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"Smarter information, smarter consumers"? Insights into the housing market

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ABSTRACT

This study explores how information helps housing consumers make informed decisions and discusses potential market outcomes. We analyse the interaction between the disclosure of information on property conditions and the disparity between home sellers' willingness to accept (WTA) and home buyers' willingness to pay (WTP). Three hypotheses are derived and validated through field experimental investigation within the property market. We find that a WTA–WTP disparity exists. The identified policy instrument for information disclosure appears to function as expected. The WTA–WTP disparity is considerably reduced after information disclosure, and market liquidity and efficiency are improved. This study is an important complement to prior research on how information changes the behaviour of consumers in housing markets. Findings can inform central governments about the wider benefits of smart disclosure in the future, as well as the scope, format and structure of information supplied to general housing consumers to promote efficiency.

1. Introduction

"Smarter information, smarter consumers", the Nobel laureate and behavioural economist Richard Thaler told us. The idea of this statement summarises and has guided government efforts and practice in recent years. In the US, the disclosure of products, services and other information in many sectors is required by federal laws and regulations. Such requirement allows the release of information intelligently and efficiently and ensures the public's easy access to and use of available information. In the UK, central government has been undertaking programs to provide individuals with access to information, thereby empowering consumers in their decision-making process. Efforts to disclose information and potential opportunities can be seen in the finance, education, health care, energy and other private sectors.

By definition, an efficiently functioning market requires full information. The housing market is no exception. Homeowners are known to have a natural information advantage over potential buyers in housing markets. Information asymmetries and gaps between sellers and buyers are well-identified in the housing sector (e.g. Eichholtz, Holtermans, & Yönder, 2016; Kurlat & Stroebel, 2015; Ling, Naranjo, & Petrova, 2018; Lützkendorf & Speer, 2005; Rutherford, Springer, & Yavas, 2007; Votsis & Perrels, 2016; Walsh & Mui, 2017). Many previous studies focused only on how information asymmetry affects the property transaction price, which is the final outcome of a real estate transaction. The present study complements prior research by analysing the interaction between the disclosure of information on property conditions and the disparity between the willingness to accept (WTA) of home sellers and the willingness to pay (WTP) of home buyers (referred to as the WTA–WTP disparity hereafter).

There are good reasons to believe that the WTA–WTP disparity is of great importance in housing markets, and the disclosure of property information helps in reducing such disparity. First, if the value divergence between WTA of a seller and WTP of a buyer exists, one can only arrive at a price range estimation of the fair value, which is normally lie between WTA and WTP. Non-economic variation in the market power of buyers and sellers may move observed prices closer to WTA or WTP, making economic assessment of the movement of fundamental values over time difficult. Moreover, the existence of a time varying WTA–WTP disparity makes performance measures based on WTA potentially misleading. Mis-valuation of property prices also has potential consequences for lenders, particularly if valuations are above fair value.

Second, if the WTA–WTP disparity is substantial, then the affected parties (e.g. home sellers and buyers) need to go through a long process of bargaining and negotiation to reach an agreement, which may keep an asset on the market for a long time and make market players reluctant to trade (Al-Ubaydli & List, 2016). The presence of such a disparity impedes efficient market exchanges (Knetsch, 1989). As a result, such a condition undermines market efficiency (i.e. the ability of the market to allocate goods efficiently), diminishes transaction volumes, reduces transaction information and poses direct implications for market liquidity (Al-Ubaydli & List, 2016; Fisher, Gatzlaff, Geltner, &

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Haurin, 2003, 2004; Knetsch, 1989), and potentially reducing household mobility with wider economic efficiency consequences (Ferreira, Gyourko, & Tracy, 2010).

In housing markets, consumers become involved with housing transactions only a limited number of times in their lifetime. During a housing transaction, market players are likely to use their own limited information, limited experience and heuristic thinking to judge the value of a property. With information asymmetry and other factors at play, consumers may ultimately arrive at a biased housing decision which gives rise to differences between their perceived property value and a reasonable price (Chang, Chao, & Yeh, 2016; Eerola & Lyytikäinen, 2015). Consequently, either the market pays for the consequences (e.g. market failure: when the property values perceived by buyers are significantly lower than any fair value, transaction activities will be much reduced) or less-informed consumers pay for the consequences (e.g. when they purchase a property at a high price or the quality of a property is not worth the price they paid for it).

Therefore, governments should make an effort to correct any existing information asymmetries and gaps for the benefit of consumers and housing markets. The disclosure of property information can potentially reduce valuation disparity, enhance fair property valuation and thereby promote efficiency in the property market.

Our research begins by identifying the existence of WTA–WTP disparities in housing markets. Using ex-post transaction data is insufficient to identify WTA–WTP disparities because the WTAs of sellers and WTPs of buyers are usually unobservable. Although real estate agencies hold relevant information, such information is subject to manipulation for marketing purposes (Zhang, Zhang, & Seiler, 2015). Verifying the accuracy and robustness of results is difficult when only listing information is used (Yavas & Sirmans, 2005). Therefore, experimental techniques are utilised in this study to collect first-hand data.

We conduct field experiments to identify WTA–WTP disparities in housing markets. These experiments are thus different from those conducted previously. Specifically, previous experiments were usually conducted in classroom settings. Items of trivial values (e.g. mugs and pens) were utilised as instruments for the participants (usually college students). Given the uniqueness and substantial value of the research item (i.e. houses) in the current study, we identify whether WTA–WTP disparities exist using actual houses on the market, house owners and potential home buyers.

In what follows, we analyse the interaction between the disclosure of information on property conditions and the WTA–WTP disparity in housing markets. Specifically, we test if information asymmetry between sellers and buyers is one of the major forces that drive such a disparity in housing markets. If so, can a policy instrument on information disclosure function as intended to reduce the WTA–WTP disparity?

Since California enacted the residential real estate property disclosure law, empirical studies have tested and shown the importance of information to the decision making of housing consumers. These studies have revealed how property transaction prices and the market are affected after the disclosure of information on past housing transactions (Eerola & Lyytikäinen, 2015; Zhang et al., 2015), structural housing characteristics (Lützkendorf & Speer, 2005; Nanda & Ross, 2012), neighbourhood housing characteristics (Fiva & Kirkebøen, 2011; Kurlat & Stroebel, 2015) and environmental dis-amenity (Pope, 2008a; Votsis & Perrels, 2016 and Walsh & Mui, 2017). Our study justifies the information disclosure laws from a different aspect. We focus on the interaction between information disclosure and the WTA–WTP disparity. Such disparities carry further information because it indicates how transaction prices could be derived and how long the transaction process will take. Specifically, the WTA–WTP disparity has important implications on the market from the following two dimensions.

First, transaction price: the price at which a property is transacted must lie between the WTA of a seller and the WTP of a potential buyer (Fisher et al., 2003). Therefore, all else being equal, property transaction prices are likely to increase if home buyers increase their WTP, as in the cases of Nanda and Ross (2012) and Fiva and Kirkebøen (2011). Similarly, property prices may drop if home buyers are willing to pay less, as in the cases of Votsis and Perrels (2016), Walsh and Mui (2017) and Pope (2008a), or if homeowners are willing to sell their property at a reduced price.

Second, market liquidity: we consider market liquidity as the ease with which goods can be transacted. Within a certain period, numerous transactions indicate that the market has considerable liquidity. However, if the WTA–WTP disparity is substantial, then properties may be retained on the market for a long time, because it takes time for home sellers and buyers to reach an agreement on price. In other words, the WTA–WTP disparity, if any, essentially diminishes the number of transactions and poses direct implications for market liquidity (Al-Ubaydli & List, 2016; Chordia, Roll, & Subrahmanyam, 2008; Chung & Hrazdil, 2010; Fisher et al., 2003; Knetsch, 1989). Therefore, our analysis of the interaction between information disclosure and WTA–WTP disparity enables us to view the housing market from a dynamic perspective.

To facilitate the investigation of the interaction between information disclosure and WTA–WTP disparity, we incorporate information asymmetry materials in our field experiments and compare the disparities obtained before and after information disclosure scenarios. China is an ideal location to conduct experiments because the Chinese government has not enacted any form of seller information disclosure laws. The reaction of housing decision makers in China to the release of information during the transaction process would be more realistic than that of housing decision makers in other countries who have already adapted to policy instruments for information disclosure. Consequently, a before-after information treatment experiment can be implemented in China. The responses of decision makers (i.e. WTA or WTP) before and after private information is released within a controlled environment can be observed, and the decision-making process can be recorded.

This research finds that, on average, sellers' WTA is significantly greater than buyers' WTP. Home buyers are usually not well informed about property conditions. They may potentially reduce their relative WTP to compensate for any information uncertainty and future risk, thereby widening the WTA–WTP disparity in the housing market. However, policy instruments such as disclosure of information on property conditions not only closes the information gap between buyers and sellers, but also narrows the gap between perceived risk and the actual risk that buyers are facing. The additional information enables buyers to reduce the risk compensation they previously required and adjust their valuation towards what might be considered a fair property value. On the other hand, market transparency makes home sellers—the informed party—unable to take advantage of the private information they hold. Hence, any deviations of their WTA from the fair market price are reduced. As a result, the disclosure of information on property conditions functions as intended. That is, it generates smart housing consumers, reduces the WTA–WTP disparity during the transaction process and motivates buyers and sellers to close deals quickly. These results can potentially improve market liquidity and enhance market efficiency.

