Microeconomic Assessment of the Home Buying Offer and Contract Process

Report to the Office of Fair Trading

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1 Introduction

1.1 Aim and Scope of the Work

This report provides a micro-economic assessment of the home buying offer and contract process in England and Wales. The main objective is to identify potential sources of inefficiencies in the current system and, on the basis of these results, to consider ways to address these inefficiencies.

To accomplish this objective we provide a formal analysis of a range of aspects and key features in the home buying process. These features include the facts that sellers and buyers seem to be relatively unprepared at their initial encounter, that initial agreements are typically not binding and that individual transactions are often embedded into larger chains of mutually contingent transactions. These features can lead to possibly avoidable costs and delay. Our analysis sheds light on the nature and source of such problems.

While our analysis will be informed by stylized facts of the home buying process and the results of a few surveys and empirical studies, it remains foremost a theoretical analysis. Therefore, our main aim is to *identify* and *qualify* rather than to *quantify* potential sources of inefficiencies.

1.2 Work Plan

To capture the salient features of the home buying offer and contract process we will proceed in a "modular approach". We start by analysing bilateral transactions. Subsequently, we enrich the analysis by considering chains of transactions. Finally, we study the full market environment where different potential buyers and sellers interact.

The modular approach is chosen as it allows to better isolate potential problems. Step-by-step we subsequently analyse how previously identified problems are either mitigated or exacerbated in a more complex environment. At each level, ie, that of individual transactions, chains and the market, our focus is on three potential sources of inefficiencies: informational problems, strategic break-up and non-strategic break-up.

Each issue that we encounter is treated in the following way. We first provide a verbal description. Next, we re-state the arguments more formally by using a simple modelling framework. Finally, each section ends with a short summary of the key results.

2 Preliminary Discussion

2.1 Short Description of the Home Buying and Contract Process

Before providing a formal analysis of the home buying and contract process, we briefly state the main features. We first record some findings about the market in residential real estate for England and Wales. We then give a short account of the main stages in the contracting process. We report some findings on the time it takes and the costs involved in reaching these stages. Finally, we list a number of "problem areas" that were mentioned in surveys and policy papers. These findings will constitute a major point of reference for our subsequent formal analysis.

We have mainly used two data sources. First, we were able to rely on survey results (DETR (1998)). These (tracking) surveys were conducted among buyers, sellers and solicitors. Secondly, we were also informed by academic papers written about property transactions in England, such as Merlo and Ortalo-Magne (2003).[1]

2.1.1 The Home Buying Market

The home buying market is essentially a search market where prices are determined by bilateral negotiations.[2] To document the search feature of the market, Merlo and Ortalo-Magne (2003) report that in their data set the average number of viewings per property until sale was almost 10, with almost two viewings taking place per week. The tracking surveys find that it takes buyers 90 days (median value) to find a property that is subsequently bought. For sellers the marketing time is 137 days (median value).

The listing price at which a property is put on the market certainly plays a role in attracting buyers and providing information. However, it is not binding and the buyer may get away with paying substantially less. Thus, bilateral negotiations form an essential part of the contracting process.

2.1.2 Main Stages in Selling and Buying

Preparing to sell and buy

It is an important feature of the home buying process in England and Wales that buyers

[1] This study uses data made available by a large private real estate agent.

[2] Admittedly, this is only true for the vast majority of transactions as some sales are concluded by auctions.

and sellers undertake very few preparations before engaging in transactions, ie, before marketing their property and submitting or responding to offers. From the tracking surveys we learned that only 50% of buyers have even talked to their mortgage lenders before submitting an offer. Only 15% obtain a mortgage certificate. Even at the offer stage little is done by buyers. Only 15% of buyers commission an own survey *before* submitting an offer.

The inactivity of buyers is matched by that of sellers. According to the tracking survey among sellers, 80% refrain from taking any preparatory step that could later facilitate the transaction, such as obtaining the property deeds, instructing a solicitor to start drawing up a draft contract or arranging a building survey on the property. In particular, almost none commissions a survey.

Once an offer is accepted, it still takes on average 80-90 days until the transfer is completed. (Subsequently, it takes another 2 weeks until the buyer moves in.) If a seller or a buyer is better prepared, the surveys suggest that this can substantially shorten the time before a contract is *agreed.* (According to the buyers tracking survey the median number of days is reduced from 61 to 49.) However, it seems that the time till completion is not affected much. (According to the same study the median number of days is 76 with preparation and 77 without preparation.) This suggests that may not be sufficient if only one side is better prepared, or that other factors play a major role in delaying completion. One candidate for the latter could be chains, ie, the fact that a buyer or seller will want to wait until he has sold or bought another property. We return to this later.

The contract process

For our purpose it is sufficient to distinguish between four phases in the contract process. First, an initial agreement is reached between buyer and seller. Any offer or acceptance is subject to a contract being signed and at this stage there are no legal obligations for the buyer to buy, or for the seller to sell, until a formal contract is signed. Second, the conveyancing process begins during which buyer and seller perform the necessary steps to be in a position to exchange contracts. During this period, the buyer often secures financing, acquires additional information and appoints a solicitor to search and collect the necessary documents to transfer the title of the property. Third, the transfer of the property takes place when written contracts are exchanged, setting out a deposit (typically 10% of the agreed price), the price to be paid and the time for completion. The seller remains in possession of the property until completion. From now on the contract is binding and parties are liable for damages. Fourth, the buyer enters in possession of

the property on completion of the contract and after payment of the agreed price.

2.1.3 Costs Involved in the Home Buying Process

We can think of at least three different sources of costs in the home buying process. First, both the seller and the buyer must spend time and resources to locate a suitable counterpart. As already noted above, the surveys found that it takes the buyer 80 and the seller 137 days (median values) to find the counterpart with whom they finally conclude a transaction. Second, the conveyancing process and the completion of the contract both involve costs, mostly in the form of fees paid to the involved agents and solicitors. Finally, part of the latter costs may have to be incurred more than once if previous transactions failed.

Costs involved in completing a transaction

The tracking surveys find that the buyer's total transaction costs sum up to about £1,500. Given an average transaction value of £80,000, this represents 1.8% of the agreed price. For sellers these costs sum up to another £1,800, or 2.3% of the agreed price. In total, transaction costs are roughly 5% of the total value. (The surveys mention also additional expenditures incurred by the buyer and the seller, which together sum up to more than £2,500, most of it incurred by the buyer.) Of the buyer's transaction costs, the mortgage valuation amounts to £200, while the price for a typical survey is £200. (The tracking surveys report that up to 50% of buyers commission an own survey.)[3]

Failure of transactions

Transactions can fail at different stages. Clearly, the later a transaction is cancelled the larger are the costs that have already been incurred. There is only scarce data from the tracking surveys on failures. On average, a seller seems to lose £200 on conveyancing costs and a similar amount of other expenditures. For buyers the foregone expenditures seem to be much larger. Conveyancing costs, expenses for mortgage arrangement and other fees sum up to roughly three times this amount.

[3] Most of these surveys are either homebuyers surveys or building surveys. Almost none of them is structural. Note that this figure does not conflict with the previous statement that only 15% of buyers commission a survey *before* submitting an offer.

2.1.4 Main Areas of Potential Problems

The surveys have pointed to the following potential areas of inefficiencies and problems in the home buying and contracting process.

Lack of preparation

The only area of reform mentioned by all parties (buyers, sellers, agents, solicitors and lenders) is that of information provision (surveys, evaluations) by sellers. Solicitors express also the feeling that buyers should be more prepared before making offers, eg, by having secured finance. As noted above, data from the surveys suggests that preparation indeed considerably shortens the time until a contract is agreed.

Offers not to be legally binding

The surveys suggest that the fact that offers are not legally binding is of some concern to buyers and sellers. This is surprising given that contractual freedom would give them any opportunity to correct for this perceived shortcoming. In particular, they could demand deposits or sign contracts stipulating penalties if one party cancels the agreement at a later stage. The surveys find, however, that only 3% of buyers make a pre-exchange deposit.[4]

Hence, at present there seems to be only small interest in putting money up front in the form of a goodwill security payment.

Chains

Whether an individual transaction is part of a chain or not importantly influences the time it takes to buy or sell a home. Figures from the surveys reveal that, if a buyer is part of a chain, this prolongs the time it takes from search to making a successful offer by 50% (or, in absolute terms, by 25-30 days). The time between acceptance of the offer and exchange of contracts is 50% longer. Finally, the time between exchange of contracts and competition is shortened by 50% if there is no chain, though this stage does not contribute much to the total delay. Counting the cases reported in the surveys, the figures suggest that almost one third of transactions were part of a chain. On the other side, 84% of sellers reported that they were at the same time considering to buy another property. However, more detailed evidence on the prevalence and "length" of chains would be required to confidently gauge their importance.

[4] Casual observation suggests that sellers' lock-out agreements are more common, which commit sellers to withdraw a property from the market.

Cancellations of agreements

The surveys and data from Merlo and Ortalo-Magne (2003) suggest that between one fourth and one fifth of all accepted offers are cancelled at some later stage. Even if we lack detailed and reliable information about the reasons for these break ups, they seem to be mostly due to events that are not fully controlled by the two contracting parties. In particular, the failure of the buyer to secure a mortgage, the revelation of additional information by the survey, and the failure to complete other transactions (in the chain) seem to be particularly important. Gazumping and gazundering seem to be relevant only to a lesser degree. This hypothesis is confirmed by responses in the tracking surveys, where gazumping and gazundering were only reported in ca. 2% of all cases.

2.2 Plan of the Formal Analysis

The analysis aims to identify areas of problems in the home buying and contract process in order to evaluate the benefits of policy measures aimed at increasing social welfare. There are two main criteria to evaluate the impact of a policy on social welfare. A policy is said to constitute a Pareto improvement if *no* agent (eg, household) is worse off and at least one is better off. For practical purposes this is, admittedly, a very demanding criterion. A less demanding criterion, to which we will mostly refer to throughout this study, is the utilitarian notion of increasing the sum of utilities of all households.[5]

In the home buying process households' utility is affected by numerous factors. First and foremost, households derive benefits from living in a suitable dwelling. If a property changes hands, this should usually imply that the transaction is mutually beneficial. The agreed price allows the two sides to share the benefits of allocating a scarce resource (houses) more efficiently. These benefits are, however, diminished by the costs and expenditures incurred in the process of locating the counterpart (search and matching) and completing the transaction. As noted in Section 2.1, both buyers and sellers spend a substantial time searching for a suitable property or marketing their home. In this process the two parties may incur expenses, eg, when visiting homes or when making homes ready to be visited. Though the true value of the opportunity cost of time would be hard to quantify, most households would typically prefer to spend the

[5] A frequently used justification for this criterion is that gains that arise at one group of households could be partially "taxed" away so as to compensate a group of households whose utility decreased. If this was feasible the policy would constitute a Pareto improvement after the re-distribution of gains.

time used to visit properties for alternative activities. Once they have successfully located a counterpart, completing the transaction involves additional costs, in particular, by way of fees paid for the services of third parties. In Section 2.1 these costs were estimated to be around 5% of the price.[6]

As noted in Section 2.1, individual transactions are prone to long delays and are often broken up at some later stage. This additional delay and, in particular, the failure to complete a transaction after some of the related expenses have already been incurred could lead to a substantial reduction of welfare.

The potential sources of delay and break-up are the focus of this analysis. We identify three main problem areas:

- Informational problems during negotiations
- Strategic break-up
- Non-strategic break-up

The presence of private information, most importantly on the side of the seller, may both delay transactions and lead to a higher probability of failure. We identify different sources of private information and discuss both private incentives to overcome informational asymmetries and the role of policy intervention.

Even absent informational problems, break-up can occur as one of the parties finds a more attractive alternative, eg, a more suitable property, and subsequently cancels the original transaction. Alternatively, there may be exogenous reasons for why a transaction is not completed, eg, the failure to secure finance. For both strategic and non-strategic break-up we discuss the private incentives to overcome these problems, eg, via contractual mechanisms, and the role of policy intervention.

To address the identified problems and inefficiencies, two policy measures are discussed in particular:

[6] Of course, assuming that the full 5% represent a loss of welfare presupposes a competitive market for these services. Otherwise, not all of this amount is fully lost for welfare as part of it represents a rent that accrues to one of the involved third parties.

- **Preparation by sellers:** Before marketing their property, sellers could be obliged to prepare a set of documents so as to facilitate negotiations and the subsequent completion of the transaction. This Home Information Package (HIP) could incorporate all legal documents and searches as well as a survey on the condition of the property.

- **Making offers more binding:** Different measures can be envisaged that would make offers and initial agreements more binding, thereby making the seller and the buyer in some way liable for the others' costs in case of cancellation. Imposing mandatory minimum deposits represents one such measure.

3 Analysis of Bilateral Transactions

3.1 Plan of This Section

In this section we focus exclusively on bilateral transactions, ignoring any issues relating to chains or to the operation of the market as a whole. We proceed as follows. First, we introduce the basic model we use to capture the main features characterizing bilateral transactions. Subsequently, we turn to the analysis of our three main areas of potential problems: i) informational problems, ii) strategic break-up and iii) non-strategic break-up.

3.2 The Basic Model of Bilateral Contracts

3.2.1 Valuations

For the purpose of this section, we will mainly consider a bilateral monopoly. There is a single putative seller and a single putative buyer. Both buyer and seller are risk-neutral expected payoff maximisers. The seller's value of the property is denoted by v_S and that of the buyer by v_B. For simplicity, we focus on only two factors that have an impact on these values and, thereby, on the surplus created in a transaction.

First, there is a "common-value" component c, which relates to the "objective" valuation of the property, eg, the need for repairs. In addition, both v_S and v_B depend also on "private-value" components, which may capture the "subjective" values, eg, how much the seller and the buyer value to live in this particular area, in this particular type of building, etc. We denote the private-value components by b for the buyer and by s for the seller.

Overall, we specify that the seller's value is given by $v_S = c + s$ and that of the buyer by $v_B = \lambda c + b$. The factor λ for the common-value component allows for some additional flexibility, eg, the fact that the buyer may have lower costs in conducting the necessary repairs as he intends to do them in his spare time.

3.2.2 Information Regimes

We can distinguish between the following three major informational regimes.

Symmetric information

Here, both sides share the same information about all components of their values, i.e., about c, b, and s. While being admittedly not too realistic, this case is an important benchmark for the analysis of possible inefficiencies in the contracting process.

Private information about the private-value components

In this case, the only sources of informational asymmetries are the private-value components, eg, the two sides' personal appreciation of some particular features of the property.

Private information about the common value component

If at all, it should be the seller who has some private information about the common-value component. The source of this information could be either personal observations made whilst living in the property or the content of previously commissioned surveys.

