A theoretical view on the link between financial markets and the real economy

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Introduction

What is the nature of macroeconomic risk that drives risk premia in asset markets?

- The central idea of modern finance is that prices are generated by expected discounted payoffs
- Some assets offer higher average returns than other assets, or, equivalently, they attract lower prices.
- These “risk premiums” should reflect aggregate, macroeconomic risks

Why are financial markets important?

- Understanding the marginal value of wealth that drives asset markets is most obviously important for macroeconomics.
- The centerpieces of dynamic macroeconomics are:
  - the equation of savings to investment,
  - the equation of marginal rates of substitution to marginal rates of transformation,
  - and the allocation of consumption and investment across time and states of nature.
- Asset markets are the mechanism that does all this equating.
- If we can derive the marginal value of wealth from asset markets, we have a powerful measurement of the key ingredient of all modern, dynamic, intertemporal macroeconomics.

The financial markets in macroeconomic models

- But there is still the “equity premium” puzzle.
- The marginal value of wealth is by far more volatile than that specified in almost all macroeconomic models.
- If, finance has anything to say about macroeconomics it is that we are desperately wrong with most macroeconomic models.

Why is it important to include finance in our macroeconomic models?

- Many macroeconomists simply dismiss asset market data.
- It is assumed that stock markets are driven by fads and fashions disconnected from the real economy.
- That might be true, but if so, how do we derive marginal rates of substitution and transformation?
- *It makes no sense to say "markets are crazy" and then go right back to market-clearing models with wildly counterfactual assetpricing implications.* Cochraine (2005)

Why does financial economics needs macroeconomics?

- The basic question in Financial Economics is still whether markets are "rational" and "efficient".
- No amount of research using portfolios on the right hand side can ever address this question.
- The "rationality" question has to adress whether asset prices — the discount factor, marginal value of wealth, etc. — mirrors macroeconomic conditions correctly.
- Price data alone cannot answer this question, that's why we have to take some more fundamental macroeconomic forces into account.

Summing up

- In sum, we have to understand the real, macroeconomic risks that drive asset prices to find an adequate representation of financial markets in macroeconomic models.
- Only with this set of data it seems crucial to make predictions in macroeconomics.

Macro variables and Forecastability

- As emphasized by Fama and French (1989), the prices that forecast returns are correlated with business cycles, with higher expected returns in bad times.
- A number of authors including Estrella and Hardouvelis (1991) and more recently Ang, Piazzesi and Wei (2004) documented that the price variables that forecast returns also forecast economic activity.

Finance variables for forecasting

- The investment/capital ratio and consumption/wealth ratios are particularly attractive variables for macroeconomic forecasts.
- The Q theory of investment says that firms will invest more when expected returns are low
- Similarly, optimal consumption out of wealth is smaller when expected returns are larger.
- In this way, both variables exploit agents quantity decisions to learn their expectations, and exploit natural cointegrating vectors to measure long-term forecasts.

