Broad Overview of Housing Economics; Discussion of Chinese Market

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Housing in Urban Economics

Canonical models in urban economics often model housing *rent*, not price. Why?

Housing rent corresponds to the price of housing services consumption for a limited period, allows us to use supply and demand model to evaluate market changes (ex: population increase in closed-city version of monocentric model)

BUT, for simplicity, many urban models ignore a very important feature of housing: it's a **durable good**. This implies:

People may purchase housing as an investment good (an asset for resale), making expectations of future value important

People may borrow money to purchase housing (finance), and there may be large transaction costs

Once built, housing persists in a location; spatial distribution of economic activity responds to market changes with a considerable lag

Today's Brief Overview

Describe simple, undergraduate-level model of housing market called "Four Quadrant Model"

Quickly mention research on durability of housing

Discuss basic idea of "user-cost" of housing

Cover recent work on Chinese housing market and Chinese housing bubble concerns

Four Quadrant Model (DiPasquale and Wheaton, 1992)

Conceptual (teaching) model of general equilibrium in real estate market

Provides a structure for thinking qualitatively about questions such as:

- How will the price of housing change if China relaxes capital controls (more freedom to invest abroad)? How will housing rent change?
- If people from other provinces buy Shanghai housing, how will this affect Shanghai rents? Does it make a difference if they live in Shanghai or are absentee investors?
- Say the population of Shanghai increases. What will happen to the price of housing if: i) the stock market currently has high returns ii) the stock market has low returns?

Four Quadrant Model: Set-up

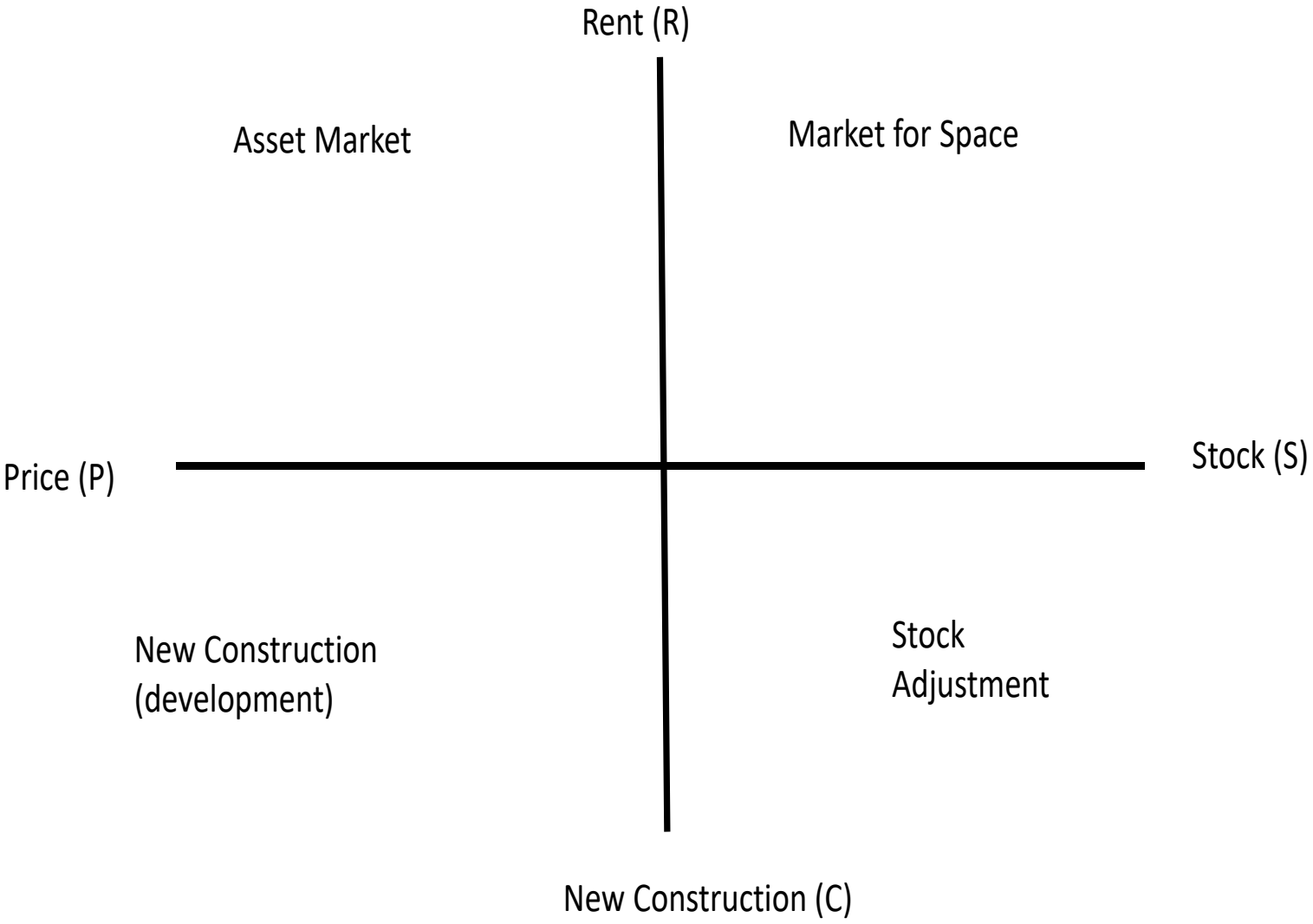
Considers equilibrium in four sectors of property market:

1. Market for space: users of real estate
2. Asset market: investors in real estate
3. New construction: real estate development
4. Stock adjustment: allows housing stock to depreciate

Simplifications:

- Static: no explanation for how move from one equilibrium to another
- Aspatial: no locations, CBD, etc...
- Owners of housing are all risk neutral investors

Four Quadrant Model: Quadrants

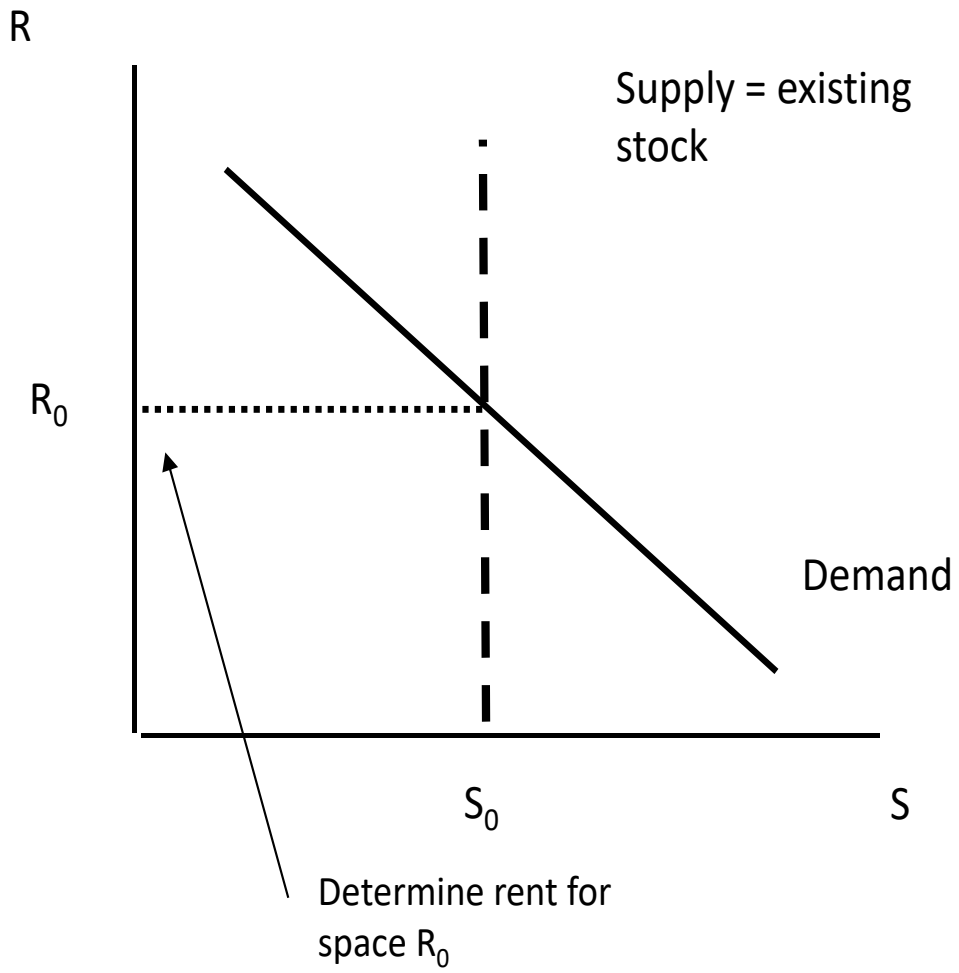


Market for Space

Supply of housing space (ex: quality adjusted square meters) perfectly inelastic

Demand for space affected by demographics, income, tastes

Market rent determined in equilibrium



Asset Market

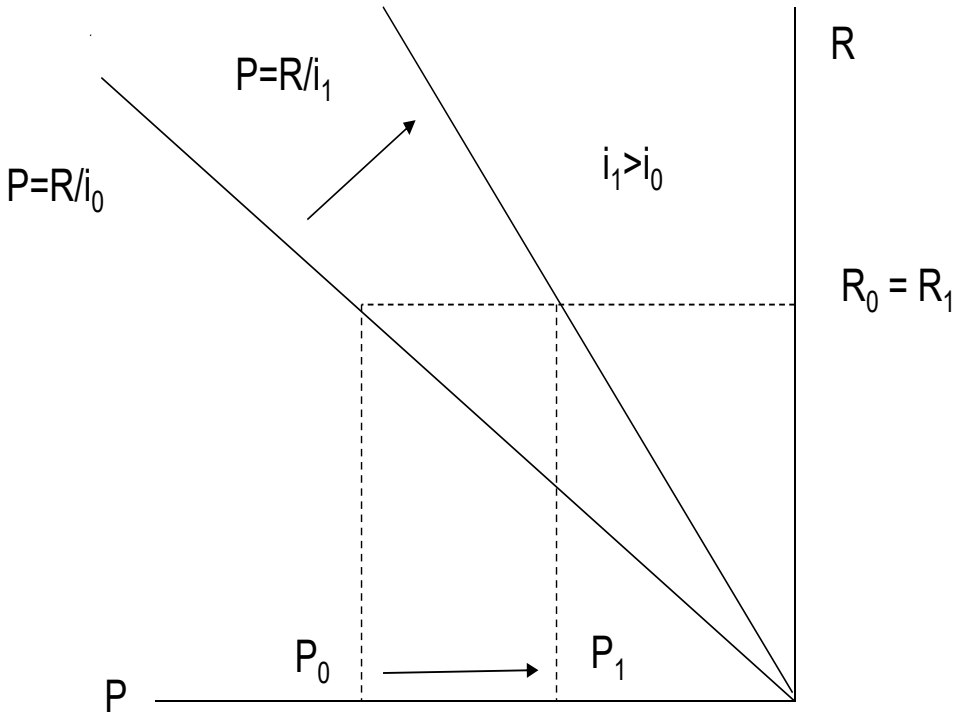
Investors buy housing to earn rent

Price is present discounted value of infinite rent stream: P=R/i

Discount rate called “cap rate”–much more on this later (user cost model)

