wolinsky (1987): "Middlemen," *Quarterly Journal of Economics*, 102, 581–593.