Examples

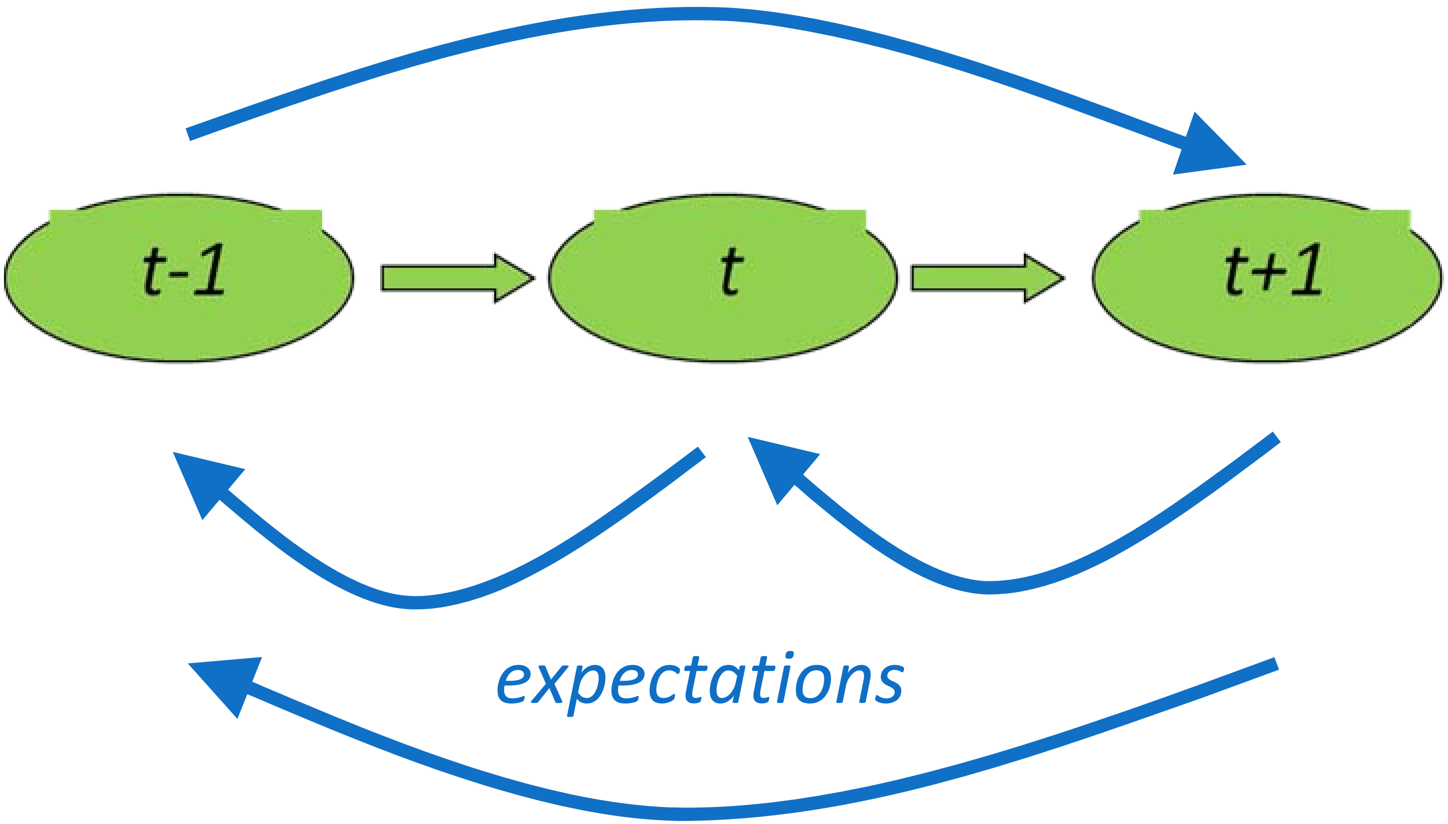
- For example, Cochrane (1994) showed that consumption provides a natural “trend” for income, and so we see long-run mean reversion in income most easily by watching the consumption-income ratio.
- Cochraine (2005) also showed that dividends provide a natural “trend” for stock prices, so we see long-run mean-reversion in stock prices most easily by watching the dividend/price ratio.
- Lettau and Ludvigson nicely put the two pieces together, showing how consumption relative to income and wealth has a cross-over prediction for long run stock returns.
- In the bottom of a recession, both returns and dividend growth will be strong as we come out of the recession. So we end up with a new variable, and an opening for additional variables, that forecast both returns and cashflows, giving stronger links from macroeconomics to finance.

The model

Features:

- A standard DSGE model with Calvo pricesetting
- With a simple labour market representation
- In a closed economy version

A dynamic problem



Households

Maximise present discounted value of expected utility from now until infinite future, subject to budget constraint