Cap rate is return on housing, must be equal to yield on other assets

If yield of competing assets increases, housing prices decrease

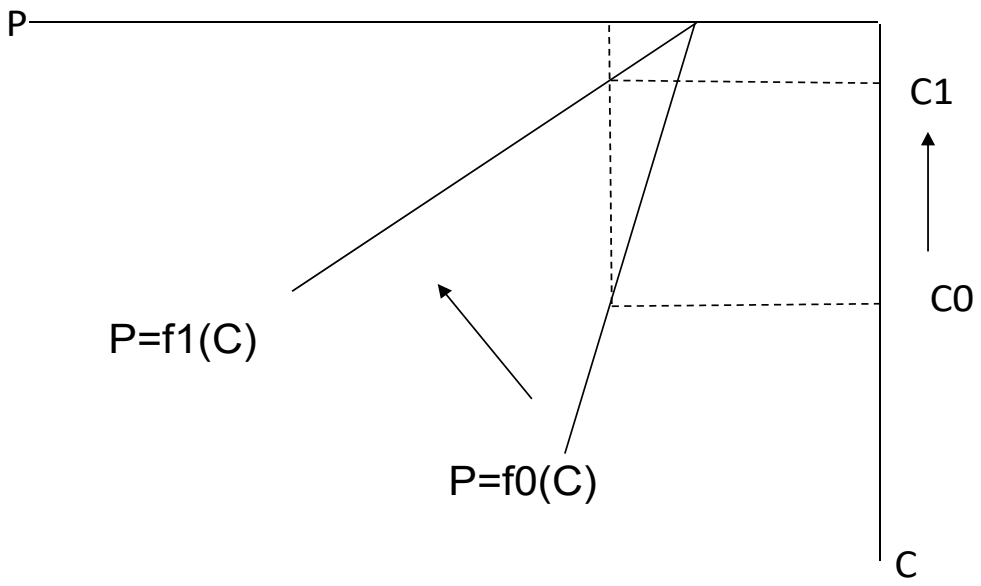


Construction Sector

Construction sector is perfectly competitive, but with upward sloping LR industry marginal cost curve

Supply of new housing determined by price of housing *space*

Note that *C* is measured as level of new housing (move from unit price to level)

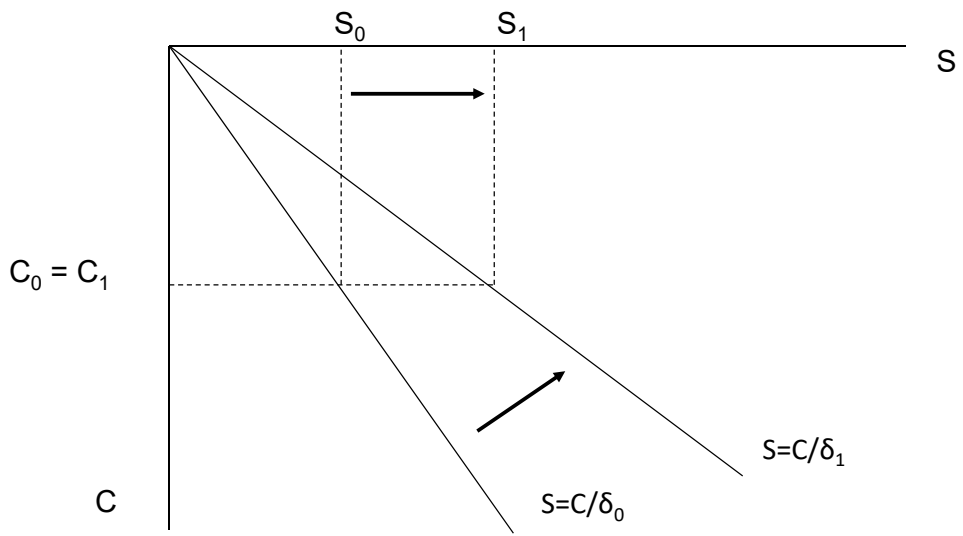


Stock Adjustment Quadrant

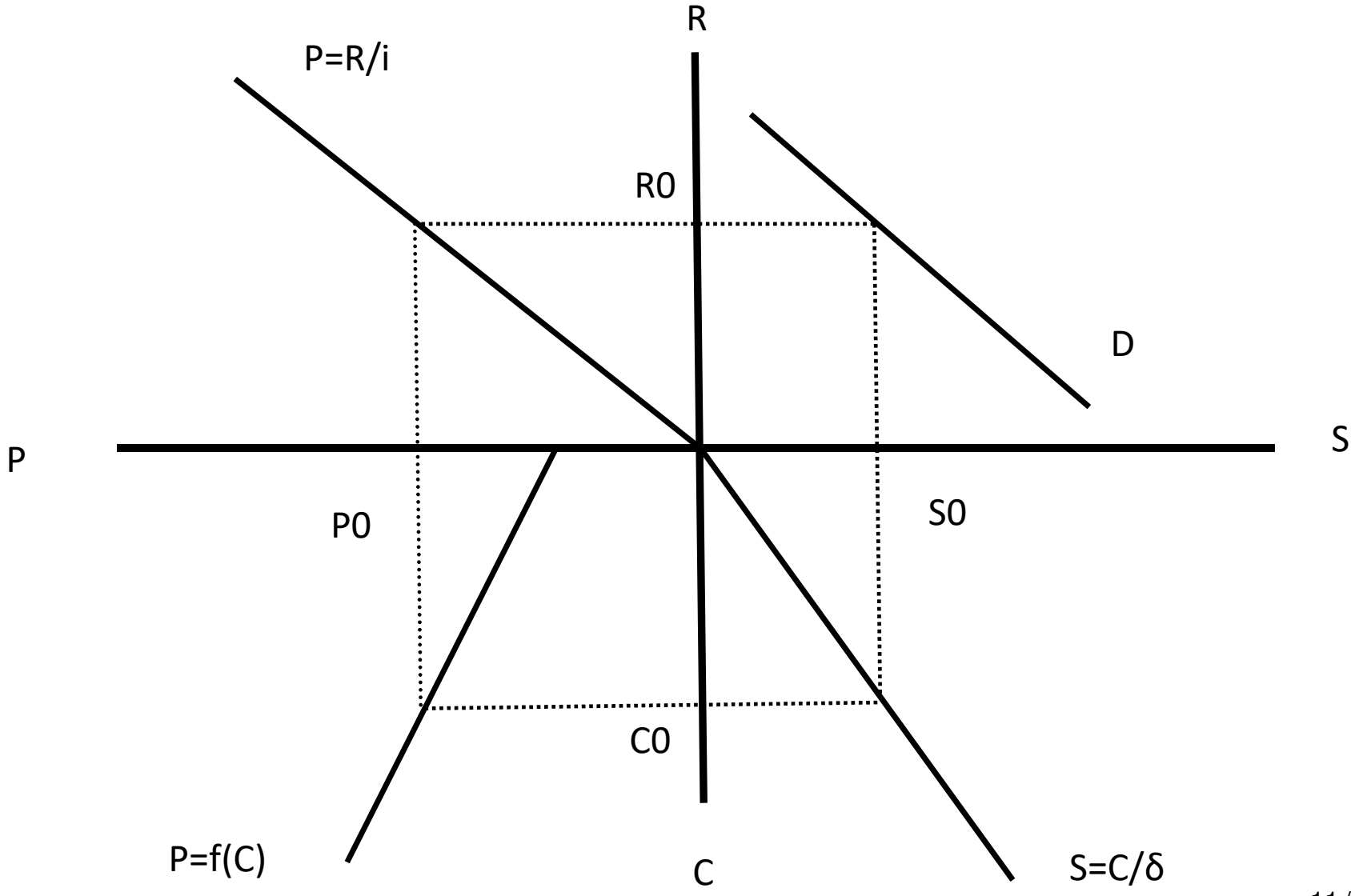
Stock increases with new construction but decreases with depreciation

$S_t = S_{t-1} - \delta * S_{t-1} + C_t$, with $0 < \delta < 1$

Stable stock S^* implies $S^* = C^*/\delta$



Real Estate Market Equilibrium



Research by Quadrant

The 4Q model provides a nice way to think about all the interrelated sectors of the housing market

Traditional urban economics (monocentric city model) basically looks at demand for space, no distinction between rent and price

Real estate investment: concerned with asset market and finance (cap rate)

Construction sector looks at housing supply (recent papers on elasticity, including Saiz 2010 QJE)

Stock quadrant: a number of important papers on depreciation and durability of housing, including Glaeser Gyourko JPE 2005, and “filtering” (Rosenthal AER 2014)

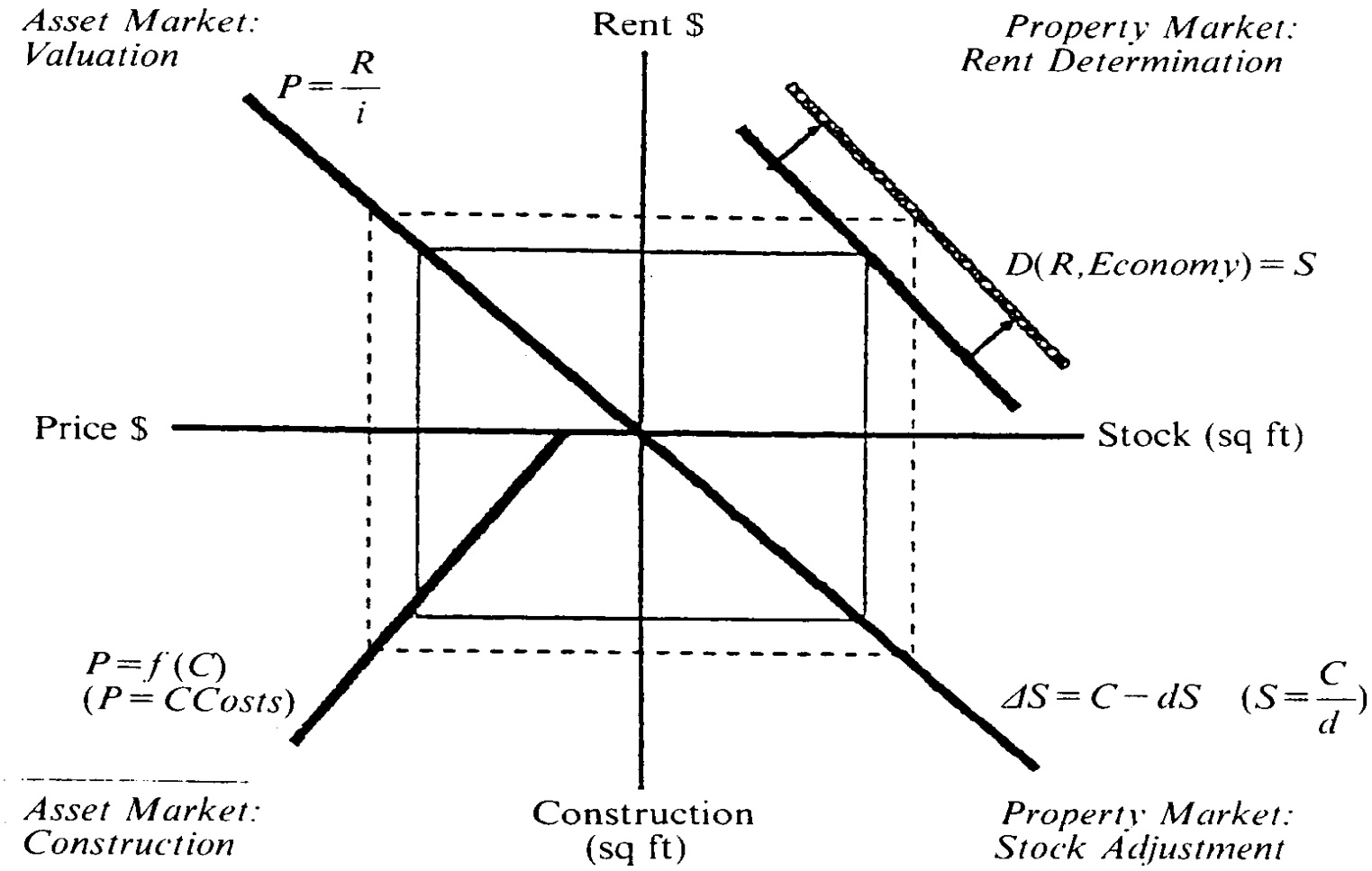
Comparative Statics

1. What happens if the population of Shanghai increases?
2. What happens if investors from outside Shanghai buy apartments but remain in their home cities?
3. What happens to Shanghai real estate if China loosens capital controls or the stock market (risk-adjusted) yields increase?
4. What happens if Shanghai allows increased floor area ratios (FAR) or allows more land to be developed?

