Price Bubbles, the Risk-shifting Problem, and Financial Fragility

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Major Topics to be Covered Today…

- The role of money & credit in asset price determination (Overarching topic)
- The Risk-shifting Problem—credit and interest rate determination
- Further extensions and discussions

- What leads to intense asset price fluctuations?

Cases Overview…

	Reason(s) for price bubble formation	Inducement(s) for bubble burst
Japan in the late 1980s	Financial liberalisation throughout the 80s Intention to support the US$	Policy reversal by the Bank of JPN (concerned with controlling inflation; tightened monetary policy)—effect on ir and bubble
Norway and Finland	N: The ratio of bank loans to nominal GDP soared; asset prices, I and C skyrocketed F: an expansionary-budget-induced credit expansion and housing bubbles	N: Oil price collapse F: tight monetary policy (ir, rrr); fall in trade with USSR
Mexico	Privatisation of banks; deregulation and the elimination of reserve requirements; lending boom	Political upheaval—assassination & uprisings
Financial liberalisation & credit expansion generate bubbles; external and internal factors burst them.		

Introducing/Reviewing Core Concepts

- **Price Bubbles**
- **Market Fundamentals/Fundamental Prices**
- **Speculations**
- **Tight** monetary policies and **Retrenchments**
- (unrelated) Is there a role for monetary policies to prevent/inhibit negative bubbles? Japan, QE, and the Lost Decades?

In general, why would a price bubble burst?

- In slide 4 we have witnessed both external and internal factors that could trigger the burst of a price bubble. Allen and Gale (2004) summarised that the bubble bursts either because:
- 1) **returns on the assets are too low,** or
- 2) **credits are tightened by the central bank**
- …which brings us to the next question…

In theory, how would <u>a price bubble collapse</u> impact the banking sector?

- Assets (real and financial) and Liabilities

- What happens if asset prices collapse? Asset value? Liabilities?

Then, how would a price bubble form in the first place?

- Consider a scenario when an investor borrows money to invest in financial assets:
- **Risk-shifting Problem**: investors obtain their funds from external sources. If fund providers cannot observe the characteristics (riskiness) of the investment, then the investor has the incentive to invest in riskier assets for greater expected returns, thereby **shifting the risk to the lender** of the fund and **bidding up the price** of the risky assets above the benchmark.(a concept developed in Allen and Gale (2000)
- The cost of default is fixed (limited liability); the expected return hinges more on the upper part of the return distribution.
- Another classical example of Asymmetric information and Moral Hazard.

Case 1: investors using their own money to invest in assets

Asset Type	Supply	Investment at t=1	Price of the asset at t=1	Payoff at t=2
Safe	Variable	1 unit wlth	1 per unit of ast	1.5
Risky	Fixed, 1 unit	1 unit wlth	P per unit of ast	R= 6, prob=25% R=1, prob=75% E(R)=2.25

- Assumptions: each investor has an initial wealth of 1 unit; he invests only with his own money; everybody is **risk neutral** and thus the marginal returns on the two assets should be equal
- In this case, how should the risky asset be priced? Or, what is the value of P?

- $\frac{2.25}{P} = \frac{1.5}{1} =$ the discount rate,
- Hence P=1.5—the value of the asset is simply the discounted PV of the payoff and the discount rate is the OC of the investor

- This is the classic definition of the fundamental/intrinsic value of the asset. Prices high above this benchmark will be called “bubbles” (end of case 1)

Case 2: leverage to invest in assets

- Here we will finally see an example of "risk shifting"

Asset Type	Supply	Investment at t=1	Price of the asset at t=1	Payoff at t=2
Safe	Variable	1	1 per unit	1.5
Risky	Fixed, 1 unit	1	P per unit	R= 6, prob=25% R=1, prob=75% E(R)=2.25

- Investors borrow 1 unit of money from the bank to invest at 33.33%
- Can P=1.5 be the equilibrium price ?

- What is the investor’s marginal return from safe asset? And how much does the lender receives?
- Similarly, what is the investor’s marginal return from risky asset? And how much does the lender receives now?

- Because the risky asset bestows greater expected return, investors put their money in them. However 0.5 in expected return was shifted from the lender to the borrower. This shift is caused by the higher risk of default (cat's face)

- The lender won’t be happy about this 

, so a higher price is required for the risky asset in order to equate the expected return rate of the two assets and avoid the risk-shifting problem.

