Eric Levin and Gwilym Pryce
Department of Urban Studies, University of Glasgow

Housing Cycles and the Supply of Housing

Presentation at the DUS/SHEFRN half-day seminar 15th May 2009:
"*Housing Cycles, Financial Crises and the Supply of Housing*"

University of Glasgow

Plan

- **Part I: Role of Real Interest Rates**
  - in determining the demand for housing and the supply response
- **Part II: Role of Market Imperfections**
  - in explaining the asymmetric supply response

University of Glasgow

Q/ How should we interpret recent extreme house price volatility and the weak supply response?

Interpreting the recent cycle

- **Real house prices more than doubled between 1996 and 2007**
  - **2007 real mix-adjusted house prices in England & Wales 127% higher than 1996**
- **Weak supply response to this house price rise**
  - **2007 private house completions in England & Wales 31% higher than 1996**
- **Inelastic price elasticity of house supply at +0.24**

University of Glasgow

Price Bubble with Sluggish Supply

- The extraordinary rise in real house prices between 1996 and 2007 is typically interpreted as a price bubble plus a sluggish supply response as the consequence of planning restrictions.
- That is, the standard interpretation requires two stories:
  1. The extreme rise in house prices was a bubble Muellbauer and Murphy (2008) for a discussion of the issues
     - **House prices are volatile relative to observable changes in fundamentals**
  2. The weak supply response was due to planning constraints
     - The Barker Review (2003) concentrated attention on the **sluggish planning system as the main cause of low price elasticity of supply for the UK house market.**

University of Glasgow

A single explanation driving both phenomena?

- **Real interest rates more than halved between 1996:06 and 2007:06**

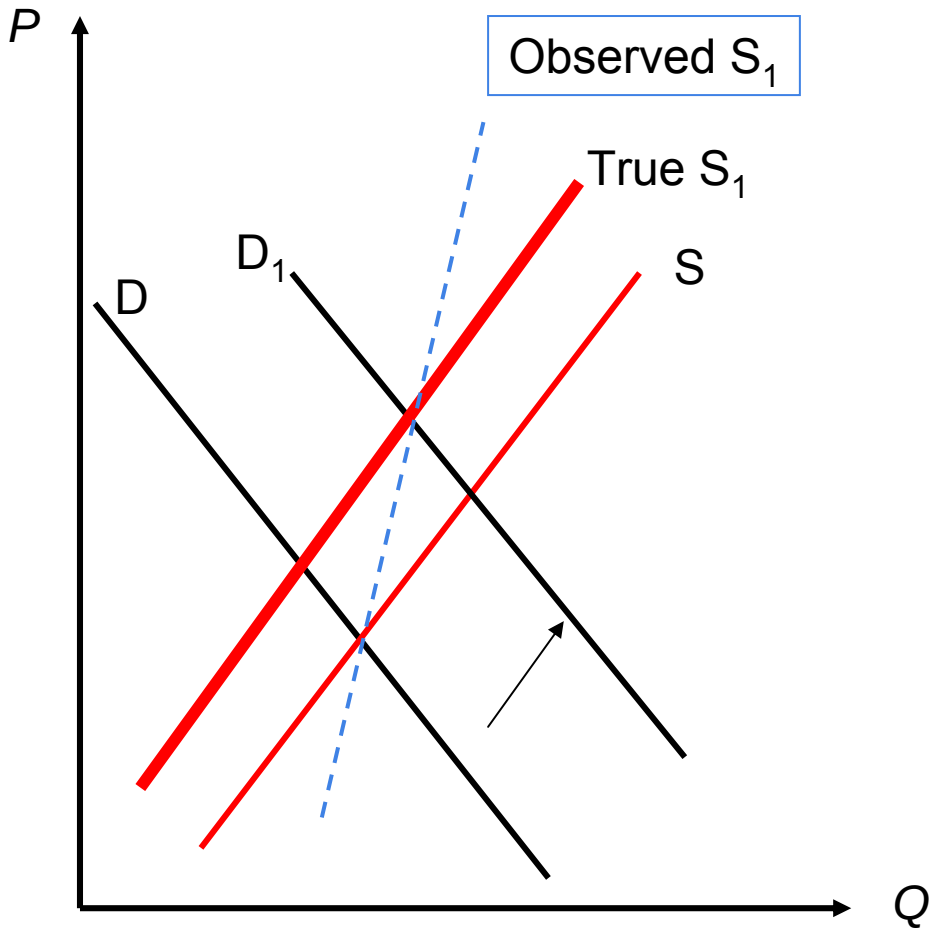
the 5 year real spot interest	3.64%	2.65%
the 20 year real forward interest rate	4.0%	0.5%

