International Macroeconomic Comovement

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Outline

- Business Cycle Fluctuations
- Trade and Macroeconomic Comovement
- What is the Cost of Business Cycles?
- Major Recessions

Business Cycle Fluctuations

Motivation

Business Cycle: The period of expansions and contractions in the level of economic activity around its long-run growth trend.

Open Economy Macroeconomics
Development of a workhorse model that can serve as a laboratory for policy analysis.

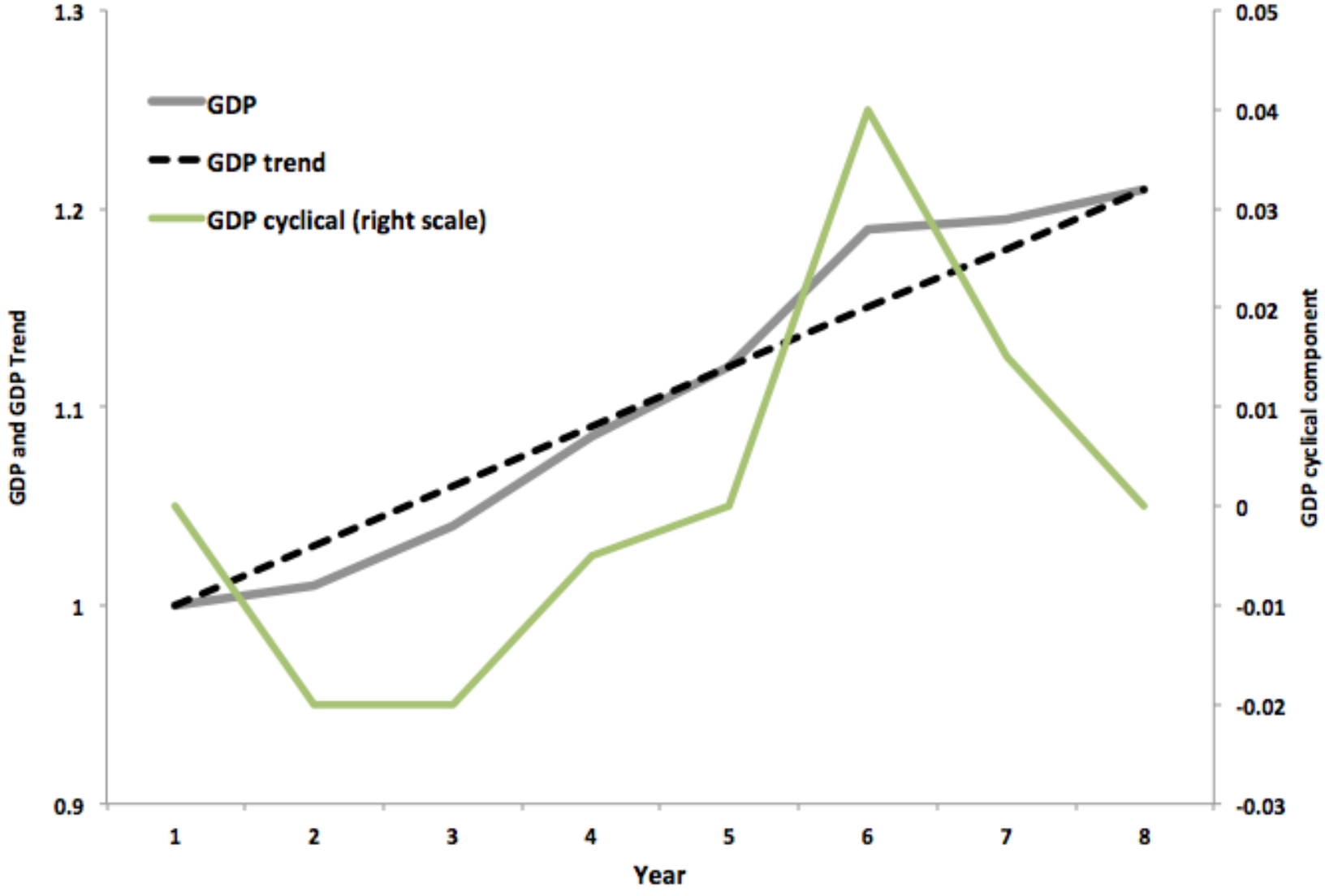
- What are the features of the model that make it successful with the data?
- Extending predictions related to the closed economy macro models.

