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Rural-Urban Migration, Structural Transformation, and Housing Markets in China

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LONGER TERM AGENDA

1. **What drives housing (especially prices)?**

   ▶ Fundamentals (demographics, preferences, structural transformation/urbanization in modern economies)
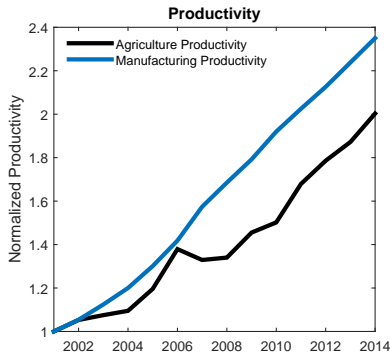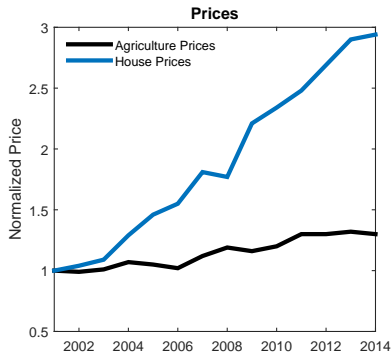
   ▶ Expectations

   ▶ Credit

   ▶ Liquidity

$$
P_t = \underbrace{R_t}_{\text{fundamentals}} + \underbrace{\mathbb{E}}_{\text{expectations}} \left\{ \Gamma_{t,t+1} \underbrace{(1 - \tau_{t+1})}_{\text{liquidity}} P_{t+1} \right\} + \underbrace{\mu_t \theta P_t}_{\text{credit}}
$$

2. **How does housing impact the macroeconomy?**

3. **What are the policy implications?**

## MOTIVATING FACTS

▶ Chinese house prices tripled in the span of 13 years, whereas agricultural prices only increased by 30%.

▶ Productivity has also risen significantly but not as much.

MOTIVATING FACTS

▶ Large population shift from rural to urban areas.

▶ However, smaller decline in agricultural output share and nearly flat income gap.

▶ Suggests declining mobility costs or rising urban amenities ⇒ lower *net* mobility costs.

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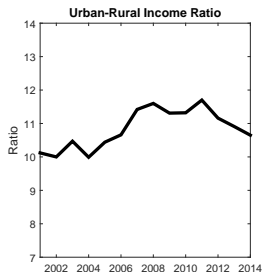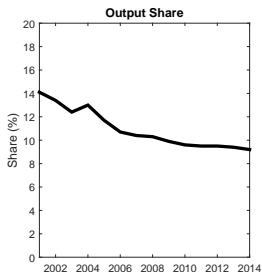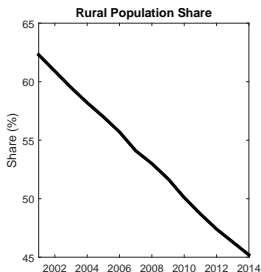
TODAY'S TALK

Explore China's **structural transformation** and **housing boom**.

1. **How much of the Chinese housing boom can be explained by structural transformation?**

   ▶ Rising productivity boosts income and housing demand.

   ▶ Rural-urban migration further increases housing demand.

   ▶ Constrained land supply limits construction.

2. **How do rising housing costs affect the extent and speed of structural transformation?**

   ▶ Expensive urban housing is a deterrent to migration.

3. **What is the impact of land and permitting policies?**

   ▶ Land supply affects house prices and possibly migration.

   ▶ Hukou permits slow the transition from renting to owning.

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MODEL SUMMARY: I

All Households

► Utility $u(x_{ft}, x_{mt}, x_{ht})$.

Rural Households

► Deterministic, inelastic agricultural income.

► Agents live in farm houses at zero cost: $x_{ht} = h_f$.

► No access to financial markets.

Urban Households

► Stochastic income $w_t e_t s_t$: $\int e_t s_t d\Phi_t^{urban} = \mu_t^{urban}$.

