2025-2026 – Econ 0016 – International Macroeconomics

Chapter 6: Uncertainty and the Current Account

Schmitt-Grohé, Uribe and Woodford, "International Macroeconomics: A Modern Approach"

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0. Introduction

- Here we explore the link between uncertainty and the current account.
- Idea: Uncertainty $\rightsquigarrow$ precautionary savings $\rightsquigarrow$ impacts the current account.

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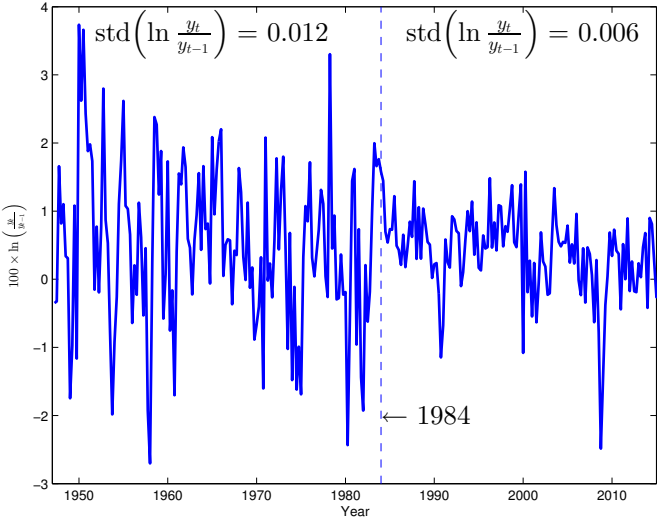
- In the postwar period, the U.S. economy was much more volatile prior to the 1980s than thereafter.
- The relatively tranquil period post-1984 is called the *Great Moderation*.
- The Great Moderation period coincided with the emergence of large U.S. current account deficits.
- This chapter expands the open economy model of Chapter 3 to introduce uncertainty.
- This modification allows us to understand the effect of changes in the aggregate level of uncertainty on consumption, saving, the trade balance, and the current account.

1. The Great Moderation

- A commonly used measure of volatility in macroeconomic data is the standard deviation.
- According to this statistic, postwar U.S. output growth became half as volatile after 1983.
- The standard deviation of quarter-to-quarter real per capita output growth was 1.2 percent over the period 1947Q1 to 1983Q4 and only 0.6 percent over the period 1984Q1 to 2017Q4.

1. The Great Moderation

Quarterly real per capita GDP growth in the United States: 1947Q2-2017Q4



2. Causes of the Great Moderation

- Three explanations:
  1. good luck,
  2. good policy,
  3. structural change.

- By chance starting in the early 1980s the U.S. economy has been hit with smaller shocks as compared to pre-1980.
- Possible.
- Plausible? If one uses a model to back out shocks, this can be tested.

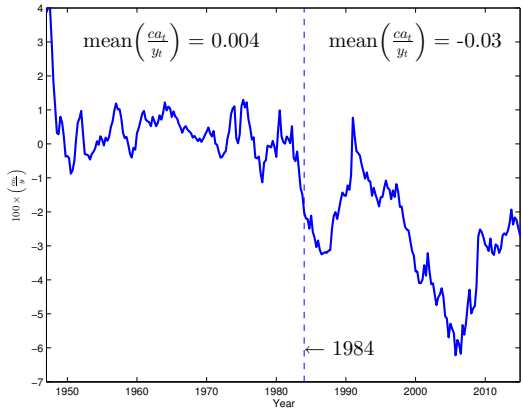
- Good monetary policy: aggressive low inflation policy started by the Volcker Fed and continued by the Greenspan Fed.
- Good regulatory policy: early 1980s regulation Q (or "Reg Q") was abandoned. (Reg Q imposed a ceiling on the interest rate that banks could pay on deposits. Regulation Q introduces a financial distortion that exacerbates with inflation).

- Structural change, particularly in inventory management and in the financial sector
- These technological developments allowed firms to display smoother flows of production, distribution, sales, employment, and inventories, thereby reducing the amplitude of the business cycle.
- Our interest is not in explaining the Great Moderation but in the possible connections between the Great Moderation and the significant current account deterioration observed in the United States over the post-1984 period.

3. The Great Moderation and the Emergence of Current Account Imbalances

- Regardless of the reason for the Great Moderation, can it explain the emergence of current account imbalances?

Current-account-to-GDP ratio in the United States from 1947Q1 to 2017Q4.