By providing an experimental investigation into how information changes consumer behaviour in the important but unique housing sector, we contribute to the literature on consumer behaviour, behavioural economics, experimental economics, and housing economics. Previous WTA–WTP disparity experiments use goods of trivial value (e.g. a pen, chocolate or mug) as instruments. Goods or entitlements of substantial value, on which the WTA–WTP disparity would pose telling implications outside the lab (e.g. houses), have not been extensively studied. The current work addresses this deficiency by providing a unique identification of the WTA–WTP disparity in housing markets and investigating how the disparity interacts with the release of information. To the best of our knowledge, this study is the first to investigate the interaction between the disclosure of information on property conditions and the WTA–WTP disparity in the housing market. The findings of this study can benefit all housing market players and

policymakers. The insights gained from our research can potentially increase public awareness of the benefits and importance of policy interventions such as information release. Results can also inform the central government on the potentially wide use of smart disclosure, as well as the scope, format and structure of information to be supplied to general consumers.

The remainder of this paper is organised as follows. A literature review of studies on the WTA–WTP disparity and derivation of testable hypotheses is presented in Section 2. Section 3 illustrates the experimental strategy. The experiment results and empirical findings are discussed in Section 4. Section 5 concludes the paper.

2. Literature review on WTA–WTP disparity and testable hypotheses

Experimental evidence obtained in the past 50 years confirms that sellers' WTA is higher than buyers' WTP is for the same good. The WTA–WTP ratio obtained from previous experiments ranges from less than 5 to more than 100 (see Tunçel & Hammitt, 2014 for a meta-analytical review on the WTA–WTP disparity). The instrument utilised in previous experiments covers ordinary private goods (Brown & Cohen, 2015; Kahneman, Knetsch, & Thaler, 1990; Morrison, 1997), environment assets (Bishop, Heberlein, & Kealy, 1983; Shefrin & Caldwell, 2001), time (Ortona & Scacciati, 1992), health- and safety-related goods (Chapman & Johnson, 1995; Gerking, de Haan, & Schulze, 1988), lotteries (Eisenberger & Weber, 1995; Nash & Rosenthal, 2014; Peters, Slovic, & Gregory, 2003) and other public or non-market goods (Garbacz & Thayer, 1983). Horowitz and Mcconnell (2002) and Tunçel and Hammitt (2014) conclude that the WTA–WTP ratio is small when the instrument used in the experiment is close to ordinary private goods when all other conditions are equal.

However, a unique but important type of instrument, namely, real estate, is overlooked and under-researched in previous experimental studies. A good understanding of the disparity between home sellers' WTA and home buyers' WTP is essential because it could explain the movement of property transaction volumes, the liquidity of property transactions and underlying housing cycles. Currently, only a few experiments have asked respondents about their WTA or WTP through a real estate-related instrument. Paraschiv and Chenavaz (2011) were the first to apply experimental techniques to the housing market and elicit respondents' evaluations on resale houses. However, their work did not comprehensively discuss the WTA–WTP disparity. He and Asami (2014) and Bao and Gong (2016) conducted WTA–WTP experiments on land price and resale property in Beijing, respectively. They confirmed the existence of the WTA–WTP disparity in land and housing markets. However, the instruments (i.e. land and houses) in these studies are generic and hypothetical. According to Sayman and Öncüler (2005), the WTA–WTP ratio is larger when participants have physical ownership of the instrument than when participants are given hypothetical ownership only. Considering the external validity of experiments, we aim to identify whether the WTA–WTP disparity exists in the housing market using actual houses on the market, house owners and potential home buyers.

Hypothesis 1. The WTA–WTP disparity exists in the housing market.

Standard economic theory predicts that in the case of a limited income effect, sellers' WTA and buyers' WTP for the same product are generally identical (Willig, 1976). However, the WTA–WTP disparities observed in previous experiments are too large to be explained by the income effect. Previous studies sought alternative explanations for such disparities from different perspectives. On the basis of psychology and behavioural economics, Thaler (1980) coined the term ‘endowment effect’ to explain why sellers' WTA usually exceeds buyers' WTP. Although the endowment effect explanation contradicts the Coase theorem, it is confirmed by laboratory experimental evidence when the income effect and transaction costs are absent. According to prospect theory, this finding is an evidence of reference dependence and loss aversion. Losses loom larger than gains do. In a typical exchange, to compensate for the potential loss and the pain of losing belongings, owners who are endowed with goods are more likely to ascribe additional value to such items than those without such goods. These psychological factors are considered the most robust explanation for the WTA–WTP disparity from the behavioural aspect (see Ericson & Fuster, 2014 for a review).

However, a typical transaction is usually accompanied by asymmetric information between agents (Casey, 1995). This scenario was not considered in previous studies because most, if not all, the experiments distributed exactly the same information on goods to the participants and information asymmetry was assumed to be not an issue. However, such an assumption is strong for a real estate-related instruments. Given that properties have heterogeneous characteristics (i.e. structural, locational and neighbourhood characteristics), sellers usually have more information on their own house than buyers do (Pope, 2008b; Wong, Yiu, & Chau, 2012). The issue of information asymmetry in the housing market and its effect on liquidity (Wong et al., 2012) and house price movements (Kurlat & Stroebel, 2015) were discussed in previous studies. However, none of those studies established a direct link between information asymmetry and home sellers' WTA (or buyers' WTP) and captured the manner by which information asymmetry influences the WTA–WTP disparity in the housing market. With these considerations in mind and by taking note of the internal validity of experiments, we seek to determine whether the observed WTA–WTP disparity in a market with heterogeneous assets and differentially informed parties is driven by information asymmetry.

Hypothesis 2. Information asymmetry affects the WTA–WTP disparity in the housing market.

If the supply side cannot meet the information required by the demand side, then the WTP value of the demand side should be substantially reduced. However, information disclosure is a potential means to correct this information gap in the housing market. Since the implementation of seller disclosure laws by each state in the US, the release of information has helped housing consumers make more informed decisions. For example, after information on school quality is disclosed to the public, housing consumers absorb such information promptly. Buyers push their WTP to a high level shortly after the release of information (Fiva & Kirkebøen, 2011). Nanda and Ross (2012) and Lützkendorf and Speer (2005), among others, examined the effect of disclosing detailed structural housing characteristics (e.g., property quality, condition, or performance of buildings) on the housing market. Homebuyers may require a large risk premium, which is usually reflected by a low bid price when they face any information ambiguity and uncertainty. The indicators of property quality and building performance, however, can substantially reduce such uncertainty and help facilitate an informed decision making process for housing consumers (Lützkendorf & Speer, 2005). On average, the risk premium that homebuyers applied to compensate for information uncertainty is reduced by 6.4% in US metropolitan areas. As a result, average property transaction price increases (Nanda & Ross, 2012). Similarly, the effect of disclosing locational housing characteristics on the residential real estate market was also discussed. Standard locational characteristics, such as distance to the nearest metro station, park, or supermarket, are publicly available to all citizens. The non-obvious information on environmental dis-amenity, such as airport noise, flood risk, and contaminated sites that housing consumers do not usually have access to, attracted considerable attention (Pope, 2008a; Votsis & Perrels, 2016; Walsh & Mui, 2017). In general, the disclosure of environmental dis-amenities reduces property values.

We postulate that, for any information that the supply side holds and is previously unpublished to the demand side, the release of information that home buyers deem desirable would increase their WTP. For the release of information deemed undesirable, owners and buyers would adjust their WTA and WTP, respectively. However, in the sale of

the property, the magnitude of the value adjustment of owners may be larger than that of potential buyers. In both cases, the WTA–WTP disparity is reduced.

Hypothesis 3. The release of information enables consumers to make informed decisions, thereby reducing the WTA–WTP disparity in the housing market.

3. Experimental strategy

Most existing WTA–WTP disparity experiments were conducted in classroom settings, and items of trivial values were utilised as instruments for participants (usually college students). Similar information was distributed to participants acting as buyers or sellers. The experimental setting of the current study is different from those of previous studies. The data utilised in this study are obtained from an online field experiment that uses big data on the Chinese resale housing market. The instruments utilised in the field experiment are actual properties on the market that home sellers own and intend to sell. The participants are real home owners and potential home buyers in Beijing, China who have indicated an interest to sell or buy resale properties by registering on a public platform that belongs to the China Index Academy, one of the largest real estate databanks in China. This platform is the same one used to conduct official surveys and collect official statistics on Chinese housing consumers. Therefore, we use this platform to recruit our experiment participants.

The experiment consists of two sequential stages that target homeowners and potential buyers in the market. **Stage one** (**sellers' experiment**) is designed for home sellers. In this stage, the information on the properties that sellers intend to sell (e.g. listed price, location and lot size) is collected. This stage is followed by **Stage two** (**buyers' experiment**) which is designed for buyers. In this stage, buyers are randomly assigned selected real properties obtained from Stage one. The buyers' experiment is conducted on the basis of these assignments. In both stages, the experiment participants (i.e. home owners and potential home buyers) are asked to complete a three-part questionnaire. **Parts A**, **B and C** provide data on identification, scenarios and background information, respectively. The experimental procedures of Stages one (sellers' experiment) and two (buyers' experiment) are shown in Fig. 1.