3.2.3 Negotiations

As noted in Section 2.1, a major feature of the home buying process is that prices are determined by (mostly bilateral) negotiations.[7] To capture negotiations we need to formulate a bargaining model that is both tractable, in particular when embedded into the market model in Section 5, and sufficiently rich to allow us to analyse the potential problems arising during negotiations.

[7] Alternative arrangements could be posted prices, whereby a seller's listing price is taken to be binding, or auctions. As noted previously, auctions seem to be used only in a small number of cases. Moreover, while the listing price has some informational content, it is neither binding nor is it perceived to be the reserve price of the seller. Most realistically, a listing price could be seen as the price at which a buyer's offer will almost surely be met with acceptance. The further the buyer's offer lies below the listing price, the less likely is it that the seller immediately accepts.

Two easy-to-solve extreme cases are those where either the seller or the buyer make a take-it-or-leave-it offer to the other party, which then decides whether to accept or to reject the offer. After rejection of the initial offer the negotiation breaks down and no party is allowed to make a counter-offer. These cases in which one party has all the bargaining power are admittedly extreme, but are particularly suitable to obtain results that are more generally valid. In order to analyse situations in which both contracting parties have some bargaining power, we consider a bargaining model in which the seller is chosen with probability σ to make a take-it-or-leave-it offer to the buyer. Otherwise, the buyer makes a take-it-or-leave-it offer to the seller. The two extreme cases introduced above are recovered by setting $\sigma = 0$, in which case the buyer has all the bargaining power, or $\sigma = 1$, in which case the seller always makes the offer. By shifting the parameter σ we have a simple tool for analysing the impact of bargaining power on the outcome and the efficiency of negotiations.

Even though we allow for a random choice of who makes the offer, the model of negotiations allows only for a single round of offers. The major source of inefficiency will be break-down, ie, the rejection of an offer even though there exist gains from trading the property. In a richer modelling framework, allowing for repeated counter-offers, some of this surplus could be recouped by subsequently adjusting the offers, though this may now involve considerable delay. Formal analysis shows that still a substantial loss of surplus can arise despite this increased flexibility.[8]

3.3 Private Information and Uncertainty as Sources of Breakdown and Delay

3.3.1 Plan of the Analysis

In this section we first argue that private information may lead to socially inefficient break-down. The reasons for inefficiency are different in the cases of informational asymmetries about the private-value and the common-value component. Next, we analyse private incentives to reveal private information. Finally, we ask whether policies of mandatory information provision, in cases where this is feasible, could increase efficiency.

Before proceeding with the analysis we provide a brief overview. Our main findings are as

[8] In particular, economic theory has obtained strong inefficiency results, even after allowing for very general mechanisms of trading, in the cases of bilateral private information and private information on the common-value component.

follows:

- **The impact of private information:** Private information can seriously hamper the realization of surplus from trade. This holds for private information about both the private-value and the common-value component, but the latter case can be particularly detrimental for efficiency.

- **Private incentives for information provision:** It may often be possible to produce and credibly document information about the common-value component, ie, the "quality" of the property. We identify circumstances when the seller has strong incentives to do so and when this is not the case. In the latter instance, there could be a case for policy intervention, but the drawbacks of mandatory information provision could also be substantial.

3.3.2 Informational Rent and the Monopoly Problem

The benchmark with complete information

Before considering private information, suppose first the values v_B and v_S were both *commonly known*. Then trade should take place whenever $v_B \geq v_S$, ie, whenever the buyer values the property more than the seller. This is the case whenever

$$c(\lambda - 1) + (b - s) \geq 0,$$

which adds up the gains from trade (or *surplus*) due to the different private valuations b and s and the different valuations of the common-value component c.

While the final price of any negotiation may depend on a number of factors, we should predict that the two parties find a way to immediately resolve their dispute and realize the gains from trade.[9]

The agreed price is pinned down in our simple model by the choice of who makes a take-it-or-leave-it offer. The seller sets $p = \lambda c + b$ and pockets the full surplus from trade, and, similarly, the buyer sets $p = c + s$ and again appropriates all of the surplus.

Inefficiency with private information: The case of one-sided private information

[9] This is the substance of the celebrated Coase Theorem.

In this section we consider only private information about the private value component. Take the case where the buyer makes the offer and is uninformed about the sellers' private-value component s. Suppose for simplicity that there are only two possible values (or "types") $0 \leq s_l < s_h$, both of which are strictly smaller than the buyer's value b. Suppose also that both sides have the same valuation of the common-value component, ie, $\lambda = 1$. The buyer believes that with probability q the seller has the high valuation s_h for his own property and with probability $1 - q$ the low valuation s_l. What offer will the buyer optimally make?

Proposing the price $p = s_h + c$ will ensure that the seller always accepts, irrespective of whether his valuation is low, $s_l + c$, or high, $s_h + c$.[10] Consequently, the buyer will realize the sure gain $b + c - p$, which from $p = s_h + c$ becomes

$$b - s_h. \tag{1}$$

Note that with this strategy the buyer can only extract the full surplus when encountering a seller with a high valuation. In contrast, the seller with valuation $c + s_l$ will be able to obtain the gain $(c + s_h) - (c + s_l) = s_h - s_l$. In economic theory this gain is often referred to as the *informational rent* of the low-valuation seller. Even if the seller has no direct bargaining power (eg, as he can not make a counter-offer), his private information allows him to obtain a share of the gains. In contrast, if the buyer had full information, he could easily extract these rents simply by adjusting the price and offering only a lower price to a seller with valuation $c + s_l$.

An alternative strategy for the buyer is to propose the lower price $p = s_l + c$, implying that the seller with low valuation will accept, while the seller with high valuation will reject. Note that this time the low-valuation seller will lose his informational rents. The drawback for the buyer is that he will only get an acceptance with probability $1 - q$. His *expected* gains from proposing $p = s_l + c$ are then

$$(1 - q)(b - s_l). \tag{2}$$

Comparing (1) with (2), the buyer will prefer to choose the lower price $p = s_l + c$ and, thereby, forego some gains from trade if $(1 - q)(b - s_l) > b - s_h$. Intuitively, this is more likely

[10] At this price, the seller with high valuation is exactly indifferent between accepting and rejecting. It is customary to assume without loss of generality that the seller breaks the indifference in favour of buying. If not, the buyer could sweeten the deal by increasing the price by an infinitesimal amount, obtaining a sure acceptance at a negligible additional cost.

if his own valuation is low, the probability of encountering a seller with a high valuation is low and if the gains from trading with a high-valuation seller are low.

The upshot of this short analysis is that under private information the buyer can no longer flexibly adjust his offer to extract all of the realized surplus. Instead, he now faces the trade-off that a lower price allows him to obtain a higher share of the realized surplus when trading but, on the other side, also lowers the probability of acceptance. The buyer's problem is equivalent to the standard problem faced by a *monopsonist* who faces different sellers with different production costs and is unable to price discriminate. Likewise, if the seller makes the offer but does not know the buyer's private-value component b, the problem is equivalent to that of a *monopolist* facing heterogeneous consumers.

The impossibility of finding a mutually acceptable price with bilateral private information

With one-sided private information it would still be possible, at least in principle, to realize all gains from trade. The solution is to sufficiently lower or increase the fixed price so as to accommodate all transactions. For instance, in the previous example the price $p = c + s_h$ allows to realize all transactions with a positive surplus.

In general, this is no longer possible with bilateral private information whenever gains from trade are not certain.[11] To illustrate this point, extend the model considered in the previous subsection by supposing that also the buyer has private information about his valuation b, which can take one of two possible values $0 \leq b_l < b_h$. There are then four configurations of types, each arising with positive probability: $\{b_l, s_l\}$, $\{b_l, s_h\}$, $\{b_h, s_l\}$ and $\{b_h, s_h\}$. To make the case interesting suppose that

$$s_l < b_l < s_h < b_h,$$

implying that all transactions but the one between a low-valuation buyer and a high-valuation seller are efficient. Maintain the assumption that both parties have the same common-value component, ie, $\lambda = 1$.

Is there any price p at which all efficient transactions will be realized? The answer is negative. To see this, note that this would require $p \leq c + b_l$, as we want to ensure that the low-valuation

[11] This insight is due to Myerson and Satterthwaite (1983). They derive a stronger result, showing that with continuous (overlapping) distributions of valuations there exists no efficient trading mechanism that is incentive compatible and satisfies the interim participation constraints.

buyer accepts when matched with a low-valuation seller. But this is not compatible with the requirement $p \geq c + s_h$, needed to ensure that also the high-valuation seller is willing to trade, at least with the high-valuation buyer.[12]

Of course, all gains from trade could again be realized if we were in a position to adjust the price adequately to take account of the different possible valuations of the buyer and the seller. But this would require complete information. Could we expect the two sides to credibly reveal their private information? Also here the answer is no. If claiming to be a high-valuation seller would result in a higher price, also the low-valuation seller would benefit from such a statement. Likewise, the high-valuation buyer would like to mimic any claims made by the low-valuation buyer if this could result in a lower price.

Concluding remarks

The upshot of this short analysis is quite simple. With complete information the agreed price can fully take into account the valuations of both sides. This flexibility is lost with private information. At any given price only some deals may be realized while others may not go through, even though there are still gains from trade. With bilateral private information this can make inefficiencies unavoidable. But even with one-sided private information the attempt of the offering side to extract more surplus will lead to inefficient break-ups.

3.3.3 Adverse Selection

The lemons' problem

If sellers are privately informed about the common value component of their property, the market is subject to adverse selection. As buyers cannot tell the quality of a property, they are willing to pay only an average price. But this price is more attractive for sellers who have bad properties than to seller who have good properties. Consequently, bad properties (i.e., lemons) are more likely to be offered in the market than good properties. If buyers are rational, they should anticipate this adverse selection and expect that at any given price, a property is more likely to be bad than good. Consistently with these expectations, buyers are willing to pay less for a property and so the proportion of good properties that is actually offered by the sellers

[12] If gains from trade were instead certain (ie, if $s_l < s_h < b_l < b_h$), it would be easy to achieve efficient trade (eg, with a price between s_h and b_l).

falls further. The "lemons' problem" can be a severe obstacle to the efficiency of the market.[13]

To illustrate the simplest manifestation of the lemons' problem, consider first a situation in which the private-value component of both sellers and buyers are zero ($b = s = 0$), and the seller has private information about the common-value component, which can be either high, $c_h = 3$, with probability q or low, $c_l = 1$, with probability $1 - q$. The buyer cares more than the seller, $\lambda = 2$. In this simple situation, trade is always efficient, as the buyer's value of 2 for a low quality (or bad) property is above the seller's value of 1 for that property, and similarly the buyer's value for a high quality (or good) property, 6, is above the seller's value, 3, for that property. As the buyer cannot tell good from bad properties, good properties are sold at the same price as bad properties. At a price above 3 both low- and high-quality sellers are willing to sell, so that the average quality of the property for the buyer is $2(1-q) + 6q = 2 + 4q$. For the buyer to be willing to pay a price above 3, the expected value must be sufficiently high. This is no longer possible if $2 + 4q < 3$, ie, if the fraction of good properties is too small, $q < 1/4$. If there are too many bad properties ("lemons") on the market ($1 - q > 3/4$), the good properties are driven out of the market. Note that at a price below 3, only bad properties are sold, so that the buyer is willing to pay at most 2, enough to compensate sellers with bad properties, whose value is only 1. Lemons are never driven out of the market, but can easily drive good properties out of the market!

The lemons' logic applies more generally also in, perhaps more realistic, cases in which the common value enters in the same way the utility of buyer and seller (ie, $\lambda = 1$) , but the buyer has a private value component. In this case, high prices that will also induce owners of properties with high value to sell may drive buyers with a low private-value component, b, out of the market as they are not willing to pay the (inflated) high price for a property of *average* quality. On the other hand, lower prices will only attract sellers with low-value properties.

Concluding remarks

Adverse selection due to private information about the common-value component can severely affect the ability to realize gains from trade. Even if there are *sure* gains from trade, it may be impossible to realize them. This finding sets the case with private information about the common-value component apart from the previously analysed case with private information only about the private-value components. In this sense, private information about the common-value

[13] This insight is due to Akerlof (1970) and won him the 2001 Nobel prize in Economics.

component presents a more serious problem.

3.3.4 Private Incentives for Information Provision: Overview

In order to understand the effect of a policy that mandates information disclosure, we need to consider the seller's private incentives to provide information to the buyer.[14]

If a party has private information about his own private-value component, say the buyer about how much he likes a particular neighbourhood, it may be next to impossible to *credibly* convey this information to the other party. It is typically easier to communicate information about the common-value component, for example by documenting certain features of the property, commissioning an independent survey, or producing bills of previous repairs. In this section we review some arguments for why sellers should want to disclose this information.

We first consider the incentives to reveal (ex post) verifiable information and then turn to the incentives to commit to reveal information before the seller observes it (ex ante). We then consider the possibility that the seller can control the buyer's information about the private value.

3.3.5 Seller's Incentives for Ex-post Provision of Verifiable Information: The Unravelling Principle

The unravelling principle

According to the unravelling principle, a seller with information will disclose it, rather than be subject to the inference that arises from the failure to disclose it when one can do so.[15] Suppose for the moment that the private-value components for buyer and seller are known to be b and s, with $b > s$. In contrast, the common-value component c can take on three different values $c_h > c_m > c_l$. For example, a luxury pad might be fitted with door handles of one of three different materials: gold (with value c_h), silver (c_m) or brass (c_l). The buyer does not know c and assigns the probabilities q_l, q_m and q_h to the three different values. We also set $\lambda = 1$, implying that the benefits from trade are just $b - s$. Will the seller want to show of which material the handles are made of?

[14] Legislation sometimes makes information disclosure mandatory. For example, according to a law of the State of California (California Civil Code, Section 1102-1102), sellers of homes are required to give prospective buyers a "Real Estate Transfer Disclosure Statement", detailing the conditions of the property.

[15] See, eg, Grossman (1981) and Milgrom (1981).

Suppose the seller makes the offer ($\sigma = 1$). If no further information about the property is revealed, the maximum price he can extract is the sum of b and $E_c = q_l c_l + q_m c_m + q_h c_h$. The seller may, however, be in the position to credibly communicate the true value of c, for instance by showing the handles to the buyer who can recognise the material. Note that the highest type, c_h, has strong incentives to disclose information. By proving to the buyer that the handles are made of gold, the seller can increase the requested price by $c_h - E_c > 0$. But if the seller of a property with gold handles follows this disclosure strategy, a buyer who is not shown the handles must believe that they are either made of silver (with value c_l) or brass (c_m). Thus, a seller who does not disclose information can only demand a price equal to the sum of b and $E_c = (q_l c_l + q_m c_m)/(q_l + q_m)$. It is now the medium type, c_m, who strictly prefers to show the silver handles, so as to increase the price by $c_m - E_c > 0$. The only type who has no strict incentive to prove itself is the lowest possible type. Full revelation results.