Households characterised by

utility maximisation

consumption smoothing

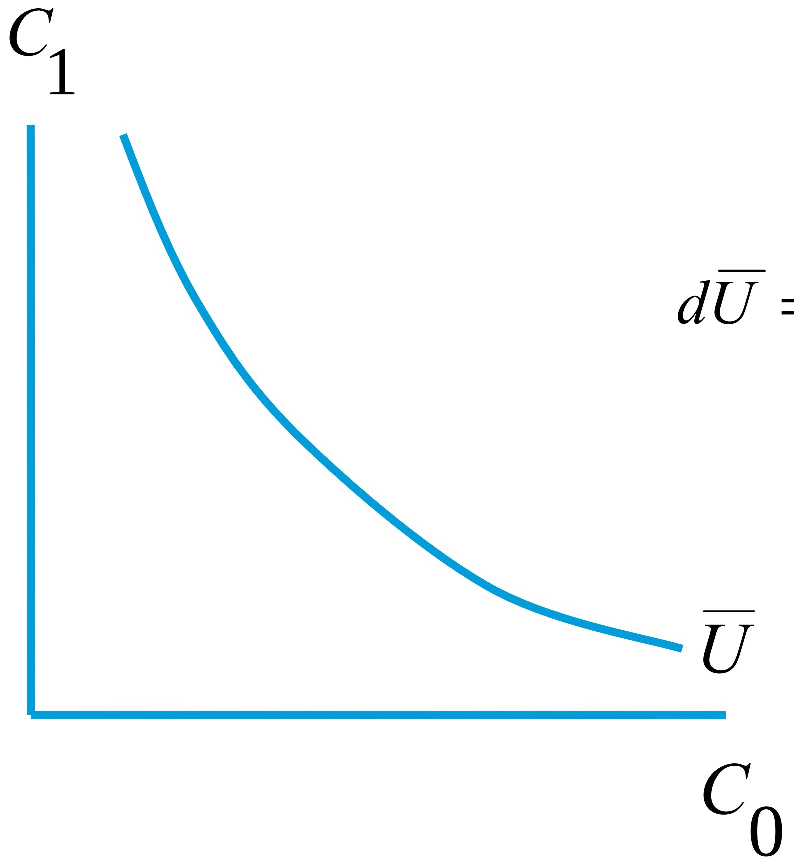
Households

We show household consumption behaviour in a simple two-period deterministic example with no uncertainty

initial wealth W_0
consumption C_0 and C_1
prices p_0 and p_1
nominal interest at rate i_0 on savings from t_0 to t_1