Part A which is labelled 'identification' constitutes the first part of the sellers' and buyers' experiment. Part A in Stage one (sellers' experiment) has 19 questions that aim to identify if a participant is a potential seller and to collect basic information on the property that this participant intends to sell (Table 1). Specifically, in Stage one, the experiment terminates when the participants do not meet the selection criteria established in this study (e.g. if property owners indicate that they do not have any plans of selling their properties in the near future, if the property for sale is not located in the areas covered by the experiment or if the property that an owner holds is a villa or an affordable home, etc.). Part A in Stage two presents 15 questions to identify whether a participant is a potential buyer who meets the criteria set in this study. For instance, the experiment will not proceed if a participant does not plan to buy a resale property in the near future, already owns more than two properties,[1] does not have the *hukou* of Beijing and has paid for tax and/or social securities in Beijing for less than five years or is not looking for a property located in the areas covered by the experiment. Several checkpoints were established to check the consistency of the participants' responses and to confirm further the ecological validity of the experiment. For example, the experiment will also terminate if a participant provides conflicting answers during the experiment. We use these selection criteria to filter eligible sellers and buyers. Our participants are then randomly selected from the population of eligible sellers or buyers via the China Index Academy platform. All participants who meet the criteria set in this study and pass all the consistency checks are instructed to answer Part B of the questionnaire.

Part B, which is labelled 'scenarios', requires participants to follow a sequence of scenarios that detail the current market price, historical information, market expectations, information asymmetry materials and others. The WTA or WTP values of participants are elicited from their responses.

Initially, home sellers are given current market information (see Seller.Scenario A) which is presented as the average price and price range of properties in the same neighbourhood with a similar unit type. The given average price and price range of a property are based on big data of the resale property market in Beijing and linked to the official statistics collected by the China Index Academy.

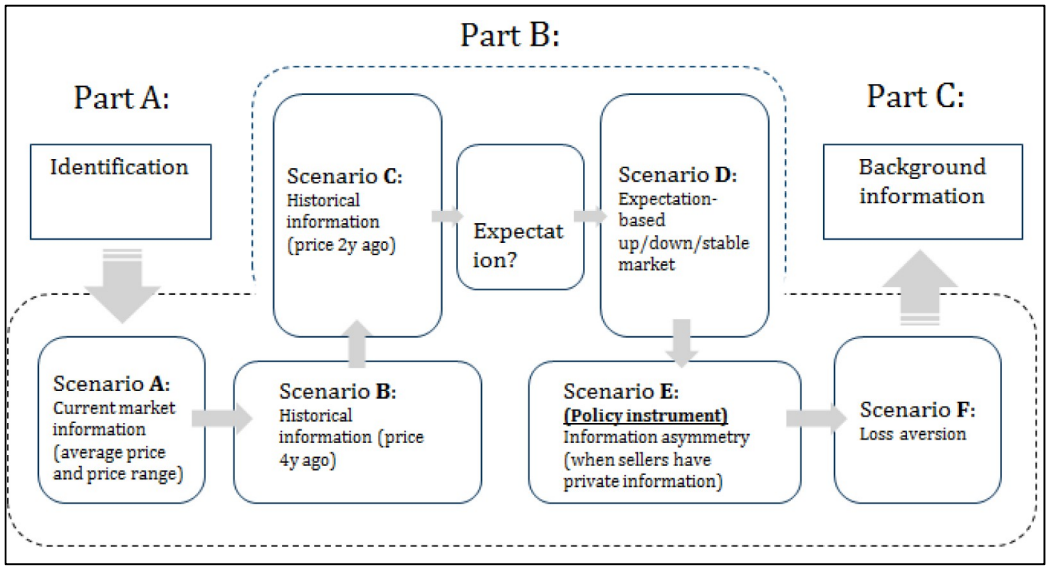
Second, historical information such as the prices two and four years ago is provided in the second and third scenarios, respectively. The first three scenarios aim to establish an existing up-market condition by using current market information and historical information. A similar design of the questionnaire and scenarios can be found in the work of Baucells, Weber, and Welfens (2011) and that of Paraschiv and Chenavaz (2011). The increase rates of property prices provided in Seller.Scenarios B and C are in accordance with the average increase in the Beijing housing market during the past two and four years.

Third, the participants are given an expectation-based up/down/stable market scenario. The design of this question is in line with the idea of the reference–dependent preference model proposed by Koszegi and Rabin (2006). In their model, the reference points are considered recent expectations of future outcomes. In other words, reference points can be determined by expected future outcomes or predictions. Similar conclusions can be found in the work of Morewedge and Giblin (2015). The importance of consumers' expectations in property value formation was also emphasised by Thanos and White (2017). Therefore, participants are asked about their expectations regarding the property market in Beijing. Thereafter, an up/down/stable market condition is assigned to them on the basis of their response.

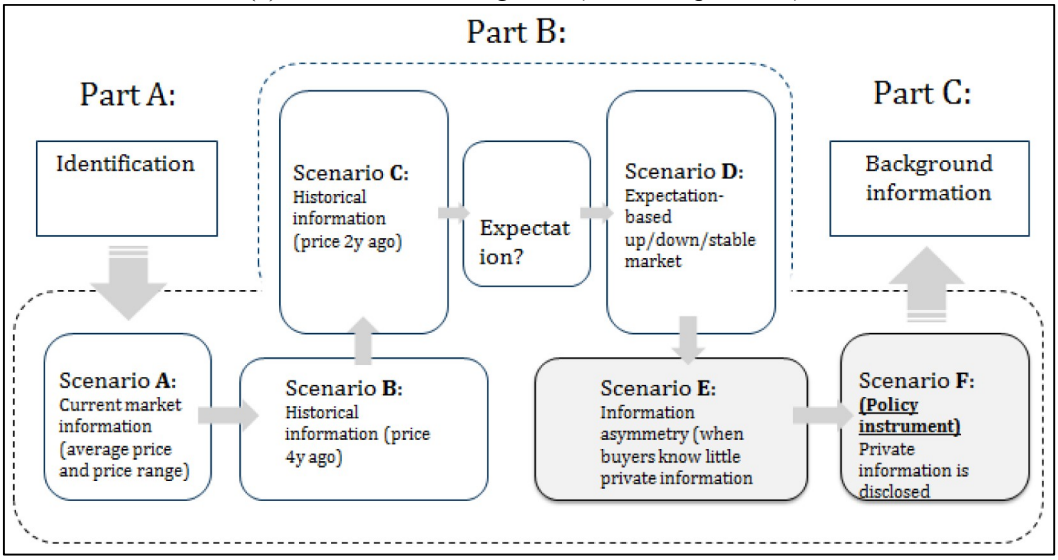
Fourth, a hypothetical scenario is given to home sellers to determine whether they update their WTA after the implementation of the policy instrument (e.g. suppose that the information disclosure law is in place and owners should consider the influence of any private information they hold such as structural defect). In this study, historical price information and neighbourhood characteristics (e.g. school catchment area) are given to participants. Standard locational characteristics are considered public information that can be accessed equally by home sellers and buyers. Environmental externalities are homogeneous across the study areas. Therefore, private information refers to structural characteristics (especially structural defects) as desirable structural characteristics are disclosed for marketing purposes. The rationale behind this hypothetical scenario is consistent with that of Wong et al. (2012). In particular, the structural defect used in this field experiment is the potential aging problem of electrical cables, which is considered as one of the biggest latent problems when purchasing resale properties in China because the quality of electrical cables used by real estate developers various greatly.

A standard randomised controlled trial (RCT) may use a between-subject design, in which Seller.Scenario E is given to participants in the treatment group only. Any observed difference between the responses from the control and those from the treatment groups should help us determine whether the treatment/intervention has functioned as intended. However, because of the uniqueness of the housing sector, we provide Scenario E to all home sellers in this field experiment and then compare the responses of sellers before and after the scenario are given. This strategy is rooted in the heterogeneous characteristics of the properties. If home sellers are divided into two groups, then making

[1] According to home purchase restrictions in Beijing, housing consumers who already own more than two properties are not eligible to purchase another property.



(a) Procedures of Stage one (sellers' experiment)



(b) Procedures of Stage two (buyers' experiment)

Fig. 1. Experimental procedures.

Table 1
Number of questions for each participant in each part.

	Stage one (sellers' experiment)	Stage two (buyers' experiment)
Part A –"identification"	19	15
Part B –"scenarios"	7	7
Part C –"background information"	10	10

sure that the participants and/or properties from the two groups are directly comparable at the baseline is difficult. Thus, any difference observed between the two groups may be contaminated because the given scenario is not the only difference between the two groups (e.g. noise may come from the heterogeneous characteristics of properties).

Fifthly, Seller.Scenario F is provided to the participants to determine whether sellers are loss averse. Similar to many experimental settings in psychology (e.g. Kermer, Driver-Linn, Wilson, & Gilbert, 2006; Paraschiv & Chenavaz, 2011), the setting used in the current study involves degree of satisfaction serving as a proxy for loss–gain (L/G) utility. Equal-sized loss and gain are assigned to sellers to create loss and gain domains, respectively. An L/G ratio is then calculated. Participants are loss averse if the L/G ratio is greater than 1. A similar approach was used by Harinck, van Beest, van Dijk, and van Zeeland (2012). Specifically, assuming that an individual's utility would increase by 2 units (e.g. the degree of satisfaction increases from 5 to 7) for an RMB 200,000 gain, we then ask the participants how they would value their degree of satisfaction if they face an equal-sized loss (i.e. RMB 200,000). Participants are considered loss averse when their degree of satisfaction decreases to below 3.[2] This scenario is included at the end of Part B in the sellers' experiment because loss aversion is used as a control variable only in the analysis of the WTA–WTP disparity. The interaction between loss aversion and the policy instrument is beyond the scope of this study.