1. **Large increase in real house prices 1996 to 2006**
2. **There was a weak supply response**
3. **There was a steep decline in the term structure of interest rates**
4. **Did the change in the term structure of real interest rates contribute to both to the house price rise and to the weak supply response?**

University of Glasgow

Supply Schedule: Observed vs Actual

- Supply response is weakened when the house price increase is driven by a real interest rate decline because:
  - **new house supply responds to the change in developers' profit, not to the change in house prices.**
  - **A decline in long real interest rates that raises house prices also raises the price of land and this raises the supply curve.**



Let us examine the hypothesis that the house price rise & inelastic supply are both driven by interest rate movements

First, could the steep house price be interpreted as a bubble?

$$P = \frac{R}{I + \tau + \delta - \pi_H}$$

- Asset-market equilibrium requires the price of a house to equal the discounted value of its net future service flow.
- Where:
  - R is the cost of renting
  - P is the house price index,
  - I is the foregone real interest rate in the money market,
  - T is the property tax rate on owner-occupied houses and
  - δ is the rate of depreciation and maintenance,
  - π_H is expected rate of real future house price appreciation

University of Glasgow

A more general expression of P is given by:

$$P_t = E\left[\sum_{j=1}^{\infty} \frac{R_{t+j}}{\prod_{k=1}^{j}\left(1 + I_{t+k} + \tau_{t+k} + \delta_{t+k}\right)}\right]$$

- **where E denotes the expectation operator.**
- **There is an important advantage of reformulating user cost this way.**
  - **In the previous expression it was impossible to calculate P without some conjecture about expected future house price appreciation because π_H is an exogenous variable.**
  - **However, in (16) *real* expected house price appreciation on the house price is endogenously determined by the term structure of forward interest rates.**
- **Consequently the equilibrium price P can be calculated because forward interest rates are observable in financial markets.**

University of Glasgow

Can real interest rates account for the rise in house prices?

- So now we can check whether the rapid house price appreciation should be interpreted as a “bubble” or as the efficient equilibrium market outcome of shifting term structures of interest rates
  - An average house purchased in June 1996 for £69,275 had a resale value of £216,096 in June 2007. However, £69,275 worth of 7% inflation-indexed UK government IL perpetuities purchased in June 1996 would have had a resale value of £209,761 in June 2007.
  - **The decline in real interest rates that raised the price of an index-linked perpetuity from £69,275 to £216,096 was enough to account for the rise in house prices from £69,275 to £209,761.**

- This conclusion requires the assumption that the value of the annual rental stream from the house is equivalent to the annual after-tax coupon payments from the 7% indexed bond.

University of Glasgow

- The collapse in the term structure of real interest rates was sufficient to explain the rise in house prices over the eleven years without recourse to bubble explanations.

- The 130% rise in house prices cannot be explained as increased demand due to high immigration or divorce rates.
  - This is inconsistent with the 9% real rise in private rents over the same period.

University of Glasgow

Second, did real interest rates affect supply response?

- **The real interest rate decline did not cause all of the rise in building land prices.**
  - Building land real prices rose to 357% of the 1996 price while an equivalent index linked bond real price rose to 303% of the 1996 price over the same period.
  - The steep rise in indexed bond prices was caused by the unexpected fall in real interest rates over this period.

- On this basis (100*203/257) 79% of the rise in building land prices during this decade can be explained by the unprecedented steep unanticipated fall in real interest rates over the same time period,
  - **leaving a 21% residual real rise in the price of building land explicable by shortage factors not associated with lower interest rates.**

- (Is this consistent with the 9% rise in real private sector rents over this eleven year period because real rents are independent of interest rates effects on asset values?)

