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Housing Market Regulations and Strategic Divorce Propensity in China

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Keywords: Housing market regulations; Strategic divorce; Baidu Index
JEL codes: D78; J12; J18; L50; R21

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1. Introduction

China has witnessed steadily increasing divorces over past years (see Figure 1). Previous studies have suggested several explanations for this trend, such as divorce laws (Dommaraju and Jones, 2011; Platte, 1988) and China's one-child policy (Zhang, 2017). A common theme in these explanations is that motivations for divorce stems both from any emotional dissatisfaction of marriage and also from changes in institutions and even social norms that make it easier for couples to divorce. Our paper considers another possibility that arises from China's housing market regulations: a couple may choose *strategically* to divorce in order to obtain some economic benefits, even though the individuals are actually in a satisfactory marriage.[1]

[Figure 1]

How do China's housing market regulations potentially link with strategic divorce decisions? As discussed in more detail later, since 2010 the Chinese government has implemented demand-side regulations to control surging housing prices. Under these regulations, if a household owns some housing already and wishes to buy more housing, the household is not allowed to do so and/or is subject to higher financing costs through housing loans. However, there is a loophole that a household might utilize to circumvent these regulations, as shown by Figure 2. A couple can get divorced, strategically separate into two "families" in the legal sense, and put all housing assets under the legal ownership of one family member. The two individuals in fact continue behaving as before like a single household, cohabitating and making consumption decisions together. Nevertheless, for legal purposes they now constitute two separate "families", in which one member has no housing and so can avoid the restrictive policies. Such a "strategic divorce" (or "fake divorce") allows the couple to purchase more houses and/or to enjoy more favorable financial leverage (Yang et al, 2018). Our paper seeks to examine the impact of housing market regulations on the propensity of this strategic divorce.

[Figure 2]

It is important to understand this behavior for at least three reasons. First and foremost, if this behavior is prevalent, it would undermine the government's efforts to control housing prices. Success in implementing the regulation is in general considered as important from either the political or the economic perspective. Many Chinese people see owning a decent house as one of their life goals because a house has implications for access to public services, social status, and so on, and extremely high and rapidly increasing housing prices have generated near universal complaints about the government since the Chinese

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[1] Throughout this study, we use the term "true divorce" to refer to getting divorced due to unhappy matches, and we use "strategic divorce" or "fake divorce" to refer to divorces whose goal is to attain some economic benefits.

government is the main driver for the expanding housing market. Reducing housing market pressures is needed in order to maintain social stability, and an overly hot housing market may lead to misallocation of resources and hurt the real economy, given especially that many investors enter the market expecting to receive high returns on housing as an investment asset.[2] Thus, policymakers should be fully aware that the successful enforcement of housing market regulations may have the side effect of generating strategic divorces. Second, strategic divorce may well contain salient moral hazard effects. Some people who intend to divorce (due to emotional dissatisfaction) may use this strategy to persuade their spouse to voluntarily forgo jointly owned housing, which poses a substantial threat to an individual's property rights. Because a strategic divorce appears legal and voluntary, the law usually cannot adequately protect property disputes associated with it. Third, a strategic divorce might incur nontrivial mental costs as households struggle with the decision of gaining huge economic benefits through a way that could generate social disapproval.

Therefore, our study investigates whether and how China's system of housing market regulations affects people's propensity for strategic divorce. Empirically testing for strategic divorce is challenging due to the difficulties in finding a measure for divorce motives. However, different keywords searched by people on the internet can help us infer their intentions. This is an important advantage compared to conventional divorce statistics, even administrative microdata, because official statistics do not provide information on the real motivations underlying a divorce. Of course, we acknowledge that these internet searches only represent *propensities* but not actual realized *behaviors*. Even so, these data provide a potentially useful measure of individual intentions, as demonstrated by other recent research that has used such information (Qin and Zhu 2018; Hamid and Heiden 2015; Kearney and Levine 2015; Enke 2018).

Based on weekly internet search data from 32 major Chinese cities between 2009 and 2016, we use a difference-in-differences model to examine the impacts of regulations on strategic divorce propensity. Several findings emerge. First, our estimates provide robust evidence that an average city experienced around a ten percent increase in divorce-related searches during the regulation era, suggestive evidence that that housing market regulations significantly increase the propensity of strategic divorce. Second, we find that such an increase in internet searches cannot be explained by couples seeking information about a divorce either because they became more emotionally incompatible following the enactment of the regulations or because they searched for divorce-related terms in order to gain protective knowledge prior to a marriage (e.g., a precautionary search motivation). These results are suggestive for the existence of strategic divorce motives. Third, we find that the increase in divorce-related searches is lower for cities

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[2] Li and Wu (2014) have shown that high housing prices discourage entrepreneurship, as the extremely high returns make talented people forgo innovative activities and dive in the housing market speculation.

with higher male-female ratios and stronger Confucian ideologies. Lastly, our study suggests that internet search data can be a timely tool for tracing a policy's influences on unobservable propensities.

