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Real estate prices in Beijing, 1644 to 1840☆

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Abstract

This paper provides the first estimates of housing price movements for Beijing in late pre-modern China. We hand-collect from archival sources transaction prices and other house attribute information from the 498 surviving house sale contracts for Beijing during the first two centuries of the Qing Dynasty (1644–1840), a long period without major wars, political turmoil, or significant institutional change in the Chinese capital. We use hedonic methods to construct a real estate price index for Beijing for the period. The regression analysis explains a major proportion of the variance of housing prices. We find that house prices grew steadily for the first half-century of the Qing Dynasty and declined afterwards in both nominal and real terms through the late eighteenth century. Nominal prices grew starting in the late eighteenth century and declined from the early nineteenth century through 1840. But these price changes occurred with contemporaneous price changes in basic measures of the cost of living: there was little change in real terms to the end of our period.

Keywords: Beijing; Qing Dynasty; House prices; Hedonic regressions
JEL classification: N95; R31

1. Introduction

In this paper, we assemble a new and unique dataset for house prices in Beijing between 1644 (the start of the Qing Dynasty) and 1840, a period without war, major political turmoil, or significant institutional change in the Chinese capital.[3] We use the dataset to document long-run house price trends in Beijing. We combine this long-run house

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[3] Readers may wonder how the terminal date of 1840 was selected. The Sino–British Opium Wars broke out in 1840. In the end Qing government was forced to open up to foreign forces. This brought about drastic changes in political institutions and economic conditions. Therefore we have decided to concentrate on house sales through 1840 only.

price index with historical information on population, economic conditions, government policies, and natural, political and economic shocks, and discuss what the driving forces behind the long-run historical price changes might be. We combine the historical house price series for Beijing with a series for consumer goods prices and wages to estimate the change in real house prices. More speculatively, we relate these to recent and present price levels for housing in Beijing.

The contracts underlying our dataset have not been previously used by economists. In fact, scholarly research on the historical housing market in China has been quite limited.[4] Lack of data hampers solid inquiry into this unknown area of research. Our work on historical housing prices in Beijing is the first quantitative study of China's historical housing market.

This paper makes several contributions. First, the dataset we have created covers a long span of the Qing Dynasty period, from its rise through its heyday and into its decline. The data are uniquely valuable: the house transaction contracts from which our dataset is drawn are the only reliable primary source for information on the development of the housing market in Qing Dynasty China.[5] Besides price, we also collect characteristics for properties that are the subject of transaction, and we identify the location of these properties. We are then able to link the locations to centers of political and commercial activity in historical Beijing.

Second, by estimating a hedonic price model, we construct a time series of housing prices for this period of nearly 200 years, as well as other economic series. Moreover, we construct other economic series, including measures of the price of rice and of consumer prices more broadly over the period, which we use to deflate the real estate price index to create a series in real rather than merely nominal terms. The hedonic model provides insights on the value to be attributed to particular characteristics of housing in this historical period, including the important factor of location. The housing price index provides insights on the time path of housing prices over time. The latter can be compared to other historical trends, for example those of prices more generally.

Third, in recent years, much work has been published that aims to compare real income and standard of living in China with those in other major economies in a longer historical horizon. Concerted efforts in collecting more historical price and wage data from Chinese historical archives have produced academic achievements.[6] Such studies provide valuable insights for us to understand the long-run causes, processes and consequences of the divergence between Europe and Asia. Housing-related expenses are an important item of household consumption, and changes in house prices and rental costs have large impacts on people's real income and standard of living. Due to data limitations, however, there is no study so far that incorporates housing expenses into the consumption basket. Our estimation of the long-run house price index and house values provides a benchmark that scholars can use to estimate expenditures on housing for Beijing residents in the Qing Dynasty, thus allowing more reliable estimates of costs of living and standard of living in that period in China.

Many scholars have, of course, studied housing prices, indeed for many places, using hedonic methods. Such studies covering short intervals of time are common.[7] Long-period studies, in contrast, are very few in number.[8]

One which comes close is the study of Case and Shiller (1987). The Case/Shiller index, in widespread use in the U.S., is based on repeat sales of the same property and starts in the late 1980s.[9] Shiller (2005) combines these data with other long term data series, including construction costs, to create series beginning in 1890. Linking these indexes, Shiller finds that until the recent run-up of prices in the U.S. starting in the mid-1990s, housing prices adjusted for inflation were basically constant.

The only other study that we are aware of that covers a long historical period, and the only study that covers a

[4] Several historians in China have done research on the city of Beijing, for example Han (1996), Zhang (2000) and Liu (2008a, 2008b). But these studies basically use history and sociology approaches and do not focus on the housing market and real estate prices. Zhang (2000) is the only research that utilizes some of these contracts to describe the city and the society in Beijing. But that study is also quite descriptive. The landmark English language works of Rawski (1998) and Naquin (2000) are also not focused on the matters which concern us here.

[5] These data are for Beijing, the capital throughout the period. There are no data available for other Chinese cities in this historical period.

[6] See, for example, Pomeranz (2000), Ma (2008), and Allen et al. (2011). Also, the Global Price and Income History Project (http://gpih.ucdavis.edu/) provides a collection of the most up-to-date scholarly achievements on international comparison of historical price and income history.

[7] For example, Nicholas and Scherbina (2010) collected house sale data from the *Real Estate Record and Builders' Guide* and construct a hedonic price index for the Manhattan area between 1920 and 1939.

[8] For example, Moorhouse and Smith (1994) constructed a hedonic house price index to study the effects of the row house on house prices in many US cities in the 19th century. Margo (1996) collected house rental data from newspaper ads in New York City and constructed a hedonic house rental price index for New York City between 1830 and 1860.

[9] See http://www.standardandpoors.com/indices/sp-case-shiller-home-price-indices/en/us/?indexId=spusa-cashpidff–p-us.

period comparable to ours, is Eichholtz (1997). That paper introduces a biennial historic index of real estate values for the period 1628 through 1973 for Amsterdam based on the transactions of the buildings on the Herengracht, one of the main canals in the city and finds, similarly to Case, that housing prices essentially do not change much when viewed over extended periods.

Our resources differ from those of Eichholtz in two respects. First, our index is temporally much coarser due to the relative paucity of reported transactions which we have access to in this period. Second, we are not able to track repeated sales. Instead, we construct a hedonic index with the usual dummying strategy for time.[10] Controlling for a variety of property characteristics including location, we construct a price index from the coefficients on the time variable, as is standard in the hedonic price index literature.

Measuring prices for same-house sales over time almost perfectly controls for house characteristics. In the absence of such rich information, the standard method for constructing house price indices involves including house characteristics directly in regressions and estimating price indexes over time from the coefficients of dummy variables for time. This method has been shown to produce robust price indices. But we believe that estimation of such an equation for a 200 year period has not been attempted before now. The equations perform well, in part due to the availability over time of data on a number of attributes. The estimates throw light on the importance of these property characteristics, including size of property, its location, the availability of onsite water supply, what building materials are used, and whether or not there had been formal legal registration of the property sale.

The paper is organized as follows. Section 2 introduces the historical background of Beijing's house market during our sample period. Section 3 explains in detail how we extracted variables and processed the data from original contracts. Section 4 explains how, using hedonic methods, we construct a house price index for Beijing from these data. Section 5 shows several robustness checks we make for our hedonic regressions. Section 6 compares our house price index with price indices for other consumption goods and wages. Section 7 offers a brief conclusion.