Result generalises to infinite horizon stochastic problem with uncertainty

Household utility

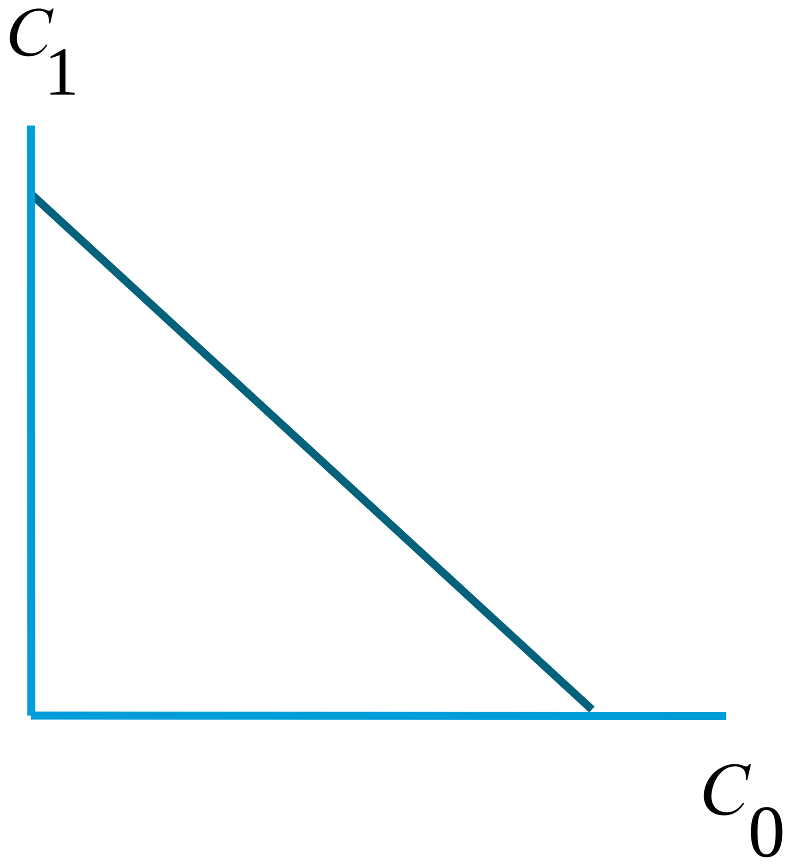


$$\max_{C_0} U(C_0) + \beta U(C_1)$$

$$d\bar{U} = 0 = U'(C_0)dC_0 + \beta U'(C_1)dC_1$$

$$\frac{dC_1}{dC_0} = -\beta \frac{U'(C_0)}{U'(C_1)}$$

Household budget constraint

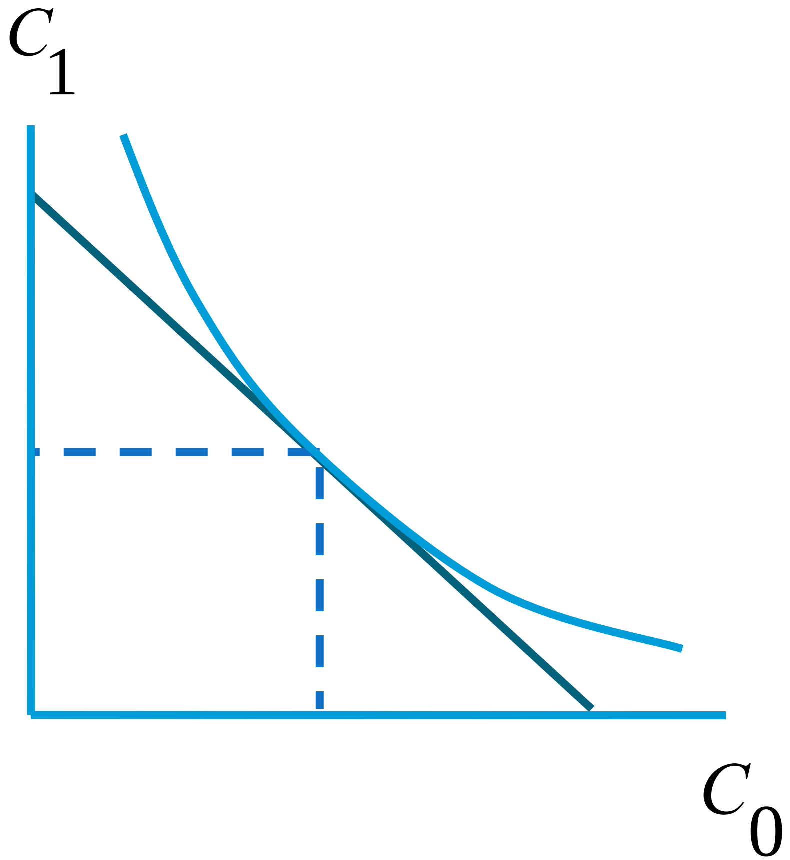


$$p_1 C_1 = (W_0 - p_0 C_0)(1 + i_0)$$

$$p_1 dC_1 = -p_0 dC_0 (1 + i_0)$$

$$\frac{dC_1}{dC_0} = -\frac{1 + i_0}{1 + \pi_1}$$

Household utility maximisation



$$-\beta\frac{U'(C_0)}{U'(C_1)} = -\frac{1+i_0}{1+\pi_1}$$

Households

General solution for stochastic ∞-horizon case

$$U'(C_t) = \beta E_t \left[U'(C_{t+1}) \frac{1+i_t}{1+\pi_{t+1}} \right]$$

Known as the **dynamic IS curve**

Known as the **Euler equation for consumption**

Households - intuition

$$U'(C_t) = \beta E_t\left[U'(C_{t+1})\frac{1+i_t}{1+\pi_{t+1}}\right]$$

$i_t\uparrow \rightarrow U'(C_t)\uparrow \rightarrow C_t\downarrow$ Higher interest rates reduce consumption

$E_t\pi_{t+1}\uparrow \rightarrow U'(C_t)\downarrow \rightarrow C_t\uparrow$ Higher expected future inflation increases consumption

Firms

Maximise present discounted value of expected profit from now until infinite future, subject to demand curve, nominal price rigidity and labour supply curve.