Our study is related to various bodies of literature. First, we add to studies on China's housing market regulations. Most existing papers focus on the regulations' efficacy in curbing housing price growth (Du and Zhang 2015; Li et al. 2017; Sun et al. 2017). However, there have not been studies that have examined the regulation's (unintended) impacts beyond the housing market. Our paper shows the link between housing market regulations and marriage market behavior. Second, we contribute to the broad literature discussing marriage and divorce motives arising from economic shocks and policy changes in a variety of diverse contexts. For example, Hellerstein et al. (2013) find that divorces in the U.S. are pro-cyclical. More relevant to our interest, there are some studies about connections between housing prices and the marriage market. For example, Rainer and Smith (2010) find asymmetric impacts of housing prices shocks on divorces in the U.K.: negative shocks increase dissolution hazards, while positive shocks do not have significant effects. Farnharm, Schmidt, and Sevak (2011) find that, when housing prices decline, owners experience a significant reduction in divorce shares but renters experience a significant rise in divorce shares. Wrenn et al. (2019) report that a one percentage point increase in house prices leads to an average fall in marriage rates by 0.31 percent in China. Other studies also find marital decisions could depend on associated changes of marginal tax rates (Alm and Whittington 1999, 2003; Whittington and Alm 1997). Third, our paper sheds light on the role of traditional culture in economic behavior in modern society. The economic literature has realized that culture could have important implications for economic outcomes (Guiso et al. 2006), and many studies in the context of China echo this viewpoint. For example, Chen et al. (2020) find that regional differences of human capital accumulation today could be attributed to different strengths of culture dating back to ancient times that value education, and Zhang (2020) argues that Chinese clan culture fosters the development of public enterprises. Our study shows that Confucianism (the core of Chinese philosophy with its emphasis on family relations and stability) may prevent people from exploiting some obvious loopholes, epitomized by the propensity fo strategic divorce.

The rest of this paper is organized as follows. In the next section we discuss the institutional background of housing market regulations in China. In Section 3, we discuss the rationale for and the details of constructing our dataset. We introduce our empirical strategy in Section 4, and we present our results in Section 5. Section 6 concludes.

2. Institutional Background

2.1. Background and Policy Instruments

Housing prices in China have been sharply soaring since the housing market was established in 1990s. Over-investment in real estate is regarded as an important reason. Speculators snap up houses, waiting to resell them at higher prices. The hot housing market could be detrimental to the economy and to the society more generally. It could result in bubbles and increased financial risks. It could also lead to a misallocation of resources. For example, Li and Wu (2014) find Chinese high housing prices discourage innovative activities. Furthermore, rising housing prices contribute to inequality concerns. The majority cannot afford houses but the minority who owns houses may not even live in them (Ang 2020). This phenomenon likely leads to universal resentment, as portrayed in the TV series "*Dwelling Narrowness*", which was released in 2009 and which showed the difficulties of urban life under out-of-reach housing prices.[3]

To tackle these challenges, Chinese central and local governments enacted a series of demand-side regulations on the housing market starting in 2010, in an attempt to curb surging housing prices.[4] Two types of policy instruments were commonly adopted, *quota restrictions* and *credit restrictions*,e often bundled and enacted into a single regulation. A quota restriction stipulates the ceiling number of houses that a household can purchase. For example, a quota restriction typically stated that a family that already holds one house can purchase a second house, but a family that already owned two or more houses was not allowed to purchase any more.

In contrast to quota restrictions that stipulate the amount of housing a family can own, credit restrictions restrict the availability of financial leverages of a single house purchase. These credit restrictions usually specify the minimum proportion of theh total housing price that must be paid in cash when one buys a second house with a loan, while they do not change the requirement for a first-house purchase. Most cities have increased the required proportion from thirty percent to fifty percent in their regulations, creating significant financial constraints for who have limited deposits at hand.

Overall, these regulations hinge heavily on being a "first" or a "second". In the face of these regulations, a "strategic divorce" strategy may well make economic sense. A couple who would be otherwise restricted can legally divorce and assign all housing assets to one spouse with the spouse possessing no housing assets. Then, when the spouse with no housing assets wishes to buy housing, his/her purchase would be considered a "first" house purchase that is not subject to the regulations. This spouse would therefore be eligible for the purchase, and he/she would also be eligible for better loan conditions.

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[3] This TV series created a historic audience rating, and its ending episode received a rating of eight percent. It was also popular in Taiwan and Japan at that time. Due to the sensitivity of its story, censorship authorities banned its broadcast. A staff member of Beijing TV station claimed that the ban was due to real estate businesses' lobbying. All in all, these suggest serious social grievances resulting from high housing prices. (See Ang (2020) pp. 147; Wikipedia https://en.wikipedia.org/wiki/Dwelling_Narrowness)

[4] Whether suppressing demand is able to cool down the housing market is beyond the scope of this paper. We take these regulations as given, and we evaluate their impacts on divorce propensity.

In general, households clearly have incentives to engage in such a strategic divorce, considering the high consumption and investment values of housing in China (Fang et al. 2016; Yang et al. 2018).

To be more specific, the marginal strategic divorce propensity should depend on the benefits of doing so, which in turn depend on the instantaneous environment and household characteristics. For example, if a household's deposits are low, getting divorced to get a more favorable loan offer does not mean much because more favorable terms do not allow the household to afford the self-pay part of the loan. Similarly, rich households do not care much about self-pay issues, and so strategic divorce only makes sense for them to obtain a purchase qualification. Overall, then, it seems most profitable for middle-class households to play the strategic divorce game.. Also, households who expect rapid housing price growth in spite of regulations may also be inclined to divorce in order to become eligible right away for housing purchases and/or better financial conditions.[5] To control for these influences, our regressions include city GDP per capita, average savings, growth rate of the housing price index, and other variables as controls, as we discuss later..

2.2. Evolution of Regulations

These housing regulations were not implemented overnight, and each city initiated its regulation in a staggered manner. To illustrate, we focus on 32 major Chinese cities in our analyses (ssee Section 3 for details). Between 2009 to 2016, there were three phases of regulations: initial regulation (2010 and 2011), deregulation (2014), and re-regulation (2016). Table A1 in Appendix displays detailed timing information.