2. Historical background

In ancient China, a city's central function was as a military fortress and it was usually surrounded by walls and moats. Beijing, as the capital, had the most complicated structure of all Chinese cities. The perimeter of the city lay approximately where the Second Ring Road runs today. It enclosed an area of about 63 km^2, or more precisely 15,561 ac.[11] As shown in Fig. 1, the city of Beijing comprised two parts, the Inner City (the upper square) and the Outer City (the lower square), both surrounded by city walls. These two parts were separated by three main gates, Qianmen (the Front Gate), Xuanwu Gate and Chongwen Gate. The Forbidden City, where the royal family lived, was located in the middle of the Inner City, and was separated from it by the walls with four main gates: Dong'an Gate, Xi'an Gate, Tian'an Gate, and Di'an Gate.[12]

As the capital of this vast empire, Beijing was certainly not only a military fortress and a political center: it had many other functions. Beijing was one of the biggest commercial centers in China, a fact we will consider below. There were also a number of temples inside the city, with many of them dedicated to the government's ritual services such as the famous Temple of Heaven. There were and are several rivers and lakes in the city, and a number of gardens were built along them, although most of the gardens were not accessible to the public at the time.[13] There were certainly schools and academies in the city. But there was no public schooling system in that era and these schools and academies were for an elite group of people rather than the general public. To summarize, the activities most relevant for the everyday life of the mass of local residents in Beijing in the Qing Dynasty were carried out in the political and commercial districts.

Beijing became the capital of the Chinese empire when the Mongolians occupied China in the thirteenth century. It then became one of the largest cities in the world in terms of both area and population, with nearly one million (Han, 1996), in the mid-fifteenth century. During the Manchu–Han civil war and the peasants' rebellions of the early seventeenth century, the city became dilapidated and its population decreased substantially. Once the Manchus took over Beijing in 1644 and set it up as the capital of what became known as the Qing Empire, however, the population stabilized and began to grow. As Table 1 shows, the majority of Inner City residents in 1647 were Manchu. Its Manchu population grew rapidly until a decline in the eighteenth century

[10] For a recent discussion of the hedonic regression methods, see Diewert (2003) and the sources cited therein.

[11] Beijing now has six concentric ring roads.

[12] This is why an old Chinese proverb refers to "seven gates in the Outer city, nine gates in the Inner city, and four gates in the Forbidden city".

[13] Some of the gardens have survived. These gardens were privately owned in the Qing Dynasty but are now open to the public and attract many visitors. Princess Gong's Garden (*Gongwangfu*) is one prominent example.

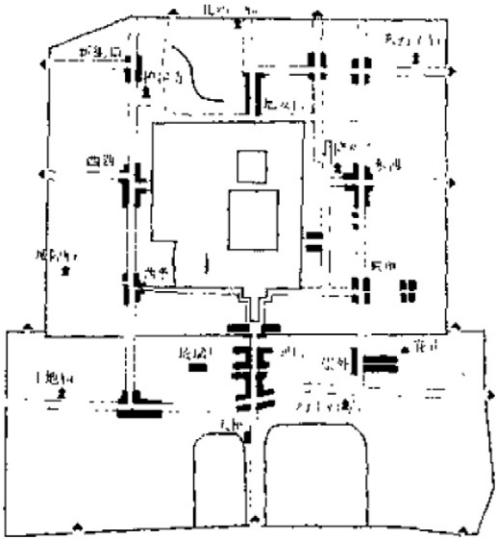

Fig. 1. The main commercial centers in Beijing in the 18th century.

while the Han population in the Inner City kept declining. In the Outer City, both the Manchu and the Han population grew substantially over this period. In the late eighteenth century, when the Qing Dynasty reached its heyday, the population of Beijing exceeded 750,000, making it once again one of the largest cities in the world.

The most popular type of residential architecture in Beijing at that time and throughout the rest of our period was a "quadrangle".[14] As shown in Fig. 2, a quadrangle is a Chinese traditional rectangular courtyard with buildings on all four sides. There are still many quadrangles inside the 2nd Ring of today's Beijing. The gate was usually on the south side of a quadrangle, and the rooms on the same side as the gate were usually for servants or nannies. The room on the north side, facing the south gate, was the master room. The rooms on both east and west sides were other living rooms and bedrooms. The sizes of quadrangles could vary a great deal. Usually a quadrangle was occupied by one (extended) family; occasionally they were shared by a few families. Some particularly large properties were composed of many connected quadrangles with two, three or even more courtyards. These were occupied by particularly large (extended) families.[15] Of course, only the quite well-off could afford such properties.

The institutions of the real estate market in Beijing changed drastically after the Manchus took Beijing in 1644. In the early years of the Qing Dynasty, this market was very primitive there and operated under tight regulation. In order to provide dwellings for Manchu troops and officials, the Manchu government occupied all the lands and houses in the Inner City and ordered that all the Han people, officials and merchants, move to the Outer City.[16] The government then took over their houses and allocated many to Manchu military and government officials according to rank. The residents remaining only had the right to use, but not to own, their residences. Buying and selling of the properties in the Inner City became illegal. Han people were allowed to enter the Inner City in the daytime but were not allowed to stay overnight. They were only allowed to own properties in the Outer City.

In contrast to the system in the Inner City, properties in the Outer City were unambiguous in private ownership and it was legal for Han people to sell these properties to other Han people though their purchase by the Manchus was restricted. Starting in the late seventeenth century, as the economy recovered from Manchu–Han civil war and the peasant rebellions, a growing number of Han merchants came to do business in the Inner City. Some of these rented properties from Manchu people. Some even discreetly purchased properties.

As time passed, the Qing government gradually relaxed the official prohibitions. Manchu people were allowed to buy houses in the Outer City from 1681 onwards. In 1733 the government officially allowed them to buy government-owned properties and issued deeds to the owners, marking that the Manchu people's ownership right was legally acknowledged. From 1758, all property transactions between Manchu people in the Inner City and Outer City were allowed. In 1782, the government began to allow property transactions between Manchu and Han people. Although the process was slow, it is very clear that a well-functioning real estate market gradually emerged in Beijing and that private property ownership gradually became established.

In the Qing period a sophisticated transaction system developed. In this system, the buyer and the seller signed a contract with the help of a real estate agent ("*Fang Ya*"). The main responsibilities of this agent were to provide house information and market suggested prices, collect

[14] In this paper we use interchangeably the terms "house", "properties", and "quadrangles".

[15] The families in question were multi-generational, including grandparents, parents, siblings and their children.

[16] As Table 1 suggests, there were some exceptions to this policy. Certain Han residents, such as those who were admitted to the Manchu military organizations, who worked and lived in government office buildings, and who worked for religious organizations, were still allowed to live in the Inner City.

Table 1
Population in the Qing Dynasty.
Source: Han (1996).

Year	1647	1656	1686	1711	1781	
The Inner City	Manchu	315,000	341,700	393,300	511,600	496,100
	Han	80,000	70,000	60,000	55,000	45,000
	Total	395,000	411,700	453,300	566,600	541,100
The Outer City	Manchu	85,000	85,600	86,700	108,400	153,800
	Han	35,000	36,300	39,000	43,700	56,900
	Total	120,000	121,900	125,700	152,100	210,736
Total	515,000	533,600	579,000	718,700	751,836	

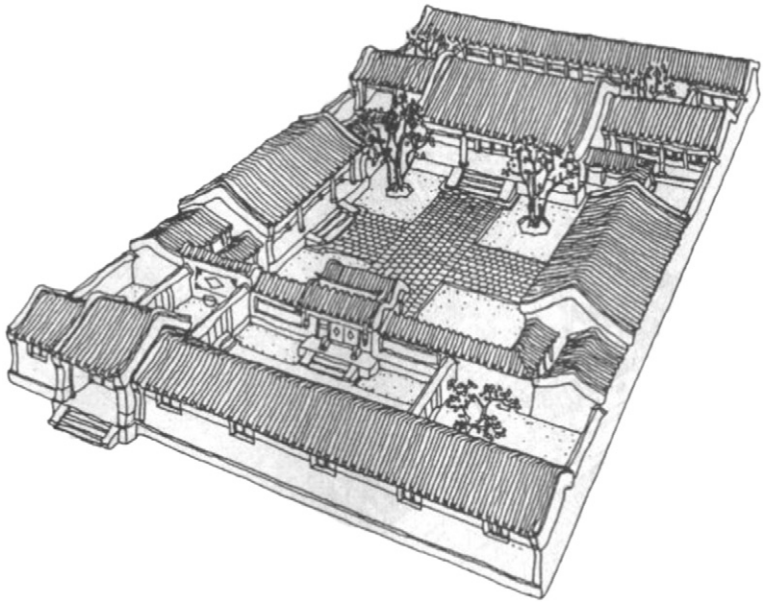

Fig. 2. Diagram of a quadrangle.

taxes for the government, and help resolve disputes. The agents were licensed by the government, and the license was renewed every five years.[17] The agents signed their names on the contracts in order to acknowledge their responsibility. The profession of real estate agent was usually inherited. In this way the agents' families could be held responsible for the house sale contracts for a longer time horizon.