More generally, if it is possible for the seller to show to the buyer the value of the property and if the seller subsequently makes the take-it-or-leave-it offer, in the only equilibrium all the seller's information is indeed revealed to the buyer. A situation where this is not the case must "unravel from the top" as the highest type strictly benefits from separating from the pool of types below.

Indirect disclosure of information

In many situations the seller might not be able to directly show the value of the property, even if he knows it. For example, the handles could either be made of solid gold or could just be gold plated, and the buyer on inspection might not be able to tell the difference between them. But the seller could certify that the handles are made of solid gold, or hire an independent expert to certify this. Alternatively, a seller may show to the buyer the results of an expert survey certifying the soundness of the structure of a house or the state of its fittings, or may disclose the bills from previous repairs. As the seller would be legally liable for making a false certification or forging documents, only truthful information will be disclosed.

Limitations to the applicability of the unravelling principle

The unravelling principle provides a theoretical benchmark result for the incentives of a privately-informed seller to disclose information. However, there are a number of serious limitations of the result when applied to the home buying process:

i) Costs: Documenting the fact that some maintenance work has been undertaken may

be easy and should not involve additional costs. Instead, commissioning a survey in order to certify c comes at additional expenses. These costs, K, must be weighted against the benefits from revealing c, which are $c_h - E_c$ for the seller with the most valuable property. The seller's incentives are clearly higher the lower K and the more he has to lose if his home is pooled with less valuable property. The latter loss depends on the buyer's ability to pre-screen properties. If buyers have a good understanding of c, this limits the range of values c with which c_h is pooled, thereby reducing the incentives to incur the additional expenditures K.[16]

ii) Surplus sharing: The seller of the property with value c_h can only extract the full benefits from documenting c_h if he is subsequently in a position to determine the terms of the deal, ie, if he can make a take-it-or-leave-it offer to the buyer. If, instead, some of the benefits are shared with the buyer, the seller might not benefit from disclosing information. To illustrate this, consider the extreme case in which the buyer makes the offer ($\sigma = 0$). If the seller does not reveal information, the buyer will make an offer that the seller will accept only when obtaining a non-negative payoff. If instead the high-type seller revealed his type, he will just get an offer equal to $c_h + s$. Having incurred the sunk costs K, this leaves him with a *negative* payoff, so unravelling breaks down. In conclusion, the incentives to (costly) reveal information are seriously reduced if the buyer is in a strong position. We return to the issue of bargaining and market power below.

iii) Mistakes in interpreting information: Suppose the seller of the most valuable property decides to commission an expensive structural survey. We know that commissioning this type of survey is not usual, neither for the seller nor for the buyer. But this implies that the buyer is not acquainted with this type of information. By mistake or just to be on the safe side, the buyer is then likely to come up with a more conservative interpretation of the information produced by c_h, which reduces the seller's gains from revealing the information.[17]

Concluding remarks

Sellers who have private information about the common-value component c, eg, whether the property needs urgent repairs, have a strong incentive to reveal this information. In practice, the benefits from revealing good information may, however, be insufficient for a number of reasons, including costs for producing or certifying this information and surplus-sharing with "strong"

[16] See Jovanovic (1982).

[17] See Fishman and Hagerty (2003).

buyers.

3.3.6 Seller's Incentives for Ex-ante Provision of Public Information: The Linkage Principle

The linkage principle

For the unravelling principle we considered a situation where the seller was informed about c. We now consider the opposite case where also the seller does not know c at the time when he decides whether to produce and reveal information about it, eg, by commissioning a survey. For this case economic theory has produced a number of strong theoretical results, most of which rely either on the assumption that there is strong competition between buyers (as in an auction) or that the seller makes the offer.[18] We take the case where the seller makes the offer.

Recall now the problem of adverse selection (the "lemons" problem). If the buyer does not know c and if he expects that both a seller with high c, say c_h, and a seller with low c, say c_l, will sell at some given price, he will only be prepared to pay for the average quality E_c. But at this price it may no longer be optimal for the high-type seller to trade. As discussed in detail above, this reasoning can imply that not all gains from trade can be realized.

Suppose now the seller could commission a survey and, thereby, commit to reveal c to the buyer. This would allow to subsequently realize *all* gains from trade. If the seller can make a take-it-or-leave-it offer, he can also capture these gains. Consequently, the seller would indeed benefit from committing to reveal c.

Of course, once a low value of c is realized, the seller would prefer to "hide" this information or pretend that c_h has been realized. If the survey is, however, conducted by an independent expert, this may not be possible.

Limitations to the applicability of the linkage principle

The linkage principle provides an important hypothetical benchmark. If the seller is in the position to extract a sufficiently large fraction of the gains from trade, he would prefer to commit to reveal information about c. However, the linkage principle has similar limitations to those discussed in the context of the unravelling principle.

First, the principle does not apply when the seller has already learnt part of the common-value component. For example, a seller who has learnt that the property has some faults will

[18] See Milgrom and Weber (1982) and Ottaviani and Prat (2001).

want to hide them. The principle just says that in the presence of rational buyers, the seller would be better offer in expected terms by committing to reveal the faults once they arise. In practice, it might be very difficult to achieve this commitment.

Second, the linkage principle does *not* apply if the seller faces a strong buyer. To see this, suppose that the buyer is chosen with high probability to make a take-it-or-leave-it offer. By revealing c the seller puts the buyer in a position to adjust his offer so as to make the seller just indifferent between accepting or rejecting. In contrast, if only the seller knows c he can extract an informational rent if c is low. Moreover, if it is costly to reveal information and if these costs are borne (up front) by the seller, the seller will not have incentives to incur these expenses if he is not subsequently in a position to extract the gains from trade.

Finally, as in the case of the unravelling principle, the information may be of little value if the buyer fails to appropriately interpret it for lack of knowledge and experience.

Concluding remarks

Sellers who are in a strong position would like to commit to reveal any available information about the common-value component c as this increases the gains from trade, which the seller can subsequently extract. If, however, information provision is costly and the seller is in a weak position with respect to the buyer, incentives for information provision are much reduced.

3.3.7 Seller's Incentives for Provision of Private Information about the Buyer's Private Value

By showing the property and providing a detailed survey, the seller allows potential buyers to find out how much they really like the property, or equivalently, to learn their true private valuation. This information is naturally private to the buyers and allows them to obtain higher informational rents.

In deciding how much to allow potential buyers to learn their private value for the property, the seller faces a fundamental trade-off between value of information and rent extraction, as illustrated in the following example.[19]

Suppose that the common-value component is publicly known, $c = 0$. Also, the seller's private value is known to be equal to s, and the buyer's private value is equally likely to be either high, b_h, or low, b_l. Assume that $s < b_h$. Initially, the buyer does not know his own value.

[19] See Lewis and Sappington (1994) for a related insight.

If the seller conducts the survey (at cost K) and shows it to the buyer, the buyer privately learns whether his value is high or low. Suppose that the seller has all the bargaining power ($\sigma = 1$) and can make different price offers to the buyer depending the presence of a survey, but clearly cannot condition the price offer on the value privately observed by the buyer. When will the seller want to conduct the survey and show it to the buyer?

First, if no survey is shown, the buyer's valuation is equal to the expected value $b_h/2+b_l/2 = \overline{b}$. Whenever the seller's value is less than $\overline{b}$, the seller will optimally demand price $\overline{b}$ and obtain profits $\overline{b} - s$. Second, if the survey is shown to the buyer, the seller can either charge a high price of b_h targeting the buyer who finds out that the property value is high, or a low price b_l, at which it is sold for sure. By showing the survey and setting a high price the seller's profits are $b_h - s - K$. Clearly, showing the survey and setting a low price is dominated by not showing the survey and setting the average price (as $b_l - s - K < \overline{b} - s$).

The solution of the seller's problem involves two cases. First, if no trade would take place without the survey, ie, $s > \overline{b}$, the only way for the seller to make a positive surplus is by showing the survey. By doing so, the seller pays the survey's cost K and collects $b_h - s$ with probability $1/2$, netting $b_h/2 - s/2 - K$. This strategy is indeed profitable provided that the seller's value is not too high when compared with the survey's cost (ie, if $s < b_h - 2K$) or, equivalently, that the survey is not too costly (ie, if $K < b_h/2 - s/2$). Second, if instead trade would take place without the survey, ie, $s \leq \overline{b}$, the seller may prefer not to show the survey and to trade with both uninformed buyers at price $\overline{b}$. For example, with $b_h = 6$, $b_l = 4$ and $K = 1/10$, the seller gives no information and charges 5 whenever $s \leq 5$, and gives information and charges 6 whenever $5 < s \leq 5.8$.

By improving the buyer's knowledge of the value for the property, the seller can create extra surplus by enabling the buyer to make a more informed decision (and not buy a low-value property). But while the seller can extract some of this surplus by carefully setting the price, he will have to concede part of the surplus (the informational rent) to the buyer. By keeping the buyer uninformed, the seller would be able to extract all the surplus of the average buyer, but this surplus would be lower as the buyer might buy a property that the seller should instead have kept (if the buyer knew that its value is below the seller's value).

In conclusion, the seller has suboptimally low incentives to give private information to the

buyer.[20] However, this inefficiency seems to be of limited magnitude, especially when buyers can easily obtain good information about a property's characteristics they most care about by informally visiting and inspecting the property.

3.3.8 Main Implications from Informational Problems

The presence of private information is likely to reduce welfare as gains from trade will sometimes be forgone. This is more likely to represent a substantial problem if the information concerns the common-value component, eg, the need for urgent repairs and maintenance work.

Using well-established arguments from economic theory we argued that the seller could have, in principle, strong incentives to provide information about the common-value component, but somewhat weaker incentives to allow the buyer to learn his private value. If the bargaining power of buyers is high and the costs involved in producing this information are non-negligible, the seller's incentives to provide information could be substantially compromised. Indeed, in the housing market buyers may have substantial bargaining power in bilateral negotiations with sellers. Sellers may then not be willing to bear the substantial costs necessary to conduct a survey to generate and credibly reveal information to buyers, even if the overall value of this information outweighs its costs.

But even if this is was the case, ie, if the seller's incentives were much compromised, it is premature to argue that this constitutes a case for policy intervention, eg, by making it mandatory for the seller to conduct a survey that must be included in the HIP. The following arguments speak *against* the adoption of such a policy:

- *Sidestepping the agents' free decision:* Even if the seller has insufficient incentives to undertake a survey as he can capture only a share of the additionally realized gains from trade, the buyer and the seller may have *jointly* sufficient incentives. By negotiating how to share the costs of a survey they may then be in a position to overcome the problem that the seller's incentives *alone* were inefficient.

- *Loss of flexibility:* Related to the previous point, in some situations there may be little need for a survey so as to reveal additional information to the buyer. For instance, a buyer may simply wish to acquire the land so as to build a new house after demolishing the

[20] This finding, here illustrated in the context of the simplest example, is valid much more generally.

existing building. Or, previous experience may have made the buyer quite an expert. In all such cases the costs incurred by a survey are just a deadweight loss.

- *Heterogeneity across sellers:* Some sellers might have an extremely urgent need to sell or have a very high value of time. A mandatory survey would impose a very high cost on these sellers.

- *Distributional consequences and knock-on effects:* Imposing on the seller the costs to provide a survey will reduce his gains from selling. Even if total welfare, ie, the sum of buyers' and sellers' payoffs, is thereby increased, it must be asked whether a small increase in welfare justifies a comparatively large reduction in sellers' profits.
  Moreover, also the buyer may suffer if we take into account the knock-on effects that arise in a general equilibrium framework. If sellers have to incur higher cost to market their homes, this will limit their incentives to participate in the market in the first place. While a mandatory survey may seem to improve efficiency by increasing the buyers' pay-offs sufficiently to compensate for the sellers' loss if we keep market conditions constant, even buyers may lose once we take account of the resulting changes in the market. This point will be analysed formally in Section 5.

We will return to the policy of making the provision of a survey mandatory at several points in the rest of this study. There, we provide potentially stronger arguments of why such a policy could increase welfare. In our concluding remarks in Section 6 we will collect all results and arguments to come to an overall conclusion.

3.4 Commitment to Agreements and Strategic Break-Up

3.4.1 The Plan of the Analysis

As noted in the Introduction, offers and their acceptance are currently not binding. Until contracts are exchanged neither the seller nor the buyer are legally committed to their agreement. As a consequence, the two parties are liable to pay damages if they withdraw from the transaction only after contracts are exchanged. As we also noted previously, this arrangement is *chosen* by the parties and not *imposed* on them by some legal restrictions. In particular, the two parties could agree on some form of financial penalty or compensation. However, the evidence of the

tracking surveys suggests that only a very small fraction of buyers (ca. 3% in the surveys) said that they indeed made a pre-exchange deposit.

In what follows, we analyse both the consequences of this reluctance to come to a more binding agreement and its potential reasons. For this purpose we first extend our modelling framework by including the possibility that a more attractive alternative arises for the seller or the buyer during the conveyancing process. Faced with a more attractive alternative, the respective party has an incentive to cancel the previous agreement. (In Section 3.5 we analyse the case where cancellation is due to an *exogenous* event, eg, the failure of the buyer to secure finance.) We first analyse the case where we *assume* that binding contracts are not feasible. Subsequently, we allow the two parties to use contractual remedies, eg, deposits, to reach a more efficient outcome. Finally, we ask whether private incentives to make contracts more binding are efficient or whether there is scope for policy intervention.

One possible reform of the home buying and contract process is to "enforce" a more binding contractual regime. For example, upon acceptance of the offer the buyer and seller could be asked to deposit some money into an independently held fund. If one party subsequently pulled out, this fund could be used to compensate the aggrieved party.

Before proceeding to a more formal analysis, we summarize our key results.

- **Negative externality on the second party:** In the absence of contractual remedies, one party's decision whether to breach the informal agreement in order to take up another opportunity fails to take into account the impact on the second party to the original contract. The failure to internalise this externality (equal to the loss of surplus that would accrue to the second party) will then result in excessive break-ups and so reduce welfare, provided that no third parties are affected.

- **Positive externality on a third party:** However, if one party walks away to undertake another transaction, the surplus lost by not completing the first transaction must be traded off against the surplus created by the new transaction. In the important special case in which the fraction of the surplus appropriated by buyers is constant across transactions, the positive externality on the third party outweighs the negative externality on the aggrieved second party.