For the initial regulation era, Figure 3 shows how these 32 cities sequentially engaged in regulation. Bars denotes the number of newly regulated cities in each week, and the curve refers to the cumulative number of regulated cities. Beijing was the first city to enact a regulation on April 20, 2010. Almost five months later, a second city initiated a regulation. More than half of cities in our study did not enact a regulation until early 2011.

[Figures 3, 4, 5]

These regulations were always in effect once initiated (i.e., not absorbing states). However, in 2014 some cities stopped regulations because the growth of housing prices lessened due to the stringent demand-side regulations or because the local economy was seriously hit by the cooling housing market. As shown in Figure 4, deregulations made their progress gradually across cities. Four cities – Beijing, Shanghai, Guangzhou, and Shenzhen (BSGS) – that never deregulated, while it took all remaining cities about six months to lift regulations. In 2016, some cities re-regulated their housing market (Figure 5). Besides BSGS

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[5] This expectation is more likely given that strategic divorces enable households to get around regulations.

that maintained regulations from the beginning, there were 12 extra cities regulated in 2016, and these cities re-instituted their regulations sequentially rather than simultaneously.

These three distinct phases of regulations create substantial timing variations, which are critical for the identification strategy in our empirical work. Note that in our analyses we employ weekly data, which allow significant timing variations, as discussed in Section 3.

2.3. Learning Information on Regulations

Given that we aim to stud people's behavior in response to a potential loophole in housing market regulations, a critical point is whether people learn the details of regulations, whether they understand the constraints that they are going to face when buying a house, and whether they realize that a strategic divorce is a way evade the regulations.

A city's housing market regulations are usually covered by media as breaking news, appearing in the headlines of local newspapers and on TV programs. The government also makes its regulations known to the public via several ways. Government holds a press briefing to announce a regulation, it posts official documents, and it releases relevant information on social media. Releasing information online is more prevalent in the case of deregulation. Because the government wants to keep a low profile in the overall regulating environment, it only announces deregulations on social media and it informs only real estate businesses, without posting a formal document.

People quickly learn and understand how these regulations work. People discuss regulations and how to get around regulations on online forums. Indeed, anecdotal evidence shows that people well recognize the strategic divorce as a way to avoid regulations. For instance, Shanghai initiated a regulation on October 7, 2010, and the number of people pursuing divorce began rising on that very day, and many people in Shanghai queued to dissolve their marriages in order to get satisfactory loan conditions.[6] (Under Shanghai rules, the self-pay proportion was 70 percent for the second house while just 30 percent for first-time buyers.[7]) Even if people did not figure out the strategic divorce game by themselves, real estate and bank staff might recommend it because these firms want to make a transaction. purchase.[8] Therefore, knowing the strategic divorce trick could well prompt households to learn how to prepare, especially by searching online for divorce-related information. Figure A.1 in Appendix A.2 shows some evidence that are indicative of this response. Figure A.1 presents searches for keyword *Housing Purchase Quota*, one

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[6] See BBC report on October 18, 2010 (http://travel.cnn.com/shanghai/life/faking-divorce-buy-home-shanghai-924307/).

[7] See BBC report on September 2, 2016 (https://www.bbc.com/news/blogs-trending-37257747).

[8] Again, see BBC report on October 18, 2010 (http://travel.cnn.com/shanghai/life/faking-divorce-buy-home-shanghai-924307/).

type of housing market regulations as mentioned earlier, and divorce-related searches for keywords *Divorce Agreement* and *Divorce Process*.[9] Among the 32 major cities in our study, searches for *Housing Purchase Quota* sharply increased when there were some cities enacting a regulation, as did divorce-related searches. These are suggestive that people do in fact rely on the internet to learn regulations and ways to overcome them (via a strategic divorce). However, it is still a question whether this observed correlational relationship can be causally interpreted. In subsequent sections, we take advantage of search data to answer this question.

3. Data

We construct a sample consisting of data on 32 major Chinese cities. Cities in our sample include all of China's directly controlled municipals,[10] most provincial capitals, and all self-planning cities.[11] They are all on the list of monthly housing price reports of selected cities, published by the National Bureau of Statistics. Complaints about surging housing prices often come from these cities. Therefore, we believe restricting our focus to this set of cities would not lead to loss of generality to understand the whole picture of housing market regulations' influences. Note that we omit Xining (capital of Ningxia), Hohhot, (capital of Inner Mongolia), Urumqi (capital of Xinjiang), and Lhasa (capital of Tibet), because of significant measurement errors or the unavailability of socioeconomic covariates.

In following subsections, we discuss the sources added to our city dataset, as well as some properties of our data and the corresponding calculations generated from our data.

3.1. Baidu Index Data

We use weekly divorce-related internet searches to measure people's interest in divorce. These data are provided by Chinese internet tycoon, Baidu. Baidu is the world's second largest search engine, trailing Google, whose market share in China is near 80 percent.[12] As a counterpart to Google Trends, the Baidu Index provides a measurement for search volumes on a certain keyword in a specific time interval.[13] Therefore, our data give us especially timely information on internet searches, which allow us to capture

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[9] See Section 3.1 for more discussions about these divorce-related keywords. All keywords in Chinese are displayed in Appendix A.3.

[10] There are four directly controlled municipalities: Beijing, Shanghai, Tianjin, and Chongqing.