Increase in Demand for Space

Figure 2

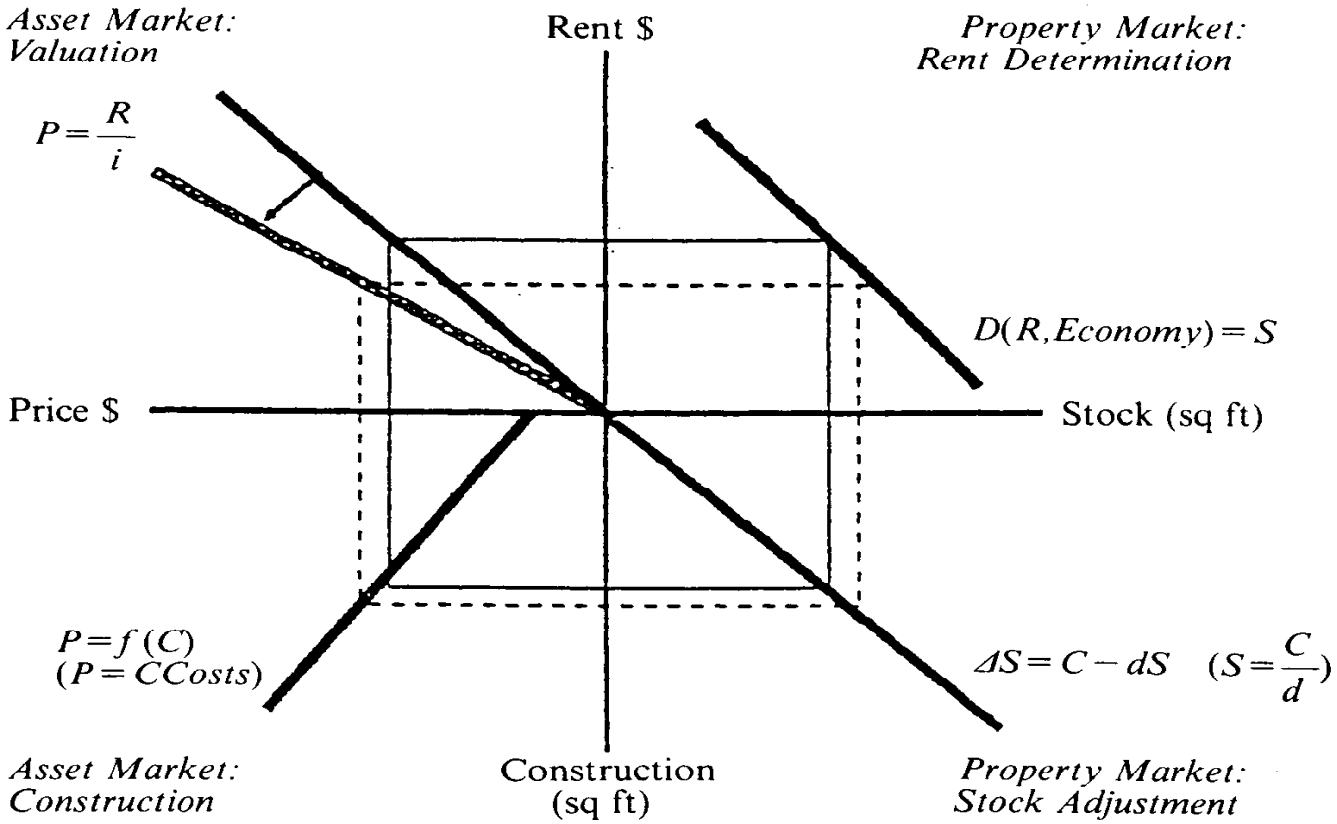
The Property and Asset Markets: Property Demand Shifts



Absentee investors

Figure 4

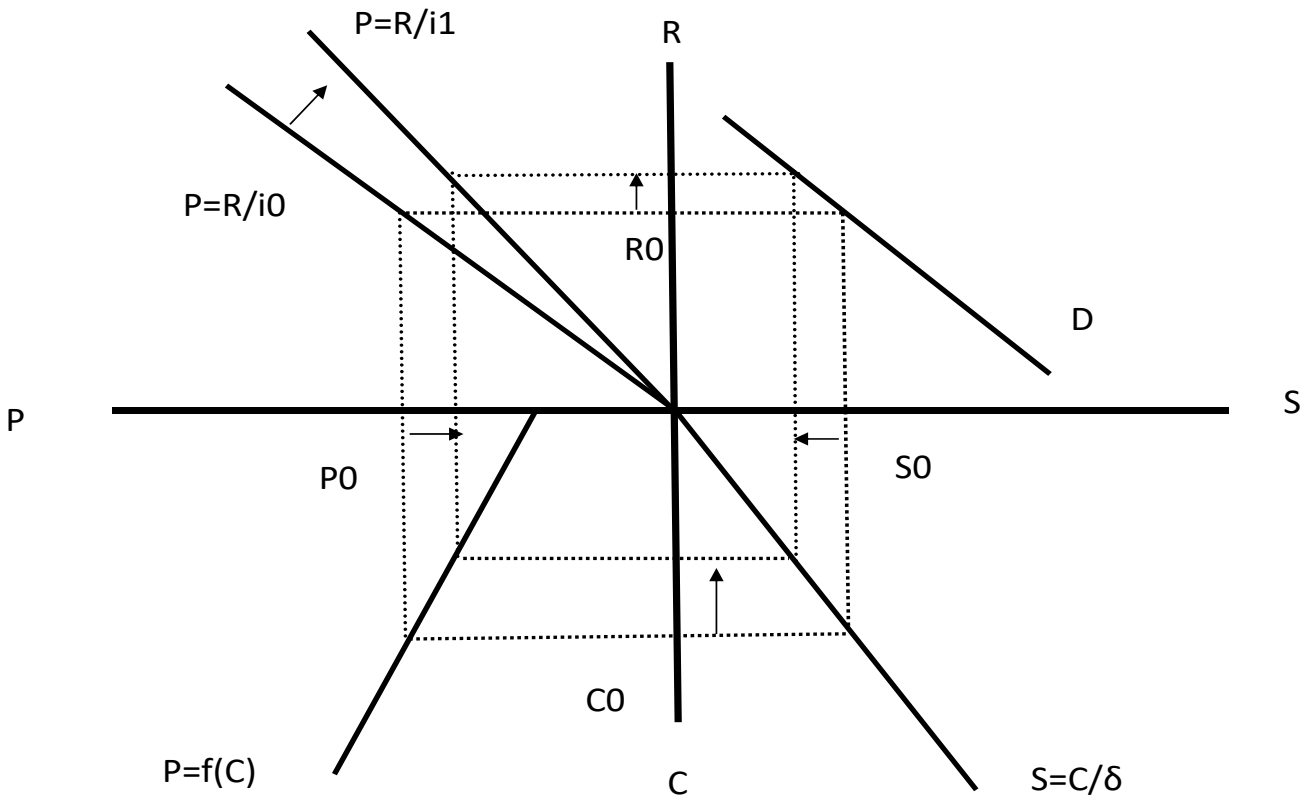
The Property and Asset Markets: Asset Demand Shifts



This picture assumes they rent out the apartments; if they buy and hold then combines demand shift and cap rate decrease

Capital Controls Loosened or Shanghai Stock Market Return Increases: cap rate increase

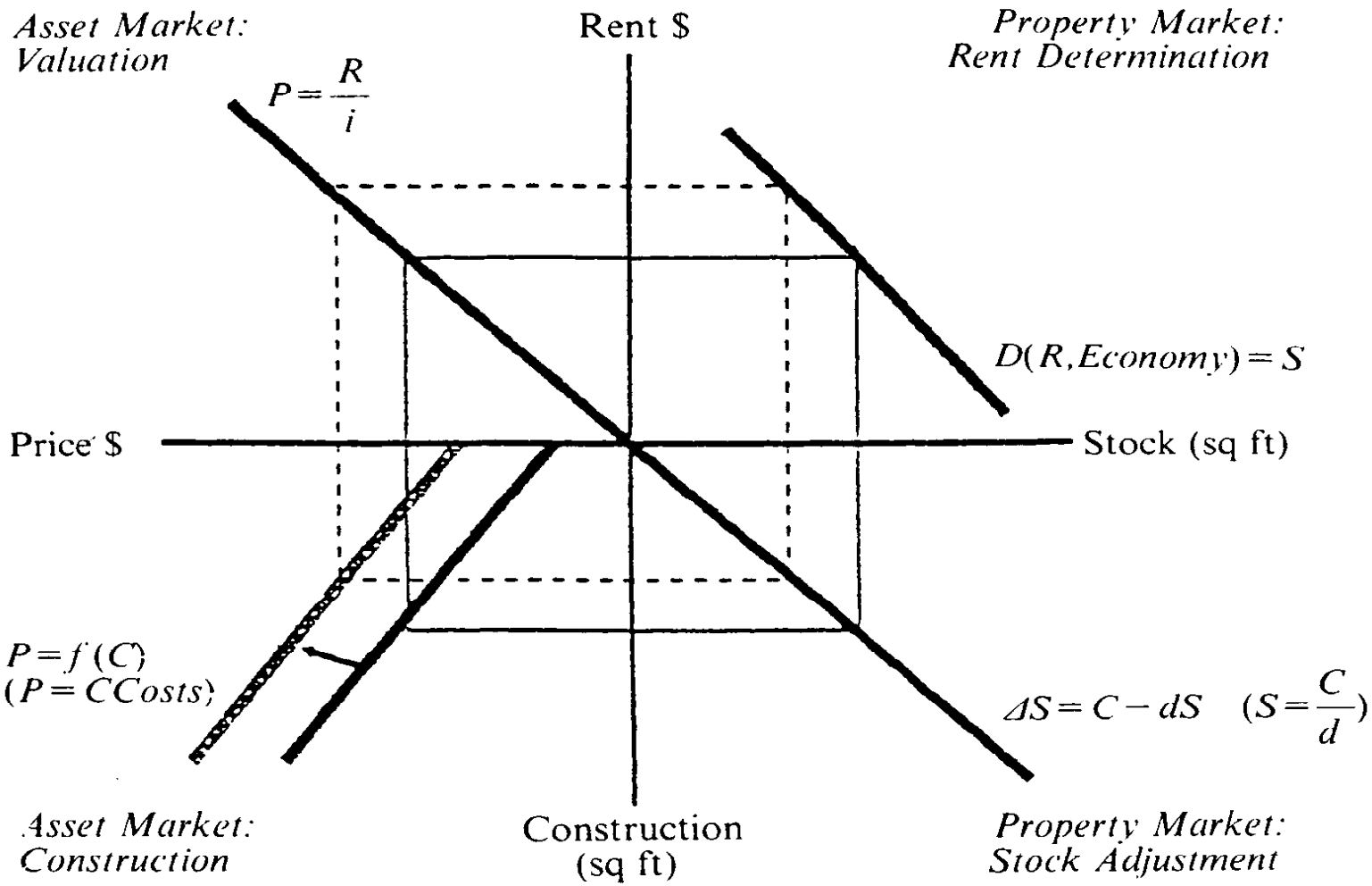
Real Estate Market Equilibrium: $i_0 < i_1$



Change in Marginal Cost of Construction

Figure 6

The Property and Asset Markets: Asset Cost Shifts



Durable Housing

Glaeser and Gyourko (GG) note that nearly all urban economics models assume housing can be built and knocked down quickly (think about monocentric city)

However, in really housing is quite durable: once it's built it remains in a location for a very long time

GG argue that this durability affects spatial equilibrium: physical housing structures can have causal effects on economic outcomes

Rosenthal shows that houses are occupied by different income groups over time and that these income transitions occur fairly quickly

An implication is that once a house is built it can have a causal effect on who lives where

Glaeser Gyourko JPE 2005

Authors start by noting the extremely strong correlation between housing units and population: essentially housing is a direct measure of population

But, if a city experiences a decline (ex: productivity decline), the housing still remains. Empirically, this implies the population doesn't shrink–why?