3. The Great Moderation and the Emergence of Current Account Imbalances

Statistic	**1947Q1-1983Q4**	**1984Q1-2017Q4**
Std. Dev. Output Growth	1.2%	0.6%
Average CA/GDP	0.34%	-2.8%

- During the period 1947Q1-1983Q4 the United States experienced on average positive current account balances of 0.34 percent of GDP.
- Starting in the early 1980s, large current account deficits averaging 2.8 percent of GDP opened up.
- The emergence of persistent current account deficits in the United States coincided with the beginning of the Great Moderation in 1984.

4. An Open Economy With Uncertainty

- Is there a causal relation linking the Great Moderation with the emergence of current account deficits?
- To address this question, we will modify the endowment economy of chapter 3 by assuming that the endowment in period 2, Q_2, is uncertain.
- Intuition:
  - × Facing an uncertain income in period 2, households are likely to engage in precautionary saving in period 1.
  - × This would allow them to hedge against a bad income realization in period 2.
  - × Thus, consumption should fall in period 1.
  - × Since the period-1 endowment is unchanged, the trade balance must improve.
- Implication: If this intuition is right, the decline in income uncertainty observed during the Great Moderation should lead to an elevation in current account deficits.

- Endowments $Q_1 = Q_2 = Q$ and Q is known with certainty.
- The utility function is: $U = \log C_1 + \log C_2$
- Zero initial assets, $B_0 = 0$.
- Zero interest rate, $r^\star = 0$.
- In this environment, the intertemporal budget constraint is

$$C_1 + \frac{C_2}{(1 + r^\star)} = Q_1 + \frac{Q_2}{(1 + r^\star)} \iff C_1 + C_2 = 2Q.$$

- Optimization problem of the household is

$$\max_{C_1} \log C_1 + \log(2Q - C_1)$$

- First order condition:

$$\frac{1}{C_1} = \frac{1}{2Q - C_1}$$

- Solution: $C_1 = Q \rightsquigarrow C_2 = Q$.
- Thus, we have $TB_1 = Q - C_1 = 0$, $CA_1 = r_0 B_0 + TB_1 = 0$.
- Intuition: Output is perfectly smooth so consumption is also perfectly smooth. No need to use the current account to smooth consumption over time.

- Suppose now that the period-1 endowment continues to be Q,
- but that the period-2 endowment is uncertain.
- Specifically,

$$Q_2 = \begin{cases} Q + \sigma \text{ with probability } 1/2 & \text{(good state)} \\ Q - \sigma \text{ with probability } 1/2 & \text{(bad state)} \end{cases}$$

- This is a *mean preserving* increase in uncertainty:

$$E[Q_2] = \frac{1}{2}(Q + \sigma) + \frac{1}{2}(Q - \sigma) = Q$$

- The parameter σ measures the degree of uncertainty:

$$\text{Variance of } Q_2 = E\left[\left(Q_2 - E[Q_2]\right)^2\right] = \frac{1}{2}(Q + \sigma - Q)^2 + \frac{1}{2}(Q - \sigma - Q)^2 = \sigma^2$$

- σ is the standard deviation of Q_2.

4. An Open Economy With Uncertainty

- There is one budget constraint for each of two states in which the economy can be in period 2. ("State Contingent Intertemporal Budget Constraints")

$$C_1 + C_2 = \begin{cases} Q + (Q + \sigma) \text{ with probability } 1/2 & \text{(good state)} \\ Q + (Q - \sigma) \text{ with probability } 1/2 & \text{(bad state)} \end{cases},$$

  which implies

$$C_2 = \begin{cases} 2Q + \sigma - C_1 \text{ with probability } 1/2 & \text{(good state)} \\ 2Q - \sigma - C_1 \text{ with probability } 1/2 & \text{(bad state)} \end{cases}.$$

- Expected Utility: households care about the expected value of utility:

$$\log C_1 + E[\log C_2] = \log C_1 + \frac{1}{2}\log C_2(\text{good state}) + \frac{1}{2}\log C_2(\text{bad state}). \quad (1)$$

- $C_2(s)$ is a function of the state s that will realize in period 2.