Table 1 Profit Per Dwelling and Completion Rates

ENGLAND	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Average new dwelling price	86945	96114	102121	117746	128976	138703	163236	194295	221682	225787	229798	227375
Average valuation residential building land with PP per hectare	816828	921288	1098965	1223258	1514834	1873027	2208962	2609001	3114430	3311667	3538359	3944900
Dwellings per hectare	25	25	25	25	25	25	27	34	39	40	41	45
Land cost per home	32673	36852	43959	48930	60593	74921	81813	76735	79857	82792	86301	87664
*Resource cost index of house-building (1995=100)	102	106	108	111	117	121	125	132	138	147	156	164
Average non-land cost per dwelling	46,666	48,496	49,411	50,784	53,529	55,359	57,189	60,391	63,136	67,254	71,372	75032
Profit per dwelling = Hp - Lp - W	7,606	10,766	8,751	18,032	14,854	8,423	24,077	57,169	78,689	75,741	72,125	64,679
Profit per dwelling (markup on unit cost)	10%	13%	9%	18%	13%	6%	17%	42%	55%	50%	46%	40%
private enterprise completions	123,616	121,165	127,835	121,194	124,466	116,644	115,701	124,457	130,096	139,132	144,937	145,383

How relevant is the real interest rate effect on price elasticity of supply, given that there is also an excess demand (rising rentals caused by planning constriction) effect on the price of land with planning permission?

Relative Strength of Demand & Supply Effects

$$P_L = \frac{l}{r} \quad \therefore \frac{\partial P_L}{\partial r} = \frac{-l}{r^2}$$

$$\therefore E_{P_L.R} = \frac{-l}{r^2} \cdot \frac{r}{P_L} = -1$$

- Mean land price with residential pp per hectare = P_L = £2,181,293 (1996 to 2007)
- Mean private housing rent per hectare per annum = h = £87.46 per week * 52 * 40 units per hectare = £181,918
- Mean real 15 year spot rate for British Government index-linked gilts between 1996 and 2007 was 2.30%
- By substitution, I = 28% of private housing rent per hectare
- **That is, house price rises caused by falling interest rates lowers the price elasticity of supply to 0.72 the price elasticity of supply where the price rise is caused by excess demand.**

University of Glasgow

Conclusion

- Falling term structure of real interest rates
  - provides a very good explanation for the 1996 to 2007 house price rise
  - provides a partial explanation for the low supply response.
- A house price rise caused by falling interest rates lowers the price elasticity of supply to 0.72 of the value of the price elasticity of supply compared with an equivalent price rise caused by excess demand.

University of Glasgow

- This analysis shifts the focus onto:
  1. the issue of a general asset price bubble and what will happen to the term structure of real interest rates over the next year or two.
  2. the interpretation of the house price reversal after the boom.
- House prices have been falling since 2008, a period when the term structure of real interest rates was not rising. Does this negate the interest rate interpretation?
  - The answer to this question requires probing if mark-to-market valuation rules during a period of systemic deleveraging cause “fire-sale” forced selling that in turn leads to market prices that do not reflect fundamental valuation.
    - I.e. house price undershooting.

- **Part II: Role of Market Imperfections**
  - in explaining the asymmetric supply response

Market Imperfections & Regulations

- If PES↓ due to ↓ long term real *r* between 1996 and 2007,
  - why did the construction sector contract so rapidly in the first half of 2008 in response to relatively modest falls in house prices (given that real interest *r* did not suddenly ↑)?

- Five complementary drivers of Apparent ↑ PES:

1. ***The One-Way Effect of Planning Constraints***
2. ***Credit Regime Switching***
3. ***Housing Market Disequilibrium and Price Index Failure***
4. ***Asymmetric Impact of Price Uncertainty***
5. ***Adverse Selection Effects of Non-Random Consents and the Heterogeneity of Land***

University of Glasgow

1. The One-Way Effect of Planning Constraints

- Constraints on the amount of land available for development will be most binding during an upswing.
  - No corresponding constraint to limit the ***fall*** in supply during a downswing,
- So,
  - ↑Qs insensitive to ↑P because of constraints to supply expansion,
  - ↓ Qs v. sensitive to ↓P because no equivalent constraints to supply contraction.