[11] There are five self-planning cities: Dalian, Ningbo, Qingdao, Xiamen, and Shenzhen. They are economically prosperous or politically important, and they are given greater autonomy in drafting economic policies independent of provinces they locate in.

[12] See https://en.wikipedia.org/wiki/Baidu.

[13] Note that data from both the Baidu Index and Google Trends are not equal to actual search volumes, but are transformed from actual search volumes through some algorithms. We do not know the statistical procedures behind the Baidu Index, but, as argued by Qin and Zhu (2018), Baidu Index data are approximately proportional (or linear) to actual search volumes. Therefore, the transformation should not lead to any significant distortions of the Baidu Index in representing people's online behavior.

how divorce-related searches respond to housing market regulations. This important virtue of the Baidu search information has been recognized and applied in recent economics literature (e.g., Qin and Zhu 2018; Hamid and Heiden 2015; Kearney and Levine 2015; Enke 2018).

A natural question is: what are the advantages and disadvantages of using divorce-related searches, compared to using conventional divorce statistics data? We believe that there are several reasons that divorce-related searches are a better measurement than official divorce statistics, given our research question. First, internet searches can better capture unobservable motives behind observed divorce behavior. To test our hypothesis that people's divorces could be strategic under housing market regulations (e.g., "fake" or "strategic" divorce), we need proper measurements for such strategic behavior. Unfortunately, commonly used divorce statistics cannot meet our needs because they are highly aggregated and they do not differentiate sources of divorces. Even administrative microdata on divorces from civil agencies may not help here because self-reported reasons for a divorce may not necessarily be real reasons. However, internet searches data may isolate the strategic behavior of interest well if we choose keywords appropriately, because the keywords searched by people can help us infer their true motives. In our analyses, we primarily focus on the keyword "*Divorce Agreement*", which relates to issues before and after a divorce. Most individuals who are not a professional or who do not have prior divorce experience are likely to be unfamiliar with divorce procedures, and they may turn to the internet for relevant information. Consequently, internet searches for *Divorce Agreement* should proxy for overall divorce propensities.

Even so, it is of interest to have a sense of the relationship between searches and actual divorce statistics. Figure 6 depicts the relationship between average annual searches on *Divorce Agreement* and divorce statistics for all cities in our sample. These two variables are positively correlated, with a correlation coefficient of 0.6 (and a correlation of 0.7 if we omit an outlier of divorce statistics (Chongqing). This positive correlation suggests that searches on *Divorce Agreement* can well proxy for eventual divorces.[14]

We also look at searches on keyword "*Divorce Process*",, and Figure 7 displays their relationship with divorce statistics. This relationship is similar to Figure 6, and the correlation coefficient maintains strong, being 0.6 (and 0.7 if the outlier Chongqing is again dropped).

[Figure 6, Figure 7]

We acknowledge that divorce-related searches could incorporate at least three potential underlying motives: learning about strategic divorces, learning about true divorces, and gaining useful precautionary knowledge before a marriage. The first two categories comprise and cannot be separated from divorce

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[14] To the best of our knowledge, there are no particular criteria for the correlation coefficient to determine a good proxy. But compared to existing literature, we deem that it is not too risky to assert a good proxy based on a correlation coefficient of 0.7.

statistics, while the third category is a unique confounder when using searches data. Although it is hard to directly analyze the first category, we cand analyze each of the other components to get a sense of changes in strategic motives. To do this, we use searches on keywords "*Child Custody After Divorce*" and "*Property Division After Divorce*", which are two terms only likely to be considered by couples who plan on a true divorce. For individuals conducting precautionary searches before getting married, we can examine how searches on "*Marriage Lucky Day*" and "*Marriage Registration*" vary at the same time, both of which represent cultural and legal issues surrounding a marriage. Our idea of isolating changes in strategic divorce motives via several search terms will become clearer when we introduce our empirical framework in Section 4.2.

Second, another advantage of using divorce-related searches is that they allow us to construct a more powerful test for the impact of housing market regulations, for several reasons. Our searches data are weekly search data, and so they allow a much larger sample size; by contrast, divorces statistics are yearly. Also, official divorce statistics combine both strategic and true divorces, which cannot be easily disentangled. If the two types of divorces move in opposite directions (trends that we cannot observe and for which we cannot control), then the use of official statistics may fail to detect changes in strategic divorces even if there are in fact underlying changes in strategic divorces, and there could also beproblems with the size of the test if true divorces drive divorce statistics. In contrast, searches data are better able to distinguish between strategic and true divorces given their reliance upon different keywords. Finally, the high-frequency enable us to utilize timing variations of regulations more fully. As shown in Section 2, there are very few timing variations at the year level, but weekly level variations are frequent., which also allows a more granular test for strategic divorce propensities in response to housing market regulations, including their persistence. These types of empirical tests are virtually impossible with official divorce statistics.

Despite these advantages, searches data are not immune to their own problems. Of most importance, divorce-related searches measure *intentions* rather than eventual *actions*, and we do not know how many intentions translate to actual divorces. Without further information, we cannot assess this translation process. We leave this for future research. Even so, we argue that our study is still able to shed light on how housing market regulations alter households' propensity of strategic divorce, as individuals at the leastbegin considering the possibility of divorce.