► Rent $x_{ht} = h_a$ at flow cost p_a.

► Hukou permit holders can buy $h \in \mathcal{H} = \{h_1, h_2\}$ at price p_{ht} and receive $x_{ht} = h > h_a$. Adjustment costs τ_b and τ_s.

► Access to saving (all) and borrowing (homeowners only).

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MODEL SUMMARY: II

Migration

- ▶ Rural workers differentiated by mobility cost $\epsilon \sim F(\epsilon)$.

- ▶ Movers draw e_t and $s_t \sim \Pi_s$. No reverse migration.

- ▶ $\mu_t^{rural} = \mu_{t-1}^{rural} - \text{migration}_{rural \to urban,t}$; $\mu_t^{rural} + \mu_t^{urban} = 1$.

Technology

- ▶ Agriculture: $Y_{ft} = Z_{ft} N_{ft}$ where $N_{ft} = \mu_t^{rural}$.

- ▶ "Manufacturing:" $Y_{mt} = Z_{mt} N_{mt}$.

- ▶ Housing construction: $Y_{ht} = F_h(L_{ht}, S_{ht}, N_{ht})$.
  - ▶ L_{ht} is supplied by the government.

- ▶ Apartment space: $Y_{at} = Z_a S_{at} \Rightarrow$ "rent" $p_a = 1/Z_a$.
  - ▶ Isomorphic to durable apartments and risk neutral absentee landlords: $\mathcal{P}_a = 1/Z_a = p_a + \frac{1-\delta_a}{1+i}\mathcal{P}_a \Rightarrow p_a = \frac{i+\delta_a}{1+i} 1/Z_a$.

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MODEL SUMMARY: III

Financial Markets

► Risk-free saving at rate i_t.

► Long-term mortgages with rate r_t that amortize at rate γ.
  ► Maximum loan-to-value at origination of θ.
  ► No default, no refinancing.

Market Clearing

► Tradable goods and financial services (open economy);
  nontradable housing.

► Exogenous i_t, r_t, p_{ft}; endogenous p_a, w_t, p_{ht}.

► Urban labor market clearing: $N_{ht} + N_{mt} = \mu_t^{urban}$.

► Housing: $\int h_t^* d\Phi_t^{rent} + \delta_h H_{t-1} = \int h \mathbf{1}_{sell_t^*} d\Phi_t^{own} + Y_{ht}$. Law of
  motion $H_t = (1 - \delta_h)H_{t-1} + Y_{ht}$.

HOUSEHOLD DECISION PROBLEMS

▶ Rural households:

$$V_t^{rural}(\epsilon) = \max_{x_{mt}, x_{ft}} u\left(x_{mt}, x_{ft}, h_f\right) + \beta \max\left\{V_{t+1}^{rural}(\epsilon), \mathbb{E}V_{t+1}^{rent,0}(y_{t+1}, s_{t+1}) - \delta_{t+1}\epsilon\right\}$$

such that

$$p_{ft}x_{ft} + x_{mt} = p_{ft}Z_{ft}$$

$$y_{t+1} = w_{t+1}e_{t+1}s_{t+1} + \mathcal{T}_{t+1}$$

$\Rightarrow$ migrate next period if $\epsilon \leq \epsilon^*$ where $\epsilon^* = \dfrac{\mathbb{E}V_{t+1}^{rent,0}(y_{t+1}, s_{t+1}) - V_{t+1}^{rural}(\epsilon^*)}{\delta_{t+1}}$