University of Glasgow

2. Credit Regime Switching

- Credit Regime I: financial innovation & unconstrained lending during boom times
  - the price of credit falls as supply of credit shifts outward
  - Lenders focus on expanding market share; adverse selection effects overlooked
  - Innovation ⇒ New financial products (e.g. BTL)
  - Mark-to-market ⇒ ↑ value of banks' collateral

↑ availability of cheap credit for new construction

University of Glasgow

- Credit Regime II: Equilibrium credit rationing during downturns
  - Lenders $\uparrow r$ during periods of credit contraction, but not enough to clear the market $\Rightarrow$ Persistent excess demand for debt.
  - Stiglitz and Weiss (1981) equilibrium credit rationing:
    - $\uparrow r \Rightarrow$ screens out low risk/low return projects $\Rightarrow$ adverse selection $\Rightarrow$ equilibrium rationing of credit
  - Mark-to-market $\Rightarrow \downarrow$value of banks' collateral $\Rightarrow$ deleverage

$\downarrow$availability of cheap credit for new construction $\Rightarrow \downarrow$Qs

University of Glasgow

3. Housing Market Disequilibrium and Price Index Failure

$$PES = \frac{\%\Delta Qs}{\%\Delta P}$$

- In 2008 we observed a small $\%\Delta\downarrow Q_s$ & a large $\%\Delta\downarrow P \Rightarrow$ large PES
  - E.g. Compare 2nd quarter of 2008 vs same quarter of the previous year:
    - ↓ starts by 19% (↓ completions fell by 13%)
    - But ↓ house prices by just 4%

- **Observed** $\%\downarrow\Delta P$ grossly underestimates the true $\%\downarrow\Delta P$
  - during a downturn, homeowners are reluctant to sell if the sale price falls below the price they paid for the property (Genesove and Mayer 2001),
  - or if the equity generated is insufficient to cover moving costs (Genesove & Mayer 1997).

University of Glasgow

- Loss aversion & equity lock-ins ⇒ Sample selection Bias
  - Mean price of transacted properties does not reflect mean price of a dwelling in the entire stock
- Published house price indices do not control for selling times.

  ⇒ observed ↓ price during a downturn < true ↓ price.

⇒ **Asymmetry in PES is illusory**

- *If true %Δ↓P were used in PES calculation, the relative ↓price would be much closer to the relative ↓Qs, and the rise in PES during a downturn would be much smaller.*

University of Glasgow

4. Asymmetric Impact of Price Uncertainty

- Regulation not just about restricting supply of land:
  - *Zero-carbon Homes*
  - *Community Infrastructure Levy* (CIL)
  - *Lifetime Homes*
  - *Water regulations*
  - *Sustainable Urban Drainage Systems* (SUDS)
- By adding to the delays and uncertainties associated with construction, regulation may make Supply more sensitive to anticipated price falls…