3.2. City-Level Covariates

In our regression analyses, we control for many factors that may confound the results. Searches are related to population sizes, and so we control for yearly population of each city. Recall that the goal of a strategic divorce is to circumvent demand-side restrictions, so underlying housing demand is relevant to the

incentives of playing a strategic divorce and searching for associated information. Accordingly, we include variables that capture demand-side factors, such as population density, average deposits, GDP per capita, and the growth rate of the housing price index. These variables may also be correlated with the implementation of housing regulations. We also control for each city's sex ratio (males relative to females) and unemployment rate, both of which could influence divorces. Data on population, population density, average deposits, GDP per capita, and sex ratios are collected from China City Yearbooks. Housing price indices are reported by the National Bureau of Statistics. Unemployment rates are reported by each city's annual socioeconomic statistic bulletin. Finallyl, to explore the link between divorce-related searches induced by regulations and Confucian ideologies, we use the number of Confucian academies constructed during Ming-Qing dynasties (1368-1912) to measure the strength of Confucian ideologies in each city, as suggested by Chen et al. (2020).[15]

3.3. Summary Statistics

Table 1 displays summary statistics of the variables used in our analyses. Our sample covers 417 weeks in total between 2009 and 2016. Each week starts from Sunday and ends on Saturday. Panel A displays policy and Baidu Index variables. For the Baidu Index on *Divorce Agreement* and *Divorce Process*, we have full data between 2009 and 2016; for several other keywords, we only have data starting from 2011 because Baidu removed earlier data from its website in one upgrade. Panel B displays the city covariates. Each variable has significant variability across the cities, which provides some additional justification for our focus on the major Chinese cities. Note that the cities in our sample are regulated during nearly half of the time period.

[Table 1]

4. Empirical Strategy

4.1. Main Specification

We primarily rely on a difference-in-differences model, specified as follows:

$$\ln(Y_{ct}) = \beta_0 + \beta_1 D_{ct} + x'_{ct}\gamma + \lambda_c + \mu_t + \delta_{ct} + \varepsilon_{ct}. \quad (1)$$

The subscript c denotes codes for cities, and t denotes time (in weeks). Y_{ct} is the relevant Baidu searches variable on divorce-related terms (e.g., *Divorcee Agreement*). D_{ct} is a dummy variable that equals one if city c's housing market is regulated at time t. The vector x_{ct} contains time varying control variables, as

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[15] Chen et al. (2020) provide a comprehensive discussion about the possible connections between the strength of Confucian ideologies and their historical origin. See also Kung and Ma (2014).

discussed in Section 3.2. λ_c, μ_t, and δ_{ct} are city, time, and city-month fixed effects, absorbing all time-invariant characteristics and aggregate shocks, such as social norms, internet access, macroeconomic fluctuations, and the like. ε_{ct} is the error term, clustered at the city level.

The key parameter of interest in equation (1) is β_1, which captures the impacts of regulations on divorce-related searches. Causal interpretations of the estimate hinges on the assumption that the timing of regulations is randomly assigned, conditional on covariates and fixed effects. As displayed by Figures 3, 4, and 5, large timing variations across cities suggest some degree of randomness. Also, we should expect that the evolution of searches does not differ systematically between cities in the absence of regulations, which we examine in an event study design (see Section 5). Also, we add city-month fixed effects to equation (1) to better control trends and to ensure the identification assumption.

Another issue when establishing inferences on β_1 is that we have a small number of clusters, i.e., 32. To construct robust inferences, we report t-statistics and p-values of the estimated parameter β_1, following wild cluster bootstrap-*t* procedures (Cameron et al. 2008).

4.2. From Divorce-Related Searches to Strategic Divorce Propensities

We are unable to draw conclusions over strategic divorce behavior from the estimate of β_1 in equation (1) because changes in divorce-related searches could result from several forces as discussed earlier: strategic divorces, real divorces, and precautionary searches before a marriage. To break down these possible associations, we design a framework, as shown by Figure 8.

[Figure 8]

Step 1. We first examine how housing market regulations affect divorce-related searches using equation (1).

Step 2. If some effects of regulations are discovered in Step 1, we then investigate whether and to what extent changes of divorce-related searches could be attributed to searching precautionary searches before a marriage, using searches for keywords relating to marriages as the dependent variable of equation (1).[16]

Step 3. If we rule out the possibility of marriage attempts in Step 2, then the observed changes of divorce-related searches should come from divorce-side factors. Both true divorces and strategic divorces should necessarily give rise to changes of divorce-related searches under regulations. Accordingly, we

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[16] Step 2 essentially examines the possibility that housing market regulations may be correlated with some factors increasing marriages and so may lead to more divorce-related searches (given the precautionary search story). It is not very likely that housing market regulations per se would increase marriages.

investigate this issue using measurements for true divorces based on searches for "*Child Custody After Divorce*" and "*Property Division After Divorce*". If the regulations do not affect the motivation of true divorces, then the effects found in Step 1 should come from motives of strategic divorce.

In next section, we present the implementation and the results of our empirical strategy.

5. Results

5.1. Increase in Divorce-Related Searches

Table 2 displays estimates of equation (1) with several different specifications. In Column (1), we run a minimum specification, regressing divorce-related searches on the regulation dummy and two-way fixed effects. Conditional on fixed effects, the regulation is associated with 12.4 percent more searches for divorces. In Column (2), we add control variables. The effect of regulations is still significantly positive, and its magnitude does not change much, suggesting that implementation of regulations is orthogonal to city covariates. Other covariates do not have significant impacts on searches, expect for the growth rate of the housing price index, which is positively associated with searches for divorce information. Given that there may be concerns about our control for the housing price index because this variable may be influenced by regulations, we drop the variable and re-estimate the model. We find that the effect of regulations remains. Column (3) is our preferred specification, where we have a full set of fixed effects and all covariates. The estimated effect of regulations on searches remains positive and significant, such that a 10.5 percent increase in divorce-related searches is induced by housing market regulations. Column (4) implements the Poisson pseudo maximum likelihood estimation (PPML), which may be superior considering that our outcome variable (or internet searches) is non-negative.[17] Again, the estimates imply a strong effect of regulations on divorce-related searches.