Part B in the buyers' experiment is commenced by assigning the properties obtained from sellers' experiment to the buyer participants. Specifically, in accordance with homebuyers' housing preferences and

[2] The experiment will be terminated if a participant selects a degree of satisfaction of 5 or higher for the loss.

Table 2
Calculation of WTA–WTP gaps.

Calculation	Label	H1	H2	H3
Seller.Scenario D minus Buyer.Scenario D	Gap 1: Information asymmetry is not considered	×	×	
Seller.Scenario D minus Buyer.Scenario E	Gap 2: A high level of information asymmetry exists.		×	×
Seller.Scenario E minus Buyer.Scenario F	Gap 3: Private information is disclosed			×

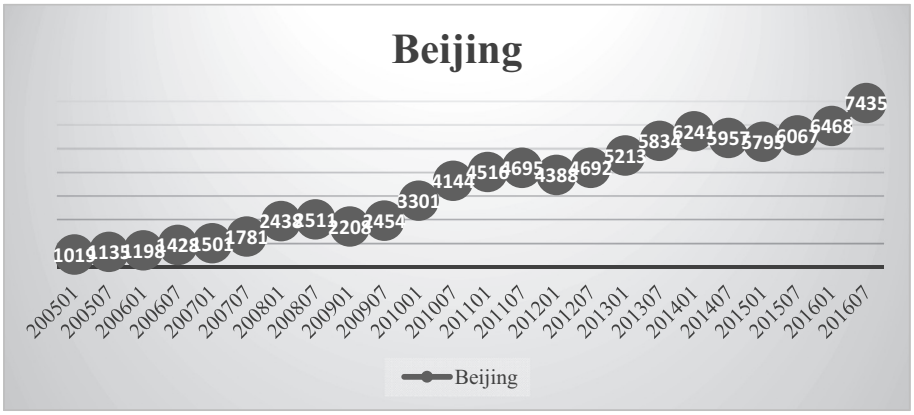


Fig. 2. *Re*-sale housing price index in Beijing from 2005 to 2016.

affordability, each participant is assigned five real properties obtained from Stage one (sellers' experiment) and asked to select one property to commence Part B ('scenarios'). For example, if a buyer participant expresses interest in buying properties in Chaoyang (one of the administrative districts in Beijing) with a budget of RMB 5 million, then the system randomly selects five properties in Chaoyang with a list price less than or equal to RMB 5 million for the buyer. The system then asks the buyer to select one property to commence Part B of the experiment. The first four scenarios (i.e. Scenarios A to D; refer to Fig. 1) used in the sellers' and buyers' experiments are the same. However, in the case of the latter, the maximum price that a participant is willing to pay for the property (i.e. WTP) is asked and recorded, with the same argument provided for the earlier case.

After the assignment of the expectation-based up/down/stable market condition (Buyer.Scenario D) to the home buyers, two hypothetical scenarios (Buyer.Scenarios E and F) with information asymmetry materials are created. In Buyer.Scenario E, homebuyers know limited private information but are reminded about the general latent problems of the resale property. Given the high level of information asymmetry, buyers may apply a discount on future cash flows to compensate for any uncertainty and risk. In Buyer.Scenario F, home buyers receive the policy instrument. Specifically, the level of information asymmetry is reduced by disclosing part of the private information. Home buyers are informed that the structural quality of the properties they are interested in is excellent, except for the quality of the cables. This scenario is given to all home buyers, with the same argument provided for the sellers' experiment.

Part C of the questionnaire is labelled 'background information'. The questions include social and cultural values (Lin & Lin, 2006; Maddux et al., 2010), educational level/experience (Bao & Gong, 2016; List, 2003, 2004; Plott & Zeiler, 2005), income effect (He & Asami, 2014) and gender (Dommer & Swaminathan, 2012). All information obtained from this part is used as control variables in the subsequent analysis. In addition, the participants' risk preferences are measured. They are asked to participate in a mock 'speed lottery' task (the question can be found in the Appendix). The design of this question is in line with that of Hanaoka, Shigeoka, and Watanabe (2018) who aimed to capture their participants' risk preferences. A participant is more risk seeking (risk averse) if he or she spends more (less) on this 'speed lottery' than others do.

Three hypotheses are then tested by comparing sellers' WTA and buyers' WTP obtained from different scenarios. For example, Hypothesis 1 is tested by using the WTA obtained from Seller.Scenario D and the WTP obtained from Buyer.Scenario D. The gap is labelled 'Gap 1: Information asymmetry not considered' which is similar to the WTA–WTP disparity in previous WTA–WTP disparity experiments and serves as a benchmark in this study. Subsequently, Gap 2 is calculated by subtracting the WTP of Buyer.Scenario E from the WTA of Seller.Scenario D, in which home sellers have information advantage, whereas buyers have little private information. Gap 2 can be observed from the market if a high level of information asymmetry exists. Gap 3 is the outcome if a policy instrument for information disclosure is in place, which serves as the ultimate goal. In this case, home sellers receive the signal to consider the discounting factor of structural defects. In the meantime, part of the private information is disclosed to home buyers (see Table 2 for details).

4. Results and discussion

4.1. Beijing housing market

Our experiments were conducted from January to early February 2016 in Beijing, China. The Chinese housing market has been particularly buoyant, especially over the last 10 years, as property prices in Beijing have grown considerably. The house price-to-income ratio is estimated to be 10.2 at the national level and 19.1 in Beijing alone. Both rates are significantly higher than the average rates in most Western countries but are at par with those of major metropolitan cities, such as London and New York. Fig. 2 shows that, despite a marginal slowdown in the growth rate in the resale housing market in Beijing after the global financial crisis, the overall trend observed since 2005 has remained strongly upward. From 2005 to 2016, the resale housing price index in Beijing increased by more than sevenfold, from 1019 to approximately 7500.[3]

The People's Bank of China and the Chinese government have issued a series of monetary and fiscal policies since the last quarter of 2014. These policies include cutting the benchmark one-year lending interest rate six times from 6.0% to 4.35%, cutting the required reserve ratio for banks five times from 20% to 17% and lowering the minimum down payment ratio for home purchases across different types of home buyers (e.g. first-time buyers with or without mortgages provided under the Housing Provident Fund and

[3] Source: http://fdc.fang.com/index/ErShouFangIndex.html.

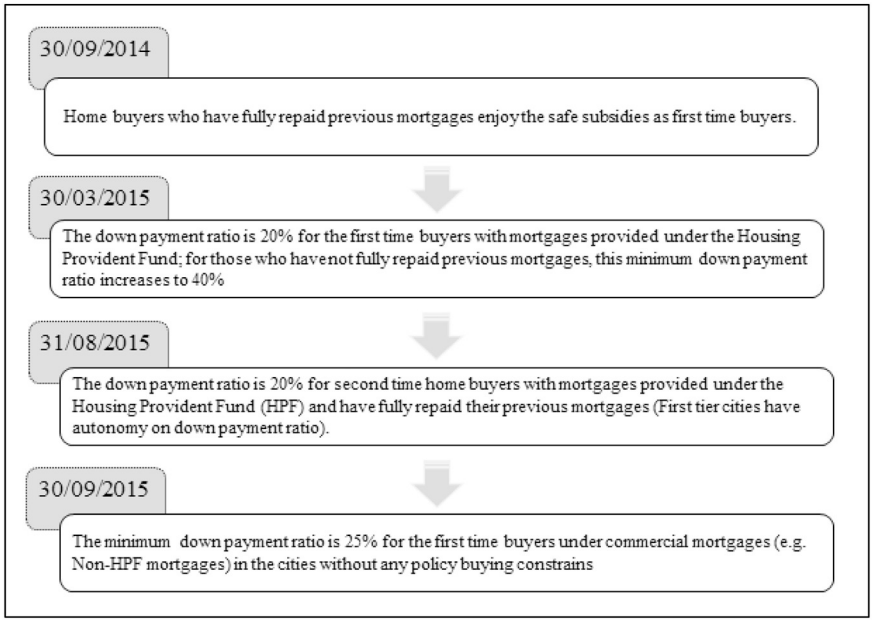


Fig. 3. Policies on the down payment ratio.