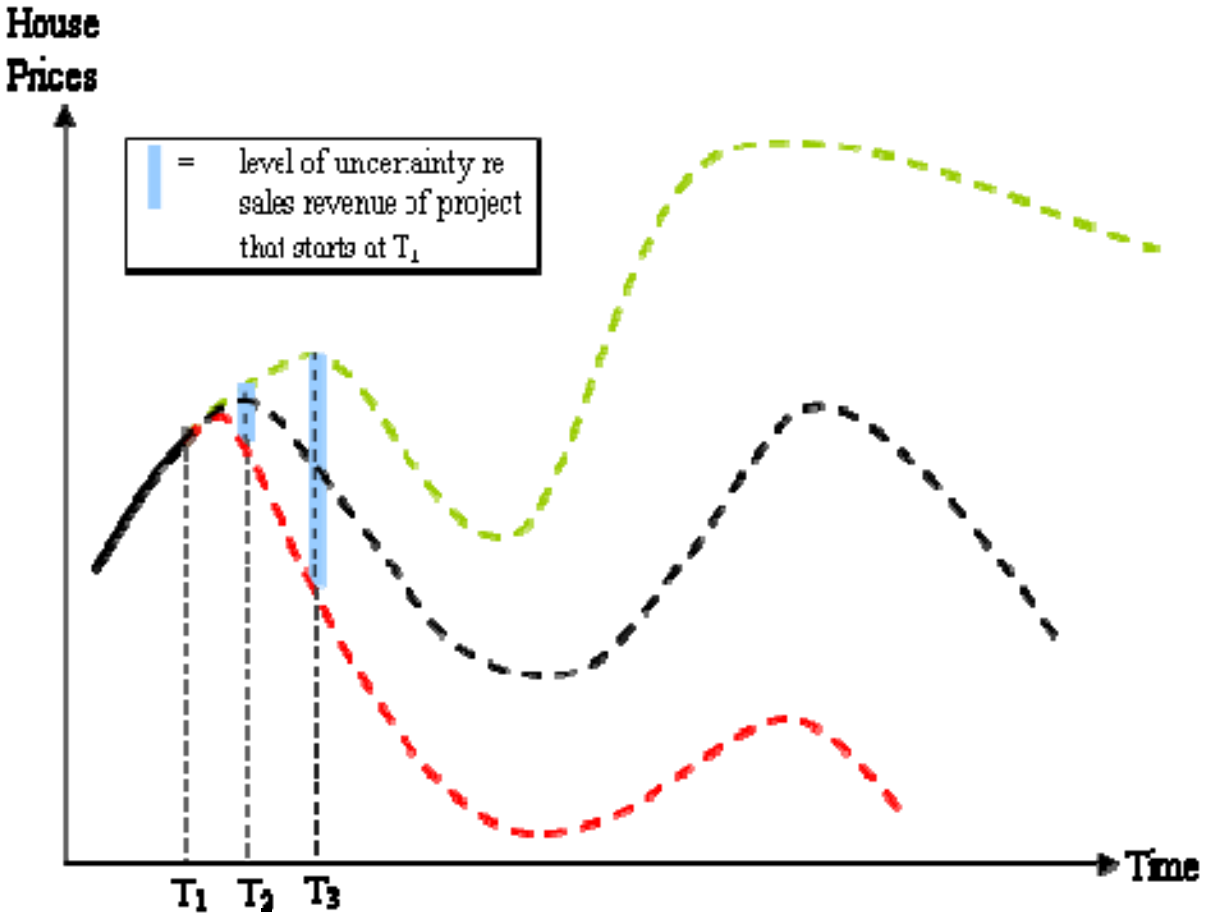
University of Glasgow

T_1: development decision

T_2: = completion (no regulation)

T_3: = completion (with regulation)

Development decision depends on expected selling price at time of completion = $f(P_{T2}, P_{T3})$



University of Glasgow

5. Adverse Selection Effects of Non-Random Consents

Only apply for PP if:

$$G_i U \geq c$$

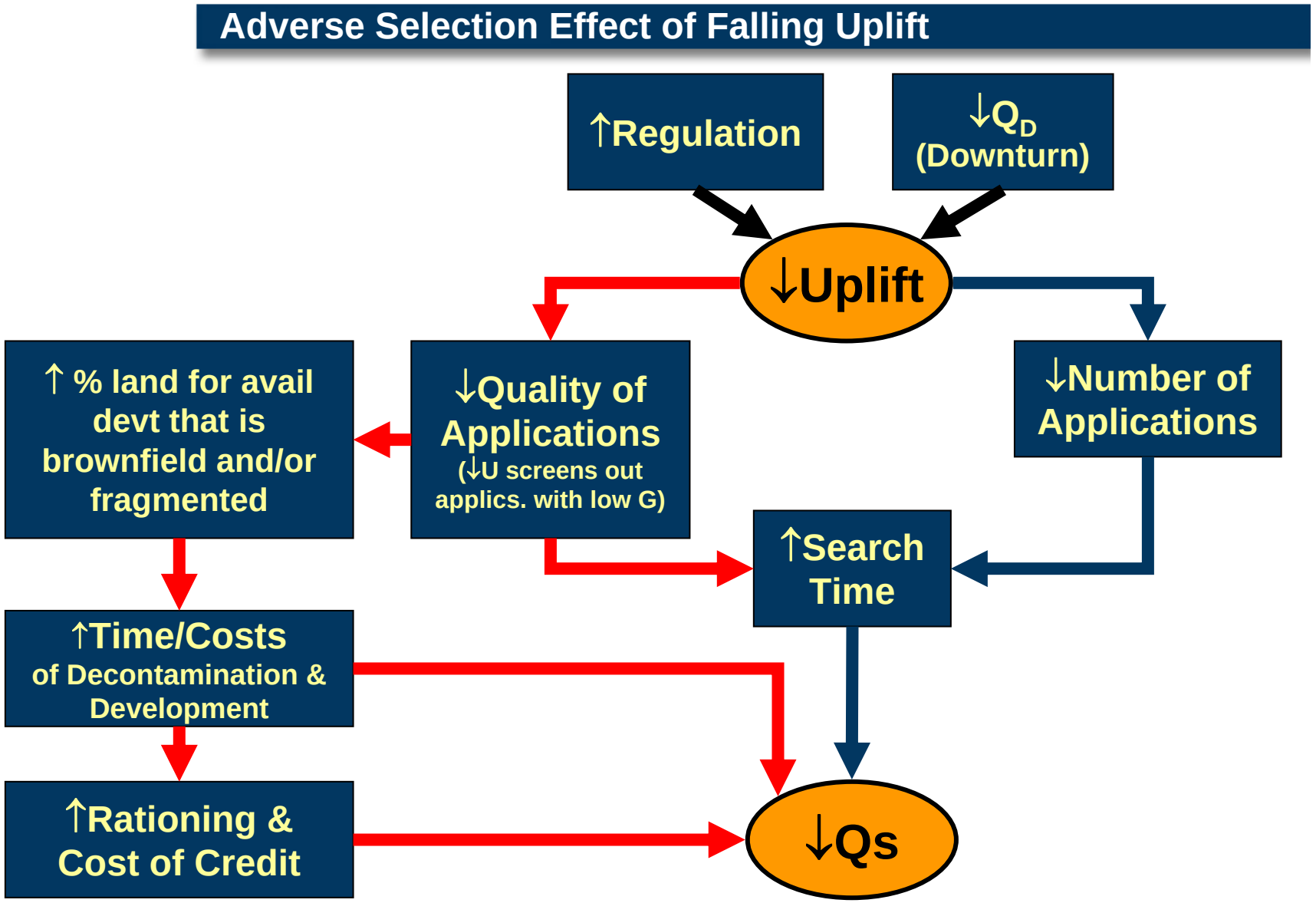
where:

G = perceived Pr(success)
U = uplift
$= Hr - Ar$
Hr = land value with PP.
Ar = land value without PP
c = cost of application

- Any land owner can put forward any plot of land in her possession for consideration for change of use.
- Some land plots will have a much higher probability, *G*, of gaining planning permission than others:
  - Brownfield sites
  - Small sites located near existing houses
- Significant cost entailed in applying for planning permission,
  - so only worthwhile applying if the expected returns outweigh the cost.

$\Rightarrow$ Adverse Selection effect of $\downarrow U$

- **Q/ What might cause uplift to fall and how does it affect Qs?**



University of Glasgow

Conclusion

- Supply responsiveness is partly determined by long cycles in long real interest rates
  - Falling *r* over the period 1996 to 2007 provides a partial explanation for the low PES.
- But why did PES rise during the downturn?
  - Rapid fall in Q_S as a result of small fall in P
  - Negative ratchet effect on PES over the cycle?
  - Five complementary explanations:
    - One-Way Effect of Planning Constraints
    - Credit Regime Switching,
    - Measurement failure,
    - Asymmetric Impact of Price Uncertainty
    - Adverse Selection Effects of Non-Random Consents

University of Glasgow

Implications for recovery?

- Real interest rate effects:
  - If real interest rates rise, PES would rise, but housing demand would fall
- Market imperfections & Regulation:
  - *If* PES falls during the upswing (exacerbated by recent & anticipated regulation),
  - *Then* large and persistent price rises would need to occur before we see Qs rising significantly.