[Table 2]

To establish causality, we check our identifying assumption that the timing of regulations is randomly assigned, conditional on covariates and fixed effects. A direct implication is that we should expect a rise in searches for divorces only in the presence of regulations, so that households are unable to anticipate the start and the end of a regulation. We use an event-study design by extending equation (1):

$$\ln(Y_{ct}) = \beta_0 + \sum_{p=-4}^{-1} \beta^p D_{ct}^p + \sum_{\tau=1}^{+6} \beta^\tau D_{ct}^\tau + \sum_{l=1}^{+4} \beta^l D_{ct}^l + x_{ct}'\gamma + \lambda_c + \mu_t + \delta_{ct} + \varepsilon_{ct}. \quad (2)$$

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[17] Qin and Zhu (2018) and Zhang and Mu (2018) implement Poisson regression models with internet searches as the outcome variable. Here we implement PPML estimations, which is more robust to specification errors than Poisson maximum likelihood estimation (Gourieroux et al. 1984). PPML estimates can be roughly interpreted as those in a log-level linear regression.

$\{D_{ct}^p, D_{ct}^\tau, D_{ct}^l\}$ contains a set of dummy variables coding regulation status. D_{ct}^p is a dummy variable that takes a value of one if at time t city c is $|p|$ periods *prior* launching its regulation and zero otherwise. D_{ct}^l is a dummy variable that takes a value of one if at time t city c is l periods *after* its regulation and zero otherwise. D_{ct}^τ is a dummy variable for whether a city's housing market has been regulated *for* τ periods at time t. By this specification, we can examine people's response to regulations period by period. A useful feature of the regulations that we study here is that they were cancelled after being implemented for a while, whereas treatments in many other applications are an "absorbing state", i.e., they are not removed once started. This feature enables us to provide a stronger argument for causation. If any changes of searches are caused by regulations, then we should expect trend reversals after deregulation. Other controls in equation(2) are identical to equation (1).

[Figure 9]

Figure 9 visualizes the results of the event study, where solid points denote point estimates of β^p, β^τ, and β^l in equation (2) and the caps are 95 percent confidence intervals. During the period when a city is regulated, there are no significant changes in divorce-related searches, implying that implementation of a regulation is not contingent upon the searching behavior. Once a regulation is enacted, searches sharply increase, and they are persistent. The impact of a regulation is salient even six weeks after the implementation, as demonstrated by the point estimate and the confidence interval of "For >5 weeks". Once the regulation is removed, the (counterfactual) effects are muted, as shown by the "Used to be Regulated" panel of Figure 9. Although the point estimates of lagged effects are not all that small for first three weeks after a deregulation, they are insignificant. Eventually, the regulation has a zero effect after it is removed for four weeks. In sum, given the lack of pre-trends and trend reversals, we believe that the results of this event student give us some confidence that housing market regulations do cause changes in divorce-related searches.

5.2. Robustness Checks

We provide several robustness checks for our estimates. All results are displayed in Table 3, where we use our preferred specification that includes all covariates and city, time, and city-month fixed effects. Column (1) uses searches on another divorce-related keyword, *Divorce Process*, as the dependent variable, and regulations continue to have significant positive effects on searches, with in fact a larger marginal effect than in our earlier estimates.

In Column (2), we drop the housing price index from the control variables to handle the potential control problem noted in Section 5.1. The exclusion of the housing price index has little effect on our

estimates, and the regulation again has a significant and positive impact on *Divorce Agreement* of 12.2 percent, which is close to the 10.5 percent estimate in Column (3) of Table 2.

[Table 3]

The remaining columns put different restrictions on our sample, addressing concerns that our results may be driven by certain groups or biased by some unobserved characteristics. As housing market regulations were urged by the central government, residents in politically important cities might have greater confidence that their local governments would respond and launch regulations. If so, couples in these cities who would be restricted by regulations may well rush to purchase housing. Then, when a regulation indeed comes, these cities would have lower strategic divorce motives as people have already made their purchases. This possibility poses a threat to our identifying assumption of conditionally quasi-random timing, and it may bias our previous estimate downward. To address this potential concern, we drop four directly controlled municipalities (DCMs), or Beijing, Shanghai, Tianjin, and Chongqing, from our sample. Indeed, three of them are in the early-implementation camp, and all but Chongqing initiated their regulations in 2010. Column (3) of Table 3 displays the results after dropping these four DCMs. The estimated effect of regulations is still significantly positive if somewhat smaller than the baseline estimate of 10.5 percent in Column (3) of Table 2, which suggests a greater impact of regulations in the four DCMs and which is inconsistent with the potential downward bias prediction if anticipation is widespread.

Another concern is that the increase in divorce-related searches may be driven by some cities with much more intensive regulations than the other cities in our sample. Four cities, Beijing, Shanghai, Guangzhou, and Shenzhen (BSGS) are never deregulated after the initiation implementation, which other cities in our sample removed regulations in 2014 or 2015. This pattern suggests that it is possible that BSGS make up most variations. To address this concern, we exclude BSGS from our sample and re-estimate equation (1). Column (4) of Table 3 presents the results. Although the impact of regulations on divorce-related searches is statistically significant, its magnitude is halved, compared to the full-sample estimate (4.6 percent versus 10.5 percent). This might suggest that the impact is greater in cities where regulations are much more intensive (e.g., BSGS). Even so, an increase in divorce-related searches is still prevalent in other cities.