The government imposed controls on house sales. In order to regulate the house sale market and collect contract taxes, the Qing government provided standardized house sale contracts with a serial number on each. The transaction tax, formally a stamp tax, was 3% of the total value. Once the contract was signed, the agent would send it to the government and pay the tax, and the government would stamp the contract in red wax and keep a record. This type of contract was known as a "red contract". Sometimes there were white contracts, that is, contracts for transactions in which the buyers and the sellers reached an agreement and signed a contract but did not report the sale to the government and did not pay the tax. Such contracts were known as white contracts due to the absence of the distinctive government stamp. White contracts were not legal, and the law clearly stipulated fines for the use of white contracts.[18] However, both red and white contracts were, in the event, used for transactions.[19]

[17] See Zhang (2000) for more details about real estate agents in the Qing Dynasty.

[18] The Grand Law of the Qing Dynasty stipulated that "those who do not pay house contract taxes receive 50 lashes and pay the fine of half the contract amount" (Zhang, 2000).

[19] It remains unclear to what extent and under what circumstances such contracts were enforced in this period (see Zhang (2000) for more detailed discussions).

Table 2
Sample distribution over periods.

Period	Sample size	Percentage of total
1645–1669	20	4.02
1670–1694	26	5.22
1695–1719	24	4.82
1720–1744	32	6.43
1745–1769	49	9.84
1770–1794	112	22.49
1795–1819	130	26.1
1820–1840	105	21.08
Total	498	100

Table 3
Distribution of the number of rooms.

Room numbers	Sample size	Percentage
$N \leq 3$	73	14.66
$3 < N \leq 5$	94	18.88
$5 < N \leq 10$	137	27.51
$10 < N \leq 15$	92	18.47
$15 < N \leq 50$	102	20.48
$50 < N \leq 100$	10	2.01
$N > 100$	2	0.40

Aside from the regular house sales, there was another type of transaction in the Qing Dynasty: pawn ("*Dian*"). Pawn usually took place when a debtor was not able to pay back the debt to his/her creditor, and transferred the house to the creditor. If the house was under a rental lease, the rental income was given to the creditor as the interests of the debt. Under the pawn contract, the creditor had the rights to use, change and transfer the houses, and the only right that the debtor kept was the redemption right when the contract was over. Therefore, pawn was a type of transaction reflecting partial transfer of property rights.

3. Data

Our study is based upon actual property transaction contracts now preserved in the No. 1 Historical Archive of China, the Chinese Academy of Social Sciences, and the Peking University Library. These contracts are the only large-scale primary source for information on the history of the housing market in Beijing in any detail. Unfortunately, a large number of the original contracts have been lost over time. (We know, for example, that fire was a problem on at least one occasion.) We do not now have enough information about the losses to assess systematically whether they have distorted the data in any way.

We hand-copied all the surviving contracts. The contracts were hand written in traditional Chinese and without punctuation, so our creation of a machine-readable database from them was no small task. We extracted from the database a number of variables useful for studying real estate prices. For the period we study in this paper (1644–1840), we utilize all 498 of the sale contracts. [20]

These sale contracts are the legal documentation of house transactions in the period under review. The information contained in the contracts is highly detailed and complete. A typical contract includes the date of the transaction, information about the buyer and the seller, the transaction price, the location of the house, information about the size of the house, about the building materials, about certain features of the house such as the presence of a garden or a well, about whether the house was to be used for business or residence, and so on. We extracted a set of variables from the contracts and coded them for use in hedonic regressions. We discuss the regression variables one by one below.

1) Transaction price

The transaction price is the central data series for our study. But the raw data require treatment. This is because currencies used in these transactions varied, even at specific moments in time, and conversion rules remain unknown. The Qing government adopted bimetallism, which is to say that silver and copper coins were in circulation. But there was never a standard exchange rate series for the two currencies. What makes the conversion particularly complex is that there were many different types of silver taels. [21] There is no standard or established method to convert prices expressed in these different coinages into those in a single currency. We use several different methods to convert all these currencies into the official standard silver tael (*Shiping Zuseyin*). We discuss the details of currency conversion in the Appendix. We

[20] There are about 100 contracts in the database not included in our study. These contracts are called Dian (pawn) instead of Mai (sale), because they allow buybacks for a prescribed period of time. For a detailed study of the differences between these two types of contracts, see Ellickson (2011).

[21] A tael is a standard weight of silver sycee (or ingot), usually corresponding to about 30 g. For transactional purposes, silver coinage was usually "sycee", which had standard shapes and weights. Copper coin was also in principle standardized. Theoretically, the exchange rate was 1 tael of silver for 1000 copper coins. But this rate kept changing in actual practice, perhaps due to problems of inconsistent purity, and the changes could be of significant proportions. The Appendix discusses these matters in greater detail.

Table 4
Distribution of courtyard numbers.

Courtyard numbers	Sample size	Percentage
1	331	66.47
2	72	14.46
3	62	12.45
4	33	6.63

then run hedonic regressions and compared results. The different methods led to similar outcomes.

These transaction prices are in nominal terms i.e. not adjusted for changes in the general price level. Since there is no extant price index for the Qing Dynasty period, we constructed an index of overall consumer prices (discussed below) to better understand house price fluctuations in long run perspective. Using this index to correct for changes in the overall level of prices, the summary statistics report that the mean real price is 492 taels, with a standard deviation of 812 taels. The minimum price is 10 taels, and the maximum price is 7631 taels.

2) Transaction date

The transaction date was recorded unambiguously in every contract. Our limited sample size does not allow us to construct an annual housing price index. So we have grouped our contracts into 25-year periods, with a total of eight from 1645. Table 2 reports the distribution of contracts (price observations) over these eight periods, and shows that transactions in early years are few but the numbers increase over time. This is true not only because recent contracts are more likely to have survived but also because the number of transactions increased over time as a result of population growth (see Table 2) and rapid developments in the economy and commerce in Beijing as we discuss below.

3) Number of rooms

Information on the square footage of the transacted units, the quadrangles, is not available.[22] We use the total number of rooms as a proxy for the size of the units. Table 3 reports the distribution of units by the number of rooms in our sample.

Using the number of rooms to proxy the size of the transacted property assumes that all the rooms are roughly of equal size. This is surely untrue. First of all, rooms with different functions also typically had different sizes. For example, the master room of a house provided for a third-ranked official was about 75 m^2, while other rooms were only about 48 m^2. Furthermore, according to historical archives, room sizes of government-provided houses varied with the status of the owners. For example, rooms of a house provided for sixth-ranked officials (usually prefecture leader) are roughly 60 m^2, while those provided for common government employees are only about 16 m^2 (Li et al., 2002). For all the potential problems with this measure, however, there is no better alternative. To minimize the problems in our study, we introduce the variable "courtyard numbers" to control for variations in room size, as discussed below.

4) Courtyard number (进, *Jin*)

As we stated earlier, dwelling houses were usually in the form of a quadrangle. Quadrangles typically were made up of four buildings.[23] Size, structure, and quality of residential properties varied a great deal and one of the biggest factors affecting the value of a house was how many courtyards it contained.[24] A small quadrangle usually contained a single courtyard surrounded by rooms on all four sides. A medium-sized quadrangle would have contained two or three courtyards, each surrounded by buildings (or chambers). A large quadrangle would have had more than four courtyards. Large quadrangles were usually very expensive and, as noted above, only very rich merchants and high-ranked officials could afford to own them. The number of courtyards a property possessed was recorded clearly in the contracts. Table 4 reports the distribution of courtyard numbers in the quadrangles in our sample. The table shows that about 2/3 of the transacted properties had only a single courtyard and only 6.63% of the houses had four courtyards.