- **Contractual remedies:** The two parties can use contractual remedies to internalise the externality they impose on each other by walking away. However, the extent to which this can be fully achieved is usually limited by informational problems.

- **Effects of policy of mandatory binding contracts:** In the bilateral framework a policy intervention aimed at making contracts more binding (eg, by prescribing some minimum deposit), would potentially have more drawbacks than benefits. Even if this policy proves feasible, the parties may find ways to avoid its consequences.

3.4.2 Extending the Model

We now extend our basic model as follows. After the offers have been made and, potentially, accepted, there is some delay until the agreement becomes legally binding. (Recall from Section 2.1 that, according to the tracking surveys, it takes more than 80 days on average to complete a transaction, while much of this time is spent on the conveyancing process.) During this time a potentially more attractive alternative may arise for either side. We refer to this alternative as the outside option of the respective party. It will arise with probability q_S for the seller and with probability q_B for the buyer. These probabilities may also depend on the parties' actions, eg, the intensity with which buyers keep on searching for more suitable properties or lower prices. We denote the value of the seller's outside option by o_S and that of the buyer by o_B. Below we will put more structure on this model when discussing some issues in detail.

3.4.3 The Case without Contractual Remedies

We discuss first the case where the initial agreement is not binding and where the two parties have *by assumption* no means to increase their commitment, eg, by making deposits.

Externality imposed on the counterpart

Recall that v_B and v_S denote the valuations of the two parties, with the difference $v_B - v_S > 0$ being the surplus generated from the sale. Suppose the two parties have informally agreed to transfer the property at a mutually agreeable price p, ie, $v_S \leq p \leq v_B$.

Suppose now the buyer can obtain an outside option. (It will be convenient to restrict most of the discussion to the case where only one side can obtain a valuable outside option.) The buyer will renege on the previous agreement whenever the value of this option v_B exceeds his

gains from the agreed transaction $v_B - p$. His decision will not take into account the surplus that would be generated at the original seller $p - v_S$.

Re-negotiations of the initially agreed price p may allow the two parties to still find a mutually beneficial agreement. However, the scope of such renegotiations should be realistically limited. To see this, suppose that sellers would willingly concede to buyers' demands and lower the price to ensure that buyers still prefer to continue with the agreed transactions. This would clearly create incentives for any buyer to claim that he found a more attractive alternative. As it should be hard to credibly communicate the existence and, in particular, the value of a buyer's alternative, it may be next to impossible for the seller to decide whether the buyer's demands are justified or not.

While we know that the buyer's decision to walk away creates a negative externality on the seller, as does the seller's cancellation on the buyer, this does *not* imply that matches are broken up inefficiently often. The buyer's or seller's alternative will involve most likely the realization of another transaction, which may create additional surplus for the other involved party. This is analysed next in more detail.

Externality imposed on a third party

Take again the case where the buyer has an outside option of value o_B. Underlying this value is the possibility to buy a different property. Suppose the buyer's valuation for this property was u_B and that the agreed price was p', such that $o_B = u_B - p'$. The seller of this new property has the valuation u_S and realizes the gains $p' - u_S$. Hence, if the buyer walks out of the previous agreement as $o_B > v_B - p$, this creates the *negative externality* $p - v_S$ for the previous seller and the *positive externality* $p' - u_S$ for the new seller.

If these transactions are all we have to consider, does the buyer have the right incentives to cancel the initial agreement?

How do the externalities compare?

Efficiency would dictate that the buyer cancels the previous agreement only if the newly created surplus is larger, ie, if

$$u_B - u_S > v_B - v_S. \tag{3}$$

This must be contrasted with his private incentives, ie, his decision to walk away if

$$o_B = u_B - p' > v_S - p. \tag{4}$$

How do (3) and (4) compare? As is easily seen, all depends on the choice of the prices p and p'. A reasonable benchmark is to assume that the buyer can extract the same fraction of the realized surplus at both transactions, say the fraction $1-\sigma$. Hence, in the original transaction the price p must ensure that the buyer's utility $v_B - p$ represents the fraction $1-\sigma$ of the total surplus $v_B - v_S$, ie, that $v_B - p = (1-\sigma)(v_B - v_S)$. A similar logic applies to the second transaction and p'. This yields the prices

$$\begin{aligned} p &= v_S + \sigma(v_B - v_S), \\ p' &= u_S + \sigma(u_B - u_S). \end{aligned}$$

If we substitute these prices into the conditions (3) and (4) we find immediately that the buyer has just the right incentives. The buyer will break the initial agreement only if this increases social welfare. Intuitively, as the prices are chosen such that the buyer obtains a constant fraction of the realized surplus, the buyer will pick the transaction generating the highest surplus.

The simple case where we assume that the buyer can capture a fixed fraction of the realized surplus provides an important benchmark. In this case, the failure to commit to the transaction during the (potentially long) process of completing the transaction does not reduce welfare. In contrast, the option to cancel an agreement will be used only if this increases welfare.

In the benchmark case the buyer (or seller) essentially searches only for another, more valuable transaction while the original transaction is completed. The buyer may, however, also shop around for opportunities that are more attractive *mainly or only* because the price is lower, but not because the generated surplus is higher. In our simple model this can be formally captured in the following way. One party, say the buyer, continues searching in the hope of being chosen as the proposer in some future match, which happens with probability $1-\sigma$. In this case, he is in a very strong position and the newly agreed transaction may be more profitable to him even if the generated surplus is lower. One interpretation of this is that some sellers and buyers are more sophisticated in negotiations than others, given their past experience on the housing market or some personal traits. A buyer would then continue to search in the hope of finding a "weak" seller. In this case, one can easily show that there are indeed *too many* break-ups.

Empirically, the important distinction between the benchmark case with efficient break-up and the case with excessive break-up is the degree and source of price heterogeneity or variance in the market. If there was little price heterogeneity between similar transactions, there should be limited scope to shop around for better prices. But also if there was substantial heterogeneity,

this could be mainly due to differences in the valuations (b and s) and, therefore, in the generated surplus. (Recall that one of the major features of the home buying market is that homes are not standardized commodities, but that individual households have particular preferences for individual properties.)

Concluding remarks

Cancelling an agreed transaction imposes a *negative externality* on the previous counterpart, but this loss in welfare must be weighted against the *positive externality* imposed on the new counterpart. Excessive break-ups will only occur if the market shows a substantial variance in prices for similar transactions, which does not reflect the difference in surplus, eg, as some sellers or buyers are more experienced in trading property.

3.4.4 Search for More Attractive Alternatives

We have so far treated the arrival of an alternative, and potentially more attractive, opportunity as an exogenous event. Realistically, the likelihood with which either side can generate a more attractive alternative should be endogenous, depending on the time and effort spent searching whilst completing the original transaction.

The fact that the parties can influence the arrival of an attractive alternative gives rise to an interesting complementarity in their strategies, which we briefly explore next. Suppose the two sides have agreed to some price p, which distributes the gains $v_B - v_S$. Before the transaction is completed, either side can choose whether to continue to search for an alternative. Continuing to search costs K, but it produces with probability q a more attractive alternative, ie, o_B for the buyer and o_S for the seller. What choices will the two sides optimally make?

Suppose, for simplicity, that everything is symmetric, ie, that p was chosen to equally share the surplus, $p = (v_B + v_S)/2$, and that the alternatives have equal value to both sides, $o_B = o_S = o > (v_B + v_S)/2$. If the seller knows that the buyer will *not* engage in search, he expects the deal to go through if also he does not generate a more attractive opportunity. Hence, he will abstain from searching if

$$qo_S + (1-q)(v_B + v_S)/2 - k < (v_B + v_S)/2,$$

or equivalently if

$$k > q\left[o_S - (v_B + v_S)/2\right]. \tag{5}$$

If this condition (5) is satisfied, it is an equilibrium for both the buyer and the seller not to search.

Next, suppose instead that the seller *does* expect the buyer to search. In this case, he knows that with probability q the deal will fall through because of the buyer's action. If this happens the seller will realize zero profits if he has not generated himself a valuable alternative. Hence, searching is profitable for him if

$$qo_S + (1-q)^2(v_B + v_S)/2 + (1-q)q \cdot 0 - k \geq (1-q)(v_B + v_S)/2 + q \cdot 0,$$

where $(1-q)^2$ denotes the joint probability that both sides do not find a valuable opportunity despite their search. This condition becomes

$$k \leq q\left[o_S - (1-q)(v_B + v_S)/2\right]. \tag{6}$$

Under condition (6), there is an equilibrium in which both the buyer and the seller search.

Comparing the conditions (5) and (6) yields the following result. If the costs of continued search, k, take on intermediate values, ie, if

$$q\left[o_S - (v_B + v_S)/2\right] \leq k \leq q\left[o_S - (1-q)(v_B + v_S)/2\right],$$

we obtain *multiple equilibria*, one with and the other without search by both parties after the initial agreement has been made. If the seller expects the buyer to continue to search, continuing to search becomes also more attractive for the seller. Intuitively, the buyer's activity will impose a negative externality on the seller in case the seller has not generated a valuable outside option. This increases the attractiveness of search for the seller.

Concluding remarks

Whether a given party will find a more attractive alternative whilst completing the original transaction should be endogenous, depending on the time and effort spent on continuing search. This can give rise to multiple equilibria. If there is little *trust* in the other party or, likewise, if it has become the *standard of behaviour* to feel uncommitted to the original transaction, either party will reasonably expect that the other side continues to search, which makes it more attractive to search as well. The two parties can then find themselves locked into an inefficient equilibrium. As we explore next, however, contractual remedies are a natural way out of this.

3.4.5 The Case with Contractual Remedies

We first illustrate how deposits can become powerful means to increase the buyer's and seller's joint surplus. Subsequently, we briefly turn to the potential limitations of contracts.

Contractual remedies to internalise bilateral externalities

Suppose that only the buyer can find an attractive alternative, which arises exogenously. The two sides now negotiate over two contractual variables: the price p and the buyer's deposit P_B. The buyer's deposit P_B is lost in case the buyer subsequently decides to cancel the agreement in order to pursue a more attractive alternative. The two sides will jointly specify p and P_B so as to maximize joint surplus. How is this achieved?

It is immediate that the optimal contract will ensure that the buyer internalises the negative externality imposed on the seller in case he reneges on the agreement. This is achieved by setting $P_B = p - v_S$. As a consequence, the buyer's payoff from cancelling the agreement is now $o_B - P_B = o_B + (v_S - p)$. Comparing this with his payoff from staying with the seller, $v_B - p$, we indeed obtain that the buyer will only renege on the initial agreement if $o_B > v_B - v_S$.

The penalty, or deposit, P_B will be higher the higher the originally agreed price p as this makes it more attractive for the buyer to cancel the initial agreement. Choosing jointly the two variables p and P_B allows the two sides to maximize joint surplus irrespective of how this is shared between them.

Note, however, that the choice of P_B only maximizes the joint surplus of the two parties, ie, the *bilateral surplus.* If the buyer's alternative generates some surplus for the new counterpart, this is clearly not taken into account. If we compare this to our benchmark case without contractual remedies and with fixed surplus-sharing in all transactions, the contractual solution increases the two sides' *bilateral surplus*, but it reduces *welfare.*

Obstacles to contractual solutions

The two parties may be reluctant to agree to deposits or penalties for a number of reasons. We single out two reasons that could be of particular importance in the case of the home buying market, given the current practices and the size of the transaction values:

i) Standards: As we have noted previously, making deposits or paying penalties are not common practices. Suppose now a seller would demand a deposit from a buyer. Naturally, the buyer would ask why the seller has deviated from standard practice and tries to lock him into an agreement. But what if the buyer proposes the deposit in order to commit not to engage in

search, thereby increasing joint surplus? This could be interpreted by the seller as a sign that the buyer is rather "weak" and eager to trade, ie, someone who has no intention to continue to search in the first place. But in this case the seller will become more aggressive and try to obtain a higher price, believing that the buyer is already more or less locked into the transaction.

Summing up, if demanding and paying deposits is not common practice, the parties to an individual transaction may refrain from using them as this could be interpreted by the other side as a "negative" signal. If, instead, deposits are common, no such changes of beliefs about the value of the transaction or the parties' intentions and preferences must be feared.[21]

ii) Risk aversion: As we argue below, there may be numerous exogenous reasons why a transaction may fail, eg, as the buyer fails to secure finance. It may be hard to tell these reasons apart from strategic cancellations. In this case, it can no longer be fully controlled by a given party, say the buyer, whether he has to pay the penalty or not. As a consequence, making a deposit that is forfeited in case the deal falls through makes it likely that the buyer loses a substantial amount of money without securing a property. The buyer may simply fail to have this amount of money at his disposal, ie, all his savings are earmarked for a mortgage downpayment. Or, he may be too risk averse to commit to make such a deposit, where the subsequent loss is not fully under his control.

Concluding remarks

Contracts, eg, deposits or penalties, are a powerful tool to "internalise" bilateral externalities. As they ignore any externality imposed on third parties, ie, the counterparts to alternative transactions, it does, however, not follow necessarily that bilaterally efficient contracts are also welfare enhancing. On the other side, if contractual remedies are not standard and if there are exogenous reasons for why transactions could fail, individual parties may shy away from using contracts.

3.4.6 Main Implications from Strategic Break-Up

If the initial agreement is not binding and in the absence of deposits or contractually agreed penalties, the seller and buyer may be tempted to search for alternatives and to, possibly, cancel

[21] Interestingly, these arguments also imply that if it is common to demand a deposit, this will typically be done according to a standard rule and will not be fine-tuned to an individual transaction. This seems to conform well with the practice in other countries.

the initial agreement at a later stage. Cancelling an agreement imposes a negative externality on the counterpart. However, we argued that this may *not* imply a loss of welfare.

Deposits could provide an easy contractual remedy to internalise the externality imposed on the counterpart. Risk-aversion and the possibility that posting or demanding a deposit may convey new, and potentially unfavourable information, if deposits are not common practice may both limit the use of contractual remedies.

But even if such obstacles to contractual remedies exit, we noted that, while reducing the two sides' *bilateral surplus,* this may again not reduce overall welfare. For each transaction that is broken up, a new transaction is generated. Mandating a *minimum deposit* that must be made at the time of the initial agreement may, therefore, create few benefits, but it much reduces the parties' flexibility, ie, the parties may find themselves locked into a relationship that is no longer efficient given their new opportunities.