▶ Urban renters without hukou permits:

$$V_t^{rent,0}(y_t, s_t) = \max_{\substack{x_{ft}, x_{mt}, \\ b_{t+1}}} u\left(x_{ft}, x_{mt}, h_a\right) + \beta\mathbb{E}\left[\begin{array}{c} (1-\eta)V_{t+1}^{rent,0}(y_{t+1}, s_{t+1}) \\ +\eta\max\{V_{t+1}^{rent,1}(y_{t+1}, s_{t+1}), V_{t+1}^{buy}(y_{t+1}, s_{t+1})\} \end{array}\right]$$

such that

$$p_{ft}x_{ft} + x_{mt} + p_a h_a + b_{t+1} = y_t$$

$$y_{t+1} = w_{t+1}e_{t+1}s_{t+1} + (1 + i_{t+1})b_{t+1} + \mathcal{T}_{t+1}$$

HOUSEHOLD DECISION PROBLEMS

▶ Urban renters with hukou permits:

$$V_t^{rent,1}(y_t, s_t) = \max_{\substack{x_{ft}, x_{mt}, \\ b_{t+1}}} u(x_{ft}, x_{mt}, h_a) + \beta\mathbb{E}\left[\max\{V_{t+1}^{rent,1}(y_{t+1}, s_{t+1}), V_{t+1}^{buy}(y_{t+1}, s_{t+1})\}\right]$$

such that

$$p_{ft}x_{ft} + x_{mt} + p_a h_a + b_{t+1} = y_t$$

$$y_{t+1} = w_{t+1}e_{t+1}s_{t+1} + (1+i_{t+1})b_{t+1} + \mathcal{T}_{t+1}$$

▶ Buyers:

$$V_t^{buy}(y_t, s_t) = \max_{\substack{x_{ft}, x_{mt}, \\ b_{t+1}, d_{t+1}, \\ h_{t+1} \in \mathcal{H}}} u(x_{ft}, x_{mt}, h_{t+1}) + \beta\mathbb{E}\left[\begin{array}{c} \max\left\{V_{t+1}^{rent,0}\left(y_{t+1}^{rent}, s_{t+1}\right), \\ V_{t+1}^{own}\left(y_{t+1}^{own}, h_{t+1}, d_{t+1}, s_{t+1}\right)\right\} \end{array}\right]$$

such that

$$p_{ft}x_{ft} + x_{mt} + (1+\tau_b)p_{ht}h_{t+1} + b_{t+1} = y_t + d_{t+1}$$

$$y_{t+1}^{rent} = w_{t+1}e_{t+1}s_{t+1} + (1+i_{t+1})b_{t+1} + (1-\tau_s)p_{h,t+1}h_{t+1} - (1+r_{t+1})d_{t+1} + \mathcal{T}_{t+1}$$

$$y_{t+1}^{own} = w_{t+1}e_{t+1}s_{t+1} + (1+i_{t+1})b_{t+1}$$

$$d_{t+1} \leq \theta p_{ht}h_{t+1}$$

HOUSEHOLD DECISION PROBLEMS

▶ Owners:

$$V_t^{own}(y_t, h, d_t, s_t) = \max_{\substack{x_{ft}, x_{mt}, \\ b_{t+1}}} u(x_{ft}, x_{mt}, h) + \beta \mathbb{E} \left[\begin{array}{c} \max \left\{ V_{t+1}^{rent,0} \left(y_{t+1}^{rent}, s_{t+1} \right), \\ V_{t+1}^{own} \left(y_{t+1}^{own}, h, d_{t+1}, s_{t+1} \right) \right\} \end{array} \right]$$

such that

$$p_{ft} x_{ft} + x_{mt} + b_{t+1} + (\gamma + r_t) d_t = y_t$$

$$d_{t+1} = (1 - \gamma) d_t$$

$$y_{t+1}^{rent} = w_{t+1} e_{t+1} s_{t+1} + (1 + i_{t+1}) b_{t+1} + (1 - \tau_s) p_{h,t+1} h - (1 + r_{t+1}) d_{t+1} + \mathcal{T}_{t+1}$$

$$y_{t+1}^{own} = w_{t+1} e_{t+1} s_{t+1} + (1 + i_{t+1}) b_{t+1}$$

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PARAMETRIZATION

▶ Preferences:

$$u(x_f, x_m, h) = \frac{\left([\phi_X X^\rho + (1 - \phi_X) h^\rho]^{\frac{1}{\rho}} \right)^{1-\sigma}}{1 - \sigma}$$

where

$$X = \left[\phi_f (x_f - \underline{x}_f)^\nu + (1 - \phi_f) x_m^\nu \right]^{\frac{1}{\nu}}$$