Lastly, one may worry that our model specification cannot sufficiently control for time trends even if we add multi-way fixed effects, given the long period and high-frequency data under study. This issue could jeopardize the identifying assumption because it introduces independence conditional on time trends. To deal with this challenge, we restrict the sample to a shorter horizon just before a second city adopts its regulation; as a result, Beijing is the single city treated, and other cities belong to the control group. Since the time interval is shorter, we should have better confidence that fixed effects could well control for time

trends. Column (5) of Table 3 reports this robustness check. Regulations in Beijing lead to about 4 percent more divorce-related searches relative to other cities. The smaller estimate for Beijing suggests that increase in divorce-related searches should be a long-run and universal phenomenon, consistent with our earlier findings.

All in all, these many robustness checks demonstrate that that housing market regulations cause people to search more about divorce information online.

5.3. Sources of Increasing Divorce-Related Searches

Previous discussions have achieved the first step of our framework in Section 4.2, but we are still unsure which sources account for the observed increase in divorce-related searches. In this subsection, we implement the remaining steps of the framework to isolate contributing factors behind the searches.

First, we ascertain whether precautionary searches prior to a marriage matter. If any factors contemporaneous to regulations lead to more marriages, we should expect searches about marriage information also to increase. We use two keywords that relate to marriages, *Marriage Lucky Day* and *Marriage Registration*. People may pick up a "best" day for their marriage, and they may also acquire information about registering their marriage, including required paperwork, appointments, and so on. Replacing the dependent variable with two marriage-related searches, we re-estimate equation (1). Note that only data on these marriage-related searches after 2011 are available, so we have to restrict our sample to this smaller period. For comparison purposes and as a further robustness check, we replicate our results for divorce-related searches using the sample after 2011 in Column (1) of Table 4, which rules out BSGS since their regulations have no variations after 2011. As shown by Column (1) of Table 4, regulations significantly bring more divorce-related searches, consistent with our main results. Columns (2) and (3) of Table 4 report results for marriage-related searches. There is no evidence supporting any significant increase of marriage-related searches during regulations. Therefore, precautionary searches prior a marriage cannot explain why we see an increase in divorce-related searches.

[Table 4]

Possible explanations for these results likely fall on the divorce side, either true divorces or strategic divorces, and so we examine whether true divorces sharply rise in the context of regulations. We deem that two keywords represent true divorce motives: *Child Custody After Divorce* and *Property Division After Divorce*. Only couples who truly intend to divorce are likely to care about these two issues, since strategically divorced couples have no such conflicts to resolve and they will collude and still live together after a divorce. Columns (4) and (5) regress true-divorce-related searches using equation (1). These results indicate that relevant searches are unaffected by regulations.

Overall, these results suggest that it is reasonable to interpret that the increase in divorce-related searches caused by regulations results from strategic divorce motives. The loophole of regulations and substantial economic benefits entice households to consider playing a strategic divorce strategy, and so they search about relevant terms online to prepare.

5.4. Heterogeneity in the Increase

In this subsection, we look more closely at strategic divorce propensities, trying to shed light on underlying behavioral determinants. We do so by investigating the effects of heterogeneity in regulations on strategic divorce propensities. We discuss several channels that might contribute to nuanced effects with the following specification:

$$\ln(Y_{ct}) = \beta_0 + \beta_1 D_{ct} + \beta_3 (D_{ct} \times z_{ct}) + x'_{ct}\gamma + \lambda_c + \mu_t + \delta_{ct} + \varepsilon_{ct}, \quad (3)$$

where z_{ct} is some exogenous variable. The parameter of interest is β_3, which captures heterogeneous effects of regulations depending on z_{ct}. We do not explicitly add z_{ct} as a regressor in equation (3) because it is either contained in vector x_{ct} or it would have been absorbed by fixed effects. All results are in Table 5.

[Table 5]

First, we explore if there are any differences between early regulated cities and late regulated cities. We are mainly interested here in whether people realize the loophole of regulations by themselves or whether they learn through social learning, i.e., they imitate what other residents have done. Although we do not have microdata to directly examine how strategic divorce behavior spreads along social networks, we get some insights here by comparing the responses of early regulated cities to late regulated cities. If people are informed in part by early regulated cities' residents, then we may expect a lower rise in strategic divorce propensities in early regulated cities and a greater rise in late regulated cities. We compare cities regulated in 2010 and 2011, so z_{ct} here is a dummy variable that equals one if a city initiates a regulation in 2010 and zero otherwise As indicated in Column (1) of Table 5, we do see that early regulated cities have lower responses, although the magnitude is negligible and statistically insignificant. Hence, the seemingly abstract strategy of strategic divorce seems well recognized by people themselves, rather than learned through social networks.

Second, we investigate heterogeneous effects in the sex composition dimension. Here we define z_{ct} as the sex ratio minus one, where the sex ratio is males relative to females, so z_{ct} measures the degree of male excess. Column (2) of Table 5 displays the results. Cities with more males experience significantly

lower increases in strategic divorce propensities with an average the reduction that is about one-fifth of the unconditional impact of regulations.[18] A potential explanation for this substantial gap is that males become more hesitant to play a strategic divorce because more males mean higher outside alternatives for their wives, so they may worry about whether they could secure their marriage after playing the strategy. Note that the Chinese sex composition is biased toward males, which gives males lower bargaining power on the marriage market and which implies that males may be cautious about their marriage security when facing competition. Indeed, we observe less strategic divorce propensities in cities with more males relative to females. Of course, risk aversion is not the unique interpretation, and other stories, such as savings linked to the sex ratio (Wei and Zhang 2011) may be a factor. Identifying the exact mechanism (s) is an avenue for future research.