Measurement

Focus on high frequency movements

- Low frequency (long-run) versus high frequency (short-run)
- Construct cycle component that corresponds to high frequency movemements of economic variables (GDP, consumption, investment, employment etc)
  - Linear detrending or Hodrick-Prescott (HP) filter
  - De-trended data: Actual data minus trend component

Example of Linear De-Trending



Trend of GNP with an HP filter

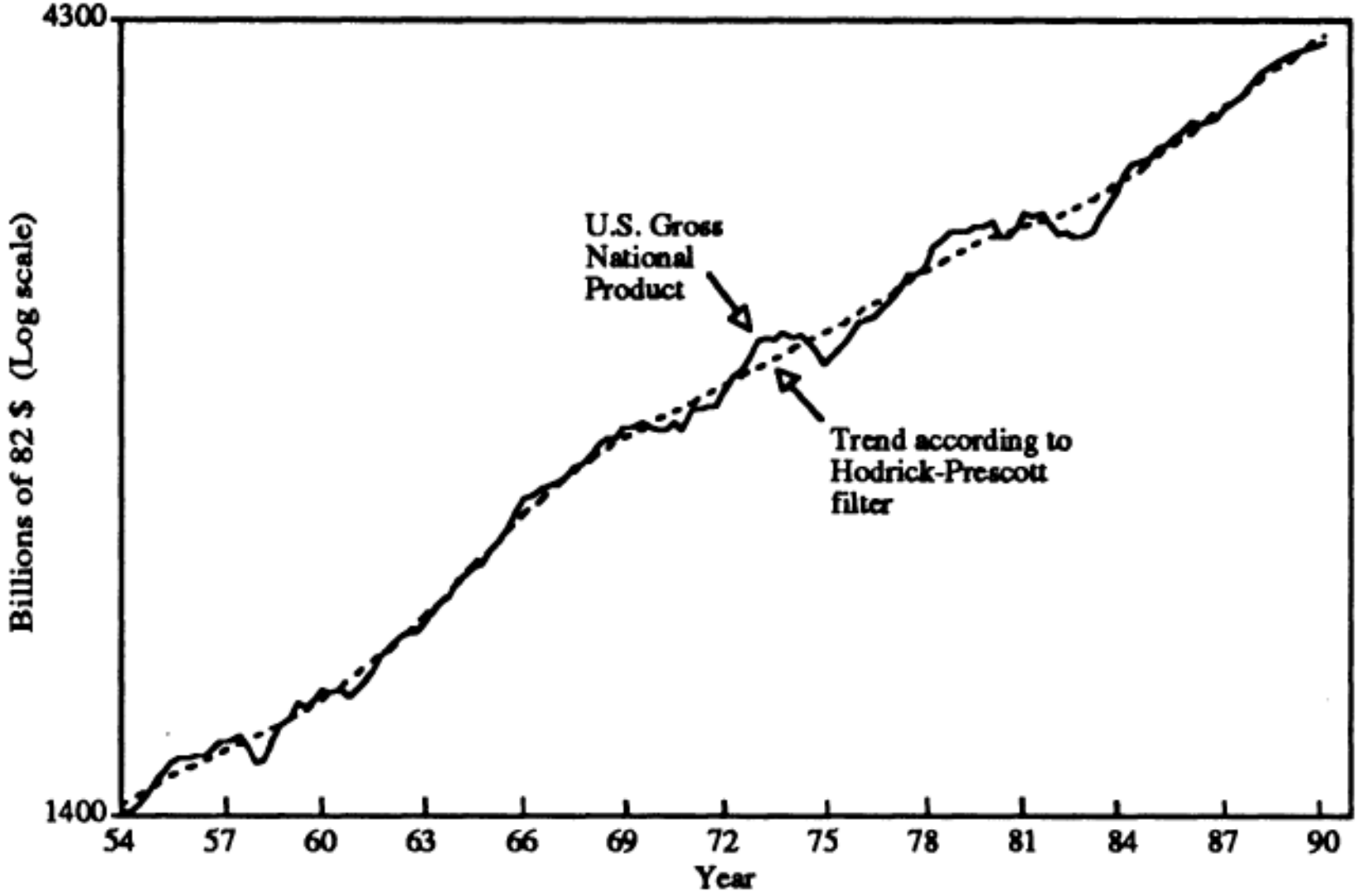


FIG. 1.—Example of a U.S. time series detrended with the Hodrick-Prescott filter.

Macroeconomic Comovement

Heathcote Perri (2002): US vs. Canada+Japan+15 European countries

- logged and HP filtered data

Main macroeconomic variables are positively correlated.

(C) Cross country correlations and international relative price volatility

	correlation between				% std. dev.	
Economy	y_1, y_2	c_1, c_2	x_1, x_2	n_1, n_2	p	rx
Data	0.58	0.36	0.30	0.42	2.99	3.73

- GDPs more correlated than consumption.
- Investments (x); relatively low correlation.