- Use the two state contingent intertemporal budget constraints to substitute C_2(good state) and C_2(bad state) in intertemporal expected utility (1):

$$\log C_1 + \frac{1}{2}\log(2Q + \sigma - C_1) + \frac{1}{2}\log(2Q - \sigma - C_1).$$

- The first order condition is

$$\underbrace{\frac{1}{C_1}}_{LHS} = \underbrace{\frac{1}{2}\left[\frac{1}{2Q + \sigma - C_1} + \frac{1}{2Q - \sigma - C_1}\right]}_{RHS} \tag{2}$$

  LHS: marginal utility of consumption in period 1.
  RHS: expected marginal utility of consumption in period 2.

- (2) is not easy to solve, but we can learn without solving it.

- Is the optimal consumption level under certainty, $C_1 = Q$, also optimal under uncertainty?
- The RHS of (2) when $C_1 = Q$ is:

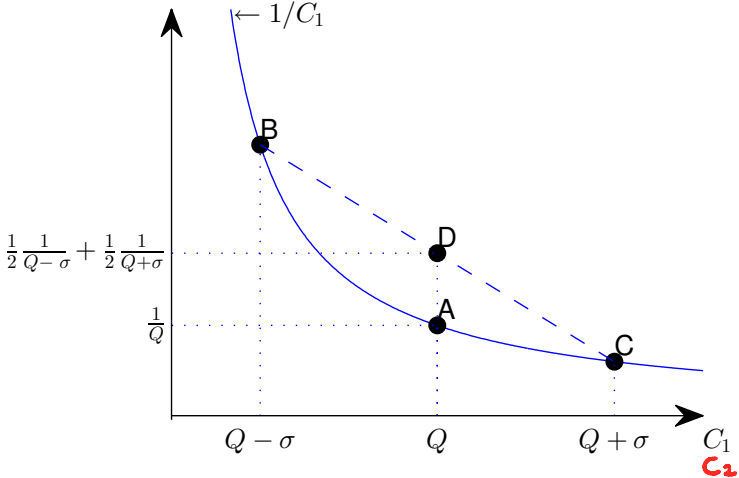
$$\text{RHS} = \frac{1}{2}\left[\frac{1}{2Q+\sigma-Q} + \frac{1}{2Q-\sigma-Q}\right] = \frac{Q}{Q^2-\sigma^2} = \frac{1}{Q}\underbrace{\left(\frac{Q^2}{Q^2-\sigma^2}\right)}_{>1} > \frac{1}{Q} = \text{LHS}$$

- $C_1 = Q$ is not the solution to the maximisation problem, as it makes the LHS of (2) less than the RHS.
- Since the LHS is decreasing in C_1 and the RHS increasing in C_1, we have that the optimal C_1 satisfies

$$C_1 < Q$$

- We conclude that a mean-preserving increase in uncertainty induces a fall in consumption and an increase in saving. This increase in saving is called *precautionary saving*.

Precautionary Saving (graphically)



- The solid line is the marginal utility (MU) of C_1 ($\frac{1}{C_1}$) as a function of C_1 (the LHS of (2))
- Suppose $C_1 = Q$. Then MU of C_1 is equal to $1/Q$ (point A in the figure).
- In this case C_2 is either $(Q - \sigma)$ or $(Q + \sigma)$ and the MU of C_2 is either $1/(Q?\sigma)$ or $1/(Q + \sigma)$ (points B or C).
- The expected MU in period 2 is then given by

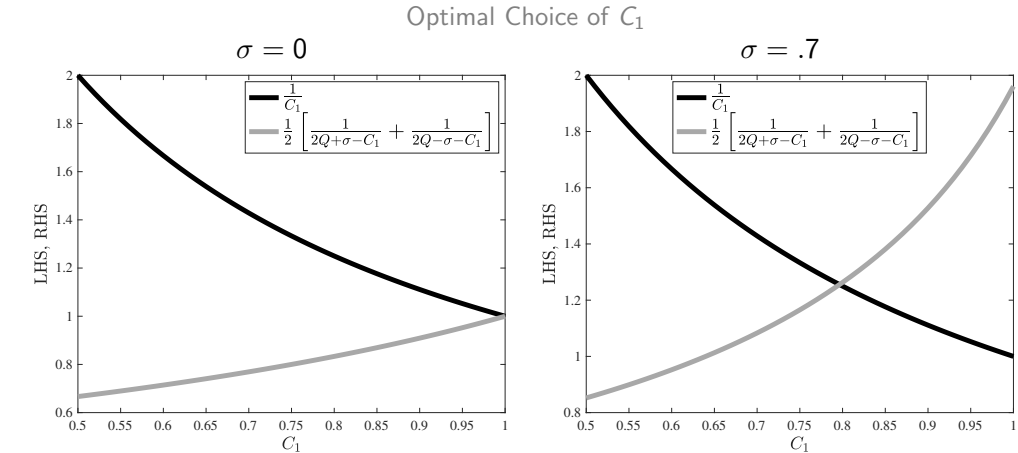
$$\frac{1}{2}\left[\frac{1}{Q+\sigma} + \frac{1}{Q-\sigma}\right]$$