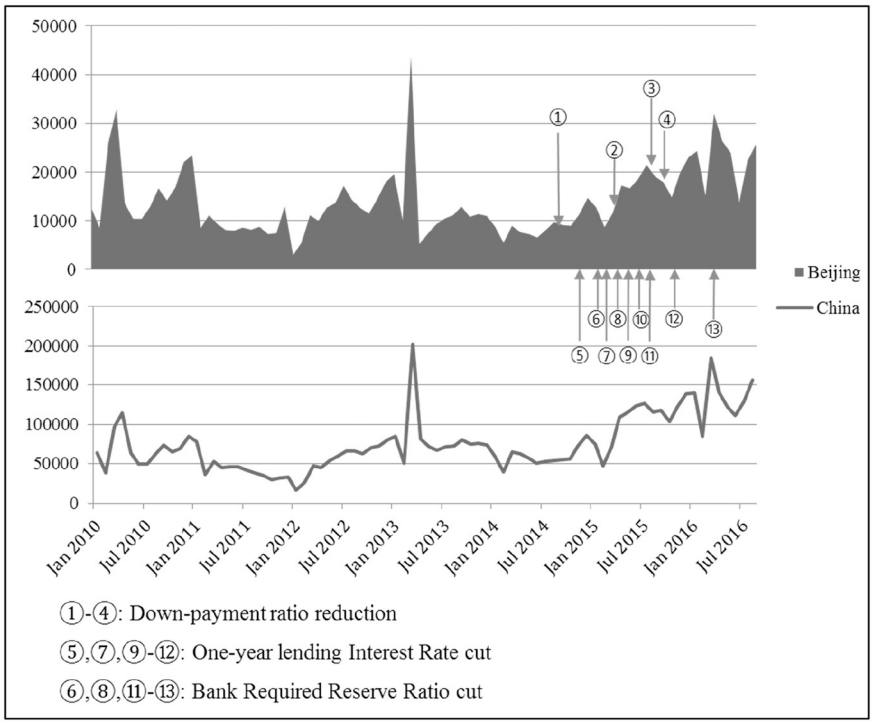


Fig. 4. Trading volume in the re-sale housing market in Beijing alone and in representative cities of China (2010–2016).[4]

home buyers looking to move up the property ladder, see Fig. 3).

The Chinese government has also lifted the long-time controversial One-Child Policy, thereby allowing a second child for all Chinese parents. The rapid expansion of the housing market in China is highly correlated with these new policies. These policies have directly (e.g. lowering the cost of mortgages to make buyers easily climb up the property ladder) or indirectly (e.g. allowing a second child boosts the demand for home upgrades) fuelled housing market expansion, thereby contributing to the phenomenal growth seen in recent years.

If the property market in Beijing is indeed going through an 'up' market phase, as shown by its price index (Fig. 2), then capital should have flowed swiftly into the housing sector. This situation should make the selling of properties easier than before and leads to a high trading volume (Fisher et al., 2003). Property prices have grown consistently over the decades, with all the government and central bank policies promising to stimulate the market. However, housing market transaction volume has not seen significant growth (Fig. 4). Transaction volumes between 2014 and 2016 were very volatile. Several monetary and fiscal policies have been observed to boost the market, but many others have proved less

[4] The representative cities are Beijing, Shanghai, Guangzhou, Shenzhen, Tianjin, Wuhan, Suzhou, Nanjing, Hangzhou, and Chengdu. Data are provided by the China Index Academy.

Fig. 5. Selected administrative districts for the field experiment.

Table 3
Summary of the statistics of Beijing and selected administrative areas.

	Beijing	Chaoyang	Haidian	Fengtai
Population (10,000)	2114.8	384.1	357.6	226.1
GDP (billion)	1950.06	396.36	383.52	100.78
Disposable income (RMB)	40,321	41,035	45,953	37,886
Transaction volume	25,711	7105	3010	2420

Source: http://www.bjstats.gov.cn/nj/qxnj/2014/zk/indexch.htm

effective (e.g. policies 3, 4, 6 and 11, as shown in Fig. 4). Apparently, the Beijing property market is not as active as expected by policy makers. Home owners and home buyers seem reluctant to trade in the resale housing market. Selling or buying properties is not easy, thus contradicting the prevailing 'up' market trend. The stagnation of market liquidity has been a rising concern for policy makers and academic scholars.

4.2. Data description

After removing the outliers, a total of 348 complete questionnaires are collected in this study, with 111 coming from real home owners (on-sale properties) and 237 from home buyers. The properties used in the experiment cover three out of 17 administrative districts, namely, Chaoyang, Haidian and Fengtai (Fig. 5). These areas are selected because they are the most popular and representative metropolitan areas in urban Beijing. As the largest administrative district in urban Beijing, Chaoyang accommodates most foreign embassies and 18.2% of residents. With > 20% of Beijing's GDP generated in Chaoyang, this district has the largest transaction volume among all administrative districts (Table 3). Haidian is the second largest administrative district in urban Beijing in terms of population and size. Most universities in Beijing and several good primary and secondary schools are located in this administrative district. The disposable income of Haidian's residents ranks first among all administrative districts in Beijing. The trading volumes in Haidian and Fengtai account for 11.7% and 9.4% of the total transaction volume in Beijing, respectively. The transaction volumes in Table 3 are based on official statistics collected by the China Index Academy in December 2015, which was one month before our experiments were conducted.

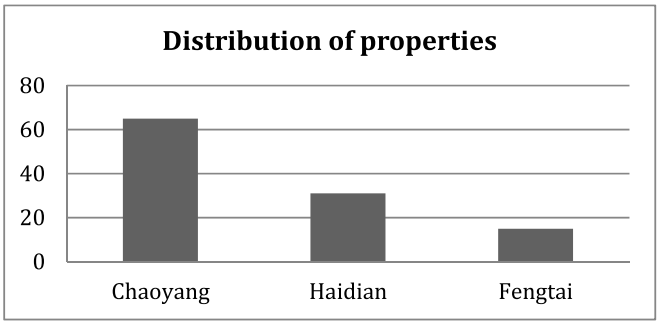


Fig. 6. Distribution of properties from the experiment.

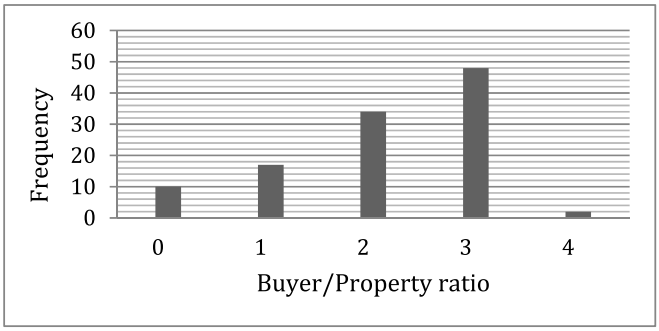


Fig. 7. Buyer/Property ratio.

The distribution of the properties obtained in the experiment (Fig. 6) is consistent with the distribution of transaction volumes in Beijing (refer to the last row of Table 3), thereby indicating that the collected sample is representative.

The buyer/property ratio of each property is not fixed and ranges from 0 to 4 (see Fig. 7), indicating that the properties are not equally popular. The average buyer/property ratio is 2.6. More than 90% of the properties were selected by at least one buyer.

4.3. Empirical results

Hypothesis 1. The WTA–WTP disparity exists in the housing market.

To test whether the WTA–WTP disparity generally exists in the housing market, we stack the WTA obtained from Seller.Scenario D and the WTP obtained from Buyer.Scenario D to form a column vector which we place in a difference-in-differences framework. All WTA and WTP values are standardised to a base of RMB 1000. A dummy variable *Participant* is included as an independent variable which equals 1 for sellers and 0 otherwise. A total of 12 other variables are included to control for the effect of the participants' social and cultural values (e.g. *Policy* and *Mkt*) and demographic background (e.g. *Income*, *Age*, *Gender* and *Edu*) on WTA and WTP.[5] Hedonic housing characteristics are also included to control for the heterogeneity among individual properties (e.g. *School*). A list of variable definitions can be found in Table 4. Specifically, *Mkt* is included to control for participants' market expectations, and equals 1 if the participant has a down-market expectation. Only 4% of participants believe that the property price in the near future will drop. *Policy* equals 1 if the participant's housing decision will be affected by recently introduced policies. Approximately 10% of

[5] *Loss_aversion* and *Affordability* are included in the tests of Hypotheses 2 and 3 only. *Loss_aversion* is designed for sellers only, whereas *Affordability* works for buyers only. These two variables affect the gap between the WTA and the WTP only. In the test of Hypothesis 1, the dependent variables are the WTA and WTP values rather than the gap; thus *Loss_aversion* and *Affordability* are not included in this step of analysis.

Table 4
Variable definition.

Variable	Definition	Mean	SD
Participant	=1 if seller; 0 if otherwise	0.500	0.501
Mkt	=1 if participant has a down-market expectation; 0 if otherwise	0.044	0.206
Income	=1 if participant's income > 11,000 RMB; 0 if otherwise	0.688	0.464
Affordability	Maximum amount that homebuyers can afford (in RMB)	3,964,346	1,105,866
Policy	=1 if participant's housing decision will be affected by the recently introduced policies; 0 if otherwise	0.122	0.328
Age	=1 if participant is under 28 years old; 0 if otherwise	0.112	0.315
Gender	=1 if participant is female; 0 if otherwise	0.371	0.484
Edu	=1 if participant has a bachelor's degree or above; 0 if otherwise	0.920	0.272
Occp	=1 if participant is in the real estate sector; 0 if otherwise	0.137	0.344
School	=1 if property is in a good school catchment area; 0 if otherwise	0.468	0.500
Haidian	=1 if property is in Haidian; 0 if otherwise	0.283	0.451
Chaoyang	=1 if property is in Chaoyang; 0 if otherwise	0.637	0.481
Holding	=1 if seller's holding period is less than five years; 0 if otherwise	0.646	0.479
Loss_aversion	=1 if seller is loss averse; 0 if otherwise	0.409	0.493

participants indicate that their housing decision will be affected by recently introduced policies. Two thirds of participants report a household income of over RMB 11000, and most participants have a bachelor's degree or higher; these characteristics are consistent with those reported by Zhang, Sun, Liu, and Zheng (2016). The majority of our participants are over 28 years old, and 37% are females. Nearly half of the collected properties are located in the good school catchment area. Two thirds of the properties had been held by their owners for less than five years.