One attractive feature of number of courtyards as a variable is that it seems likely to have been highly correlated with average room size. In this period,

[22] Many hedonic studies use the number of rooms in this way and the variable is viewed even in the literature on current periods as a good proxy for size. For an example from the historical literature, Margo (1996) adopts this proxy in his study on the house rental prices in New York between 1830 and 1860.

[23] In this paper we use the word house as a synonym for quadrangle (in the sense of the sentence in the text—the Chinese symbol for quadrangle means both the architectural formation and the geometric shape). This is a slightly technical usage and does not quite correspond to that in ordinary English (in which 'courtyard' and 'quadrangle' are roughly synonymous). The unit in our data is the sale of a "quadrangle".

[24] In a large family residence, as was noted above, several of what might otherwise be quadrangles might be connected, so that the property had several courtyards. Such properties could sell as a single unit.

	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	XIII
I		3	3	3	3	3	3	3	3	3	3	3	
II	3	3	3	3		2	2	2	3	2	2	2	
III	3	3	2	2	2	2	1	2	3	2	1	1	
IV	3	3	2	1	2	2	2	2	3	2	2	2	
V		3	2	2	2		3	2	2	2	2	3	
VI	3	3	2	1	2			2	1	1	2	3	
VII		2	2	2	2			2	2	2	2	3	
VIII	3	2	1	2	3			3	3	2	2	2	
IX	3	2	2	2				3	3	2	1	2	
X	2	2	2	2	2	2	2	2	2	2	2	2	
XI	2	1	1	1	1	1	1	1	1	1	1	1	2
XII	2	1	1	1	1	1	1	1	1	1	1	1	2
XIII	2	2	2	2	2	2	2	2	1	2	2	2	2
XIV	3	2	1	1	2	3	3	2	2	2	3	3	3
XV	3	2	2	2	2						3	3	3
XVI	3	3	3	3	3						3	3	3
XVII	3	3	3	3	3						3	3	3

1 Commercial center 2 Areas close to commercial centers 3 Areas far to commercial centers Restricted areas

Fig. 3. Commercial centers in Beijing.

quadrangles with more courtyards were usually luxurious properties owned by members of the upper class and such properties usually had bigger rooms. So we construct a "number of courtyards" variable for our hedonic regressions to control for unobserved variations in room size.

5) Contract type

In the Qing Dynasty, as noted above, there was a legal requirement that every property transaction contract be endorsed (via the red stamp) by the government and that at that time a transaction tax of 3% of the transaction value be paid. A red contract is a complete legal document, and private ownership established by a red contract was fully protected by the government. However, as described above, some buyers and sellers agreed not to send the contracts to the government for endorsement so as to avoid paying the transaction tax. Such "white contracts" were not, strictly speaking, complete legal documents and private property ownership interests associated with these contracts were, at least in principle, not fully recognized and protected by the government. Whether a contract was red or white might have affected the market value of the property. In our dataset 24.1% of the contracts are white. We included this variable in our hedonic analysis to check whether any significant price difference between two types of contracts, all else equal, can be observed.

6) Location

Location is, needless to say, a key attribute of any property. There are usually a relatively small number of types of important functional centers in a city, particularly a large one, such as commercial districts, political centers, and education centers, and this was the case in historical Beijing. Adjacency to these functional centers is likely to have a significant influence on the demand for individual properties and thus on their prices.

In order to measure the distances between our sample properties and major commercial and political centers, we need to first position our properties and these major centers on a map. We spent a great deal of time consulting surviving historical materials attempting to locate these addresses precisely. The idea was then to mark these addresses on a digitized historical map of Beijing city. The historical map we used is a famous one called "A Complete Map of the Capital in the Qianlong Period" (*Qianlong Jingcheng Quan Tu*). Completed in 1750, the original of this map is about 14 m long and 13 m wide,

	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	XIII
I		2	2	2	2	2	2	2	2	2	2	2	
II	3	2	2	2		2	2	2	2	2	2	2	
III	3	2	2	2	2		2	2	2	2	2	2	
IV	3	2	2	1	1		1	1	2	2	2	2	
V		2	2	1	1		1	1	2	2	2	2	
VI	3	2	2	1	1			1	2	2	2	2	
VII		2	2	1	1			1	2	2	2	2	
VIII	3	2	2	1	1			1	2	2	2	2	
IX	3	2	2	1				1	2	2	2	2	
X	3	2	2	1	1	1	1	1	2	2	2	2	
XI	3	2	2	1	1	1	1	1	2	2	2	2	3
XII	3	3	3	3	3	3	3	3	3	3	3	3	3
XIII	3	3	3	3	3	3	3	3	3	3	3	3	3
XIV	3	3	3	3	3	3	3	3	3	3	3	3	3
XV	3	3	3	3	3						3	3	3
XVI	3	3	3	3	3						3	3	3
XVII	3	3	3	3	3						3	3	3

1 Royal City 2 Inner City 3 Outer City Restricted areas

Fig. 4. Political centers in Beijing.

with a scale of 1/650. The map is considered to be very reliable and is probably the most widely used historical map of Beijing city for the early and middle Qing period.

Because many addresses recorded in the contracts changed over time (as areas were redeveloped, houses were renumbered, and individual street names sometimes even came and went), it was not possible on a consistent basis to attach precise locations to all house properties for which we have contracts. But the situation is better than it sounds. It was possible to divide the map into 17 * 13 = 221 grid cells, each of which encloses a relatively compact area of about 70 ac, and to locate each of the properties in a specific cell. The grid map is illustrated in Fig. 3 (compare Fig. 1).

It will be helpful to inscribe some features of the city on the grid map. The biggest commercial district in Beijing city during the Qing Dynasty, an area which is still commercially very active today, was Qianmen (the front gate). Located in the Outer City, the Qianmen area was not simply a commercial district but was also the biggest center of the financial industry and other service industries such as catering, performance art, and hotels. Caishikou was another major commercial district in the Outer City. The Inner City was designed as a political center at the beginning of the Qing Dynasty, and commercial activities in the Inner City declined significantly in the early Qing period. From the late seventeenth century onwards, commerce revived in the Inner City and a few large markets came into existence. Longfusi, Huguosi, Dongsi and Xisi were the four biggest markets in the Inner City. These main commercial districts are marked in Fig. 3.[25]

The most important political center in Beijing city during the Qing Dynasty was of course the Forbidden City. The Forbidden City, also known as the Palace City, was where the royal family lived and worked, and was located at the center of the Inner City. Outside the Forbidden City was the area called the Royal City, where many central government departments were located. The Forbidden City and the Royal City were political centers throughout the dynasty. Their cells are marked with the number 1 in Fig. 4.

Table 5
Summary statistics of distance to commercial centers.

Distance to commercial centers	Number of observations	Percentage
At commercial centers	222	44.58
Close to commercial centers	202	40.56
Far to commercial centers	74	14.86

[25] A close reading of Fig. 1 will show that some areas on the map are identified as uninhabitable and others "blank". Uninhabitable cells are largely taken up by rivers, lakes, or temples. Fig. 1 shows inter alia that the city walls did not enclose a precisely rectangular shape. Blank areas are outside the city walls.

Table 6
Summary statistics of distance to political centers.

Distance to political centers	Number of observations	Percentage
Close to the Forbidden City	42	8.43
Other areas in the Inner City	125	25.1
The Outer City	331	66.47

With all the addresses, the commercial districts and the political centers inscribed on the grid map, we need to create variables measuring the distances between the properties and these centers. We do this in a stratified rather than continuous fashion. We assign variable values according to the distances to the nearest commercial district as follows: 1 corresponds to the cell including a commercial district; 2 corresponds to the cells adjacent to a commercial district cell; and 3 corresponds to the cell neither including a commercial district nor being adjacent to one which does. In this way, every property in our sample is assigned a value measuring its distance to the nearest commercial district according to which cell in the map grid it occupies. Of course this measure is a variably accurate proxy for the actual distance: we are obliged to adopt this method because the precise distances could not consistently be measured. Table 5 reports the summary statistics of distance to the commercial districts on this basis. It shows that about 85% of real estate transactions took place in or close to the commercial districts, demonstrating that distance to commercial districts is indeed a critical factor in determining demand for the properties, the imprecision of our measure notwithstanding.