  (point D in the figure).
- Point D is above point A (because the MU is convex), therefore when $C_1 = Q$ the MU of C_1 is below the expected MU of C_2.
- This shows that if we set $C_1 = Q$, then the LHS of (2) is less than the RHS of (2)
- It follows that the household would be better off consuming less in period 1 and more in period 2.

4. An Open Economy With Uncertainty

Precautionary Saving (numerically)

- Assume $Q = 1$, $\sigma = 0$ or $\sigma = .7$.



- An increase in uncertainty (from say $\sigma = 0$) causes an improvement in the trade balance and the current account:

$$TB_1 = Q - C_1 > 0.$$
$$CA_1 = r_0 B_0 + TB_1 > 0$$

  (since B_0 is assumed to be 0.)
- Recalling that under certainty $TB_1 = CA_1 = 0$, we have that a mean-preserving increase in uncertainty leads to an improvement in the trade balance and the current account.
- Similarly, a fall in uncertainty causes a deterioration in the trade balance and the current account.
- Viewed through the lens of this model, the reduction in output volatility that came with the Great Moderation should have contributed to the observed concurrent deterioration of the U.S. current account.

4. An Open Economy With Uncertainty

Bond holding (=NIIP)

- In period 1, bond holding is given by

$$B_1 = Q - C_1$$

  If σ increases, C_1 falls, so B_1 increases.

- $\rightsquigarrow$an increase in uncertainty raises the country's net foreign asset position.
- Notice that B_1 is a bond that pays the same return in period 2 (namely $1 + r^\star$) *regardless of the state of nature in period 2*.
- Thus, the household cannot buy a portfolio of assets with different state-contingent payments in period 2
- She would like to buy an asset that pays more in the low-endowment state and less in the high-endowment state.
- That would provide insurance.
- For this reason, we say that the present model has *incomplete asset markets*.

- Suppose that in period 1 there exist the two following assets, known as state contingent claims:
  - × One asset pays 1 unit of goods in the good state of period 2 and 0 in the bad state. Its price is P^g.
  - × The other asset pays 1 unit in the bad state and 0 in the good state. Its price is P^b .
- This economy is said to have complete asset markets because households can buy asset portfolios with any payoff pattern across states in period 2:
- Indeed, if the household wishes to have a portfolio that pays x units of goods in the good state and y units in the bad state, then, in period 1, it must simply
  - × purchase x units of the asset that pays in the good state
  - × purchase y units of the asset that pays in the bad state.
  - × This portfolio costs $P^g x + P^b y$.
- This was not possible in the economy with a single bond studied earlier in this chapter.

Redundancy of Additional Assets

- The 2 state contingent claims allow us to replicate any conceivable asset.
- Example: A Risk-Free Bond:
  - × A risk-free bond is an asset that costs one unit of good in period 1 and pays $1 + r_1$ units of good in every state of period 2, where r_1 is the *risk-free interest rate*.
  - × Consider now constructing a portfolio of contingent claims that has the same payoff as the risk-free bond, that is, a portfolio that pays $1 + r_1$ in every state of period 2.
  - × This portfolio must contain $1 + r_1$ units of each of the two contingent claims.
  - × The price of this portfolio in period 1 is $(P^g + P^b)(1 + r_1)$.
  - × This price must equal the price of the risk free bond, namely 1, otherwise a pure arbitrage opportunity would allow agents to become infinitely rich. (No arbitrage condition)
  - × So we have that

$$1 = (P^g + P^b)(1 + r_1) \iff 1 + r_1 = \frac{1}{P^g + P^b}.$$

  - × Thus, the gross risk-free interest rate is the inverse of the price of a portfolio that pays one unit of good in every state of period 2.