- In practice, the price of the risky asset, given this risk-shifting problem, will be bid up until the expected return of the risky asset is the same as the expected return of the safe asset (for the investor)

- Marginal return of risky assets = marginal return of safe assets
- $0.25\left(\frac{1}{P} \times 6 - 1.33\right) + 0.75 \times 0 = 1.5 - 1.33$
- Solve and find the value of P: P=3
- A bubble above the benchmark of 1.5
- Therefore, the debt-financed investors are more willing to invest in assets priced above their fundamental. (end of case 2)

Summarising the points arisen from case 1 and 2…

- The amount of risk that is shifted depends on how risky the asset is;
- The greater the risk is, the greater the motivation to shift risk, and therefore the higher the price will be.

- Consider a third, more complicated case in which the expected return on the risky asset is a mean-preserving spread of the original returns (i.e. E(R) is still 2.25, but the distribution of the return is different from case 2)

Asset Type	Supply	Price at t=1	Payoff at t=2	Note
Safe	1	1	1.5	Bank lending rate at 33.33%
Risky	1	P	R= 9, prob=25% R=0, prob=75% E(R)=2.25	

- Emulating the method that we've used in case 2, we can calculate the P in this case
- Hint: $MR_{risky} = MR_{safe}$;
- MR_{risky}=0.25(net return when not default)+0.75(net return when default)

- $0.25\left(\frac{1}{P} \times 9 - 1.33\right) + 0.75 \times 0 = 1.5 - 1.33$
- P=4.5
- End of case 3

- Since the investors are indifferent between investing in the safe and risky asset, then the chance of default always exists.

- Why the banks are willing to lend money to the investors?

- For this to happen, banks' expected marginal return must be greater than 1, so they must make sure that the majority of people will invest in safe assets.

- Allen and Gale (2004) introduced a simple model to illustrate this point…

Going back to the 2nd case when the equilibrium price of the risky asset is P=3……

- Assume there's a fixed supply of risky asset of 1 unit
- Also suppose at the equilibrium the supply of risky asset meets demand
- And as usual, each investor has an initial endowment of 1 which they borrowed from the bank.
- Suppose there are a total of 10 borrowers in the economy
- When P=3, at equilibrium there are 3 people investing in risky assets and each of them gets $\frac{1}{3}$ unit of the risky asset.
- The remaining 7 investors will purchase safe assets

Calculating Banks' expected return:

- $0.3\left(0.25 \times 1.33 + 0.75 \times \frac{1}{3} \times 1\right) + 0.7 \times 1.33 = 1.11 > 1$

- * Banks can also raise lending rates for the borrowers; it would be perfect if they can **distinguish the different types of borrowers and charge different rates**, but that is a different story from the one we're interested in today ☺ (cannot differentiate; high flat rate crowd out safe borrowers; adverse selection bla bla bla…) (concluding part 1)

Interest rates determination
(credit amount taken as exogenous)

- In the previous discussions, the quantity of credit supplied and the interest rate have been taken as exogenous
- the fundamental price of the risky asset is the discounted expected payoff:
  $P_F = \frac{E(R)}{r}$
- In the following example, we still assume that the amount of credit supplied is exogenous (controlled by the central bank), and we will study how interest rates and asset price levels are determined.

Case 4: Model Assumptions

- The Central Bank determines the amount of credit **B** available to commercial banks (via rrr, dr, open market operations, QE, etc.)
- The banking sector is competitive; the number of banks and the number of borrowers are both normalised to 1. (1 bank lends to 1 borrower in the economy)
- Hence the investor gets an amount of B from the bank
- The amount B is invested in both safe assets (with an amount of X) and risky assets (with an amount of P). We have X=B-P.

Asset Type	T=1	T=2
Safe	X is invested	F(X), or F(B-P) is obtained as return plus principal
Risky	P	

- The return rate of the safe asset can be denoted as $f'(B-P)$.
- Assume F(X)=3$(B-P)^{0.5}$, then $f'(B-P) = 1.5(B-P)^{-0.5}$
- Provided that the loan market is perfectly competitive, then at equilibrium the interest rate on bank loans r should equate the return rate of the safe asset $r = f'$ (also brainstorm the situations when $r > f'$ or $r < f'$)

- In this competitive equilibrium, $r = f' = 1.5(B - P)^{-0.5}$
- To calculate the maximum amount the investors are willing to pay for the risky assets, P, can be calculated by equating the marginal return of risky assets with that of safe assets.
- 0.25($\frac{1}{P} \times 6 - r$)+0.75*0=0, plug in $r = f' = 1.5(B - P)^{-0.5}$
- $P = 4(B - P)^{0.5}$, and P=4$\sqrt{B + 4} - 8$

What if the amount of credit B is uncertain as well?