We use a similar method to create a variable to measure the properties' distances to the political centers and assign a value to this variable according to its distance to the Forbidden City: 1 if the property was inside the Royal City, 2 if the property was not in the Royal City but in the Inner City, and 3 if the location was in the Outer City. Table 6

Table 7
Hedonic regression results.

	(1)	(2)	(3)	(4)	(5)	(6)
No. of rooms	0.0499***	0.0502***	0.0626***	0.0934***	0.0492***	0.0494***
	(0.0029)	(0.0035)	(0.0039)	(0.0063)	(0.00262)	(0.00274)
No. of courtyards	0.320***	0.330***	0.269***		0.322***	0.330***
	(0.0454)	(0.0471)	(0.0459)		(0.0407)	(0.0422)
No. of rooms per courtyard				−0.486***		
				(0.0069)		
Red contract	0.0790	0.0958	0.0242	0.0652	0.0455	0.0217
	(0.0948)	(0.1210)	(0.0940)	(0.0880)	(0.0853)	(0.0865)
Close to commercial center	−0.261***	−0.264***	−0.245***	−0.225***	−0.237***	−0.231***
	(0.0851)	(0.0944)	(0.0842)	(0.0794)	(0.0766)	(0.0795)
Far from commercial center	−0.318**	−0.853***	−0.278**	−0.343***	−0.386***	−0.369***
	(0.1270)	(0.2150)	(0.1280)	(0.1187)	(0.114)	(0.117)
Forbidden City	−0.0142		−0.0428	−0.0894	−0.0775	−0.151
	(0.1560)		(0.1540)	(0.1457)	(0.139)	(0.145)
Outer City	−0.302***		−0.220**	−0.306***	−0.374***	−0.378***
	(0.1070)		(0.1080)	(0.0980)	(0.0962)	(0.0996)
Clay material	−0.675***	−0.679***	−0.473**	−0.782***	−0.705***	−0.690***
	(0.2040)	(0.2570)	(0.2100)	(0.1898)	(0.182)	(0.189)
Commercial property	0.235**	0.1510	0.276**	0.1929*	0.0911	0.204**
	(0.1110)	(0.1500)	(0.1100)	(0.1034)	(0.101)	(0.104)
In poor repair	−0.333**	−0.2910	−0.391***	−0.329	−0.355***	−0.339***
	(0.1430)	(0.1860)	(0.1400)	(0.1330)	(0.128)	(0.133)
Having a well	0.756***	0.640*	0.507*	0.743***	0.719***	0.699***
	(0.2710)	(0.3350)	(0.2690)	(0.2527)	(0.243)	(0.253)
Year						0.0037***
						(0.0008)
Constant	3.893***	3.606***	3.817***	4.343***	3.967***	−1.723
	(0.2390)	(0.2240)	(0.2400)	(0.2171)	(0.228)	(1.438)
N	498	331	488	498	498	498
R^2	0.5220	0.5830	0.5130	0.5492	0.601	0.540

Standard errors in parentheses.
* $p < 0.1$.
** $p < 0.05$.
*** $p < 0.01$.

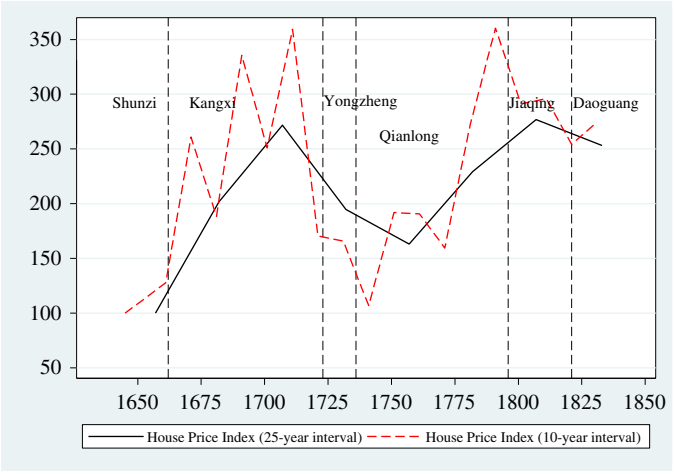

Fig. 5. House price indices for 25-year interval and for 10-year interval.

reports the summary statistics of distance to the political centers. The table shows that about 2/3 of our sample transactions took place in the Outer City, which was far from the Forbidden City.

7) Construction materials

Most houses in Beijing during the Qing Dynasty were built of brick with roofs covered in tile. Bricks and tiles had been in wide use since the Ming dynasty, and houses built with these materials withstand bad weather better. However, the materials and workmanship required were expensive. A small number of houses in Beijing were built from limestone clay, which was an inferior material. Building from limestone clay was much less expensive at that time despite the materials not providing sufficient warmth in the cold weather of winter. If a house was built with limestone clay, its market value would be seriously affected. We find that only 3.6% of our sample properties were built with limestone clay.

8) Usage of house

Our dataset covers both residential and commercial properties and the contracts record clearly whether the houses were for commercial use or not. About 85% of our samples are residential properties. All else equal, a commercial property might be more expensive due to the prospective profits from the commerce.[26] We put a variable showing house usage into our hedonic regressions and control for the effect in estimating house prices.

9) Condition of the properties

Some properties in our dataset were in poor repair.[27] In particular, summary statistics show that 7.43% of our sample properties were recorded as in poor condition. The market value of a property was certainly adversely affected if this was the case. We control for this factor in our hedonic regressions to better estimate house prices.

10) Having a well

Some properties in our dataset came with an on-site water well. Water supply was not easy in such a big city in this pre-modern period. Most families in Beijing had to fetch water from public wells or buy it from water suppliers. Therefore, having a private well in the house provided huge convenience and such properties were usually in great demand. Although only a small number of properties had a well, we find it helpful to control for this factor in our regressions.

4. Empirical analysis

The first objective of this paper is to construct a house price index for Beijing for the period we study. In order to obtain this index, we use hedonic regressions to adjust

[26] In this period, urban life seems to have been much more desired than relatively rustic tranquility. We find no evidence of grand properties away from the center of the city.

[27] The properties that were marked as "in poor condition" were inhabitable but usually needed further renovation. Naturally, the extent of the necessary renovation varied; and we have no independent means of capturing this.

Table 8
Hedonic regression results for robustness checks.

	(1)	(2)	(3)
No. of rooms	0.0499***	0.0459***	0.0493***
	(0.0029)	(0.00918)	(0.00280)
No. of courtyards	0.320***	0.355***	0.323***
	(0.0454)	(0.0875)	(0.0526)
Red contract	0.0790	0.169	−0.00325
	(0.0948)	(0.263)	(0.0919)
Close to commercial center	−0.261***	−0.243*	−0.250***
	(0.0851)	(0.178)	(0.0874)
Far from commercial center	−0.318**	−0.451	−0.391***
	(0.1270)	(0.389)	(0.122)
Forbidden City	−0.0142	−0.339	−0.0982
	(0.1560)	(1.016)	(0.140)
Outer City	−0.302***	−0.637	−0.341***
	(0.1070)	(0.528)	(0.0988)
Clay material	−0.675***	−0.794	−0.835***
	(0.2040)	(1.045)	(0.186)
Commercial property	0.235**	0.00341	0.205**
	(0.1110)	(0.526)	(0.101)
In poor repair	−0.333**	−0.387	−0.310**
	(0.1430)	(0.363)	(0.138)
Having a well	0.756***		0.706***
	(0.2710)		(0.239)
Constant	3.893***	4.079***	4.684***
	(0.2390)	(0.625)	(0.186)
N	498	113	385
R^2	0.5220	0.578	0.566

Standard errors in parentheses.
* $p < 0.1$.
** $p < 0.05$.
*** $p < 0.01$.

for changes in the attributes of the sample over time (for example, different sample sizes in different periods), as well as to control for characteristics of the individual transactions. The dependent variable is the log price of each transacted property, and the independent variables are period dummies as well as the characteristics of these properties: distance to commercial district, distance to political center, number of rooms, number of courtyards, contract type, building materials, commercial or residential property, whether it was in poor condition, and whether it had a well. The regression specification is as follows:

$$\log p_{it} = \alpha_0 + \alpha_t D_t + \sum_{n=1}^{N} X_{in}\beta_n + \varepsilon_{it},$$

where $\log p_{it}$ is the log price of property i in period t; α_0 is the constant term; and D_t is the period when the contract was signed. We have 8 periods from 1645 to 1840, 25 years for each period; X_{in} is a series of attributes of the quadrangles mentioned above; and ε_i is the error term. The first column of Table 7 reports the results.