Table 5 presents the results for Hypothesis 1. The coefficient of interest is *Participant*. A positive and significant coefficient of *Participant* implies that the WTA of sellers is generally higher than the WTP of buyers. We first run a univariate analysis. It can be seen from Model 1 in Table 5, the coefficient of *Participant* is statistically significantly larger than zero at the 1% significance level. The result of the univariate regression implies that the WTA of sellers is RMB 29,815 higher than the WTP of buyers (per RMB 1 million). Subsequently, 11 other independent variables are added in the regression analysis. Although the significance of *Participant* in Model 2 decreases, the coefficient estimation remains positive and statistically significant (at the 10% level, as denoted in bold in Table 5) under the control of the given variables. All else being equal, the sellers' WTA is higher than the buyers' WTP by RMB 23,072 per RMB 1 million. This difference is independent of participants' social and cultural values, demographic background and hedonic characteristics of properties. As we use the WTA (WTP) values obtained from Seller.Scenario D (Buyer.Scenario D), such values are formed after accounting for market trend (e.g. market boom or crash) and market expectations.

The coefficient estimates of other significant variables are as expected. For example, housing market players with a bachelor's degree or higher would have higher WTA or WTP values than others. The same is anticipated from the participants who work in the real estate sector. All estimations of coefficients reported in Table 5 are based on White heteroskedasticity-consistent standard errors and covariance. All Variance Inflation Factor (VIF) statistics are relatively low, which indicate that the correlation among the included independent variables is low. No serious variance inflation and bias issues exist in the model. The results indicate that the WTA–WTP disparity exists in the housing market and thus support the first hypothesis.

Hypothesis 2. Information asymmetry affects the WTA–WTP disparity in the housing market.

Once the WTA–WTP disparity is confirmed, the sellers and buyers are paired according to their property code. This is done in order to obtain the WTA–WTP disparity of each individual property. The calculation of the WTA–WTP disparities is presented in Table 2.[6] As indicated in Table 2, we use two WTA–WTP disparities calculated from different scenarios (i.e. Gap 1 and Gap 2) to facilitate the testing for Hypothesis 2. Hypothesis 2 can be supported if Gap 2 is significantly larger than Gap 1 is. To test whether Gap 2 is statistically significantly larger than Gap 1 with other factors held constant, we stack two disparities to form a column vector (*Gaps*). We then use *Gaps* as the dependent variable and place it in a difference-in-differences model. A dummy variable *Full_IA* is included as the independent variable which equals 1 if the gap is from the high information asymmetry scenario. In

Table 5
Regression results for H1

Variable	Model 1 coefficient	Model 2 coefficient	Model 2 VIF
c	985.126***	940.030***	–
Participant	**29.815*****	**23.072***	1.071
Mkt		−54.541	1.102
Income		−17.889	1.194
Policy		23.097	1.188
Age		−7.237	1.101
Gender		−14.405	1.144
Edu		85.530***	1.124
Occp		30.240*	1.142
School		−2.478	1.174
Haidian		30.146	3.734
Chaoyang		−57.740**	3.650
Holding		20.330	1.284
Adj R^2	0.856%	9.872%	
F-statistic	5.084	5.318	

This table presents regression results for H1. To test whether WTA–WTP disparity generally exists in the housing market, we stack WTA and WTP to form a column vector and place it in a difference-in-differences framework. The dependent variable is WTA obtained from Seller.Scenario D and WTP obtained from Buyer.Scenario D.
A dummy variable *Participant* is included as an independent variable, which equals 1 for sellers and 0 if otherwise. *Mkt* = 1 if participant has a down-market expectation; 0 if otherwise. *Income* = 1 if participant's income > 11,000 RMB; 0 if otherwise. *Policy* = 1 if participant's housing decision will be affected by the recently introduced policies; 0 if otherwise. *Age* = 1 if participant is under 28 years old; 0 if otherwise. *Gender* = 1 if participant is female; 0 if otherwise. *Edu* = 1 if participant has a bachelor's degree or above; 0 if otherwise. *Occp* = 1 if participant is in the real estate sector; 0 if otherwise. *School* = 1 if property is in a school catchment area; 0 if otherwise. *Haidian* = 1 if property is in Haidian; 0 if otherwise. *Chaoyang* = 1 if property is in Chaoyang; 0 if otherwise. *Holding* = 1 if seller's holding period is less than five years; 0 if otherwise. The coefficient of interest is *Participant*. A positive and significant coefficient of *Participant* implies the WTA of sellers is generally higher than the WTP of buyers.
*** $p < 1\%$.
** $p < 5\%$.
* $p < 10\%$.

[6] In the subsequent analysis, the calculation of the WTA–WTP gaps is based on the responses from Scenarios D to F. These calculations are based on the WTA and WTP values formed after market expectations are established. Scenarios A to C are included in the experiments as part of the validity and reliability checks.

addition to the independent variable included in the testing of Hypothesis 1, *Loss_aversion*, a well-established contributor to the WTA–WTP disparity, is incorporated to control for any endowment effect (Thaler, 1980). Buyers' *Affordability* is also included as it might affect buyers' WTP and the WTA–WTP disparity.

Table 6 presents the results for Hypothesis 2. The coefficient of interest is *Full_IA*. A positive and significant coefficient estimation of *Full_IA* implies information asymmetry that enlarges the WTA–WTP gap. Three models are estimated to test this hypothesis. Model 1 includes basic driving forces (e.g. information asymmetry, psychological forces, market expectations and income effect) only. Subsequently, we control for nine confounding factors (e.g. age, gender, education and hedonic characteristics of properties) in Model 2. As the WTA–WTP gaps are determined by both sellers and buyers, we include the interaction terms between *Participant* and various characteristics to capture the incremental effect of being a seller in Model 3.[7] Table 6 shows that Model 1 has the lowest adjusted R-squared. Models 2 and 3 marginally improve the explanation power over Model 1. Model 3 includes the confounding factors and interaction terms between *Participant* and various characteristics with the highest goodness of fit. Hence, our subsequent discussions are inferred from the regression results of Model 3. The result indicates that information asymmetry persistently causes the WTA–WTP disparity to be RMB 69.067 (per RMB 1000) greater than the benchmark gap is. In other words, for every RMB 1 million, a gap of RMB 69,067 between WTA and WTP is due to information asymmetry.

In addition, the gap increases by RMB 33,378 when sellers have a high degree of loss aversion. Sellers are reluctant to sell if they are sensitive to potential losses. The so-called endowment effect may be one of the explanations. Moreover, five out of nine control variables are significant in our model. The coefficient estimations of control variables, such as *Policy*, *Age* and *Gender*, are as expected and in line with those in previous studies. For example, participants who believe that recently introduced policies would benefit them exhibit a lower WTA–WTP gap. Two out of five interaction terms between *Participant* and various characteristics are significant in Model 3. Specifically, young sellers may exhibit a low WTA–WTP gap in general. However, when the seller works in the real estate sector, the WTA–WTP gap tends to be higher (*Participant*Occp* = 47.822*). This finding is consistent with that of the previous literature which indicates that real estate agents sell their own properties at prices higher than those of similar client-owned properties (Rutherford et al., 2007).

All estimations of the coefficients are based on White heteroskedasticity-consistent standard errors and covariance. Model 3 passes the Ramsey RESET test (*F*-stat = 0.435, *p* value = 0.648) and is thus assumed free from omitted variable bias. All VIF statistics are less than 10 which indicate that the correlation among the included independent variables is low. No serious variance inflation and bias issues exist in the model. In summary, the regression results support the second hypothesis stating that when all other conditions are equal, information asymmetry affects the WTA–WTP disparity in the housing market.

Hypothesis 3. The release of information enables consumers to make informed decisions, thereby reducing the WTA–WTP disparity in the housing market.

The effect of information asymmetry on the WTA–WTP disparity in the housing market is significant because of market frictions. However, the policy instrument for information disclosure effectively eliminates many of the effects of information asymmetry. As indicated in Table 2, we use the two WTA–WTP disparities calculated from different scenarios (i.e., Gap 2 and Gap 3) to facilitate the testing for Hypothesis 3. Hypothesis 3 can be supported if Gap 3 is significantly smaller than Gap 2. To test whether Gap 3 is statistically significantly smaller than Gap 2 whilst holding other factors constant, we again stack the two disparities to form a column vector (*Gaps*) and use *Gaps* as the dependent variable in a difference-in-differences model. A dummy variable *Infor_Dis* is included as the independent variable which equals 1 if the gap is from the information disclosure scenario. The set of independent variables and interaction terms used in the regression analysis is the same as that used in Model 3 in Table 6.