3.5 Commitment to Agreements and Non-Strategic Break-Up

3.5.1 Plan of the Analysis

As noted in Section 2.1, both sellers and buyers undertake little preparation when marketing their property or engaging in search. Sellers typically do not provide a survey or collect the documents necessary for a transaction. Buyers often fail to secure finance before submitting an offer. As a consequence, even if the two sides come to an agreement on the price, the deal may still fall through at a later stage. For instance, the buyer may fail to secure finance or the search may reveal some facts about the property or its neighbourhood that make it unsuitable for the buyer.

The likelihood with which a deal may fail could, however, be reduced if buyers and sellers were better prepared. In what follows, we show that this can give rise to two connected problems:

- *Public good problem:* The action of one party has a *positive externality* on the other side. As not all of the benefits can be extracted, each party may fail to choose a better preparation even if this was socially optimal.

- *Co-ordination failure:* There may be substantial complementarities if *both* sides are better prepared. In this case, there can exist multiple equilibria and buyers and sellers can find themselves locked into a "bad equilibrium".

3.5.2 Public Good Problem

In Section 2.1 we reported results from surveys that showed how a better preparation can reduce the time it takes to complete a transaction. Though we lack direct evidence, it can be reasonably conjectured that it also reduces the failure rate of a deal. In what follows, we analyse the latter situation, though our arguments also apply to the case where lack of preparation does not necessarily cause more break-ups but, instead, more delay.

Formalisation of the public good problem

Sellers and buyers must choose to become better prepared *before* they meet a counterpart. The important consequence of this is that there are no easy contractual remedies simply because the two parties do not meet early enough. If a party, therefore, incurs the costs F to become better prepared, these costs are *sunk* at the time they start to negotiate.

In this section, we restrict ourselves to the simple case where only one side, say the seller, can decide whether to be better prepared or not. Suppose that being prepared increases the probability with which the subsequent agreement will be successful. Preparation increases the success probability from $P < 1$ to one. As the costs F are sunk, they will not influence the subsequently negotiated sales price. Suppose, for simplicity, that the agreed price distributes the gains equally. We denote the gains realised by either party by $V > 0$.

If the seller does not become prepared, the total expected surplus is $P(V+V)$. Otherwise, it becomes $2V - F$, given that the success probability is increased to one, the joint surplus is $2V$, and the costs are F. Hence, it is socially efficient to undertake preparation if $F \leq 2V(1-P)$. In contrast, the seller's payoff is PV without preparation and $V - F$ with preparation, implying that he will optimally become prepared only if $F \leq V(1-P)$. This threshold is strictly lower than that derived previously, ie, the seller's incentives are too low compared to the welfare benchmark.

Intuitively, by becoming better prepared the seller creates a positive externality of value $(1-P)V$ for the buyer. As the seller decides *before* the two parties meet, there is no way of internalizing it by way of a contract. The seller creates a *public good* for any buyer he subsequently encounters.

Concluding remarks

Better preparation creates a positive externality on the counterpart. Due to the failure to internalise these gains, private incentives are too low compared to what would be socially

efficient. In this case, contractual solutions are unlikely to exist as the actions are typically taken before the two parties meet. (In addition, a seller's or buyer's action may benefit more than one potential trading partner during the search process. We return to this point below.)

3.5.3 Co-ordination Failure and Multiple Equilibria

We now enrich the model by allowing *both* sides to choose whether to become better prepared. This will generate scope for multiple equilibria and co-ordination failure.

Extending the model

Suppose now either side can decide whether to become better prepared. There is also a complementary between the two sides' actions. If none or only one side becomes better prepared, the success probability will be P. If both sides become better prepared, the success probability will increase to one.

Suppose that preparation comes for each side at the costs F. As a consequence, it is socially optimal to ensure that both sides are better prepared if $2F \leq 2V(1-P)$, ie, if $F \leq V(1-P)$. What is the optimal choice for each of the two parties?

As either side obtains half of the generated surplus and also bears half of the total costs of being prepared, we can now obtain an equilibrium that *is* socially efficient. Precisely, if one party expects the other to be better prepared, it is willing to also incur the costs F if the resulting profits $V - F$ exceed those without preparation, VP. But this implies that becoming prepared is optimal if $F \leq V(1-P)$, ie, if it is also socially optimal.

Unfortunately this is not the only equilibrium. Suppose, instead, that one party, say the seller, does not expect the other party to become prepared. In this case it is not optimal for the seller to become prepared. Hence, it is also an equilibrium outcome that both sides expect each other to stay unprepared and act accordingly.

Concluding remarks

Multiple equilibria are likely to exist if there are complementarities in the buyer's and the seller's decisions, ie, if the reduction in delay or the break-up probability becomes only substantial if both sides are well prepared. The cases where buyers and sellers are well or poorly prepared are both equilibrium outcomes.

3.5.4 Main Implications from Non-Strategic Break-Up

Deals may fall through not because of opportunistic actions, ie, searching and pursuing better alternatives, but simply because of exogenous events such as the failure to secure finance. Still, these break-ups may be costly as gains from trade are not realised or as costs that have already been incurred to complete the transaction are lost, eg, fees paid to solicitors. Both delay and the risk of break-up could be reduced if the parties were better prepared. Our analysis yielded the following insight:

- Being better prepared imposes a positive externality on future trading partners.
- Contractual remedies may fail as the counterparts are not around at the time when decisions are made.
- Complementarities may lead, additionally, to co-ordination failure, which can again not be resolved contractually as buyers and sellers will meet only after making their individually optimal decisions.

These features imply that, in contrast to the case of strategic break-up where contractual remedies exist, non-strategic break-up may pose a more fundamental problem.

One potential remedy could be to make preparation mandatory, eg, in the form of a mandatory HIP for sellers. However, as we have already pointed out when discussing informational problems, such a mandatory policy may have serious drawbacks. It reduces flexibility, may have serious distributional consequences and may also have further knock-on effects once we make sellers' and buyers' decisions to come to the market endogenous.

4 Chains

4.1 Extending the Analysis

4.1.1 Plan of the Analysis

In this section we extend our analysis to chains. Here, the success of an individual transaction depends on the success of other transactions into which the buyer and seller are also involved.

For instance, home owners may want to move up the "property ladder", trying to sell a smaller property in order to buy a larger property.

In principle, a household can arrange the transactions in a number of different ways. One way is to first sell the currently owned property and to start searching for a new property thereafter, while possibly renting in the meanwhile. Alternatively, the household may search at the same time for a new property and for a buyer for his old home, concluding the transactions on a first-come-first-serve basis. This strategy may, however, be only feasible if the household has sufficient wealth to buy before selling. The final alternative is to search at the same time for a seller and a buyer, but to only complete one deal if also the other deal has materialized.

Comments on the market in England and Wales suggest that the last variant is very common.

In what follows, we provide a first analysis of chains. We analyse externalities and contractual problems that are created or amplified by the existence of chains.

Our analysis provides the following insight.

- *Externalities across chains:* Building on our previous analysis of individual transactions, we show how chains can grossly amplify the externalities on other buyers and sellers. Amongst other things, this can severely exacerbate the public good problem and co-ordination failure.

- *Failure of contractual remedies:* In addition, the fact that the different links of a chain only fall into place over time gives contractual solutions to the identified problems only very limited clout.

Furthermore, we ask how chains come to exist in the first place if they are the potential source of major inefficiencies. This question is key as an answer to it may help to gauge the true extent of problems and inefficiencies caused by the existence of chains.

4.1.2 Extending the Model to Chains

It is straightforward to extend our basic model to chains. The most simple extension considers only three households, whom we call X, Y, and Z. Household X is a first-time buyer. He is interested in acquiring a flat. Household Y currently owns a flat, but wants to move into a larger property, a house. Finally, household Z actually owns a house and wants to sell without buying again. For instance, Z may be retired and wants to liquidate his major asset, his house.

The values in the first transaction, between X and Y, are denoted by v_B and v_S, as previously. For the second transaction, between Y and Z, denote the respective values by u_B and u_S. Hence, Y's value for his flat is v_S, while his value for the house owned by Z is u_B.

We assume in this section that the two transactions are concluded in a chain, ie, the success of each individual transaction depends on that of the other transaction.

For parts of our analysis we will also use chains of arbitrary length N, where we make simplifying assumptions on the parties' values and the created surplus.

4.2 Externalities in Chains

4.2.1 Sources of Externalities

The key externality in chains arises immediately from the definition of chains. Each transaction will only be successful if all other transactions are successfully completed. Hence, if any involved party takes an action or, likewise, refrains from taking an action with the consequence that a particular link is more likely to "break", this imposes a negative externality on all other links in the chain.

When studying individual transactions in Section 3, we isolated three causes of failure or delay: i) informational problems, ii) strategic break-up and iii) non-strategic break-up. When discussing how to address the related problems, we focused on two areas: Making contracts more binding and making more preparation and the provision of information mandatory.

We now organise the discussion of externalities in chains along as follows. First, we discuss the role of the HIP and of similar measures that intend to increase the preparedness of the seller or the buyer. Secondly, we discuss the role of (more) binding contracts to increase commitment.

4.2.2 The Role of a Mandatory HIP

As analysed in Section 3, we can expect that break-down and delay are reduced if buyers have initially more information, which bridges the informational asymmetry between buyers and lenders. Additionally, any further preparation by the seller (but also by the buyer) should help to reduce the likelihood that the deal will later fall through for exogenous reasons.

The action of an individual seller, ie, whether to come to the market with more or less preparation, will now not only affect the likelihood that this particular transaction goes through. Instead, externalities are imposed on all other links in the chain. We explore this more formally,

focusing on the two effects isolated before: the public good problem and co-ordination failure.

The public good problem in chains

A seller can increase the likelihood with which an agreement is successfully completed by incurring the costs F. These costs are sunk before the seller meets a particular buyer. By becoming better prepared the seller can increase the probability of success from $P < 0$ to one.

We now assume that there are N links in the chain. As previously, we simplify the analysis by assuming that the surplus $2V$ is realised if a particular transaction goes through. Of this surplus, half goes to the respective seller and half to the respective buyer. (With our notation for chains comprising only two links, we would have $v_B - v_S = 2V$ and $u_B - u_S = 2V$.)

What surplus is created if only $n \leq N$ sellers become better prepared? In this case, we know that the success probability of the whole chain is $P^{N-n} \cdot 1^n$. (Recall that the sale is surely successful if the seller is prepared.) But this is achieved only by incurring the costs nF. Hence, total expected surplus becomes

$$N2VP^{N-n} - nF.$$

As can be shown, the problem to solve for the optimal value n has a unique solution:[22] If

$$F \leq 2V \left[1 - P^N\right] \tag{7}$$

it is efficient that *all* N sellers spend F to become prepared. Otherwise, no seller shall spend F. This outcome is intuitive as the benefits from making a single link more "stable" increase with the stability of all other links. Therefore, it is efficient that either all or none of the sellers become better prepared.

Note that the threshold (7) is strictly increasing in the length of the chain. (Note that P^{N-1} is strictly decreasing and goes to zero as N increases.) Intuitively, the longer the chain the larger the externality that is created for other links as we make a particular link more "stable". Consequently, the wedge between what is socially optimal and individual incentives *increases* as the chain becomes longer. Intuitively, without preparation the probability that no link fails decreases with the length of the chain, while a single failure destroys the surplus from more and more transactions.

[22] To see this, note that the expected total surplus is a convex function of n, and so it is maximized at one of the two boundaries ($n = 0$ or $n = N$). Expected total surplus is equal to $N2VP^N$ at $n = 0$ and to $N2V - NF$ at $n = N$.

Consider next the incentives of an individual seller who expects all other sellers to become prepared. He can become prepared and realise the payoff of $V - P$, or he can stay unprepared and realise $V(1 - P)$. (Recall that all other links are successful with probability one, provided that also this particular link is successful.) Hence, the seller will only undertake the costly action if

$$F \leq V(1 - P). \tag{8}$$

Comparing (7) with (8) reveals that the seller fails to internalise the positive externality imposed on all other links. Consequently, his incentives are too low. Putting it differently, the threshold for F is lower than the efficient threshold. Also, the seller's incentives do not depend on the length of the chain, while social incentives do so. The wedge between individual and social incentives, therefore, grows and the public good problem becomes severe as the chain becomes longer.

The co-ordination problem in chains

In Section 3.4 we already illustrated how multiple equilibria and co-ordination failure may arise. These problems are exacerbated in chains.

Consider once more a seller's decision whether to incur F. Previously, we analysed the case where the seller assumed that *all* other links were stable as all other sellers had spent F. Suppose now, instead, that the seller can only reasonably assume that n out of the other $N - 1$ sellers are prepared. How does the choice of n influence his incentives? If he also spends F, the success probability increases from P^{N-n} to P^{N-n-1}. Consequently, the seller will find this to be optimal only if $F \leq V(P^{N-n-1} - P^{N-n})$, ie, if

$$F \leq VP^{N-n-1}(1 - P). \tag{9}$$

Note first that the threshold for F in (9) is strictly increasing in n, ie, the more sellers choose to become prepared the more this becomes profitable also for each individual seller. If $F > V(1 - P)$, which is the threshold from (8), incentives are always too low, even if all other sellers choose the action. On the other side, if F is sufficiently small such that $F \leq VP^{N-1}(1 - P)$, an individual seller will always choose to become prepared. Note that the latter threshold goes to zero as the length of the chain increases. Intuitively, if the chain becomes increasingly long, it becomes more and more likely that at least one link fails. In this case the seller's costs were incurred in vain.

For the intermediate region, where F lies between $VP^{N-1}(1-P)$ and $V(1-P)$, we can find a threshold on the number n such that an individual seller only chooses to become prepared if he can expect that at least $n \geq n^*$ other sellers have done the same. As the length of the chain increases, the fraction n^*/N goes to *one!* This is, if the chain becomes increasingly long, an individual seller will only have sufficient incentives to become prepared if he can expect that almost the fraction one of all sellers is prepared. This is again intuitive by previous arguments. If a substantial fraction of sellers would remain unprepared, the fact that the chain is now relatively long must imply that the total success probability is still low. This stifles an individual seller's incentives to become prepared.

Concluding remarks

Both the public good problem and the problem of co-ordination failure become exacerbated in the presence of chains. The longer the chain, the larger the total externality that is exerted by any single link. Moreover, incentives to incur costs in order to increase the success probability of a particular transaction depend now on the simultaneous choices of many other parties. This increases the co-ordination problem across the chain.

We ruled out contractual remedies. This is reasonable. The sellers' and buyers' actions are taken *before* the chain forms.

4.2.3 Making Contracts More Binding: Strategic Break-Up

We now return to strategic break-up. We analysed previously how contractual remedies can help to reduce this type of opportunistic behaviour. There, we showed how seller and buyer can use penalties or deposits to partly internalise the externalities a cancellation may have on the other party. (However, recall that contracts may not necessarily increase welfare as they ignore any surplus created for the counterpart in a new transaction.)