The regression shows that house prices increase significantly with the number of rooms and the number of courtyards. Each additional room increases the price by 5%, and each extra courtyard increases it by 32%. This confirms that the size of a property is a critical factor in determining its market value.

Our regressions also indicate that the price difference between red and white contracts is not significant. This is surprising, at least in principle, because presumably the property price in red contracts could be higher because this type of contract was fully recognized and protected by the law. Certainly we need to study this issue further before we can explain this result with any confidence. But it is an established fact that in some lawsuits in the Qing Dynasty a white contract was still accepted as a proof of property ownership (Xu, 2009). Therefore, for a buyer and owner, signing a white contract did not absolutely hamper sale and ownership. Whatever the dangers to unregistered ownership were, they may have been small. This is possibly the reason why the price difference between the two contracts is insignificant.

It is clear from our regressions that location is extremely important for a property's market value. We use two dimensions to measure location premium: distance to commercial districts and distance to political centers. We find that the properties close to commercial districts were about 26% cheaper than those in commercial districts, and the properties far

Table 9
House price index and rice price index.

Period	House price index	Period	Rice price index
1645–1669	100.00	1641–50	100.00
1670–1694	201.78	1651–60	95.12
1695–1719	271.83	1661–70	67.80
1720–1744	194.84	1671–80	51.60
1745–1769	163.07	1681–90	68.39
1770–1794	229.33	1691–1700	58.37
1795–1819	276.77	1701–10	76.44
1820–1840	253.20	1711–20	73.30
		1721–30	69.71
		1731–40	79.32
		1741–50	90.62
		1751–60	129.61
		1761–70	136.32
		1771–80	120.46
		1781–90	127.38
		1791–1800	155.55
		1801–10	172.21
		1811–20	170.22
		1821–30	153.77

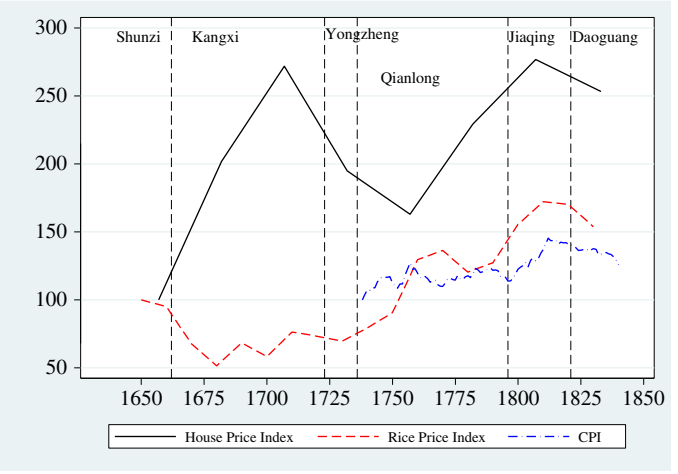

Fig. 6. House price index, rice price index and CPI.

Table 10
Consumer price index in the mid Qing period.

Year	CPI	Year	CPI	Year	CPI
1738	100	1773	115.96	1807	128.65
1739	103.91	1774	114.95	1808	130.13
1740	107.24	1775	114.5	1809	134.33
1741	107	1776	117.99	1810	137.02
1742	109.05	1777	115.63	1811	141.55
1743	108.84	1778	114.94	1812	145.48
1744	113.17	1779	117.03	1813	143.67
1745	115.85	1780	117.77	1814	143.47
1746	116.82	1781	116.51	1815	144.07
1747	116.73	1782	118.7	1816	141.13
1748	116.6	1783	123.16	1817	142.46
1749	117.16	1784	122	1818	141.98
1750	112.4	1785	120.09	1819	142.1
1751	110.31	1786	120.69	1820	140.81
1752	108.65	1787	121.67	1821	140.88
1753	111.73	1788	122.91	1822	139.53
1754	111.69	1789	123.35	1823	138.34
1755	118.2	1790	121.77	1824	136.36
1756	122.67	1791	122	1825	136.52
1757	127.21	1792	121.41	1826	136.97
1758	122.5	1793	117.55	1827	136.25
1759	122.97	1794	116.88	1828	137.65
1760	119.66	1795	116.62	1829	136.76
1761	116.29	1796	113.91	1830	137.69
1762	117.31	1797	113.95	1831	137.12
1763	117.2	1798	116.11	1832	133.27
1764	115.69	1799	119.16	1833	133.62
1765	113.08	1800	122.5	1834	134.24
1766	114.25	1801	124.24	1835	134.83
1767	114.36	1802	125.31	1836	133.87
1768	111.24	1803	127.55	1837	133.4
1769	110.08	1804	124.3	1838	131.74
1770	109.94	1805	129.32	1839	129.56
1771	112.53	1806	130.55	1840	125.79
1772	115.45				

away from commercial districts were about 32% cheaper than those in commercial districts. In terms of distance to political centers, our regressions show that as long as the property was in the Inner City, prices did not significantly differ from each other. This is probably because many other important government offices were located in different parts of the Inner City. Therefore, although the Forbidden City was where the central court located, being adjacent to the Forbidden City did not bring substantial price premium as long as the property was in the Inner City. In sharp contrast to that finding, our regressions confirm that it made a huge difference if the house is located in the Inner or in the Outer City. Houses in the Outer City were about 30% cheaper than those in the Inner City. This shows that the Inner City as a whole was the political center and thereby secured a significant location premium for all the properties there.

Commercial properties were 23.5% more expensive than residential properties, according to our regression analyses. Our regression also shows that the prices of the properties built with clay were 67.5% lower than those built with brick and tile. Houses in poor repair were about 33.3% cheaper than those in good condition. Having a well added a premium of 75.6% to the market value of a property, according to our regression results.

While our dataset contains fewer observations than we might like, we are able to successfully estimate a hedonic house price model for the entire period with a relatively high degree of explanatory power. Our results show the characteristics that contributed to the value of Beijing housing. The inclusion of a time variable enables us to construct a housing price index for Beijing over the time period.

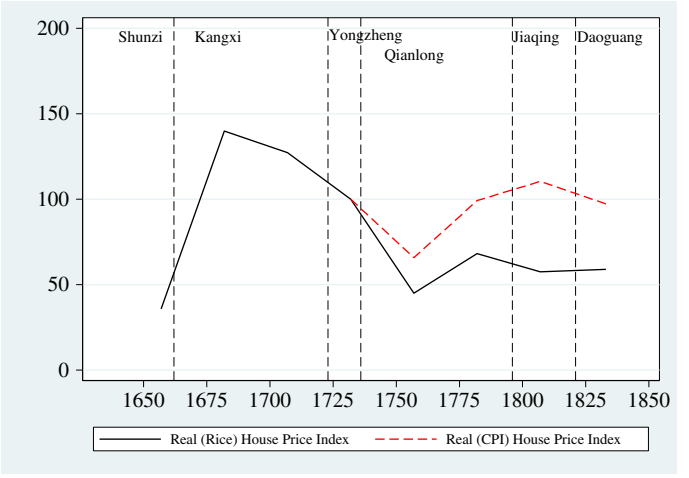

Fig. 7. Real house price indices deflated by rice price index and CPI.