Firms characterised by

profit maximisation

subject to **nominal price rigidity**

Nominal price rigidity

Calvo model of price rigidity

Proportion of firms able to change their price in a period $1-\omega$

Proportion of firms unable to change their price in a period ω

Aggregate price level

$$\hat{p}_t = (1-\omega)\hat{p}_{it} + \omega\hat{p}_{t-1}$$

$(1-\omega)\hat{p}_{it}$: price setters

$\omega\hat{p}_{t-1}$: price non-setters

Do not worry about the hat (^) notation. We will explain it later

Optimal price setting

$$\hat{p}_{it} = (1 - \beta\omega)\hat{p}_t^* + \beta\omega E_t \hat{p}_{it+1}$$

price set at t	myopic price	desired price at t+1

$\omega = 0$ → perfect price flexibility → $\hat{p}_{it} = \hat{p}_t^*$

$\omega \to 1$ → price inflexibility → $\hat{p}_{it} \to E_t \hat{p}_{it+1}$

Derivation

$$\hat{p}_t = (1-\omega)\hat{p}_{it} + \omega\hat{p}_{t-1}$$

$$\hat{p}_{it} = (1-\beta\omega)\hat{p}_t^* + \beta\omega E_t \hat{p}_{it+1}$$

Myopic price

Approximate myopic price with price that would prevail in flexible price equilibrium

$$p_t^* = k \; p_t mc_t$$

Price is constant mark-up k over marginal cost

In our hat (^) notation – to be explained later – the myopic price is given by

$$\hat{p}_t^* = \hat{p}_t + \hat{m}c_t$$

Full derivation

$$\hat{p}_t = (1-\omega)\hat{p}_{it} + \omega\hat{p}_{t-1}$$

$$\hat{p}_{it} = (1-\beta\omega)\hat{p}_t^* + \beta\omega E_t \hat{p}_{it+1}$$

$$\hat{p}_t^* = \hat{p}_t + \hat{m}c_t$$

Marginal cost

No capital in model $\longrightarrow$ all marginal costs
due to wages

Assume linearity between wages and marginal cost

$$\hat{mc}_t = \hat{w}_t$$

Derivation

$$\hat{p}_t = (1-\omega)\hat{p}_{it} + \omega\hat{p}_{t-1}$$

$$\hat{p}_{it} = (1-\beta\omega)\hat{p}_t^* + \beta\omega E_t \hat{p}_{it+1}$$

$$\hat{p}_t^* = \hat{p}_t + \hat{m}c_t$$

$$\hat{m}c_t = \hat{w}_t$$

Wages

Assume a labour supply function

wages rise when output is above trend ⟷ wages rise with output gap

1/α is elasticity of wage w.r.t output gap

$$\hat{w}_t = \frac{1}{\alpha}\hat{x}_t$$

Full derivation

$$\hat{p}_t = (1-\omega)\hat{p}_{it} + \omega\hat{p}_{t-1}$$

$$\hat{p}_{it} = (1-\beta\omega)\hat{p}_t^* + \beta\omega E_t \hat{p}_{it+1}$$

$$\hat{p}_t^* = \hat{p}_t + \hat{m}c_t$$

$$\hat{m}c_t = \hat{w}_t$$

$$\hat{w}_t = \frac{1}{\alpha}\hat{x}_t$$

Firms

Full solution

$$\hat{x}_t = \frac{\alpha\omega}{(1-\omega)(1-\beta\omega)}(\hat{\pi}_t - \beta E_t \hat{\pi}_{t+1})$$

Known as the **New Keynesian Phillips curve**

Known as the **forward-looking Phillips curve**

Firms - intuition

$$\hat{x}_t = \frac{\alpha\omega}{(1-\omega)(1-\beta\omega)}(\hat{\pi}_t - \beta E_t \hat{\pi}_{t+1})$$

$(\hat{\pi}_t - \beta \hat{E}_t \pi_{t+1}) < 0 \rightarrow \hat{x}_t < 0$ Inflation expected to rise in future, firms set high prices now, choking supply