▶ Mobility costs:

$$F(\epsilon) = 1 - \left(\frac{\underline{\epsilon}}{\epsilon} \right)^\kappa$$

▶ Housing construction:

$$Y_h = Z_h L_h^{\alpha_L} \left(S_h^{\alpha_S} N_h^{1-\alpha_s} \right)^{1-\alpha_L}$$

with $\alpha_L = 0.33$ and $\alpha_S = 0.3$.

PARAMETRIZATION

- Z_{m0} normalized to 1; Z_{f0} set to ensure μ_0^{rural} at price $p_{f0} = 1$; Z_{h0} set to ensure $p_{h0} = 1$; Z_a set such that $p_a = 0.05$.

- Urban income process:

$$\ln(s_{t+1}) = \rho_s \ln(s_t) + \varepsilon_{t+1}$$
$$\varepsilon_{t+1} \sim \mathcal{N}(0, \sigma_\varepsilon^2)$$
$$\ln(e_t) \sim \mathcal{N}(0, \sigma_e^2)$$

with $\rho_s = 0.9172$, $\sigma_\varepsilon^2 = 0.0469$, $\sigma_e^2 = 0.032$ from Fan et al (2010).

- Government income floor:
$$\max\{w\underline{y} + p_a h_a + p_f \underline{x}_f, wes\}$$

where $\underline{y} = 0.5\underline{es}$

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QUANTITATIVE EXPERIMENTS

▶ Calibrate the economy to match Chinese population and GDP shares in both 2001 *and* 2014.

▶ Back out the path of mobility costs that replicates the observed path of urbanization.

▶ Solve for the equilibrium path of house prices.

▶ Two sets of experiments: counterfactuals and policy.

▶ The baseline path of mobility costs is left unchanged.

BASELINE RESULTS

▶ The model captures two-thirds of the house price boom.

▶ Matches the decline in agriculture-to-GDP.

▶ Increased migration implies declining mobility costs.
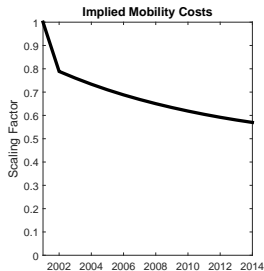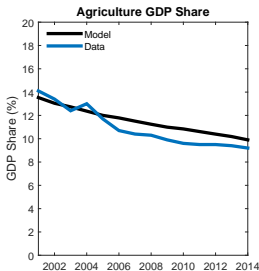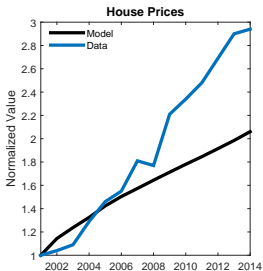
COUNTERFACTUAL I: AGRICULTURAL PRODUCTIVITY

- ▶ 200% greater migration to the city.
- ▶ 23% higher house prices from 2001 – 2014.
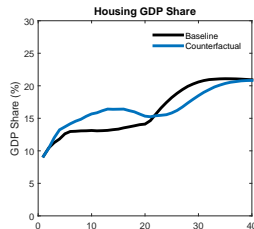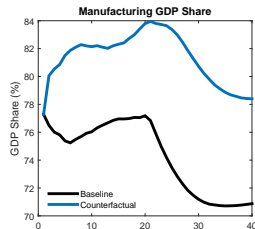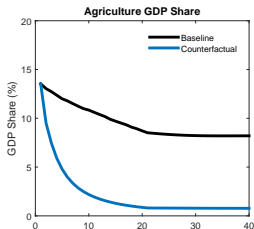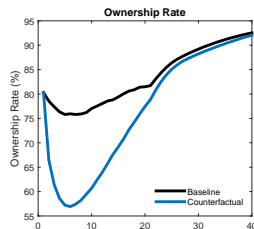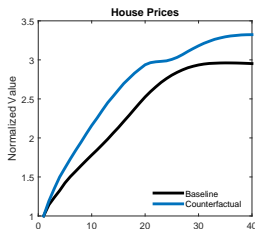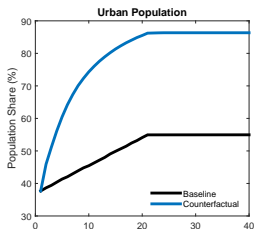
COUNTERFACTUAL II: NET MOBILITY COSTS