5. Robustness check

We calculate four different specifications of our regressions. In the second column of Table 7 we use only the contracts from the Outer City. We do this because the real estate market in the Outer City was much more active than in the Inner City, and was less regulated by the government. In the third column we drop a few outlier contracts in which the number of rooms was either more than 100, or only 1. We drop these few outliers for a robustness check. As Table 7 shows, the results are quite similar to the regression result when we use the full sample, which is reported in the first column. This shows that our hedonic estimation is quite robust.

In the above specifications, we use the number of courtyards to control for unobserved differences in room size, because historical evidence suggests that these features are positively correlated. As population grew in Beijing over time, demand for more housing became acute. One simple method of increasing housing supply is to divide a courtyard into more rooms. This would imply smaller room sizes over time and, if this factor is not controlled for, an underestimate of the housing price index would be underestimated if this factor is not controlled. Our data indicated this was true. In the 17th century, each courtyard had about 4.5 rooms, in the 18th century about 6 to 7 rooms, and in the early 19th century had about 10 rooms. Therefore, it is reasonable to believe that there is a negative correlation between the room size and number of rooms per courtyard. By this token, as a robustness check we use the number of rooms per courtyard instead of the variable "number of courtyards" to control for the unobserved differences in room size. The regression result is reported in column 4 of Table 7. As we would expect, the coefficient of the number of rooms per courtyard is significantly negative. The coefficient of the number of rooms remains significantly positive after we control for the room size factor. The coefficients of other house attributes are similar to those in previous regression specifications. Such results indicate that our hedonic regression is robust.

In our main regression specifications, we estimate the house price index for every 25 years. This is a quite coarse partition, and we do this because our sample is small. However, we also group our sample into 10-year intervals and check if the hedonic regression results are significantly different. As column 5 of Table 7 shows, the results are quite robust even if we group our samples into 10-year intervals. We also plot the house price index using the 10-year interval method in Fig. 5 and compare this with our main index. As the figure suggests, the general patterns of the two house price indices are quite similar.[28]

All the previous regressions treat dates of transactions as dummy variables. Alternatively, we treat years of transactions as a continuous variable to check if the estimation results from this specification are significantly different from the results of dummy regressions. The results are reported in column 6 of Table 7. The estimated

[28] Our discussion is based on the 25-year partition due to concern about small cell sizes with the finer partition.

coefficients of other attributes are quite similar, and the coefficient of the variable "year" is significantly positive, indicating a moderate rising trend in house price. This is consistent with the results using a 25-year interval dummy and a 10-year interval dummy.

In all previous specifications, we pool all the house sale contracts together and treat different periods as dummies or one single continuous variable. In order to check the robustness of our estimation results, we divide the contracts into two groups: 1645 to 1750, and 1751 to 1840, and estimate house prices in these two periods separately. Table 8 reports the results. Its first column is identical with column 1 of Table 7, which reports the results of the pooled regression, and columns 2 and 3 report the estimation results for the two periods respectively. Table 8 shows that the estimated coefficients of major attributes remain roughly the same when we divide our sample into two parts. For several attributes such as "close to commercial center", "far from commercial center", etc., the estimated coefficients for the first period are not significant, mainly because there are no enough sample points in this period. Therefore, we are confident to conclude that the estimated house price trends are robust.

6. A housing price index

One of the main objectives of doing the above hedonic regressions in this paper is to estimate the coefficients of 8 period dummies and obtain the housing price index. We report the index values in Table 9. In Fig. 6 we plot out the estimated coefficients of the period dummies obtained in our first regression specification.

This house price index is not inflation-adjusted. In the period we study there is no extant price index for Beijing or for China that resembles a consumer price index. That being the case, we first compare our house price index with a rice price index. Secondly, we construct a new consumer price index for Beijing for the eighteenth and nineteenth centuries and compare our house price index with this CPI. In this way we can better understand the economic implications of the fluctuations in the real estate prices.

Rice was probably the most important commodity in pre-modern China. According to Peng (2006), expenditure on grain was on average no less than 55% of the total expenditure for Chinese families in the eighteenth century, and a large portion of this expenditure was on rice. Because of its importance, the Qing government collected rich data on rice prices across the country, and these data provide us with a benchmark in estimating house price levels in the Qing Dynasty. Some scholars have utilized these grain price data to study various aspects of the economy in the Qing Dynasty.[29] Peng (1954) presents a national average rice price series for the Qing Dynasty, and we use this data. We index the data, report the rice price index in Table 9, and plot the index in Fig. 6.

The price of rice is of course only a partial proxy for the general level of consumer prices. A comprehensive estimation of price levels requires more information. In order to better understand the changes in the real estate prices, we construct a consumer price index for Beijing in the Qing Dynasty. Our CPI starts from 1738 because the only price data available before 1738 are for rice alone. Between 1738 and 1840, however, we obtain price data of 14 main consumption goods for Beijing from Allen et al. (2011).[30] Suitable weights for these commodities are available in Yan (2008). Combining these, we generate the CPI for Beijing over our sample period which is reported in Table 10 and plotted in Fig. 6 (above).

To examine more precisely the changes in the housing prices relative to the general price level, we deflate the nominal house price index by the rice price index and the CPI, and obtain the two real house price indices which are plotted in Fig. 7.

It is evident from Fig. 6 that the trend of the nominal house price index is roughly consistent with the rice price and our proposed CPI from the early eighteenth century to the end of our sample period. This is more clearly shown in Fig. 7. As we see from the figure, the real house prices, deflated by both rice prices and CPI, were relatively stable in this period.

The situation was quite different in the first half of the period we study, from 1650 to 1750. Fig. 6 shows that in this period the trend of our nominal house price index differed from that of the rice price index and CPI. The trend of the rice price index indicates that the price level remained very low from 1640 to 1725, but then began to rise markedly, suggesting substantial economic growth. However, our estimation shows that house prices soared in the late seventeenth century, and plummeted in the early eighteenth century. Real house prices increased about three times in the late seventeenth century and dropped about the same amount (in rice price terms, less in terms of the CPI) in the early eighteenth century (See Fig. 7). Such drastic changes in the price of housing may not have been caused by the state of the economy but rather by government policy.

[29] See, for example, Wong (1975), Li (1992), Shiue (2002), and Shiue and Keller (2007).

[30] The price data used by Allen et al. (2011) are available on the Global Price and Income History website (http://gpih.ucdavis.edu/Datafilelist.htm), and not in the published paper.

Starting in the mid-seventeenth century, the economy gradually recovered and the population of Beijing, particularly the Manchu population, increased very briskly (see Table 1). The government began to relocate the Manchu population from the Inner City to the Outer City, to suburban areas and even to other cities and provinces. Retired officials were ordered to move back to their home towns. Quite apart from the planned relocations initiated by the government, many Manchu people voluntarily moved out of the city due to soaring living expenses. According to Han (1996), a total of at least two hundred thousand people moved out of the Inner City. The government also enforced tight control on the movement of people from other provinces to Beijing. In addition, according to Li et al. (2002), when the government observed that the low-income Manchu people were not able to afford expensive houses in the Inner City, it built a great number of new houses in the Inner City and the suburbs very close to the Inner City and allocated them to the low-income Manchu people in the late 17th and early 18th centuries, and also encouraged the Han people to build new houses in the Outer City. These policies alleviated population pressure in Beijing and drove down house prices in the early eighteenth century. Historians have speculated about these population shifts, political pressures, and resulting policy shifts. Here we confirm that house prices fell in this period, evidence that is certainly consistent with the implementation of such policies.

7. Were houses expensive in Qing Dynasty?

A natural question following on our study of the real estate market and estimation of house price index in the Qing Dynasty is: were houses expensive in Qing Dynasty? One benchmark we use to answer this question is recent house prices in Beijing. According to the data released on the website of Beijing Municipal Commission of Housing and Urban–rural Development, the average price of second-hand apartments in Beijing for October 2011 is 21,852 Yuan per square meter.[31]

Another benchmark one might use for comparisons is the house prices in Beijing around 2002. The Chinese government commenced housing market reform in 1998 and a well-functioning market was in place by 2002, four years after the reform began. House prices in major Chinese cities began to soar after 2002. It is estimated that in megacities such as Beijing and Shanghai between 2002 and 2010, nominal growth rates in the price of housing were over 20% per annum.[32] We therefore also compare the house prices in the Qing Dynasty with the prices before this recent house price run-up so that we can form a more robust notion of how expensive the houses then from today's perspective.[33] According to the data source noted in the previous paragraph, the average price of second-hand apartments in Beijing for 2002 was 4467 Yuan per square meter.