- The budget constraint in period 1 is

$$C_1 + P^g B^g + P^b B^b = Q, \tag{3}$$

  where B^g and B^b are the quantities of state contingent claims purchased in period 1.
- In period 2, there is one budget constraint for each state.
  - × Good state:

$$C_2^g = Q + \sigma + B^g \tag{4}$$

  - × Bad state:

$$C_2^b = Q - \sigma + B^b \tag{5}$$

- Use the budget constraints (3), (4) and (5) to eliminate C_1, C_2^g, and C_2^b in intertemporal expected utility.
- The Hh problem is

$$\max_{B^g, B^b} \log(\underbrace{Q - P^g B^g - P^b B^b}_{C_1}) + \frac{1}{2}\log(\underbrace{Q + \sigma + B^g}_{C_2^g}) + \frac{1}{2}\log(\underbrace{Q - \sigma + B^b}_{C_2^b}).$$

- The optimality conditions associated to B^b and B^g are:

$$\frac{1}{C_1} = \frac{1}{2}\frac{1}{P^g}\frac{1}{C_2^g} \tag{6}$$

$$\frac{1}{C_1} = \frac{1}{2}\frac{1}{P^b}\frac{1}{C_2^b} \tag{7}$$

- Note: two optimality conditions, 1 per state. Compare with the incomplete market economy with just one risk-free bond, where we only have 1 such optimality condition (the Euler equation).

- With free international capital mobility, the prices of state contingent claims must be the same domestically and abroad:

$$P^g = P^{g\star} \text{ and } P^b = P^{b\star}$$

- The world interest rate must satisfy

$$1 + r^\star = \frac{1}{P^{g\star} + P^{b\star}}.$$

- As we did in the one-bond economy we assume that $r^\star = 0$.

- Assumption: Foreign Investors Make zero Expected Profits. (No arbitrage condition)
- The revenue in period 1 of a foreign investor who sells B^g and B^b units of state contingent claims is

$$P^{g\star}B^g + P^{b\star}B^b$$

- The foreign investor can invest this sum in a risk free bond and receives in period 2:

$$(1+r^\star)\left(P^{g\star}B^g + P^{b\star}B^b\right)$$

in both states.

- And the foreign investor must pay B^g if the state is good and B^b if the state is bad:

$$\begin{array}{lcl} \text{payoff in good state} & : & (1+r^\star)(P^{g\star}B^g + P^{b\star}B^b) - B^g \\ \text{payoff in bad state} & : & (1+r^\star)(P^{g\star}B^g + P^{b\star}B^b) - B^b \end{array}$$

- So, expected profits (nil by the no arbitrage condition) are

$$(1 + r^\star)(P^{g\star}B^g + P^{b\star}B^b) - \frac{1}{2}B^g - \frac{1}{2}B^b = 0$$

- Rearrange terms and recall $r^\star = 0$:

$$(P^{g\star} - 1/2)B^g + (P^{b\star} - 1/2)B^b = 0.$$

- This must be true for any B^g and B^b, so that we have:

$$P^g = P^b = \frac{1}{2}$$

- Using the result that $P^g = P^b = 1/2$, to replace P^g and P^b in the household's optimality conditions (6) and (7), we obtain

$$C_1 = C_2^g = C_2^b.$$

- Thus, complete asset markets allows households to completely smooth consumption across time and states of nature.

- Combine the result that $C_1 = C_2^g = C_2^b$ with the budget constraints (3), (4), and (5) to get

$$\begin{aligned} B^g &= -\sigma, \\ B^b &= \sigma, \\ C_1 &= C_2^g = C_2^b = Q. \end{aligned}$$

- Thus, the household takes a short position in contingent claims that pay in the good state and a long position in claims that pay in the bad state.

- The trade balance and current account are

$$TB_1 = Q - C_1 = 0$$
$$CA_1 = r_0 B_0 + TB_1 = 0.$$

- Under complete financial markets precautionary saving is zero and the link between the level of uncertainty and the current account disappears.
- Note that the net asset position is nil ($B^g + B^b = 0$), but gross positions ($B^g = -\sigma$ and $B^b = \sigma$) increase with uncertainty.
- In the real world, it is unlikely that financial markets are complete.

6. Summing Up

a. Great Moderation (1984-): lower output growth volatility.

b. Three main explanations: good luck, good policy, and structural change.

c. The Great Moderation coincided with the beginning of sizable U.S. current account deficits.

d. A model of an open economy with uncertain future endowments predicts that an increase in uncertainty causes an increase in precautionary saving and improvements in the trade balance and the current account.

e. Under complete markets the positive relationship between the level of uncertainty and the current account disappears.