We show first that bilateral contracts are a powerful remedy even in chains, at least in principle. However, as we argue next, as the different links of a chain may not fall into place at the same time, serious contractual problems may arise in a chain.

Contractual remedies to achieve commitment

Take the simple model of Section 4.1, where the chain has two links. Suppose first that both links fall into place at the same time. We confine our analysis to the case where only household X, the buyer of a flat, may subsequently be tempted to take up an alternative with value o_X.

Consider first the transaction between X and Y. As discussed previously, after making a deposit of size $p - v_S$, X will subsequently only cancel the agreement if o_X exceeds the surplus from the original transaction, $v_B - v_S$. With a chain, however, the deposit should be further increased. Recall that Y is the buyer of Z's house, where the price p' has been agreed. Hence, if the transaction with X fails, this will also imply that Y loses the surplus $u_B - p'$ from the transaction with Z. Consequently, Y should demand a higher deposit from X.

But this is not where the story ends. There is still the surplus of Z, $p' - u_S$, which X would not take into account when deciding whether to cancel the agreement. One way to internalise this would be via a contract between X and Z. However, this can also be achieved with bilateral contracts along the chain. Y and Z agree that Y makes the deposit $p' - u_S$. Having made this deposit, Y is bound to lose not only his share of the surplus $u_B - p'$ but also the deposit $p' - u_S$ if he cancels the agreement with Z. One reason why Y may (have to) cancel the agreement is that his own deal with X went sour. When negotiating with X, Y will thus make sure that all of the surplus from the transaction with Z, ie,

$$(u_B - p') + (p' - u_S) = u_B - u_S$$

is indeed taken into account. Making a long story short, X will optimally make a very large deposit of

$$(p - v_S) + (u_B - u_S)$$

and internalise all negative externalities along the chain if he subsequently cancels the agreement.

Failure of contractual remedies in chains

The previous case of contracting along the chain is, at best, a hypothetical benchmark. There, we assumed that all involved households were present at the same time. This was necessary as the deposit agreed between X and Y took into account the simultaneously agreed deposit between Y and Z.

Given that only X is able to walk away from the agreement in our simple model, it would also be sufficient if the link between Y and Z was established first. However, the bilateral contracting process fails if the links fall into place in a different order. If X and Y are first to come to an agreement, they have no incentives to internalise any externalities which X's decision may have on the future trading partner of Y. Anticipating the subsequently negotiated price p', the deposit made by X will only take into account the surplus from their transaction, $v_B - v_S$, and Y's expected loss from the second transaction, $u_B - p'$.

Concluding remarks

At least in principle, bilateral contracts can provide a powerful remedy against opportunistic behaviour also in chains. However, as the different agreements along the chain are realistically not made simultaneously, it is very likely that not all externalities are considered. Hence, in contrast to the case with only individual agreements, we can be less optimistic that bilateral contracts are a powerful remedy against strategic break-up.

4.2.4 Making Contracts More Binding: Ex-post Flexibility vs. Ex-ante Commitment

In the previous section we analysed how contracts can help to reduce the parties' propensity to strategically walk away from an agreement. Penalties and deposits provide a way to commit *ex-ante*, ie, before alternative opportunities arise, to the original agreement. Suppose now that an individual transaction has, nevertheless, failed, maybe due to exogenous reasons beyond the control of the two parties. With only individual transactions, ie, in the absence of chains, the affected parties would start searching for a new counterpart. This is, however, different in chains.

Lock-in in chains

Realistically, contracts involving penalties and deposits should exhibit some flexibility in the following sense. Given the uncertainty involved in the conveyancing process, which is exacerbated in chains, it is unlikely that two parties would find it optimal to agree that some deposit is forfeited if the transaction is not fully completed until some fixed and final date x. Instead, both sides should have some flexibility in postponing this date, eg, to accommodate problems in securing finance.

If this is the case, bilateral contracts designed to control opportunistic behaviour can be detrimental from an *ex-post* perspective. To see this, suppose that one link of the chain, say the one between Y and Z, was broken, possibly for exogenous reasons. All other transactions are then no longer feasible, at least for the moment. If Y and X continue to uphold their agreement, X has to wait until Y has found a replacement for Z. Facing the prospects of a long delay, X may be tempted to search for another buyer, ie, a replacement for Y. If he is lucky or just eager to trade quickly, this can be a faster alternative. However, if there are penalties for cancelling the agreement with Y, this strategy looks less attractive. The deposit made to Y keeps X locked into the original transaction even though it may now be quicker to transact with a new party.

Concluding remarks

Deposits and penalties make the whole chain more stable by reducing opportunistic cancellations. However, once a link in the chain breaks, these contracts may lead to excessive delay of transactions, keeping agents locked into the broken chain. In other words, what works well for reducing strategic break-up can inefficiently reduce flexibility *after* a transaction has failed. If break-ups are very likely, eg, as sellers and buyers are not well prepared at the time of the agreement, the drawbacks from more binding contracts may become substantial.

4.2.5 Implications of Chains

Our analysis showed how the presence of chains can severely reduce efficiency and, in addition, limit the power of contractual remedies. Chains exacerbate externalities, make co-ordination problems more severe and limit the scope of bilateral contracts.

In contrast to the analysis of only individual transactions, the presence of chains may provide a stronger case for policy intervention. Therefore, it is important to obtain a better understanding of both the scope and the origin of chains.

Why do chains arise in the first place, given that they are prone to lead to inefficient delays and break-ups?

The existence of chains, by definition, depends on the presence of households who buy and sell at the same time. Naturally, this is more likely if there is a large owner-occupied sector, ie, if renting is less common. Related to this, it should be common for households to buy early and move up the housing ladder over time, instead of, for instance, renting until acquiring a property which one wishes to occupy for the rest of one's life. The liquidity of the housing market and the size of transaction costs should be important determinants of a household's decision on how often to move during its lifetime.

Moreover, one must explain why this particular way to conduct transactions is chosen. As noted previously, there are clearly alternative ways to conduct the transactions if a household seeks to buy and sell at the same time. For instance, the household could first sell the existing property and, subsequently, try to buy a new property. In the meantime, the household could rent a temporary accommodation, if this become necessary. Some determinants for why transactions are conducted in chains may be exogenous, eg, the costs of temporary renting. But there may also be interesting and important endogenous reasons.

A thorough analysis, backed up by data, would be necessary to obtain a better understanding on the *exogenous* reasons i) for why property ladders and frequent transactions are common in some places and ii) for why chains are chosen as the mode of transacting. This is beyond the scope of the current analysis. Additionally, one would like to know when and whether, taken all exogenous factors as given, a particular mode of transacting becomes self-sustaining. Can it be the case that, all else equal, trading in chains and other forms of transactions can *both* arise as different equilibrium outcomes? The market model presented in the following section could provide a vehicle for studying these questions.

5 The Home Buying Market in Equilibrium

5.1 Introductory Remarks

So far our analysis has been one of partial equilibrium. We have taken either one buyer and one seller, as in Section 3, or a simple chain, as in Section 4. While generating important results, such a partial equilibrium analysis is incomplete. We now embed the individual transactions into a model of the housing market. Completing our analysis in this way is essential for the following reasons:

- First, many ingredients in the partial equilibrium analysis were taken as exogenous, eg, the arrival of a better offer for a buyer or a seller. Of course, the availability of a better deal and its conditions are also an endogenous outcome of the market process. Without making all key variables endogenous one risks choosing parameter constellations that are simply not feasible in equilibrium.

- Second, when taking some variables as exogenous as in a partial equilibrium analysis, we have no guidance how these variables are affected if we consider a change in some fundamental market conditions (eg, the availability of housing) or a change in policy. In contrast, a fully fledged general equilibrium analysis will lead to a consistent adjustment of all variables.

- Third, when reasoning in a partial equilibrium framework, we are prone to omit a range of possible feedback effects.

When introducing a general equilibrium framework, there is the danger of choosing the wrong primitives. We briefly illustrate this pitfall as it justifies the specific modelling choice we make below.

A first take on the housing market could be as follows. We may think of a fixed number of homogenous properties. With a certain probability, which is exogenous, the current home owners may have to sell, eg, as they have to move away. To balance the market, the same number of households moves to this region every period. Current home owners who have to sell and the newly arriving households interact in a market environment. The inflow and outflow of households, ie, the number of successful transactions, may be 1000 per month. The main characteristic of the market, which determines the respective market power of sellers and buyers and, thereby, prices, is the ratio of sellers to buyers θ. An important feature of this model is that *any* value of θ is compatible with an equilibrium. The only difference between equilibria with high and low values of θ is that, say, buyers may have to search longer or shorter until they succeed in buying a property and that they do so at a higher or lower price. The only equilibrium requirement is that the market process generates 1000 deals per month so as to accommodate the in- and outflow of households. In the terminology of economists, the market condition θ (ie, the ratio of properties on the market to potential buyers) is not endogenous but part of the model's *primitives*.

While the sketched model is convincing in terms of simplicity, taking θ as an exogenous variable has the following major drawback. Suppose we change some exogenous parameter, eg, raising the seller's costs of bringing the property to the market by making a HIP mandatory. Then we have no guidance as to how this will affect the market conditions, as characterized by θ, and, thereby, prices. This is because θ is itself an *exogenous* parameter, which we—as researchers—have to specify.

The insight from this small illustration is that we must make sure to choose the *right primitives.* In particular, market conditions should be realistically endogenous, ie, they should not be included into the primitives. This will be indeed the case in our model.

5.2 Plan of the Section

The rest of the material on the home buying market in equilibrium is organized as follows.

We first provide a verbal discussion of the major features of the model. Subsequently, the

model is introduced more formally. We then solve the model for the most basic scenario, thereby illustrating its working. Finally, we put the model to use and analyse the question of whether a HIP package should be made mandatory to overcome the public good problem of sellers. We will identify an important equilibrium feedback effect. We show that, if we ignore this effect, our predictions on the welfare implications of mandatory information provision could be fundamentally flawed.

Finally, we discuss how the model may prove useful for future (more far reaching) studies on the impact of various policy measures.

5.3 The Basic Model Ingredients

5.3.1 The Primitives of the Model: An Informal Description

Our baseline market model has the following main features. We consider only one class of properties, say houses. The primitives of the model are the flows of *potential buyers and sellers* arriving over time. Take the following picture as an illustration.

In each period a given number (or, more technically, "mass") of households arrives at the stage where they can afford to buy a property, eg, as they have accumulated a sufficient amount of savings to obtain a mortgage. They may then decide to take the plunge and buy a house or, alternatively, they may consider the current prices to be so high that they continue to rent. For simplicity, we will assume that the household will then continue to rent forever. This is justified in our *stationary* model as house prices will not change over time. Those households who decide to buy will enter the market and search until they have found an appropriate property.

On the other side of the market are potential sellers. Think of them as households who are close to retirement and may want to tap into the wealth locked up in their homes. Alternatively, these households may no longer be able to reap the full benefits of owning a (large) property.

We normalise to one the mass of potential buyers flowing into the market in each period. The flow of potential sellers is denoted by ψ, which could be larger or smaller than one. Note that ψ is then the ratio of *potential demand* to *potential supply.* As explained below, the condition on the property market depends on whether ψ is greater or smaller than one, but not by its actual magnitude.

We will look at a stationary equilibrium, ie, at a state where all shocks have been absorbed and all adjustments have occurred. In this (admittedly somewhat fictional) world also the con-

ditions of the property market will be stationary. (We comment below on important extensions to incorporate shocks and cyclical movements of the market.) The main characteristic of the property market is the stationary ratio of sellers to buyers who are engaged in active search for a counterpart. We denote this ratio by θ. Formally, we obtain this ratio from the stationary masses of buyers and sellers on the market, denoted by m_B and m_S.

Suppose now that $\psi > 1$, so that in each period there are more potential sellers than buyers. This may reflect a shrinking population. Likewise, it could reflect a period of very low stock market values, which has eroded the wealth of both retiring households and young households, forcing more of the former to consider selling and allowing less of the later to even consider buying. In this case, stationarity dictates that not all of the potential sellers will try to sell by listing their properties. In equilibrium, which we define formally below, it will hold that only the fraction $1/\psi$ of potential sellers will actually decide to do so.

As this insight into the working of the market model is crucial and as this will also drive most of the general equilibrium implications, let us rehearse it in a different way. Suppose still that $\psi > 1$ and assume now that *all* potential sellers and buyers enter the property market. As more potential sellers than buyers will enter each period, the ratio of sellers to buyers θ will increase more and more, which will ultimately erode prices. Of course, this can not go on forever as at sufficiently low market prices it is simply no longer optimal for potential sellers to list their properties. New sellers will then no longer enter the market, θ will drop and prices will recover. All these adjustments are "out of equilibrium". In equilibrium, these adjustments are no longer necessary. Precisely, the stocks of buyers and sellers in the market and, therefore, θ have *already* adjusted to ensure stationarity. The resulting market conditions are such that potential buyers and sellers just have the right incentives to either enter the market or not.

To go on further, we turn to the formal model.

5.3.2 Preferences of Potential Buyers and Sellers

Renting is the alternative to owning a house. We normalize the value of renting to zero, so that if a household decides to rent it just gets zero utility out of it.[23] We specify that a current home owner who continues to own his property derives the continuous "flow value" $v = c$, equal

[23] One important (remaining) partial equilibrium aspect of our model is that the market for renting is not endogenised.

to the common-value component c. All households discount future utility by the same interest rate $r > 0$. Consequently, the value of deriving the constant flow utility of v is just $V = v/r$.[24] Properties could have different flow utilities, which could depend on their size, their location or their physical condition. (We can think of c being net of any constant expenses for repairs.)

Consider now the value of a house to a potential buyer. We treat c as a pure "common value" component, ie, it is incurred by whoever owns the property. In addition, a potential buyer can get the "private value" component $b > 0$. For an interpretation, just recall our illustration from the last section, where potential buyers are young households ("first-time buyers") and potential sellers are retiring households.

To create a role for searching for the right property, we could assume that not all properties have the same private value to an individual buyer. We could model this by assuming that, when matched with some chosen property, the private value is a random draw from $0 < b_l < b_h$. Putting it differently, for each individual buyer only a fraction of all homes yields the higher private value. If a buyer with private value b owns a property, he derives the constant flow utility $v = c + b$, ie, $V = v/r = (c + b)/r$.