Our data allow us to compare house prices for Beijing in recent years with those in the past. In order to do so, we first need to estimate the market value of one square meter of an average house in Beijing in the Qing Dynasty. An average house in our study is defined by averaging all the house attributes we discuss in the hedonic regressions. By this principle, a hypothetical "typical" house in Qing Dynasty had the following attributes: 8 rooms, 2 courtyards, red contract, in the commercial district of the Outer City, residential properties, made in tile, not in major disrepair, no on-site well. As we noted, the size of a usual room in Qing Dynasty varied from 20 to 50 m^2. In this way we estimate the price of 1 m^2 of a typical house in different periods. Table 11 reports the market values of this house in different periods.

Given that we try to compare the house prices over two hundred years and over these two centuries there was drastic political and economic changes in China, we cannot deflate the house prices with a single price index. Instead, we try to estimate how expensive the houses were over the two centuries by comparing them with wages and the prices of some representative consumption goods.

A representative consumption good that we use to compare how expensive the houses were in different periods is rice. Rice has been one of the most important staple foods in China in past centuries, and the rice price is available throughout our sample period.[34] The retail price of common rice in Beijing was about 5 Yuan per kg in 2011 and 2002. One square meter of house in Beijing was therefore worth about 4370 kg of rice in 2011, and about 893 kg of rice in 2002. For the house price relative to rice during the Qing Dynasty period,

[31] See http://www.bjjs.gov.cn/publish/portal0/tab1094/.

[32] The property prices are obtained from "the Property Price Indices of 70 Large and Medium Cities" and "Report on Property Developments in 35 Large and Medium Cities" compiled by the National Bureau of Statistics. We use geometric average in calculating these indices. Note that the indices may have underestimated the actual price rises because they use property sale data alone, and fail to take into account characteristics such as location.

[33] We would prefer to use 1998 as the later year for these comparisons. But that was the year in which transactions began, and the market was relatively small and dispersed.

[34] As noted earlier, the rice data are obtained from Peng (1954).

Table 11
House price relative to rice price and wage (in silver tael).

Period	Value of house	Value of 1 m^2	Rice price (1 kg)	Kilograms of rice per square meter of house	Daily unskilled wage	Days needed for 1 m^2 of house
1645–1669	111	0.28–0.69	0.0055	50–126	0.14	2–5
1670–1694	224	0.56–1.40	0.0038	147–368		
1695–1719	302	0.76–1.89	0.0045	168–419		
1720–1744	216	0.54–1.35	0.0049	110–276	0.12	4.5–11
1745–1769	181	0.45–1.13	0.0078	58–145		
1770–1794	254	0.64–1.59	0.0082	77–194	0.038–0.061	16–26
1795–1819	307	0.77–1.92	0.0107	72–179		
1820–1840	281	0.70–1.76	0.0110	64–160	0.083	8.5–20

we report estimation results in Table 11. We find that in the early eighteenth century 1 m^2 of house was worth 168 to 419 kg of rice. Measuring with the price of rice, today's house price is at least 6 times as high as that in Qing Dynasty. The upper bound could be 40 times.[35] Comparing the price of housing in the Qing Dynasty to housing prices in Beijing in the pre-run-up year of 2002 we find that the housing price measured by rice roughly doubled between the early eighteenth century and 2002.

Using the price of a single commodity to compare house prices is clearly insufficient. Quality improvement in today's houses remains an issue too.[36] Moreover, the long-run decline of rice price and share of rice in today's consumption budget undermines the utility of our estimation. Alternatively, we compare the relative price of housing in terms of the wage level in different periods.

According to the *Statistical Yearbook of Beijing 2011*, the average annual wage for urban employees in Beijing then was 65,683 Yuan in 2011.[37] It would therefore take an average employee about 120 working days to earn enough to purchase (without a mortgage) 1 m^2 of housing in Beijing. The same data source indicates a 2002 average annual wage for urban employees in Beijing of 21,852 Yuan. It therefore would have taken an average employee about 73 working days to earn enough to purchase (without a mortgage) a square meter of housing.

We also attempt to compare house prices with wage levels in the Qing Dynasty. Unfortunately, we do not have anything resembling a time series for wages for the early- and mid-Qing Dynasty—we can only collect a few observations to form rough estimates. These scattered wage records are reported in Table 11 as well. According to "Collection of the Cases of Imperial Statutes" (*Qinding Daqing Huidian Shili*), the daily wages of ordinary workers in palace building projects was 0.14 silver tael between 1645 and 1669. A typical house in that period was worth 111 silver taels. It would therefore have taken 793 working days to earn enough to purchase the typical home and 2–5 working days to earn one square meter of house in that period. Between 1720 and 1744 the daily wage of an unskilled laborer was about 0.12 silver tael. A typical house in those years was worth 216 silver taels, implying that it would have taken about 4.5–11 working days to purchase one square meter of a house.

For the late eighteenth century, Peng (2006) records from *Wuliao jiazhi zeli* ("Regulations and precedents on the prices of materials") that a regular laborer in Zhili province, the province surrounding Beijing city, earned about 34 to 55 copper coins a day, worthy of 0.038 to 0.061 silver tael. A typical house in this period was worth 181 silver taels, i.e., about 0.45 to 1.13 silver taels per square meters. Therefore, in this period it took about 10 to 40 days for a regular laborer to earn 1 m^2 of house.

Gamble (1943) recorded some wage observations in Beijing in the early nineteenth century. According to this record, the daily wage of unskilled workers in that period was about 0.083 silver taels. Thus it would then have taken about 8.5–20 working days to buy a square meter of house. If we compare these estimates with 73 working days for 1 m^2 in 2002, we find that the price change is consistent with a doubling or tripling of the price of a home relative to wages between 1840 and 2002.

8. Conclusion

With 498 surviving real estate transactions contracts, we use hedonic regression methods to estimate a long-run house price index for Beijing between 1645 and 1840.

[35] Of course the typical house that sells today is of far better quality than that in the Qing Dynasty, so even this range surely represents an underestimate.

[36] Today most residents in Beijing live in apartments instead of quadrangles. If we focus on single houses in Beijing today to make the comparison between the past and the present more reliable, the house price today would be even higher, and our result would be more significant.

[37] See http://www.bjstats.gov.cn.

We are able to explain a large amount of the variation in housing prices by the characteristics of the properties, including the number of rooms and location. We also create rice- and more broadly based consumer price indices. We compare the house price index results with these series and estimate real house price series. We find that real house prices increased in the second half of the seventeenth century, declined in the first half of the eighteenth century, and then remained relatively constant in real terms. We are in this study limited in our data over this approximately 200 year period and thus we estimate values at intervals of 25 years. Nonetheless the observations we do have for the second half of the seventeenth century indicate that price increases are consistent with the rapidly growing economy and urbanization that historians have attributed to the period. The decline of house prices that we observe in the first half of the eighteenth century is consistent with a government policy change that allowed the construction of new homes and deregulated housing markets.

We briefly compare house prices in the Qing Dynasty with prices in 2002 and in 2012. It is well known that house prices increased dramatically between 2002 and 2011. Even in 2002, prior to the run-up, we see that prices appear to have increased between 1840 and 2002. While this increase raises questions about more recent price trends, our results for the period 1644 to 1840 are consistent with the findings in Shiller (2005) and Eichholtz (1997) which show no significant price increase in real terms, for 150 years in Shiller and for nearly 350 years in Eichholtz.

Appendix A. Supplementary data

Supplementary data to this article can be found online at http://dx.doi.org/10.1016/j.eeh.2012.10.003.

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