Table 7 presents the results for Hypothesis 3. The coefficient of interest is *Infor_Dis*. A negative and significant coefficient estimation of *Infor_Dis* implies that the release of information reduces the WTA–WTP disparity. As can be seen, the release of private information reduces the WTA–WTP disparity by RMB 45,424 (per RMB 1 million). The coefficient estimates of other significant variables are as expected. All estimations of the coefficients are based on White heteroskedasticity-consistent standard errors and covariance. The model passes the Ramsey RESET test (*F*-stat = 0.009, *p* value = 0.991), thereby suggesting that

Table 6
Regression results for H2

Variable	Model 1 coefficient	Model 2 coefficient	Model 3 coefficient	Model 3 VIF
c	25.023	44.322	50.545	–
Full_IA	69.067***	69.067***	69.067***	1.023
Loss_aversion	28.589***	36.145***	33.378***	1.506
Participant	4.738	11.911	22.838*	2.136
Mkt	−86.384***	−87.059***	−56.314	3.125
Income	−50.639***	−39.435***	−45.934***	1.214
Affordability	0.071	0.102**	0.099**	1.309
Policy		−35.163**	−49.160*	5.149
Age		15.228	50.602**	2.148
Gender		23.409**	31.965**	2.116
Edu		−32.129	−36.342	1.171
Occp		7.424	−15.849	2.108
School		18.819*	21.804**	1.386
Haidian		−46.178**	−48.373**	5.025
Chaoyang		−20.907	−25.580	4.938
Holding		−8.424	−4.877	1.281
*Participant*Mkt*			−15.505	3.848
*Participant*Policy*			26.222	5.635
*Participant*Age*			−92.168***	2.951
*Participant*Gender*			−30.720	2.692
*Participant*Occp*			47.822*	2.213
Adj R^2	8.616%	10.151%	10.933%	
F-statistic	15.882	8.133	6.812	

This table presents regression results for H2. Two gaps calculated from different scenarios are stacked to form a column vector (*Gaps*). We then use *Gaps* as the dependent variable and placed it in a difference-in-differences model. *Full_IA* = 1 if the gap is in a scenario with a high level of information asymmetry; 0 if otherwise. *Loss_aversion* = 1 if seller is loss averse; 0 if otherwise. A dummy variable *Participant* is included as an independent variable, which equals 1 for sellers and 0 if otherwise. *Mkt* = 1 if participant has a down-market expectation; 0 if otherwise. *Income* = 1 if participant's income > 11,000 RMB; 0 if otherwise. *Affordability* measures the maximum amount that homebuyers can afford. *Policy* = 1 if participant's housing decision will be affected by the recently introduced policies; 0 if otherwise. *Age* = 1 if participant is under 28 years old; 0 if otherwise. *Gender* = 1 if participant is female; 0 if otherwise. *Edu* = 1 if participant has a bachelor's degree or above; 0 if otherwise. *Occp* = 1 if participant is in the real estate sector; 0 if otherwise. *School* = 1 if property is in a school catchment area; 0 if otherwise. *Haidian* = 1 if property is in Haidian; 0 if otherwise. *Chaoyang* = 1 if property is in Chaoyang; 0 if otherwise. *Holding* = 1 if seller's holding period is less than five years; 0 if otherwise. The coefficient of interest is *Full_IA*. A positive and significant coefficient of *Full_IA* implies information asymmetry enlarges the WTA-WTP gap.

*** $p < 1\%$.
** $p < 5\%$.
* $p < 10\%$.

[7] *Participant*Edu* was included in our regression analysis. However, this variable is highly correlated with our independent variables. The VIF of *Participant*Edu* is as high as 25. We therefore remove *Participant*Edu* in the regression results reported here. The exclusion of *Participant*Edu* does not affect the loading of the coefficient estimations of other variables.

Table 7
Regression results for H3

Variable	Coefficient	VIF
c	85.298**	–
Infor_Dis	−45.424***	1.025
Loss_aversion	28.449**	1.489
Participant	26.003*	2.153
Mkt	−87.382*	3.684
Income	−41.092***	1.141
Affordability	0.158***	1.296
Policy	−37.436	4.811
Age	71.682***	2.280
Gender	42.749***	2.085
Edu	−23.668	1.160
Occp	−22.012	2.193
School	10.652	1.331
Haidian	−52.255**	4.851
Chaoyang	−19.493	4.789
Holding	−13.626	1.193
*Participant*Mkt*	29.051	4.520
*Participant*Policy*	31.224	5.396
*Participant*Age*	−125.798***	3.118
*Participant*Gender*	−32.870	2.712
*Participant*Occp*	33.692	2.382
Adj R^2	8.599%	
F-statistic	5.455	

This table presents regression results for H3. Two gaps calculated from different scenarios are stacked to form a column vector (*Gaps*). We then use *Gaps* as the dependent variable and placed it in a difference-in-differences model. *Infor_Dis* = 1 if the gap is obtained from the scenario after private information is disclosed; 0 if otherwise. *Loss_aversion* = 1 if seller is loss averse; 0 if otherwise. A dummy variable *Participant* is included as an independent variable, which equals 1 for sellers and 0 if otherwise. *Mkt* = 1 if participant has a down-market expectation; 0 if otherwise. *Income* = 1 if participant's income > 11,000 RMB; 0 if otherwise. *Affordability* measures the maximum amount that homebuyers can afford. *Policy* = 1 if participant's housing decision will be affected by the recently introduced policies; 0 if otherwise. *Age* = 1 if participant is under 28 years old; 0 if otherwise. *Gender* = 1 if participant is female; 0 if otherwise. *Edu* = 1 if participant has a bachelor's degree or above; 0 if otherwise. *Occp* = 1 if participant is in the real estate sector; 0 if otherwise. *School* = 1 if property is in a school catchment area; 0 if otherwise. *Haidian* = 1 if property is in Haidian; 0 if otherwise. *Chaoyang* = 1 if property is in Chaoyang; 0 if otherwise. *Holding* = 1 if seller's holding period is less than five years; 0 if otherwise. The coefficient of interest is *Infor_Dis*. A negative and significant coefficient of *Infor_Dis* implies that the release of information reduces the WTA-WTP gap.

*** $p < 1\%$.
** $p < 5\%$.
* $p < 10\%$.

the model does not suffer from omitted variable bias. All VIF statistics are less than 10 which indicate that the correlation among the included independent variables is low. No serious variance inflation and bias issues in the model are indicated. This evidence supports the last hypothesis stating that the WTA–WTP disparity is significantly reduced after information disclosure. Three reasons explain why housing consumers may decrease their relative WTP, leading to an enlarged WTA–WTP disparity when information gaps exist between sellers and buyers. We also provide illustrations on how smart disclosure helps in generating smart decision makers. The WTA–WTP disparity decreases after information disclosure because buyers and seller may adjust their price. Specifically, buyers' WTP rises for the following reasons.

First, in the resale housing market, a homeowner may form a new estimation of property conditions (e.g. a new probability to future risk or maintenance cost) after owning the property for a certain period. This estimation should be more accurate than the one that the homeowner formed when buying the property and the one formed by potential buyers. Information asymmetry between owners and potential buyers then occurs endogenously. Buyers may face a range of uncertainties, such as any differences in future risks as perceived by buyers and actual future risk. To mitigate this uncertainty, potential buyers may irrationally overestimate the probability and/or risk of future maintenance. Consequently, consumers may apply for a large discount on future cash flows to compensate for any uncertainty and risk. Thus, a low WTP is set which in turn widens the WTA–WTP disparity in the housing market. This phenomenon corroborates the uncertainty hypothesis in previous studies, that is, ambiguity increases the WTA–WTP disparity (Brown, 2005; Casey, 1995; Shefrin & Caldwell, 2001). However, a policy instrument for information disclosure reduces the ambiguity and uncertainty faced by housing consumers. Such information helps homebuyers adjust their judgment and estimation on future maintenance cost towards the direction of true probability. As a result, the disclosure of information on property conditions eliminates the information uncertainty caused by information gaps. Buyers' WTP rises and ultimately reduces the WTA–WTP disparity.

Second, decision makers usually use their own experience in the market to form and update any belief about the market and products. However, given the uniqueness of the housing sector, consumers in this market have little practice and lack experience. Hence, they would place greater value on information regarding market and property conditions in the housing sector than on the information in other markets. Housing consumers may spend more time than usual in searching for the information that they need through research, enquiries and visual inspections. The time and money that they spend on searching are likely to reduce their WTP (Chang et al., 2016). This explains why informed decision makers typically make smarter decisions than others do. For example, real estate agents sell their own properties at a price higher than those of similar client-owned properties (Rutherford et al., 2007). Out-of-state buyers tend to have lower WTP than local buyers do because of higher search cost (Chang et al., 2016). Home buyers are willing to increase their WTP for green housing if they are provided with reliable and concrete information set by the government (Zhang et al., 2016). If the supply side successfully meets the information requested by the demand side and if an effective information exchange system between the two sides is created, then consumers can extract the information that may serve as signal for the informed decision-making process during property transactions (Lützkendorf & Speer, 2005). If the information exchange substantially saves time and money for consumers, then the WTP values would increase and the WTA–WTP disparity would be reduced.

Third, resale properties are of unequal quality. Homeowners are knowledgeable about the conditions of their properties, whereas potential buyers face quality uncertainty. If informed sellers take advantage of this information asymmetry and take inappropriate actions during the transaction (e.g. hiding structural defects), then less-informed buyers may have to pay for the consequences when they face repair/maintenance bills that are heavier than expected for their new property. This situation is known as moral hazard. To act against information ambiguity, consumers may underestimate property quality and demand a high risk-premium. Hence, WTP is priced down. We may also observe house price drop and market efficiency loss (Brown & Gregory, 1999; Izquierdo & Izquierdo, 2007). Releasing information on property conditions helps consumers adjust the risk premium they demand. As a result, WTP values increase after information disclosure.

Conversely, homeowners should be aware that hiding private information and setting an irrationally high WTA, as if their belongings are not ‘lemons’ (an American expression referring to inferior goods), may pose imminent risk to their properties because these houses may sit on the market for a long time. Therefore, such policy instrument that supports information disclosure also changes the behaviour of homeowners as WTA may move towards the market fair value. In other words, sellers' WTA may decline and contribute to the reduction of the WTA–WTP disparity.