► No migration.

► The lack of population inflows mitigates the house price increase (by 14% in the long run); ownership rate rises.
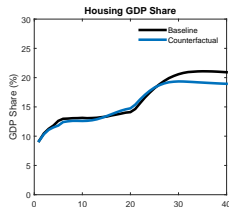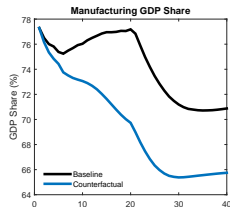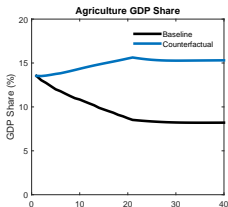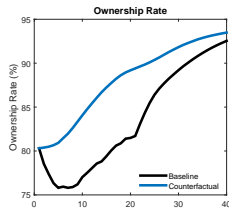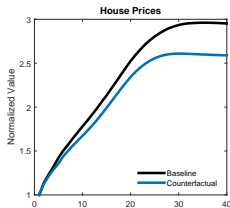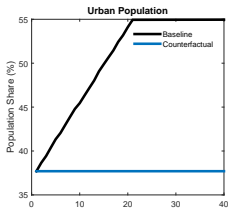
COUNTERFACTUAL III: CONSTANT HOUSE PRICES

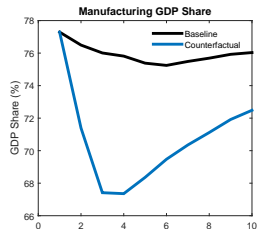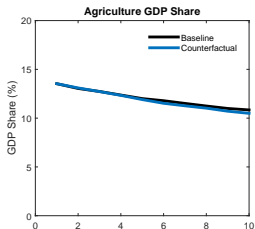▶ If house prices hadn't risen, China would have reached its current urban population share 7 years earlier.
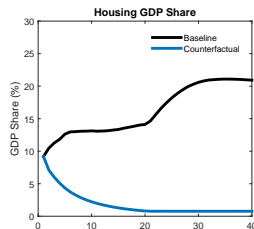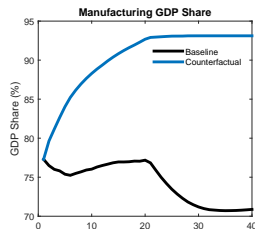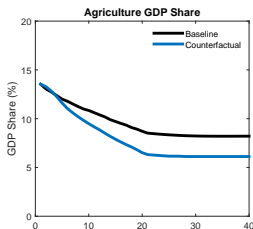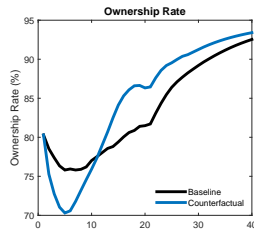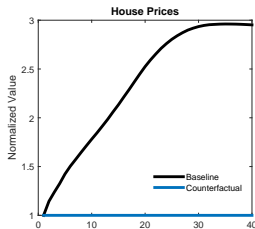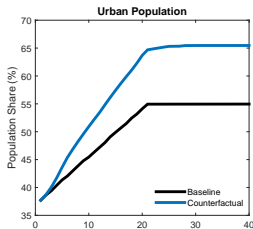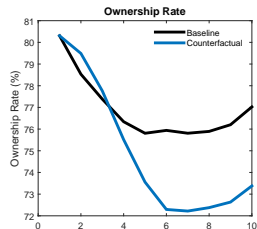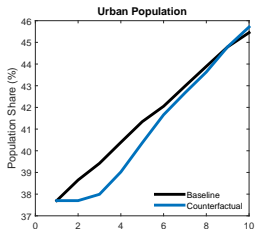
POLICY I: TIGHTEN BORROWING LIMITS

► No long run effect.