5.3.3 The Operation of the Market

Recall that we denote the mass of buyers and sellers *on* the property market by m_B and m_S, while their ratio is given by $\theta = m_S/m_B$. Our simple picture of the market is that of a random matching or search market. The market operation is captured by the "matching function" $x(m_B, m_S)$, which gives us the mass of matches between a buyer and a seller that form per period of time. Note that these matches are supposed to be bilateral. Also, there is no pre-segmentation of the market, which could be, for instance, achieved by different brackets of listing prices. Our most basic formulation is supposed to capture two ingredients. First, the market is not frictionless, as it takes time and effort to find a partner for a deal. Second, there is limited transparency and prices are only determined after matches are formed.[25]

If the mass x of matches forms over one period of time and if there is the mass m_B of buyers in the market, what does this imply for the speed with which an individual buyer can expect to

[24] This equation is immediately intuitive when we re-write it as $rV = v$. Here, v is the constant flow payoff (eg, interest payment) of an asset (eg, bond) with value V and the interest rate r.

[25] Is it worth contrasting the characteristics of our search market with those of the benchmark of a perfect ("Walrasian") market, where all transactions are immediately concluded at a uniform market clearing price.

be matched? Formally, for an individual buyer a match arrives with the constant arrival rate $q_B = x/m_B$. If we considered a one-shot economy or, likewise, a model set in discrete time, then x/m_B would be the probability with which any given buyer finds a match.[26] (Note that multiplying this probability x/m_B with the mass of buyers m_B gives, of course, the total mass of matches.) Define likewise for the seller the arrival rate $q_S = x/m_S$.

In general, q_B and q_S can depend on both the ratio θ and on the size of the market. For instance, scaling up m_B and m_S by the same factor ξ, which leaves θ constant, may increase the flow of matches by more than the factor ξ. In this case we would speak of increasing returns to scale: The more buyers and sellers there are in the market, the better it may work. The opposite case is that of decreasing returns to scale. As we are agnostic as to whether there are increasing or decreasing returns to scale, we choose the middle ground of constant returns to scale. In this case, q_S and q_B are only determined by the ratio of sellers to buyers θ. Naturally, the higher θ the higher is the buyer's arrival rate $q_B(\theta)$ and the lower is the seller's arrival rate $q_S(\theta)$. Putting it differently, as the expected time of finding a match is just $1/q_S(\theta)$ and $1/q_B(\theta)$ respectively, the expected time is decreasing in θ for the buyer and increasing for the seller.

Below we will work out numerical examples with the following specification of the matching technology. We use a Cobb-Douglas matching technology, which generates the arrival rates $q_S(\theta) = \xi\theta^{-0.5}$ and $q_B(\theta) = \xi\theta^{0.5}$. Here, ξ is an efficiency parameter for the market. The higher ξ, the more quickly can buyers and sellers find each other, ie, the more transparent is the market.

The market is constantly refilled by potential buyers and sellers. Recall that over one unit of time the mass one of *potential* buyers and the mass ψ of *potential* sellers newly arrives at the *market fringe*. We return to the specification of entries and exits when solving the most basic model in Section 5.3.

5.3.4 Price Setting

We use the following specification for the price setting process. If a match forms, the seller is chosen to make a take-it-or-leave-it offer with probability $0 < \sigma < 1$, while the buyer is chosen with the residual probability $1 - \sigma$. If the offer is rejected, the match breaks up. If instead the offer is accepted, contracts are exchanged immediately.[27] This specification of the negotiation

[26] Technically, finding a match, ie, a potential seller, is a stochastic event that is characterized by the Poisson process with Poisson (arrival) rate q_B.

[27] Modifications could include the necessity to conduct surveys and the potential for gazumping and gazundering.

process is admittedly a short-cut, which rules out, in particular, continuous haggling. Inasmuch as haggling leads to costly delay, this type of welfare loss is captured in our case by the risk of break-down.

5.3.5 Payoffs from Entering the Market

Does it pay a potential seller to list his property and enter the market, or is he better off to hold on to his property and realize the value c/r? This depends clearly on what the seller will get from entering the market.

To determine this value, suppose first the seller is already in the market and tries to find a buyer. We denote his expected payoff (or utility) from this strategy by R_S. It is now determined as follows. Consider "being in the market" as owning a particular asset, say an interest-bearing bond. The flow value of this bond—let us denote it for the moment by y—together with the time preferences of the holder, ie, the interest rate r, determine the value of the bond: $R_S = y/r$ or $rR_S = y$. What is now the equivalent of y in the case of a potential seller? The seller may occur constant costs of listing the property. Also, spending time on search may have high opportunity costs. Overall, we specify the he incurs a constant flow of costs equal to k_S. On the other hand, while living in his property the seller still enjoys the flow utility c. Additionally, being on the market gives the seller the *option* to possibly sell. For this he must find a potential buyer, which happens with the arrival rate q_S. If the match is successful and leads to an exchange at the expected price of p^E, which is what we assume for now, the seller swaps the "asset" of being in the market for the price p^E.

Summing up, we have

$$y = c - k_S + q_S[p^E - R_S]$$

and thus

$$rR_S = c - k_S + q_S[p^E - R_S],$$

or finally

$$R_S = \frac{c - k_S + q_S p^E}{r + q_S}. \tag{10}$$

Equation (10), which is often referred to as the Bellman equation or the asset value equation, is key to understand the operation of the model. Note that, if $k_S = 0$ and if it is very unlikely to find a buyer as q_S is close to zero, being in the market is, of course, just as valuable as having decided not to sell.

We will refer to R_S as the reservation value of a seller. What is now the value of entering the market? By stationarity, it is clearly the difference of R_S and any up-front costs that must be paid, which we denote by (the listing costs) L, ie, $R_S - L$.

For the buyer we can proceed in analogy to the seller. It is, however, convenient to skip this for the moment and turn right to the specification of the most basic model.

5.4 The Basic Model

5.4.1 Specifications and Solution to the Model

We specify that $\psi > 1$, ie, that potential sellers outnumber potential buyers. Recall that the payoff obtained by one of the (homogenous) potential sellers from entering the market was given by $R_S - L$. As we abstract from any "set-up" costs for buyers, their value from entering the market is equal to their reservation value R_B, derived below.

We first turn to the determination of equilibrium prices. If the seller can make an offer, he will optimally choose the price p_S such that the buyer is just indifferent between accepting and rejecting. (Leaving her with a penny more is clearly suboptimal.) The buyer's value from owning the property is $(c+b)/r$. If the buyer rejects, he will turn back to the market, in which case his expected payoff is again just R_B. Thus, the seller will optimally choose p_S such that

$$\frac{c+b}{r} - p_S = R_B.$$

A similar logic applies to the buyer's offer. Here, the buyer chooses $p_B = R_S$ as this makes the seller just indifferent between accepting and getting p_B and rejecting and having to start to search anew. The expected price is then

$$\sigma\left(\frac{c+b}{r} - R_B\right) + (1-\sigma)R_S.$$

Substituting this price into the equation for the seller's reservation value (10), we obtain

$$(r+q_S)R_S = c - k_S + q_S\left[\sigma\left(\frac{c+b}{r} - R_B\right) + (1-\sigma)R_S\right],$$

which transforms to

$$(r+q_S\sigma)R_S = c - k_S + q_S\sigma\left(\frac{c+b}{r} - R_B\right)$$

and finally to

$$R_S = \frac{c}{r} + \frac{q_S\sigma\left(\frac{b}{r} - R_B\right) - k_S}{r+q_S\sigma}. \tag{11}$$

This is quite intuitive. Recall that c/r is the value from continuing to own the property. The arrival rate of a match (and thus of a sale) is q_S, while with probability σ the seller can also extract some rents from the buyer. The buyer's value for the property exceeds that of the seller by b/r, while his reservation value is R_B. Finally, k_S are the constant costs that are incurred while the property is on the market.

Turn now to the buyer. The buyer may also incur some cost while searching for a property, which we capture by k_B. Proceeding as before, the buyer's reservation value can be derived in the following steps:

$$\begin{aligned} rR_B &= -k_B + q_B\left(\frac{c+b}{r} - p^E - R_B\right) \\ &= -k_B + q_B\left[\frac{c+b}{r} - \sigma\left(\frac{c+b}{r} - R_B\right) - (1-\sigma)R_S - R_B\right], \\ (r + q_B(1-\sigma))R_B &= -k_B + q_B(1-\sigma)\left(\frac{c+b}{r} - R_S\right), \end{aligned}$$

and finally

$$R_B = \frac{q_B(1-\sigma)\left(\frac{c+b}{r} - R_S\right) - k_B}{r + q_B(1-\sigma)}. \tag{12}$$

With (11) and (12) we obtain the two reservation values for the buyer and the seller as linear functions of each other. If we fixed the ratio of sellers to buyers θ, which drives q_B and q_S, we could determine the equilibrium values of R_B and R_S for any value of θ. If we did this, we would find the intuitive result that a higher value of θ increases R_B and decreases R_S. Hence, our model has the intuitive feature that one side of the market is better off if there are relatively more participants on the other side.

We now need to show how the ratio θ is determined, depending on the exogenously specified flows of potential buyers and sellers. As we assumed $\psi > 1$ there is constantly more supply of potential sellers. To keep the market stationary, sellers must not have a strong preference for going into the market to sell their property. (Recall our argument how this would drive up θ until a drop in prices would ultimately drive out sellers etc.) On the other side, to keep the market in operation sellers must not prefer to stay out of the market. The solution is to make sellers *indifferent* between staying out of the market and holding on to their property, which yields c/r, and entering the market, which yields $R_S - L$. This indifference requires that

$$R_S - L = \frac{c}{r}. \tag{13}$$

Substituting R_S from (11), we obtain the equilibrium condition

$$\frac{c}{r} + \frac{q_S\sigma\left(\frac{b}{r} - R_B\right) - k_S}{r + q_S\sigma} - L = \frac{c}{r}. \tag{14}$$

Substituting R_B from (12), where we can immediately use from (13) that $R_S = L + \frac{c}{r}$, the requirement (14) transforms to

$$q_S\sigma\left(\frac{b}{r} - \frac{q_B(1-\sigma)\left(\frac{b}{r} - L\right) - k_B}{r + q_B(1-\sigma)}\right) - k_S = L(r + q_S\sigma),$$

and finally to the key equilibrium condition

$$q_S\sigma\left(\frac{b + q_B(1-\sigma)L + k_B}{r + q_B(1-\sigma)}\right) - k_S = L(r + q_S\sigma). \tag{15}$$

The equilibrium market condition θ must solve (15). It can be shown that this yields a unique solution. Below we use the Cobb-Douglas matching technologies $q_S(\theta) = \xi\theta^{-0.5}$ and $q_B(\theta) = \xi\theta^{0.5}$ to obtain some numerical examples.

Having solved for the equilibrium market condition, which we denote by θ^*, we can complete the description of the equilibrium as follows. Given θ^* and as we know that at each point in time a mass one of buyers and sellers enter the market, stationary requires that also a mass one of buyers and sellers exit the market. As each match is successful, the stocks of buyers and sellers in the market is obtained from the requirements $m_S q_S(\theta^*) = 1$ and $m_B q_B(\theta^*) = 1$.

5.4.2 Welfare

We are not only interested in the market characteristics (or the positive predictions), but also in the desirability of the outcome (or the normative properties). To ask questions relating to welfare, we must define an adequate welfare criterion. Our model captures a dynamic economy where new households arrive over time. In this "open-ended" model the relevant welfare criterion is the flow of utility that is constantly created. Of course, this is just the sum of utilities that is generated for each new cohort of arriving potential buyers and sellers.

Surplus is created as property moves to households who value it most. On the other side, surplus is destroyed as search is costly (k_S, k_B) and as there are set-up costs for the seller L. Additionally, the realization of the valuation difference b/r is delayed due to search frictions, and this delay is costly as future utilities are discounted. We now add up all these streams of benefits and losses. By the assumption that $\psi > 1$, sellers are reduced to their reservation value

of c/r and all created surplus goes to the buyers. In our simple model, the social welfare is then equal to the buyers' reservation value R_B, encompassing all benefits and losses on both sides of the market.

5.4.3 Numerical Example

To illustrate the working of the model, we provide some numerical examples. We start with the following specifications:

- One unit of time is one month. We choose the monthly interest rate $r = 1\% = 0.01$.
- We are agnostic about the distribution of bargaining power and, therefore, specify $\sigma = 0.5$.
- We specify that keeping the property listed and "enduring" the buyers' viewings comes at the monthly costs (disutilty) of $k_S = £100$ to the seller. For the buyer we specify the monthly costs of search $k_B = £50$.
- Initial expenditures to get the property listed are $L = £200$.
- Note that for our equilibrium with free entry the common-value component c plays no role. What plays a role, however, is the buyer's private value component b, which generates the gains from trade. We specify that the buyer's lifetime valuation exceeds that of the seller by $£20,000$. As this is equal to b/r and as $r = 0.01$, we obtain $b = £20,000 \cdot 0.01 = £200$ per month.
- We use a Cobb-Douglas matching technology, which generates $q_S = \xi\theta^{-0.5}$ and $q_B = \xi\theta^{0.5}$.

Note that our remaining unspecified parameters are the following: the endogenous parameters (R_B, R_S, θ) and the exogenous parameter ξ, which is an indicator of the transparency or efficiency of the market.

We have chosen $\xi = 0.22$. The resulting equilibrium characteristics are as follows. The equilibrium ratio of sellers to buyers is $\theta^* = 2.29$. Moreover, the expected time it takes a buyer to find a (suitable) property is 3 months, while the corresponding time for a seller is slightly more than 6 months. Finally, we obtain $R_B = £18,390$. This is a reasonable figure. To see this,

note first that the total benefits from trade are $b/r = £20,000$. Hence, the amount $£1.610$ is lost due to transaction costs. Transaction costs arise as follows. The expected search costs for a seller are roughly $6 \cdot £100 = £600$, while those for a buyer are roughly $3 \cdot £50 = £150$, which sums up to the total expected search costs of $£850$. The seller also incurs the initial costs $£200$. The remaining loss of surplus is due to delay and discounting.

If we reduce the seller's initial costs to $L = £100$, we obtain a slightly higher equilibrium ratio $\theta^* = 2.3$. Intuitively, as selling a property is less costly, there is more pressure from potential sellers to enter the market. The ratio of sellers to buyers must increase. In this case we obtain $R_B = 18.500$, which is *more* than $£100$ higher than in the previous case. How can this be the case if listing costs L have only decreased by $£100$? The answer is that the market operates now more efficiently in the following sense. If we calculate R_S and R_B as functions of θ alone, ie, if we use a partial-equilibrium analysis, we can see that the joint surplus $R_S + R_B$ is a hump-shaped function of θ. Total search costs arising from delay and from incurring k_B and k_S, respectively, are minimised at an *intermediate* level of competition θ. As we decrease L and, thereby, increase θ, we gain roughly $£10$ in surplus by moving to more efficient market conditions.