4.4. Robustness checks

In addition to the variables utilised in the model specification, psychological forces (i.e. loss aversion) are confirmed through

alternative methods (e.g. risk preference). According to prospect theory, loss aversion is revealed by individuals' asymmetric behaviour in different domains. The asymmetry originates from the asymmetric risk preferences in the gain and loss domains. Specifically, individuals are risk averse in the gain domain but risk seeking in the loss domain. Risk-averse individuals are prone to be affected by uncertainty, which in turn makes them loss averse (Georgantzis & Navarro-Martnez, 2010). The results obtained from the question on risk preferences in the experiment are consistent with the prediction of prospect theory. The risk preferences of home sellers and buyers are significantly different. When *Loss_aversion* is replaced by the risk preference of buyers and sellers, the WTA–WTP disparity narrows if sellers are risk averse or if buyers are risk seeking. This finding is consistent with that of Georgantzis and Navarro-Martnez (2010).

5. Conclusions

This study examines the effect of information disclosure on the changing behaviour of housing consumers during transactions and discusses the dynamics of potential market outcomes. We conduct a field experimental investigation within the property market and find that the WTA–WTP disparity exists. However, a policy instrument for information disclosure enables decision makers to update their WTA or WTP accordingly. The release of information helps consumers adjust their judgment and estimation on future maintenance cost towards the direction of true probability, reduces any time and cost spent on searching for information and corrects the high risk-premium they demand in buying resale properties. Informed decisions can then be made by housing consumers. The WTA–WTP disparity is significantly reduced after information disclosure. Market liquidity and efficiency can be improved.

Our study contributes to the academic community in the following aspects. First, we provide an important complement to prior research on how information can help consumers make smart decisions in the important but unique housing sector. Consumers in this market usually lack experience. Thus, understanding their information needs and how they navigate and absorb information in their decision-making process is important. A profound understanding of these issues offers insights into home purchase behaviours, smooths housing transactions and market exchanges.

Second, we contribute to housing economics by justifying the effectiveness of information disclosure in housing markets from a dynamic perspective. Prior research tested how information disclosure affects market transaction price only. In the present study, we analyse the interaction between information disclosure and the WTA–WTP disparity, thereby providing implications not only for the final transaction price but also for housing market liquidity.

Third, the design of field experiments in this study broadens the prospect of experimental economics and its significance in explaining individual behaviours and market phenomena. To the best of our knowledge, this study is among the first to provide field experiment evidence from the housing market. To ensure the internal and external validity of such experiment, we use actual houses on the market as the stimuli and real house owners and potential buyers as participants. We also include information asymmetry materials in the housing decision-making process, which is rarely investigated in WTA–WTP disparity research.

The findings of this study can benefit all housing market players and policymakers. The insights gained from our research can potentially increase public awareness of the benefits and importance of policy instruments, such as information release. Such instruments can be considered a 'behavioural nudge'. The 'paternalistic' aspect of this nudge lies in the claim that disclosing information on property conditions that home sellers and real estate agents plan to sell is regulated or mandated. By contrast, the 'libertarian' aspect of this nudge lies in the fact that even after information disclosure, home sellers and buyers are free to set their WTA and WTP and opt out of undesirable scenarios.

The findings can also inform the central government about the wide use of smart disclosure in the future, as well as the scope, format and structure of information to be supplied to general housing consumers. Nowadays, decision makers are sometimes confronted with important but complicated information. People cannot always absorb all information and decide easily. Therefore, policymakers should make sure that information is disclosed smartly so that the public can easily understand and use it. Information on housing structural defects, as tested in this study, is regarded as one type of smart information that assists consumers in making informed purchase decisions. Future research can be conducted on the basis of this study by testing how decision makers respond to the release of other key information (e.g. historical prices, school quality and environmental dis-amenities). In addition, the format used in supplying information to decision makers is important in the process of smart disclosure. A policy instrument used to release different information might not be introduced in one go. In our field experiment, we ask participants to provide a response (i.e. WTA or WTP value) after each scenario is provided to them. The results from two sample *t*-tests show that home sellers and buyers adequately absorb information and update their WTA and WTP when new information is given. Future studies may examine whether the same conclusion can be drawn if all pieces of information (e.g. current price, historical price and structural defects, etc.) are provided to participants in one scenario rather than different scenarios.

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Appendix A

Materials and scenarios in Stage one (sellers' experiment)

Firstly, owner participants are told the following: 'The instrument used in this experiment is the property that you want to sell, so you will act as a home seller'. Scenarios are then provided.

Home sellers are initially given current market information (Seller.Scenario A).

Seller: *Q20*. (*Scenario A*): *If you are aware that the current market price of a property in the same neighbourhood with a similar unit type ranges from* (*Min*) *to* (*Max*) *and the average price is* (*Avg*), *then what is the minimum price you can accept for your property*?

The given average price and price range of a property are based on big data of the resale housing market in Beijing and linked to the official statistics collected by the China Index Academy. For example, if the property owned by a participant is located on Xueyuan Road (a neighbourhood) in Haidian (an administrative district in Beijing), then the scenario that he or she receives is as follows: '*If you are aware that the current market price of a property in the same district with a similar unit type ranges from RMB 3.8 million to RMB 5.8 million, and the average price is RMB 4.7 million, then what is the minimum price you can accept for your property*?'[8]

Secondly, historical information, such as the prices two and four years ago, are provided in the second and third scenarios, respectively. The prices with an underscore (e.g. RMB 4 million in Seller.Scenario B and RMB 3.1 million in Seller.Scenario C) are calculated according to the current average price and corresponding increase rate.

Seller: *Q21*. (*Scenario B*): *If you are aware that compared with the price*

[8] The provided prices are based on the sample property owned by the participant.

two years ago, the current market price has increased by 15% (*the price two years ago was RMB 4 million*), *then what is the minimum price you can accept for your property*?

Seller: *Q22*. (*Scenario C*): *If you are aware that compared with the price four years ago, the current market price has increased by 50%* (*the price four years ago was RMB 3.1 million*), *then what is the minimum price you can accept for your property*?

Thirdly, the following expectation-based up/down/stable market scenario is given to the participants.

Seller: *Q23*. *What is your expectation regarding the property market in Beijing*?

1. *The property price will continue to increase* (*go to Q24–26*).
2. *The property price will become stable* (*go to Q27–29*).
3. *The property price will decrease by a small scale* (*go to Q30–32*).

For example, if a participant has an up-market expectation in mind, then an up-market scenario (see below) is assigned to him or her.

Seller: *Q24*. (*Scenario D*): *If you are aware that the property price will continue to increase in the next few years, then what is the minimum price you can accept for your property*?

Fourthly, the following hypothetical scenario is given to home sellers:

Seller: *Q25*. (*Scenario E*): *Suppose that the cables used for the initial internal decoration in your residential area were of mediocre quality. They have not been changed, and they were not replaced when you renovated your property. If these potentially undesirable characteristics are considered, then what is the minimum price that you can accept for your property*?

Fifthly, the following scenario is provided to the participants to determine whether sellers are loss averse.

Seller: *Q26*. (*Scenario F*): *On a scale of 1 to 10, with 10 being the highest degree of satisfaction and 1 being the lowest degree of satisfaction, suppose that the buyers' bid price is RMB 200,000 higher than the minimum value you are willing to accept for your property and that your degree of satisfaction is 7*.

If buyers' bid price and your minimum willingness to accept are identical, then your degree of satisfaction drops to 5.

If the buyers' bid price is RMB 200,000 lower than the minimum value you are willing to accept, how do you value your degree of satisfaction?

○ 1
○ 2
○ 3
○ 4
○ 5 or higher

Materials and scenarios in Stage two (buyers' experiment)

Buyer.Scenarios A to D are the same as the ones used in the sellers' experiment, except that in the case of the buyers' experiment, the maximum price that the participant is willing to pay for the property (i.e. WTP) is asked and recorded, with the same argument provided for the earlier case.

After the assignment of the expectation-based up/down/stable market condition (Buyer.Scenario D) to the home buyers, two hypothetical scenarios (Buyer.Scenarios E and F) with information asymmetry materials are created.

Buyer: *Q21*. (*Scenario E*): *Suppose that you learned from an experienced home buyer that various uncertainties* (*e.g. latent problems*) *and problems* (*e.g. aging problems of cables, leaking pipes, blockage of drains and cracks on the wall*) *might be encountered in the future and these latent problems may cause future expenses. With these issues in mind, what is the maximum price that you are willing to pay for the property*?

Buyer: *Q22*. (*Scenario F*): *Suppose that a friend, who is in charge of the initial internal decoration in this residential area, has informed you that the quality of the structure in this area is generally excellent. The only concern might be the cables, which are of mediocre quality. What is the maximum price that you are willing to pay for the property*?

Risk preferences in Part C

Q. Risk preference: *Suppose that you have a chance to take part in a 'speed lottery' which gives you a 50% chance of winning RMB 1,000. If you win, then you will instantly receive the prize. If you lose, then you will receive nothing. How much will you spend to buy a ticket for this lottery*?

○ *RMB 1*
○ *RMB 20*
○ *RMB 40*
○ *RMB 80*
○ *RMB 150*
○ *RMB 250*
○ *RMB 350*
○ *RMB 500*

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