$E_t \hat{\pi}_{t+1} \uparrow \rightarrow \hat{p}_{it} \uparrow \rightarrow \hat{x}_t \downarrow$ Higher expected future inflation chokes supply

Monetary authority

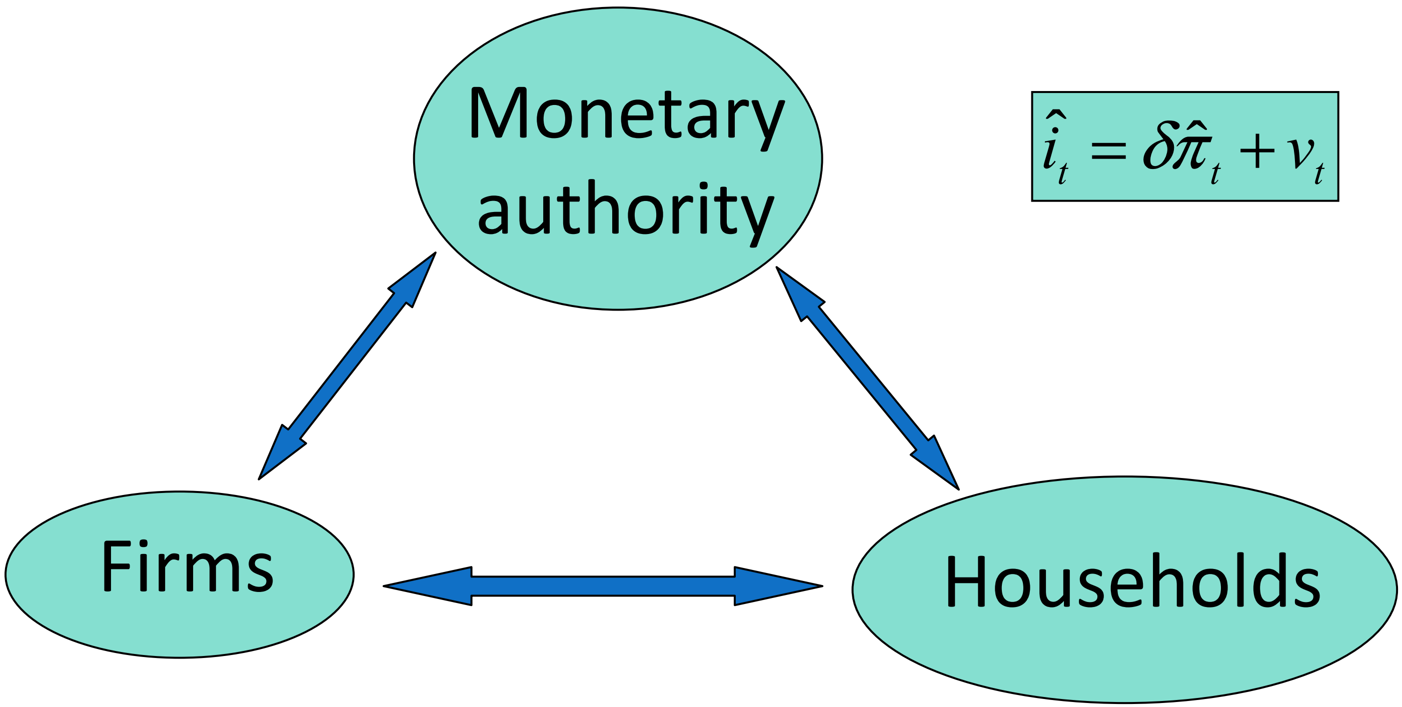
Sets the interest rate

Simplest case is **simple rule**

Interest rate reacts to inflation, with shocks

$$\hat{i}_t = \delta \hat{\pi}_t + v_t$$

Baseline DSGE model



$$\hat{i}_t = \delta \hat{\pi}_t + v_t$$

$$\hat{x}_t = \frac{\alpha\omega}{(1-\omega)(1-\beta\omega)}(\hat{\pi}_t - \beta E_t \hat{\pi}_{t+1})$$

$$U'(C_t) = \beta E_t \left[U'(C_{t+1}) \frac{1+i_t}{1+\pi_{t+1}} \right]$$