The third dimension of heterogeneity we examine is population density. As shown in Column (3) of Table 5, we do not find support for a distinct impact of regulations in more or less populous cities. This may indicate that social learning is weak there (e.g., higher population density may mean great exposure to couples who take a strategic divorce). Also, this may reflect that the demand-side pressures of housing purchase are homogeneous across cities, making it attractive to conduct a strategic divorce regardless of the city's population density.

Finally, we examine how Confucianism may play a role in affecting strategic divorce propensities under regulations. Confucianism is the core of Chinese philosophy, and it has pervasive influences on modern society even though it was developed thousands of years ago. Confucianism manifests itself in the way it highlights the importance of lineages and a disregard for economic considerations.[19] Therefore, we expect stronger Confucian ideologies will discourage people from pursuing strategic divorce despite its considerable economic benefits because people in cities with a strong tradition of Confucianism are more likely to regard a strategic divorce as unacceptable, even as a stigma. To examine this issue, we follow Chen et al. (2020) by using the number of Confucian academies built in a city during Ming-Qing dynasties. Confucian academies are sites constructed for communicating and imparting Confucian ideologies, and research has shown that these historical sites contribute to shaping social norms that are long lasting and influential for socioeconomic outcomes (e.g., Chen et al. 2020; Kung and Ma 2014). Column (4) of Table 5 displays these results. Cities with stronger local Confucianism, measured by the number of Confucian academies, have fewer divorce-related searches under regulation, with quite significant impacts; despite a small marginal effect, the associated reduction in searches (evaluated using the average (number of

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[18] This magnitude is based on the calculation that 0.824 X 0. 029/0.123 = 0.194.
[19] Confucianism emphasizes the harmony of interpersonal relationships, where family stability is an important content. Hence, destroying a family would be regarded as an ideological betrayal. Also, Confucianism opposes any pursuit of wealth at the expense of harmony,. As Confucius said, "It is void for me to seize wealth in an unjust way."

Confucian academies of 547) is 1.76 percent,[20] or nearly one fifth of the baseline effect of over 10 percent. This result further supports our strategic divorce story. We interpret this result as a signal that the emphasis on family relations advocated by Confucianism makes people avoid exploiting the defect of regulative policies even if they are aware of its existence, which confirms the important role of cultural norms in shaping individual behavior.

6.   Conclusions

Our study explores a side effect of China's housing market regulations that couples can circumvent via strategic divorce. Our basic difference-in-differences framework confirms that regulations cause more divorce-related searches. Our many robustness tests help clarify potential sources of these results, especially by excluding hypotheses that an increase in divorced searches may result from higher true divorce motives or from precautionary searches before a marriage. We conclude that housing market regulations increase divorce propensities by stimulating strategic divorce behavior. We also find the sex ratio (male-female) and Confucianism has a mitigating effect on strategic divorce propensities.

Our findings have several important implications. First, even though the primary goal of housing market regulations lies in making houses more affordable, this goal may not be achieved in the presence of fake divorces; that is, it is difficult to regulate the housing market when homebuyers strategically divorce to avoid these regulations. In fact, Wu and Li (2018) find that housing market regulations are largely ineffective in curbing speculative demand, and our results suggest that strategic divorce could be a reason. Second, a strategic divorce may eventually become a true divorce, according to some anecdotal reports in the Chinese media,[21] and true divorce seems likely to cause severe welfare losses. Indeed, much existing research documents the negative effects of true divorces on such social indicators as crime (Cáceres-Delpiano et al. 2012) and children's health (Gruber 2004). Third, our results indicate that it is crucial for the government to consider possible unintended side-effects on the marriage market when designing regulations, especially because these regulations are likely to persist in the long run. Indeed, along this line, our study implies that more policy can be used combined with the housing market regulations. Come cities,

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[20] Note that 3.22e-5 X 547 = 0.0176.
[21]   For   example,   see   the   Tencent   News   report   on   November   14,   2017 (https://news.house.qq.com/a/20171114/003890.htm).   As reported there, a couple got divorced for better loan conditions. After the divorce, the husband put one old house under his wife's name, and purchased a second house together in his name together with his wife. They re-married after that. However, the couple now intends to divorce owing to family struggles, and the husband is on the verge of losing his property rights for the old house because it is under his wife's name and it cannot not be divided by a divorce.

such as Shanghai, recently become aware of strategic divorces, and took actions to combat them[22], and this policy appears to be effective and applicable to other cities. However, policymakers should still be cautious with the "one-size-fits-all" approach, given the potential harm to truly divorced couples. Finally, the influence of culture helps to lower the adverse impacts of a carelessly designed policy. The interplay of culture and policy responses (either expected or unexpected) is a fruitful area for future research. Fifth and more generally, our results indicate that the use of searches data is a useful tool in evaluating the effects of policy innovations, a tool that has not yet been fully exploited.

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[22] According to Xinhua News (http://sh.xinhuanet.com/2021-01/22/c_139688366.htm), starting from January 21, 2021, a divorced couple in Shanghai is subject to housing market regulations that consider two spouses still married in the first three years of a divorce, a provision that invalidates playing the strategic divorce game.