Declining cities have an inelastic stock of housing–price (or rent) is independent of cost (can decline to zero)

These declining cities offer cheap housing, which attracts low human capital (low wage) workers

Kinked Supply Curve for Housing

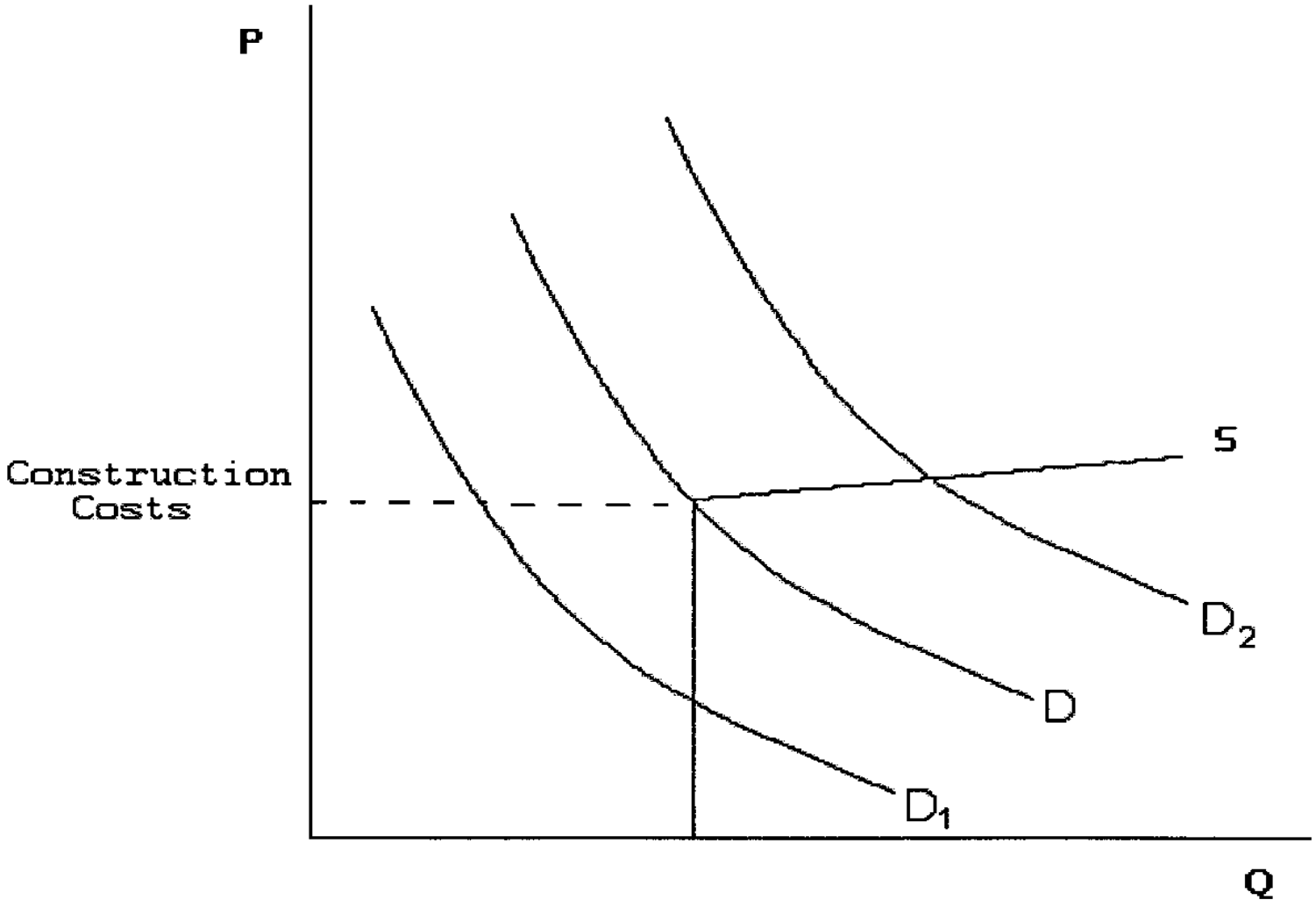


FIG. 1.—The nature of housing supply and construction costs

Implications of Model

Summary of model ideas:

1. Cities will grow faster in response to a positive shock than they will decline in response to a negative shock of the same size
2. Positive shocks increase population but have small effects on prices; negative shocks have large effects on prices but small effects on population
3. Supply curve is kinked at construction cost threshold–cities with housing prices below this threshold are “in decline” and will have rapid price decreases in response to negative shocks

How should government provide housing assistance for low income households?

If the government wants to help, should it provide vouchers (payment for housing) or build low income housing directly?

Many economists would argue that unless there is market failure, it's better to provide aid as money, rather than government production of a product

However, there is evidence that most new housing construction is not developed for low income households

Instead, the market provides housing for low-income households through a process called "filtering"

The question is then: is filtering fast enough to provide adequate housing for these households?

Filtering (Sweeney, JUE 1974)

Housing is a “hierarchical good” in quality, roughly meaning consumers agree on ranking of each house

As soon as a house is built, it starts to deteriorate so that the same unit offers less value to a consumer over time (fewer housing services)

Owners can affect the rate of deterioration through maintenance expenditure; they choose the level of maintenance to maximize profits

As a house deteriorates, households with higher incomes move out and lower income households move in

Eventually, the house deteriorates beyond a minimum quality and it is then knocked down and removed from the market

Filtering, Low Income HH's, and Renters

Developers may not build new housing for low income households or renters ("purpose built rental")

Many explanations for this, including high land values, financing difficulties (pre-sales help developers to get loans),

However, if filtering transitions are fairly quick, then even new luxury housing benefits low income owner-occupiers and renters

Important policy question because housing assistance can be provided as vouchers (US: Section 8 Housing) or through direct provision (government owned buildings, or credits to developers like Low Income Housing Tax Credit)

Rosenthal AER 2014: Main Idea

Provide first direct evidence on filtering by analyzing a panel of houses from 1985-2011

Includes information on occupants (used for looking at income transitions), “tenure” of house (do occupants rent or own), extensive info on characteristics of house (incl. age)

Uses methodology similar to repeat sales method to deal with heterogeneity of housing

Shows filtering rate can be decomposed into function of income elasticity and price elasticity of housing demand, along with basic depreciation rate of housing services (deterioration rate)

Argues that in many markets filtering is sufficiently quick to provide low income housing, but in most expensive markets it’s significantly slower. Suggests direct provision of low income housing is inefficient in most markets (possibly excepting most expensive)

User Cost Model

User cost models equate the current price of housing P_t with the present discounted value of all future flows of housing benefits, usually thought of as rent R_t, but sometimes utility (Poterba QJE 1984)

Glaeser and Nathanson (GN, recent handbook article on housing bubbles) describe this as the linear asset pricing model (LAPM)

$P_t = R_t + \frac{E(P_{t+1})}{1+r}$, or $P_t = E\left(\sum_{j=0}^{\infty} \frac{R_{t+j}}{(1+r)^j}\right)$, with discount rate r

GN note that this model assumes risk neutral home-buyers and ignores portfolio considerations (maybe appropriate for China)

Stochastic Processes for R_t

GN describe effect of assuming four different stochastic processes for rents: i) constant growth ii) no growth but moving average error iii) mean reverting, MA error iv) stochastic growth rate

Constant growth: $R_t = (1+g)R_{t-1} + \epsilon_t$

This yields: $P_t = \sum_{j=0}^{\infty} \frac{R_t(1+g)^j}{(1+r)^j} = \frac{R_t(1+r)}{r-g}$

This $r-g$ term is the "cap rate" from 4Q model (additional $1+r$ just comes from starting at $j=0$ vs $j=1$)

Rearranging gives price-to-rent ratio: $\frac{P_t}{R_t} = \frac{1+r}{r-g}$

User cost is $P_t * u_t = R_t$; interpretation is the cost of one period of housing consumption

Himmelsberg, Mayer, and Sinai (JEP 2005)

Very famous paper, used the idea of user-cost to assess whether US was in a housing bubble

Basic idea is that no arbitrage condition says people should be indifferent between renting and buying for one year of housing consumption: $u_t * P_t = R_t$

Concluded no bubble (!), BUT, data only up to 2003; still influential paper made a series of important points

To estimate user cost included many components:
$u_t = r_t^{rf} + \omega_T - \tau_t(r_t^m + \omega_t) + \delta_t + \gamma_t - g_{t+1}$

In order: risk free interest, property tax rate, tax deductibility of mortgage and property taxes, depreciation, risk premium for homeownership (over renting), expected growth

HMS: Prices When User Cost is Low

Since $P_t = R_t/u_t$, it implies that house prices can change *dramatically* when u_t is already low

Ex: if annual rent is 100,000 and $u_t = 0.05$, then one percentage point drop in interest rate changes prices from 2,000,000 to 2,500,000

Same drop when $u_t = 0.02$ changes prices from 5,000,000 to 10,000,000.

Note that user cost is *city specific*, and thus cities where residents have very high expectations of house price growth (Shanghai) will have low user costs

HMS argued that historically low interest rates were leading to high prices, not irrational expectations

Problems with User Cost Models

GN show that with other assumptions about R_{t+j} it's possible to generate serial correlation in prices and rents, as well as mean reversion, which are commonly observed patterns in the housing market

However, GN note that user cost models are financial models which ignore important features of housing market:

1. no short-selling (or very difficult)
2. housing is very heterogeneous–every house is different!
3. most investors are amateurs
4. information is limited

In remainder of article, GN try to relax some assumptions of user cost model, and finally look at behavioral explanations for housing bubbles–highly recommended reading

Recent Work on Chinese Housing Market

Lots of recent work on the Chinese housing market

1. Wu, Gyourko, Deng, "Evaluating conditions in major Chinese housing markets", RSUE 2012
2. Wu, Gyourko, Deng, "Evaluating the risk of Chinese housing markets: What we know and what we need to know", CER 2016
3. Glaeser, Huang, Ma, Shleifer, "A Real Estate Boom with Chinese Characteristics", JEP 2017
4. Deng, Girardin, Joyeux, "Fundamentals and the volatility of real estate prices in China: A sequential modelling strategy", CER 2018

Much of the work focuses on whether the market is in a housing bubble–why?

(following figures from Glaeser et. al.)

Housing Price Indices

Housing is a heterogeneous good (quality, location, characteristics): how can we control for this heterogeneity when calculating the change in housing prices over time for a location?