- The analysis from slide 22-25 assumes that the quantity of credit, B, is still controllable by the central bank. What if this assumption no longer holds?

- In the following model, we extend the model to involve an extra period t=0. We also assume that the amount of credit B supplied at t=1 is uncertain.

t=0	t=1	Remarks:
$B_0 = 6$; however the value for B at t=1 is uncertain	B=5 with Prob=0.5 B=7 with Prob=0.5	B=5 corresponds to default B=7 corresponds to success

- Assume F(X)=3$(B-P)^{0.5}$ and $f'(B-P) = 1.5(B-P)^{-0.5}$ still holds:

Probability	B_1	P_1	r_1
0.5	5	4	1.5
0.5	7	5.27	1.14

- The asset pricing equation at t=0 is still $MR_{risky} = MR_{safe}$, and thus…

- $0.5\left(\frac{1}{P_0} \times P_1 - r_0\right) + 0.5 \times 0 = 0$—(1)
- $r_0 = f'(B_0 - P_0) = 1.5(B_0 - P_0)^{-0.5}$---(2)
- $B_0 = 6$—(3)
- From (1) (2) (3) we can get $r_0 = 1.19$ and $P_0 = 4.42$
- Here the uncertainty is due to variations in credit supply (5 or 7). What effect will it have on P_0 and r_0 if the spread in credit supply distribution is greater?

Similarly, we adjust the previous table and change the value for the two B's to 4 and 8, respectively…

t=0	t=1	Remarks:
$B_0 = 6$; however the value for B at t=1 is uncertain	B=4 with Prob=0.5 B=8 with Prob=0.5	B=4 corresponds to default B=8 corresponds to success

Probability	B_1	P_1	r_1
0.5	4	3.14	1.81
0.5	8	5.86	1.03

This is a mean-preserving adjustment of the credit amount B. Now a greater fluctuation in B implies greater financial uncertainty. Let's see how this will affect P_0 and r_0. (4.608 and 1.272)

Compare the two cases:

- In the first case, B=5 or 7, and the corresponding values for P_0 and r_0 are 4.42 and 1.19 (t=1 and t=2)
- In the second case, B=4 or 8, and the corresponding values for P_0 and r_0 are 4.61 and 1.27 (t=0, t=1 and t=2)
- A more uncertain credit supply will lead to greater price bubbles.
- During financial liberalisations and credit expansions, more periods will be added into the investment cycle and it is fairly possible for the bubble to become very large (that's why a abrupt monetary policy reversal might burst the bubbles)

Concluding part 1 and 2…

- What determines risky asset's price at t=0?
- Expectation about aggregate credit supply at t=1
- What determines risky asset's price at t=1?
- Concerns for risk shifting and the endeavour to equate $MR_{risky} = MR_{safe}$
- If credit supply goes up, then asset prices will rise until the investor is indifferent between investing in safe or risky assets ($MR_{risky} = MR_{safe}$), provided that he is risk neutral
- If credit supply goes down, then asset prices will be low and investors will be prone to invest in risky assets for greater expected return. Then there'll be a greater chance of default and risk-shifting problems will reoccur.

The importance of expectations in price bubble formation and investor's decision-making

- Rational Expectations: expectation is identical to the optimal forecast, using all information available (Mishkin's textbook definition of RE)
- The prospect of credit expansion is already taken into account, when the borrower is making his (1) borrowing decisions and (2) how much to pay for the risky asset.
- If credit expansion fails to meet anticipation, then P won't be high enough to deter people from investing in risky assets, then the chance of default is higher and the borrowers may not be able to repay their loans. (Note here…)

Further Extension

- So far we've talked about:
- (1) Possible inducements for breaking a bubble
- (2) A mechanism of price bubble formation, i.e. risk shifting between the lender and the borrower.
- (3) Credit and Interest Rates determination
- (4) The importance of expectations in price bubble formation and investor's decision-making

So what sort of financial crisis is the most dangerous for the economy?

- Debt-fuelled crises are the most dangerous and can spread to real economy
- Dot-com bubbles (didn't lead to a huge recession) vs. 1929 stock market crash (Great Depression)
- http://www.economist.com/news/finance-and-economics/21657817-new-research-suggests-it-debt-not-frothy-asset-prices-should-worry
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