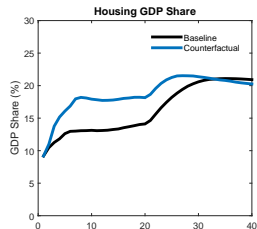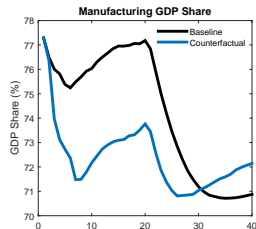► Short run slow down in house price appreciation–but also structural transformation.
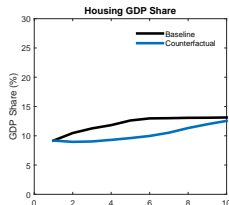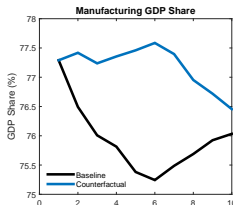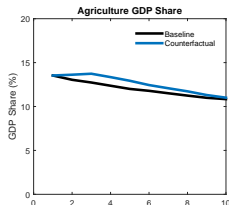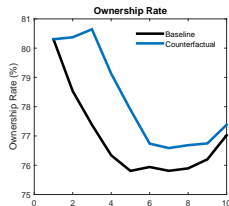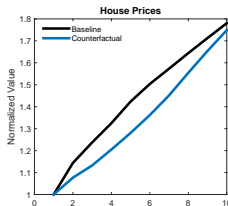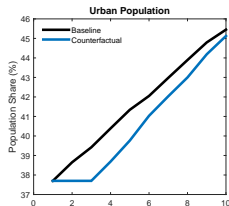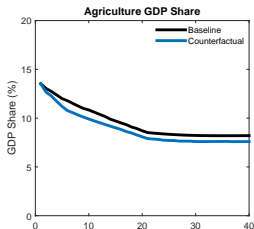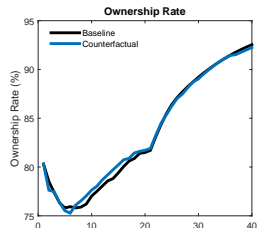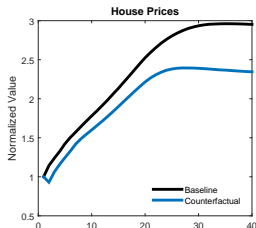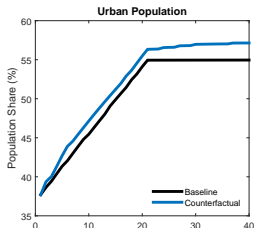
POLICY II: REDUCE HUKOU DELAYS

▶ More rapid house price growth slows urbanization.
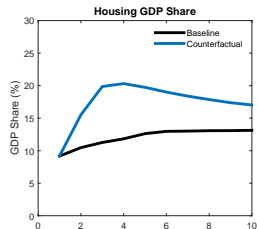
POLICY III: INCREASE LAND SUPPLY

▶ Slows house price growth and increases urbanization.

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CONCLUSIONS

► Develop a quantitative theory of house prices, structural transformation, and urbanization.

► Structural transformation can account for two-thirds of the housing boom.

► Rising house prices slow and reduce structural transformation.

► Efforts to slow house price growth by tightening credit harms structural transformation.

► Increasing land supply slows house price growth and accelerates structural transformation.