Two general methods:

1. Hedonic regressions: adjust for characteristics with regression typically semi-log: $lnP = X'\beta + \epsilon$
2. Repeat sales method: compare sales prices for the same house over time

The repeat sales method is generally considered more robust and is widely used in the U.S. (FHFA and Case Shiller indices)

However, it doesn't adjust for changes to housing characteristics (ex: renovation), which may be better modeled with hedonic approach (often combined with repeat sales)

Repeat Sales Indices

Start with multiplicative hedonic model that include indicators for effect of time period sold:

$$P_{it} = X_{1i}^{\beta_1} * X_{2i}^{\beta_2} * ... * X_{ni}^{\beta_n} * exp[\gamma_1 D_1 + ... + \gamma_T D_T] \quad (1)$$

Then comparing same house sold twice yields ratio of period effects:

$$\frac{P_{ik}}{P_{ij}} = exp(\gamma_k D_k)/exp(\gamma_j D_j) \quad (2)$$

$$ln(P_{ik}) - ln(P_{ij}) = \gamma_k D_k - \gamma_j D_j \quad (3)$$

We can then calculate the appreciation from year 1 to k as $exp(\hat{\gamma}_k - \hat{\gamma}_k)$

See recent Wharton working paper by Nagaraja, Brown, and Wachter (2017) for more sophisticated approaches

Repeat Sales in Shanghai: Zhou, RSUE 2016

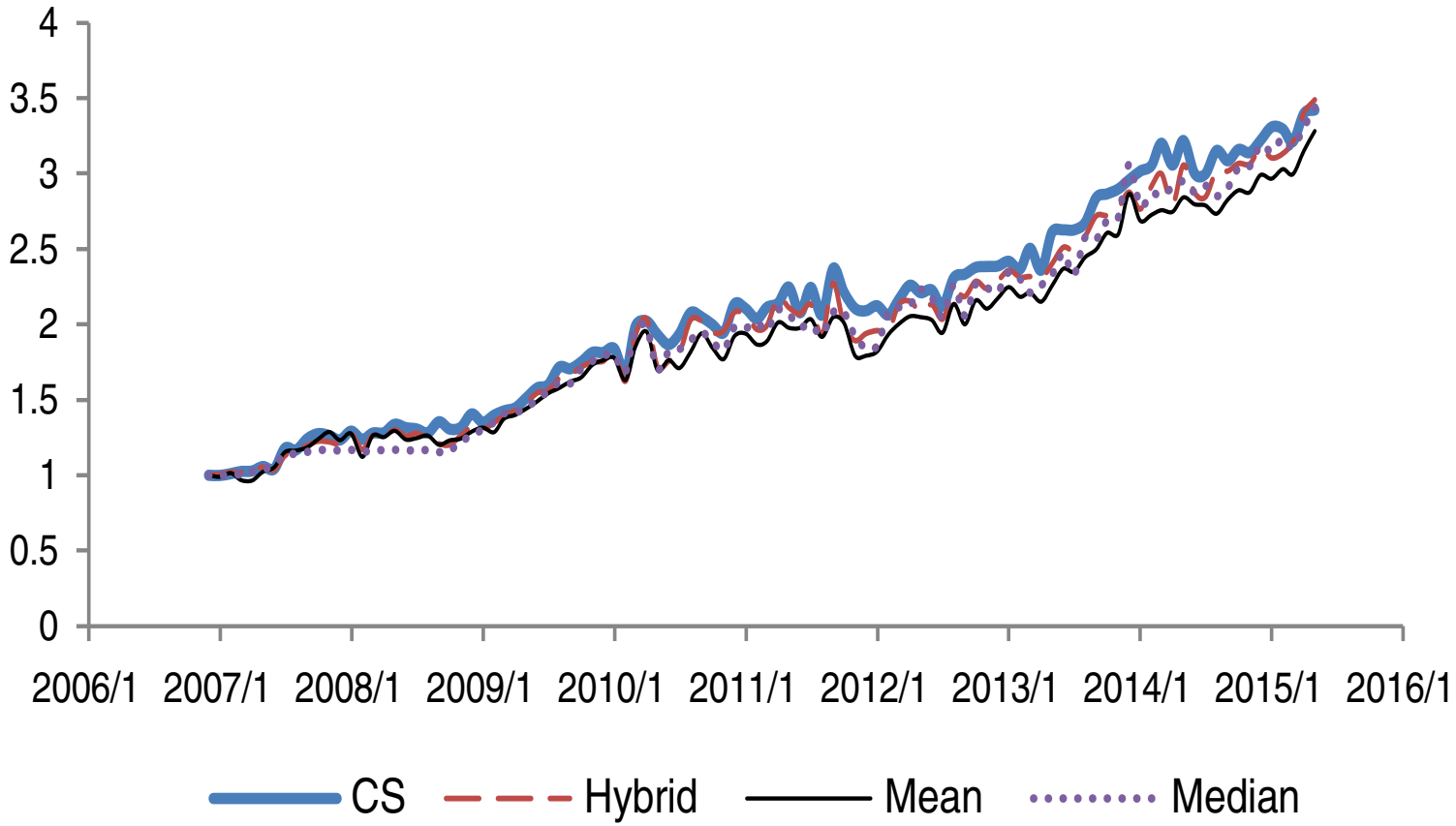
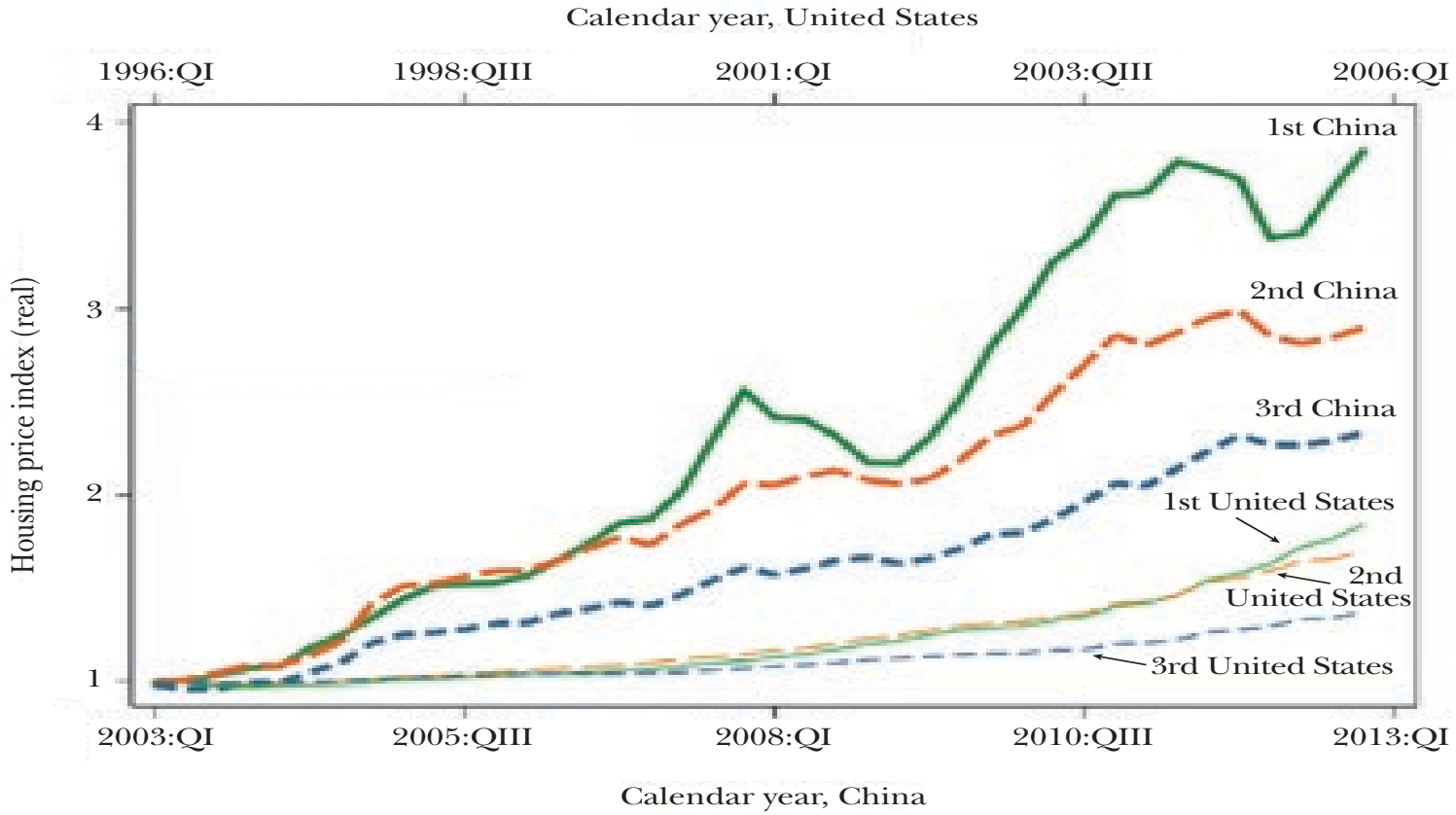


Fig. 2. Comparison with alternative construction approaches. CS refers to Case and Shiller's repeat-sales approach. Hybrid refers to the hybrid approach of Fang et al. (2015). Mean (Median) is the index based on the average (median) price/m^2.

Price Growth Comparison: US and China

US boom (and bust) tiny in magnitude compared to Chinese boom

Figure 1
Price Growth by Tier: China and the United States

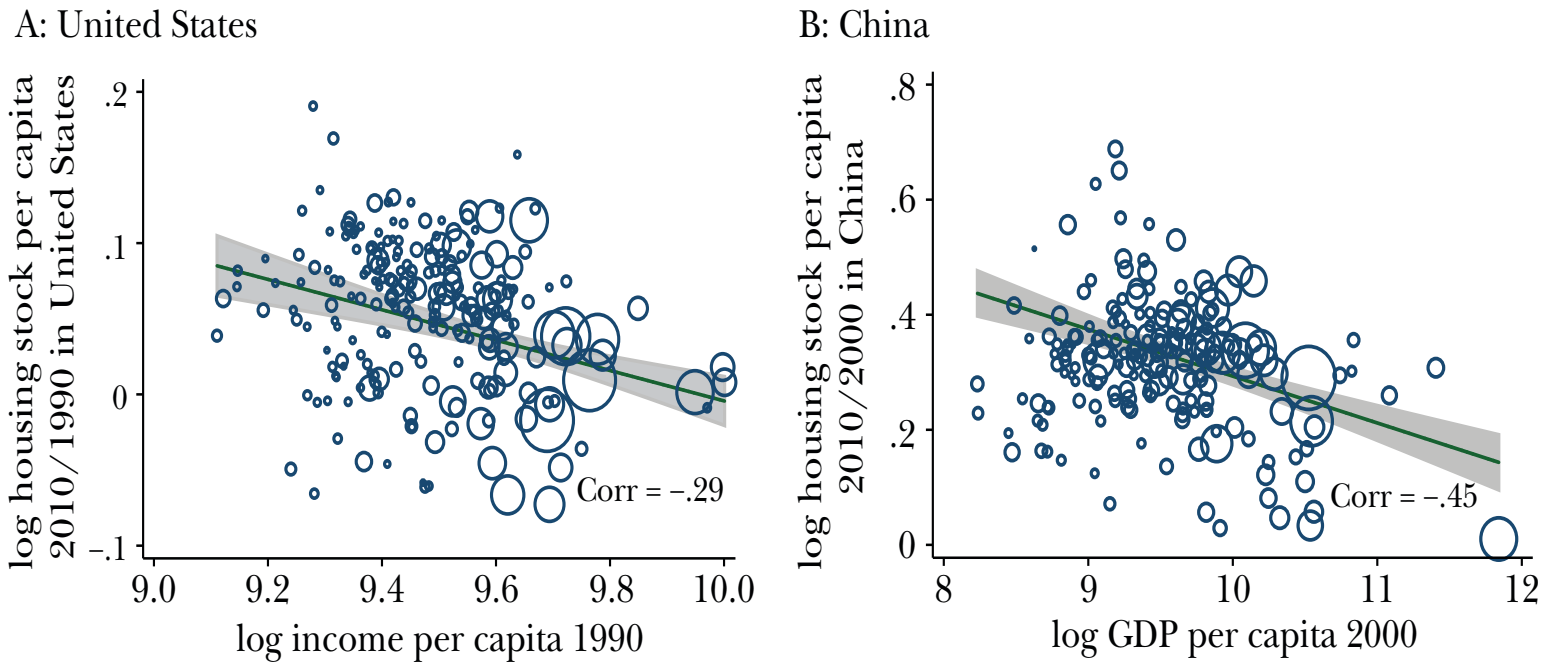


Source and Note: Housing price index data for China are from Fang et al. (2015). Housing price index data for metropolitan statistical areas (MSAs) in the US are from the Federal Housing Finance Agency. We construct tiers in the US by ranking US MSAs based on 1990 income per capita and assign tiers so that each tier has the same population share as that in China; the richest MSAs are assigned to 1st tier and so