5.5 Application: Provision of Documents for the HIP

5.5.1 The Question

In this section, we analyse the seller's private incentives to spend resources and time to provide the type of documents that could go into the HIP. This includes legal documents, searches as well as a survey on the condition of the property. We then ask whether the seller's incentives are sufficient or whether welfare may be improved by making it mandatory to provide these documents prior to marketing the property. We, thus, consider the following two options for a seller:

- The seller may choose to provide the documents. In this case, he must spend the resources F_0 in addition to the listing costs L. After the seller meets a buyer, the buyer still needs to incur costs prior to the exchange of contracts (eg, for the valuation required for the mortgage). Denote these costs of the buyer by F_2.

- The seller may choose not to provide the documents. In this case, after meeting a seller the buyer must incur the costs $F_1 > F_2$ before the exchange of contracts.

The match is only successful with probability ϕ. Hence, with residual probability $1 - \phi$ there will be break-up, implying that the costs F_1 or F_2 were incurred in vain. We ask now the following questions. First, what is the equilibrium outcome and will sellers provide a survey? Second, if we impose on the seller the obligation to provide a survey, will this increase efficiency? In answering these questions we will have to address the following issues:

- *Efficiency:* If a potential buyer must incur the costs F_2 or F_1 and if there is the possibility of break-up, there may be duplication of these costs until the property is finally sold. As $F_2 < F_1$ this makes the case where the seller provides the survey potentially more efficient. On the other hand, if the existing survey is not a perfect substitute for the buyer's later activities the seller's survey may cause inefficiently high costs.

- *Hold-up:* The seller bears the costs F_0 up-front, ie, before finding a buyer and engaging in negotiations. In other words, these costs are sunk before negotiations begin. In contrast, F_1 and F_2 are either born fully by buyers before negotiations or they are part of the negotiations in case these costs are incurred only after the price has been agreed. We can, therefore, expect that the seller has a bias for not providing a survey (compared to the efficient choice).

- *Equilibrium feedback:* Imposing on the seller the obligation to provide a survey may have far reaching implications for the conditions of the property market. To recoup these costs, sellers must obtain a higher price, which in turn requires that market conditions change to their favour, ie, that θ is reduced. This has (unintended) implications for welfare.

5.5.2 How Market Conditions Are Affected and Why This Matters

The numerical exercise for our basic model already highlighted an important issue. Changing the ratio of sellers to buyers θ not only affects property prices, which leads to a different *distribution* of surplus, but it also affects the size of the generated surplus. If θ is high, sellers must search longer, while buyers must search longer if θ decreases. There is an intermediate value of θ for which total costs are minimised and, therefore, total surplus is maximised. Any policy measure

may thus lead to a potentially important change in welfare via its effect on the equilibrium market conditions.

Suppose we are in an equilibrium where sellers do *not* provide a survey. Hence, sellers save the initial outlay F_0, while each time they meet a buyer the costs F_2 have to be incurred. Take any given property. What are the expected discounted costs arising from marketing the property? An intuitive and simple way to calculate these costs is to think of them as an "asset", for which we can apply our previous methodology. If the value of this asset is C, we obtain

$$rC = q_S(\theta^*)\phi(F_2 - C) + q_S(\theta^*)(1-\phi)F_2$$

and thus

$$C = \frac{q_S(\theta^*)}{r + q_S(\theta^*)\phi}F_2. \tag{16}$$

Suppose now, instead, that we make a survey mandatory, implying that sellers have to incur F_0 before listing their properties. If we keep the market conditions, ie, θ^*, constant, the expected costs are now

$$F_0 + \frac{q_S(\theta^*)}{r + q_S(\theta^*)\phi}F_1. \tag{17}$$

Comparing (16) with (17) suggests that a mandatory policy would increase welfare in case

$$\frac{q_S(\theta^*)}{r + q_S(\theta^*)\phi}(F_1 - F_2) > F_0. \tag{18}$$

Moreover, sellers typically do not have the right incentives. In the first regime they have to incur the costs F_0 up front. To know how the costs F_1 or F_2 are shared, we have to specify exactly when these costs are incurred. We specify that they are incurred *after* the price has been agreed. Thus, the expected surplus from the transaction will be reduced by F_1 or F_2 respectively. In this case the seller will on average bear only the fraction σ of these costs. It is then intuitive (and easy to show) that a seller will, for given θ^*, indeed choose not to provide the survey in case

$$\frac{q_S(\theta^*)}{r + q_S(\theta^*)\phi}\sigma(F_1 - F_2) < F_0. \tag{19}$$

From (18) and (19) we see that social incentives and those of the seller only coincide if the seller has all bargaining power, ie, if $\sigma = 1$. Otherwise, the seller's incentives are too low. All this suggests that, if (18) and (19) hold at the same time, making a HIP mandatory will improve welfare.

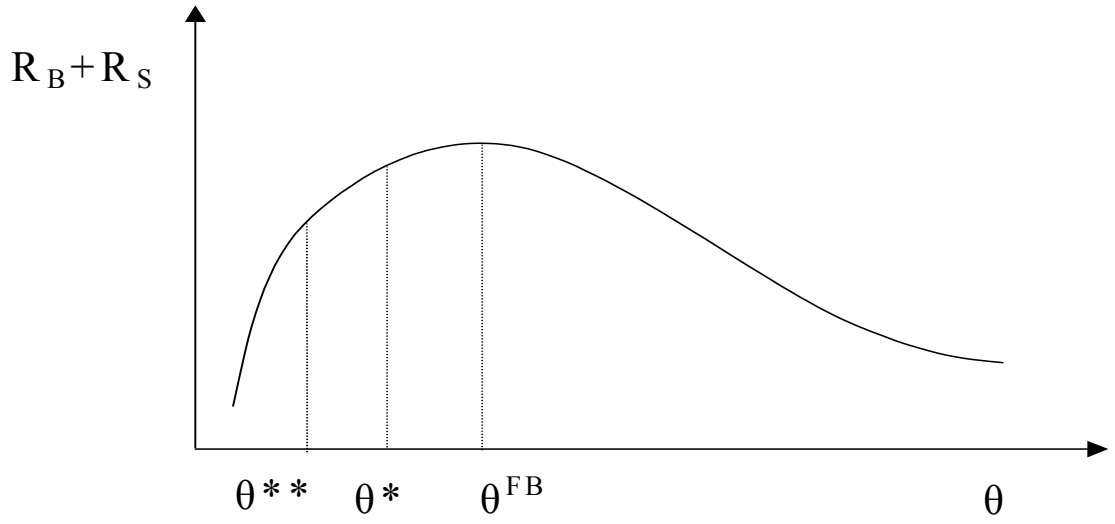

Figure 1: Welfare and Market Conditions

The mistake we are prone to make at this stage is that we keep market conditions unchanged at θ^*. However, if the seller has to incur F_0 up-front *against his will*, he will have to be compensated by a sufficiently higher price in the market. This will, of course, only be the case if the new equilibrium ratio of sellers to buyers, θ^{**}, is strictly *lower* than θ^*.

How will this adjustment affect welfare? It is now helpful to briefly return to a partial-equillibrium analysis, where we change θ *exogenously* and where total surplus is captured by the sum $R_B + R_S$. As noted previously, total surplus is maximised at an intermediate degree of competition, which we now denote by θ^{FB}. If the original market equilibrium satisfies $\theta^* < \theta^{FB}$ the wedge between the efficient and the equilibrium value of the ratio of sellers to buyers becomes even larger under θ^{**}. We illustrate this in Figure 1.

In this case it can occur that the policy to introduce a mandatory HIP can reduce welfare. While the policy leads to a reduction in total costs incurred by conducting surveys, the impact on the equilibrium market conditions may be such that total transaction costs from search and delay are increased. The latter effect may dominate the first in case the initial cost savings are not substantial. We have been able to verify this with simple examples, which are omitted for brevity.

However, one needs further evidence on both the size of the costs F_0, F_1 and F_2 as well as on the factors determining the initial equilibrium condition θ^* to obtain meaningful quantitative results.

5.6 Extending the Market Analysis

Based on the extensive analysis of bilateral transactions in Section 3 and of single chains in Section 4, a further analysis of transactions and chains in a market equilibrium setting would be useful. This is, however, beyond the scope of the present study.

As discussed further in our concluding remarks below, extending the market equilibrium analysis would seem to be an important next step to understand the impacts of policy measures on the working and efficiency of the housing market. The following extensions of the market model would seem to be most relevant for this purpose:

- *Asymmetric information:* Our basic market model assumes symmetric information. Making use of the simplifying assumption that prices are determined by take-it-or-leave-it offers, where the proposer is randomly chosen in each match, it is possible to incorporate private information, eg, on the common-value component c, while still preserving tractability.[28]

- *Chains:* Preliminary analysis shows that our model can be extended to incorporate simple chains, eg, linking the market for flats, where first-time buyers enter, to that of houses, where second-time buyers are active. A fully-fledged equilibrium analysis seems to be warranted given the potentially intricate feedback effects between the different markets (for flats and houses).[29]

- *Dynamics:* For tractability we only looked at stationary equilibria in our market model, ie, the constant flow of potential buyers and sellers was time-invariant and the market was in equilibrium.[30] On the other side, cyclical patterns and, more generally, movements in demand, supply and prices seem to be relatively typical for the housing market in England and Wales. In particular in light of the welfare implications of a policy change, these characteristics should be taken into account. Our basic matching and search model can be extended to study such types of dynamic adjustments.[31]

[28] Inderst (2001) has extended matching and search markets to private information.

[29] Rosenthal (1997), Price (1998) and Anglin (2001) are some of the first papers analysing some interesting economic issues arising in housing markets with chains.

[30] Wheaton (1990) was the first to provide such a stationary model of the housing market.

[31] Fersthman and Fishman (1992) provide a framework for studying non-stationary search markets.

6 Concluding Remarks

This report provides a modelling framework for a micro-economic analysis of the home buying offer and contract process, with particular reference to issues relevant to the current situation in the UK. According to results from recent studies and surveys, the home buying market is characterised by extensive search and negotiated prices. Buyers and sellers seem to take few preparatory steps before agreeing on a deal. Initial agreements are typically stipulated either verbally or written but "subject to contract", and so are not legally binding. A substantial number of deals fall through, mainly due to reasons that are not directly associated with gazumping or gazundering. Finally, transactions are often part of a lager chain of deals, making the success of each transaction contingent on that of all the other links in the chain.

We next identified three potential problem areas: i) informational asymmetries, ii) strategic break-up and iii) non-strategic break-up.

Sellers' private knowledge of the conditions of their properties may generate delays and excessive break-ups. But we discussed several reasons why sellers have, in principle, strong incentives to reveal this information. In practice these incentives could be severely muted when it is costly to credibly provide this information and when surplus must be shared with buyers in negotiations.

With non-binding contracts, sellers and buyers have the incentive to keep searching for better alternatives while the original deal is completed. When cancelling an agreement, their decision fails to internalise the negative externality this imposes on the counterpart. On the other hand, by entering into a new transaction gains are created for the new counterpart. As we discussed in detail, in the most natural benchmark case a buyer or seller will cancel the existing agreement if and only if this also increases social surplus. On the other hand, the more buyers hunt for "bargains" instead of searching for a more suitable property, the more likely it is that surplus is reduced. We further argued that there exist simple contractual remedies which the two parties could use to become more committed to the agreement. If these remedies, eg, deposits, are, however, not standard practice, we showed that individual parties may also (inefficiently) abstain from using them.

Even without opportunistic behaviour, an initial agreement may fail due to exogenous reasons, eg, the failure to secure finance. The better prepared the two parties are at the time they start negotiations, the more likely it is that the deal will not be delayed and that it will not

fall through at some later stage. Being prepared creates a positive externality for any future counterpart, which drives a wedge between what is socially and what is individually optimal. Furthermore, there can exist serious problems of co-ordination failure if the actions of sellers and buyers are complementary, ie, if it is necessary to have two well prepared parties to ensure the successful and swift processing of a transaction. Importantly, contractual remedies do not exist as buyers and sellers must incur the related costs before even meeting their counterpart.

Chains can severely reduce efficiency and, in addition, limit the potential of contractual remedies. We showed how chains exacerbate externalities, make co-ordination problems more severe and limit the scope of bilateral contracts. Individual actions have now an impact not only on the respective counterpart, but also on all other links in the chain. Moreover, as the links of a chain are likely to fall into place only over time, bilateral contracts are of little use to address some of these externalities.

Throughout the analysis we mainly focused on two types of policy interventions: making contracts more binding, eg, by making deposits mandatory, or requiring buyers or sellers to be better prepared, eg, by making a HIP mandatory for sellers. Our theoretical analysis can not provide sufficient grounds for advocating either for or against adopting these policies. A thorough empirical study, eg, an impact analysis in a calibrated model, would be needed for this. Notwithstanding this reservation, our analysis sheds some light on the implications of using such measures.

In the absence of chains, our analysis suggests that there may be only limited benefits from implementing these policies. While we have identified a number of reasons for why individual incentives, eg, to provide information in the form of a survey, may be smaller than what would be socially optimal, imposing standards that are mandatory is likely to reduce flexibility. For instance, there may be good reasons for why parties do not want to make contracts more binding. Likewise, for some properties or some buyer-seller matches a survey may not be necessary, given the information that is already available.

However, our analysis shows how chains exacerbate externalities and lead to new contractual problems. As the prevalence and length of chains increases, our analysis suggests that the related inefficiencies can become substantial. We argued that this can strengthen the case for a HIP. On the other hand, while chains can create larger benefits from making contracts more binding, they can also increase the costs of such a policy. As we discussed in detail, more binding contracts

may be beneficial *ex ante*, eg, to reduce opportunism, but they may be detrimental to efficiency *ex post*, ie, once a link in the chain has broken and all transactions are stalled.

Our analysis of the market equilibrium finally warns of the pitfalls of *any* policy intervention. If we use data on existing market conditions, eg, the participation of sellers and buyers, the time spent on search, etc., in order to calculate the potential welfare gains, we ignore the fact that market conditions will adjust once the policy has been implemented. For instance, making the marketing of property more costly for sellers will reduce their incentives to sell, implying that prices and market conditions have to adjust until the market is again in equilibrium. We showed how these feedback mechanisms can easily lead to unwarranted outcomes.

For a better understanding both of the home buying market and of the likely impact of any policy, the following two further steps would prove extremely useful. First, more data on the prevalence and importance of chains is needed. Second, building on this data one should extend and enrich the market equilibrium model developed in Section 5 in order to better gauge both the qualitative and quantitative implications of the discussed policy measures.

7 References

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