Construction is larger in less productive places

Figure 3

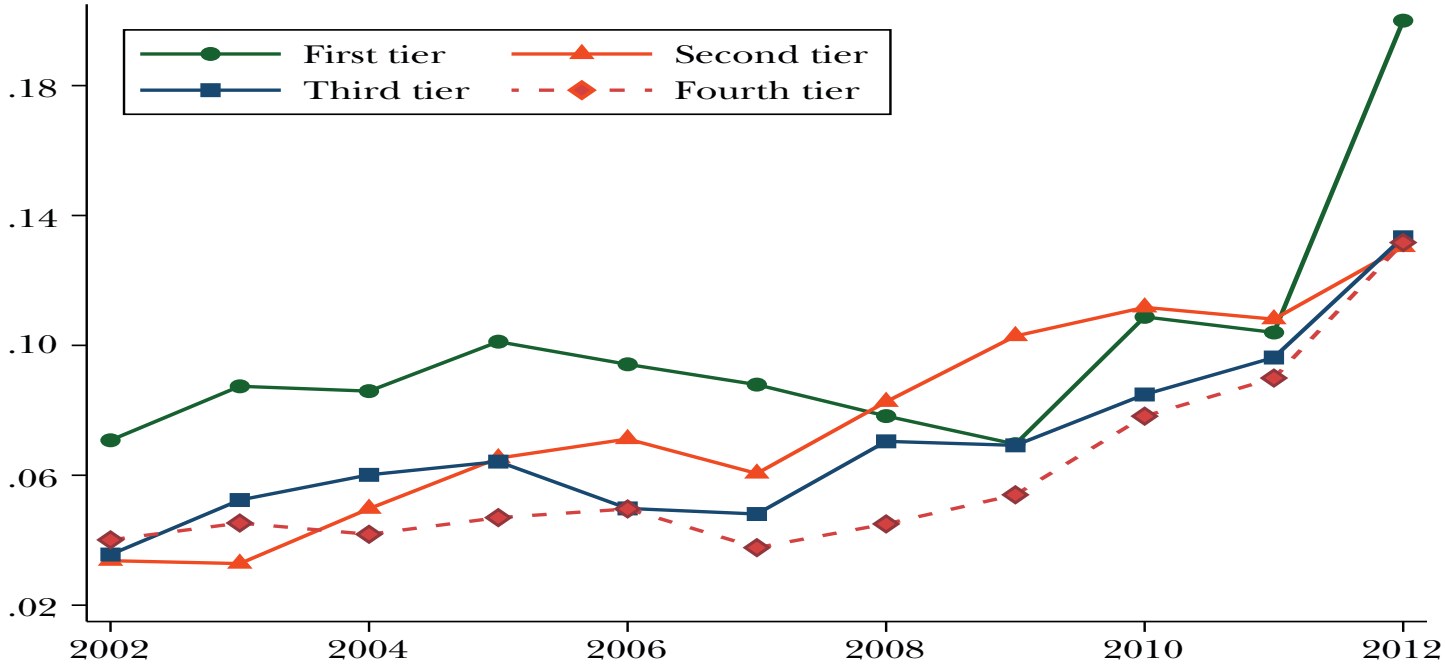
Construction and Income across US and Chinese Cities



Source and Note: In panel A, housing stock per capita and income per capita for US metropolitan statistical areas (MSAs) are from the decennial census. In panel B, housing stock per capita for Chinese prefecture level cities is from 2000 and 2010 censuses and is restricted to counties that are designated as urban in the 2000 census. Log GDP per capita in 2000 is from *China City Statistical Yearbook 2000* for city proper. The correlations are weighted by initial population.

Vacancies much higher in China, seem to be growing

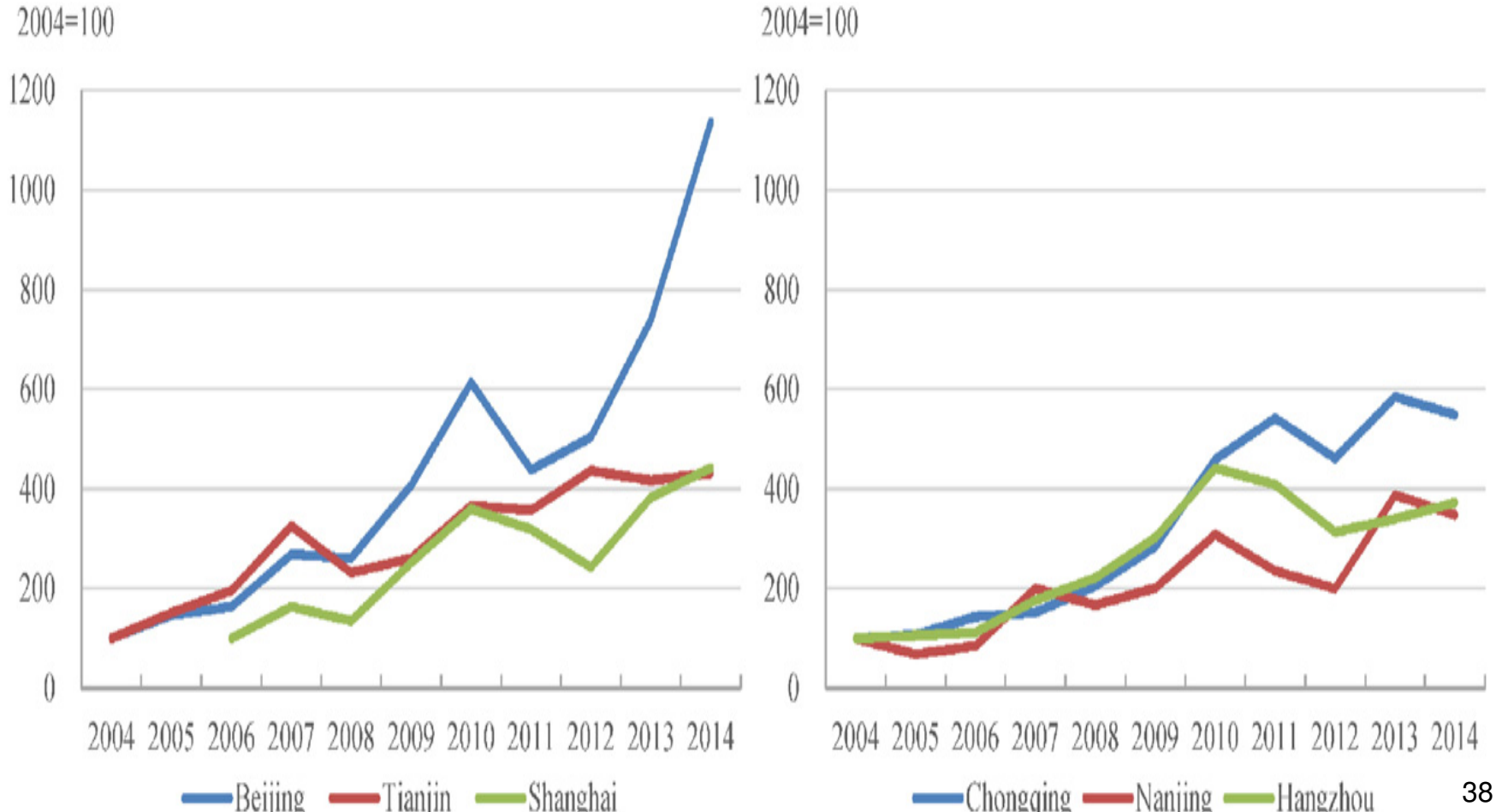
Figure 5
Household Vacancy Rates 2001–2012



Source: Data from China Urban Household Survey.
Note: We compute a vacancy rate across 36 cities by calculating the total number of vacant units owned by the residents of each city in the sample, and then dividing by the total number of housing units owned or occupied by the city's residents in the sample. We keep the 36 cities with observations throughout 2002–2012.

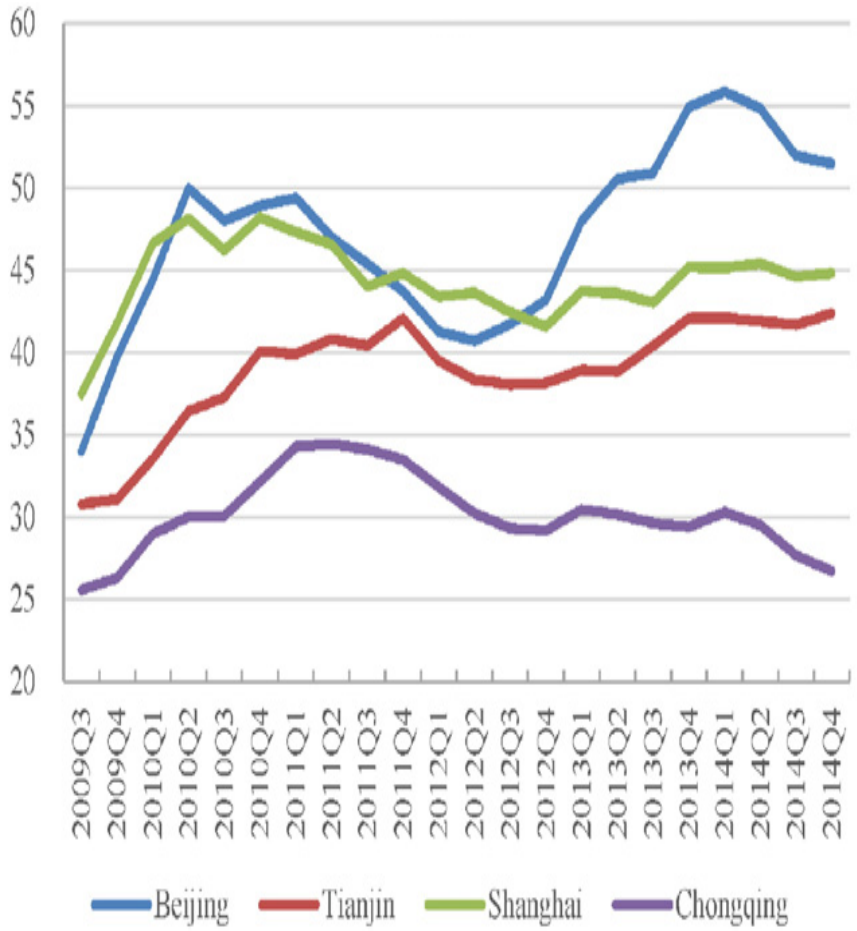
Deng et.al., Land Price Growth

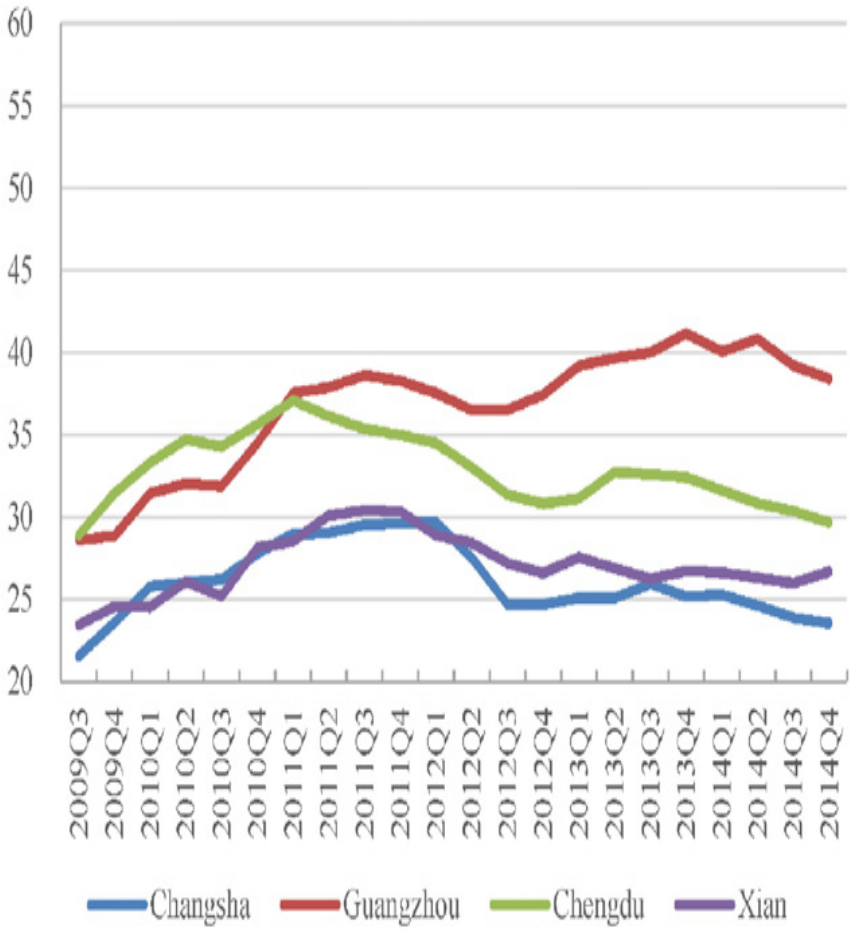
Authors use their own constant quality land price index (see RSUE 2012 paper); estimates of growth much higher than government index



Deng et.al., Quarterly Price-to-Rent

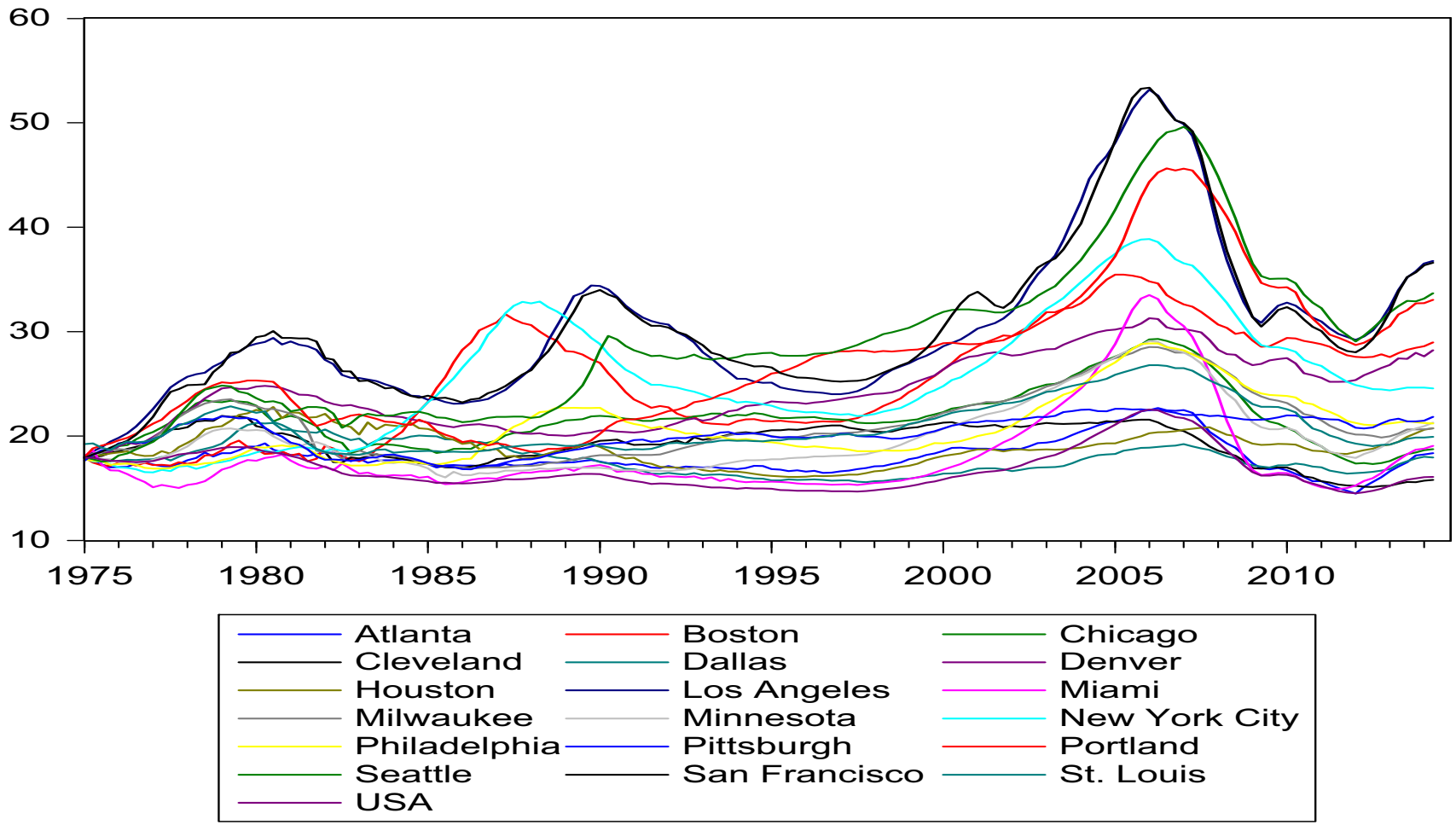
A price-to-rent of 50 implies 2% user cost: zero or negative return after depreciation





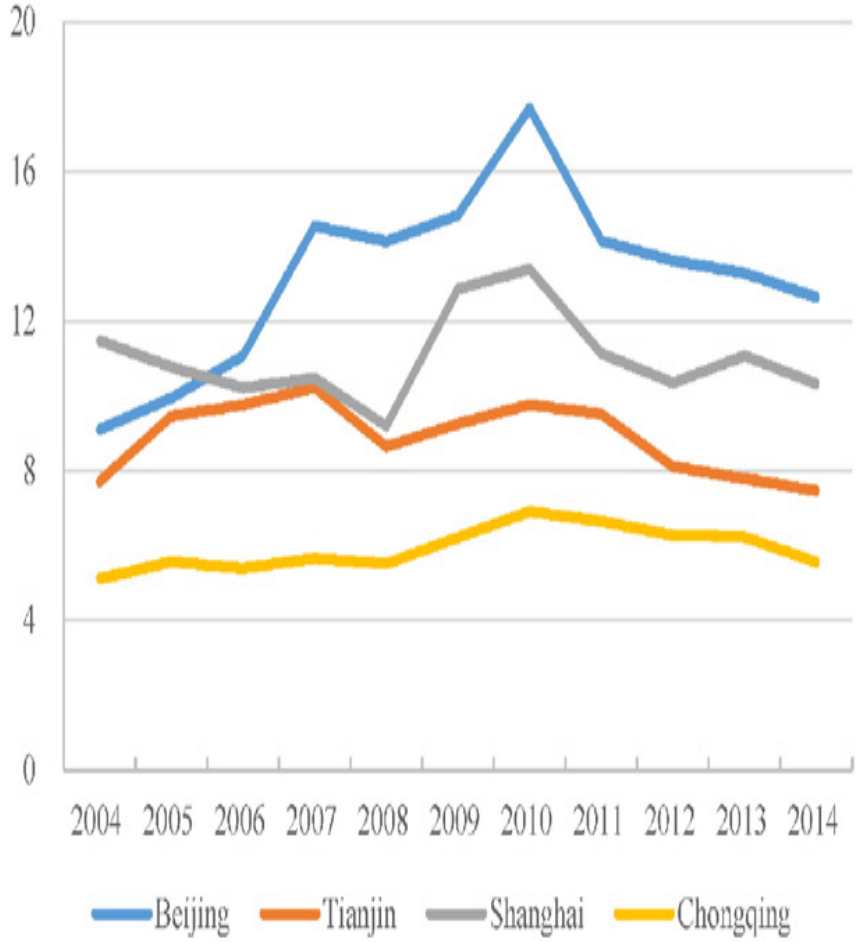
US Price-to-Rent from Kishor Morley 2015

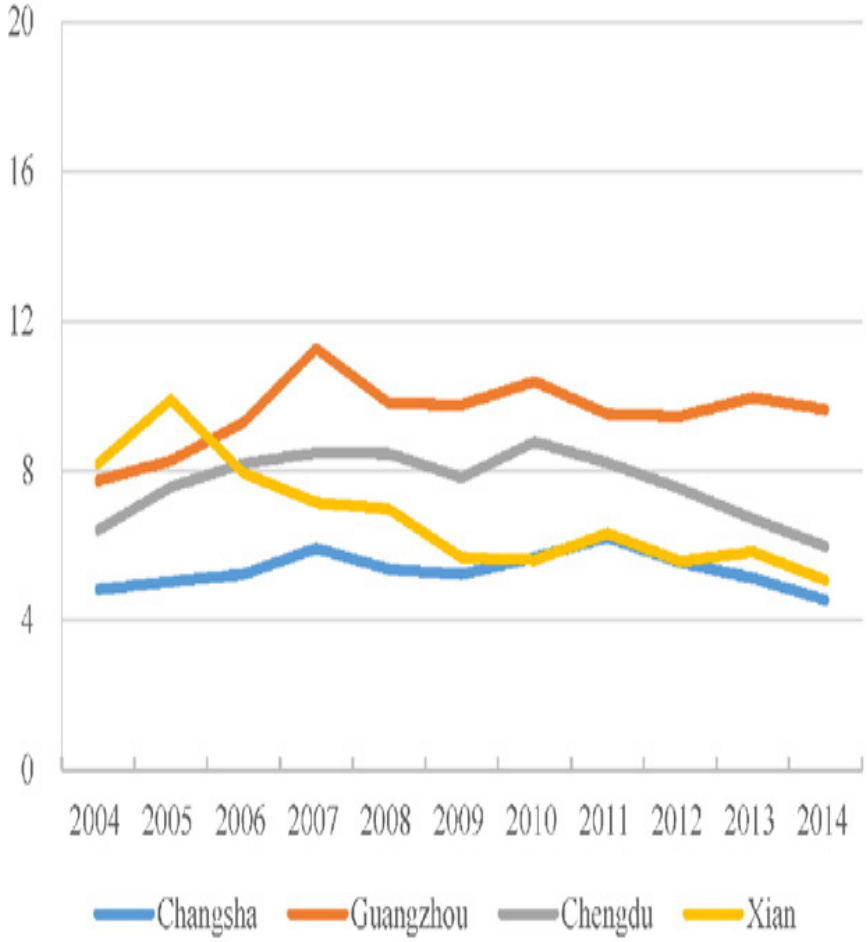
Chinese price-to-rent ratios makes Americans nervous



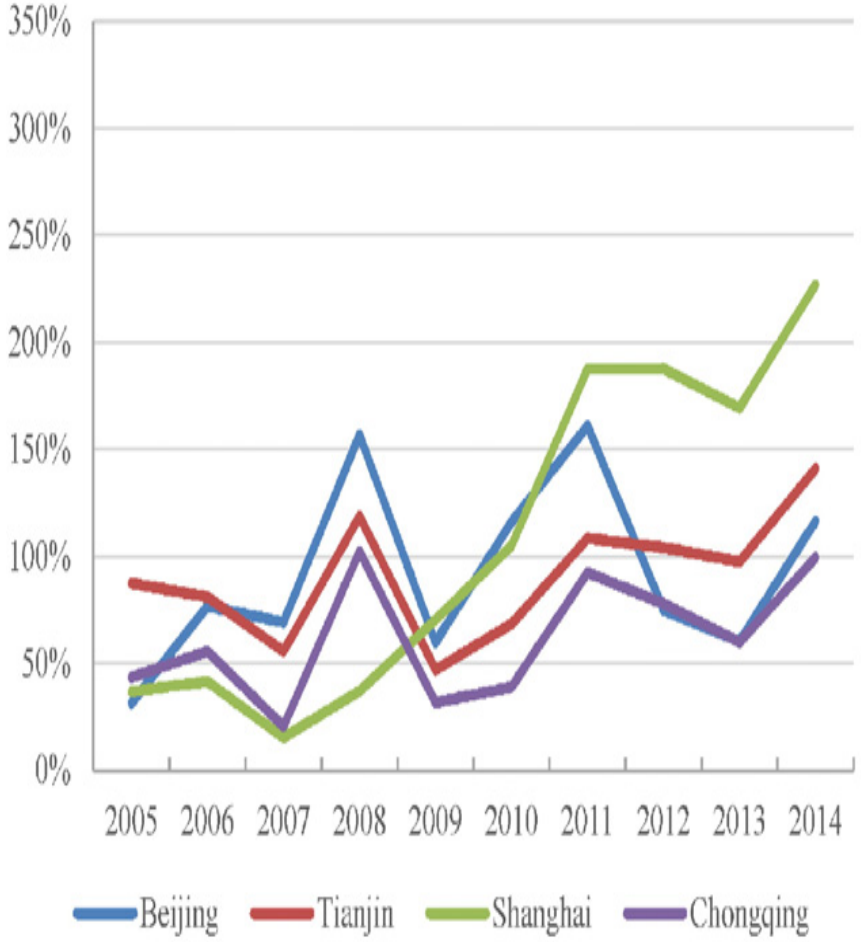
Deng et.al., Annual Price-to-Income

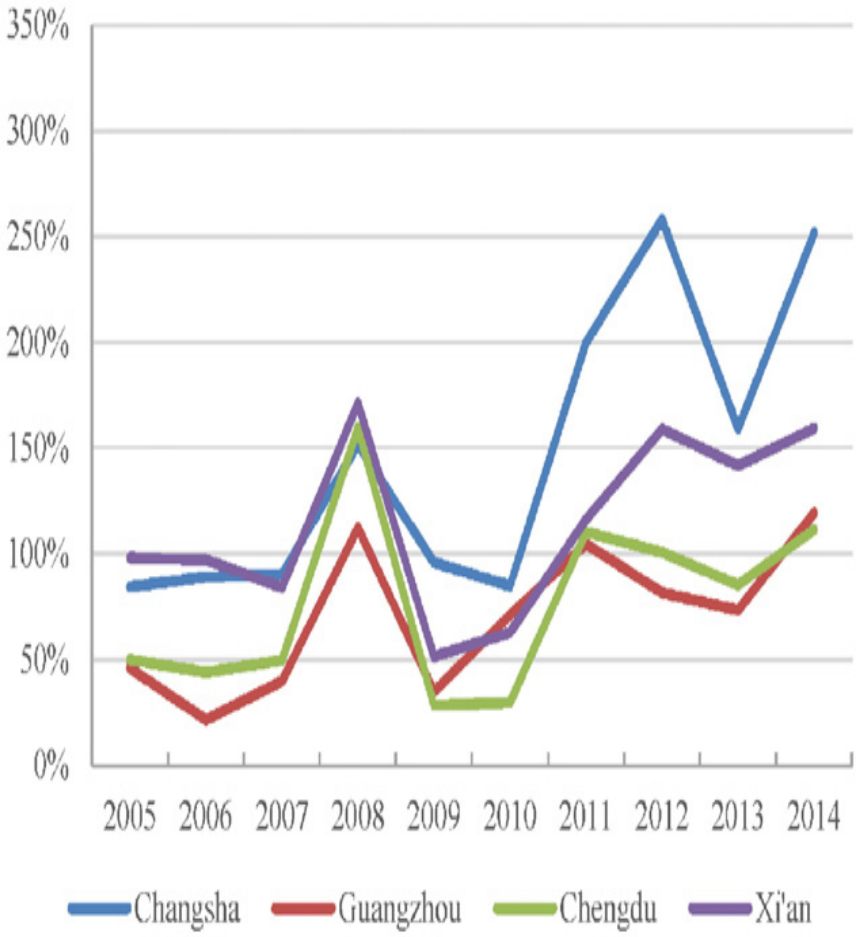
Fang (2015) finds similar numbers; Glaeser et.al. notes that in 2016 ratio is 25 in Beijing and Shanghai for 90m^2 apt





Deng et.al., Unsold Inventory





Glaeser et. al.: Supply-Side Approach to Evaluation Bubbles

Authors note that price-to-rent and price-to-income ratios are very sensitive to estimates of user cost components (version of HMS argument)

Instead try and estimate how supply compares to demand

Assume willingness-to-pay will converge to 10 times annual income (high) and represent CDF of income distribution as $F(Y)$ (implies current Beijing/Shanghai ratios cannot be sustainable in LR equilibrium)

Then equilibrium price P^* with potential urban pop N:

Housing Supply=$N(1 - F(P^*/10))$

Need future distribution of income, growth in potential urban pop, growth in housing stock

Housing Price Predictions from Glaeser et. al.

Table 2

Estimates of Housing Prices in 20 Years, by City Tier

A: Key Inputs and Assumptions

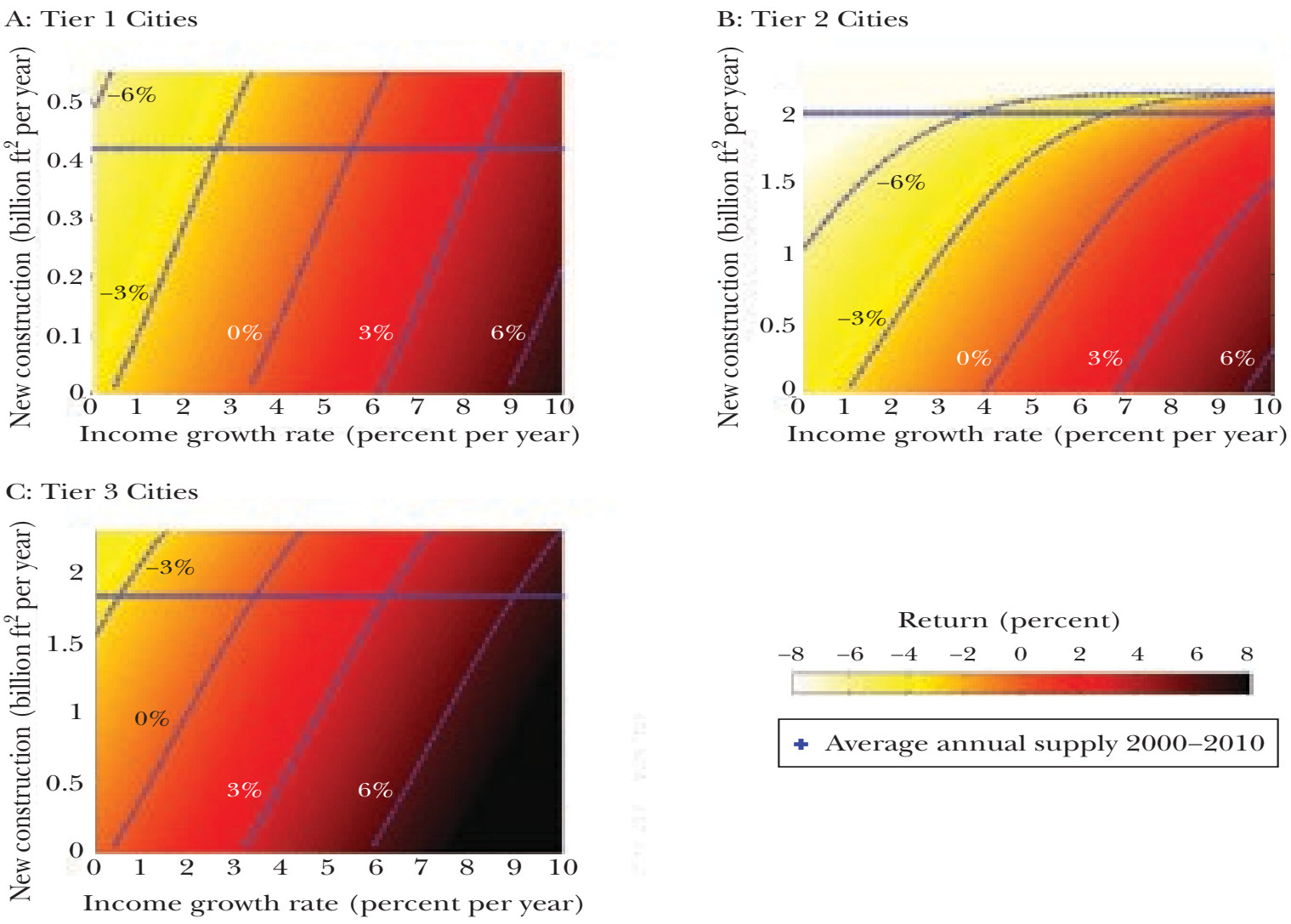
City tier:	*1st*	*2nd*	*3rd*
Total housing in urban area 2010 (billion ft^2)	8.6	37.3	36.1
Used	7.7	32.1	32.2
Developer inventory	0.3	1.9	0.9
Household vacancy	0.6	3.3	3.0
Total population growth 2000–2010	50%	26%	7%
Urbanization rate 2010	90%	70%	50%
Assumptions			
Depreciation rate of housing	2%	2%	2%
Housing per capita	403.56 square feet (or 40 square meters)		
Long-run price to income ratio	10	10	10
Total population growth 2010–2030	40%	20%	10%
Urbanization rate 2030	90%	80%	70%

B: Selected Scenarios

City tier	*1st*		*2nd*		*3rd*	
Scenarios	*Conservative*	*Aggressive*	*Conservative*	*Aggressive*	*Conservative*	*Aggressive*
Additional assumptions						
Annual housing supply 2010–2030 (billion ft^2)	0.17	0.48	0.72	2.00	0.90	2.83
Annual income growth	5%	5%	5%	5%	5%	5%
Price in 2030 (2014 RMB per ft^2)	2,165	1,531	1,039	410	1,017	403
Annual price growth	0.82%	−0.91%	−0.29%	−4.82%	3.37%	−1.30%
Annual housing supply 2000–2010	0.42		1.98		1.84	
Price in 2010 (2014 RMB per ft^2)	1,840		1,102		524	

Heat Map of Predictions

Estimates of Average Annual Housing Price Growth, 2010—2030



Summary

Glaeser et. al. note that government policy could sustain high housing prices but would lead to huge economic inefficiency (misallocation)

Without government intervention and with supply growing at current rates, it's quite possible for prices to *fall*

Even if prices don't decrease, growth should be much lower than in last decade: likely below 3% unless Chinese incomes somehow grow at 7% a year

Deng et. al. papers a bit more optimistic about first tier and second tier cities, but note lots of risk in other markets (ex: North)

Most papers agree that financing of Chinese housing (high downpayments) makes effects of a housing bust less dangerous than US situation of 2009