Trade and Macroeconomic Comovement

Trade & International Business Cycles: Cross-Sectional Evidence

- Is trade the main link?... GDP correlation is linked to trade.

Figure: Kose and Yi (2006). Trade and International Business Cycles Correlation

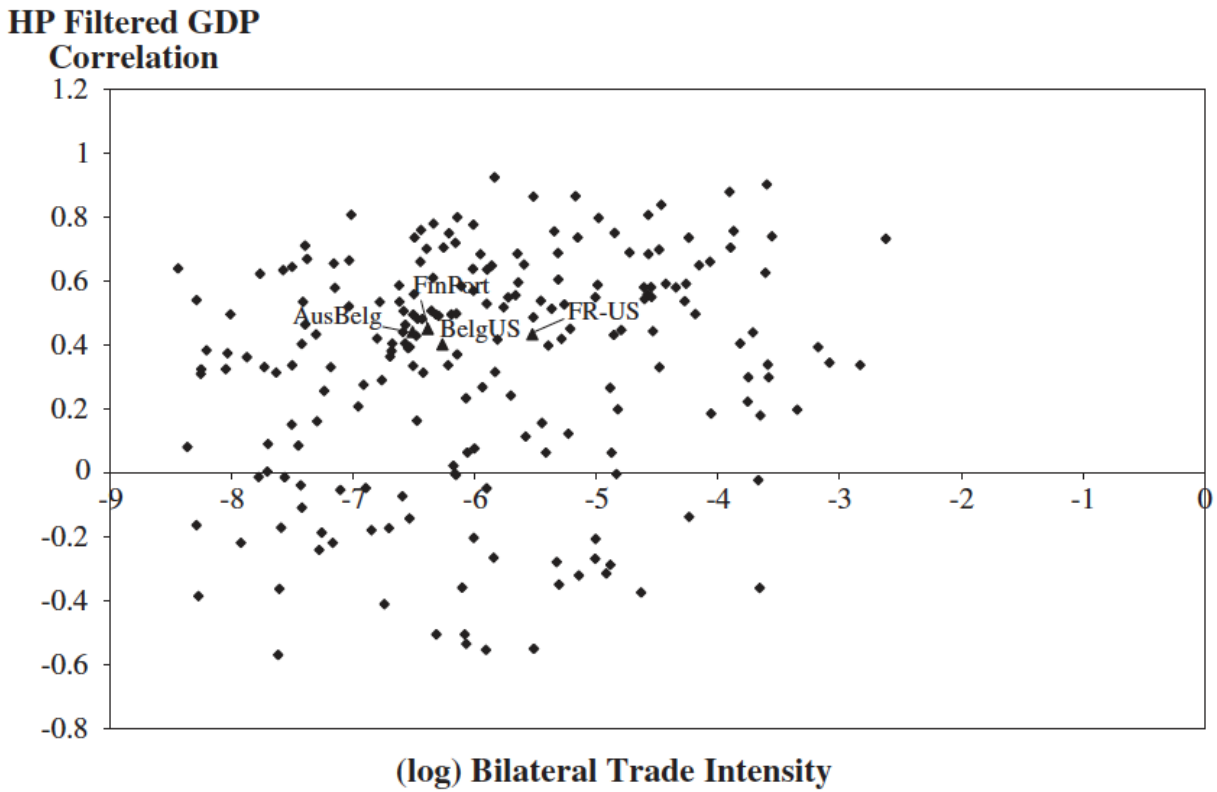


Fig. 1. GDP correlation and trade intensity.

Relationship Between Trade and Comovement

Kose & Yi (J of International Econ, 2006, "Can the standard international business cycle model explain the relation between trade & comovement?")

- Authors look how GDP correlation is changing with trade

$$GDP\ Corr_{ij} = \beta_0 + \beta_1 \ln\left(Trade_{ij}\right) + \varepsilon_{ij}$$

where i, j are different trade partnerns (e.g., $i = USA$, $j = FRA$ etc)

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- Coefficient $\beta_1 \simeq .08$. Thus, doubling trade increases correlation of GDP by $.08 * \ln(2) = .055$ higher GDP correlation among the country pair
- Relationship first uncovered by Frankel and Rose (1998, Economic Journal, "The endogeneity of the optimum currency area criteria")

Output fluctuations: Evidence from the US-Mexico trade Agreement

US-Mexico output fluctuations seem to be more correlated after the **N**orth **A**merican **F**ree **T**rade **A**greement. NAFTA went into effect on Jan 1st, 1994.

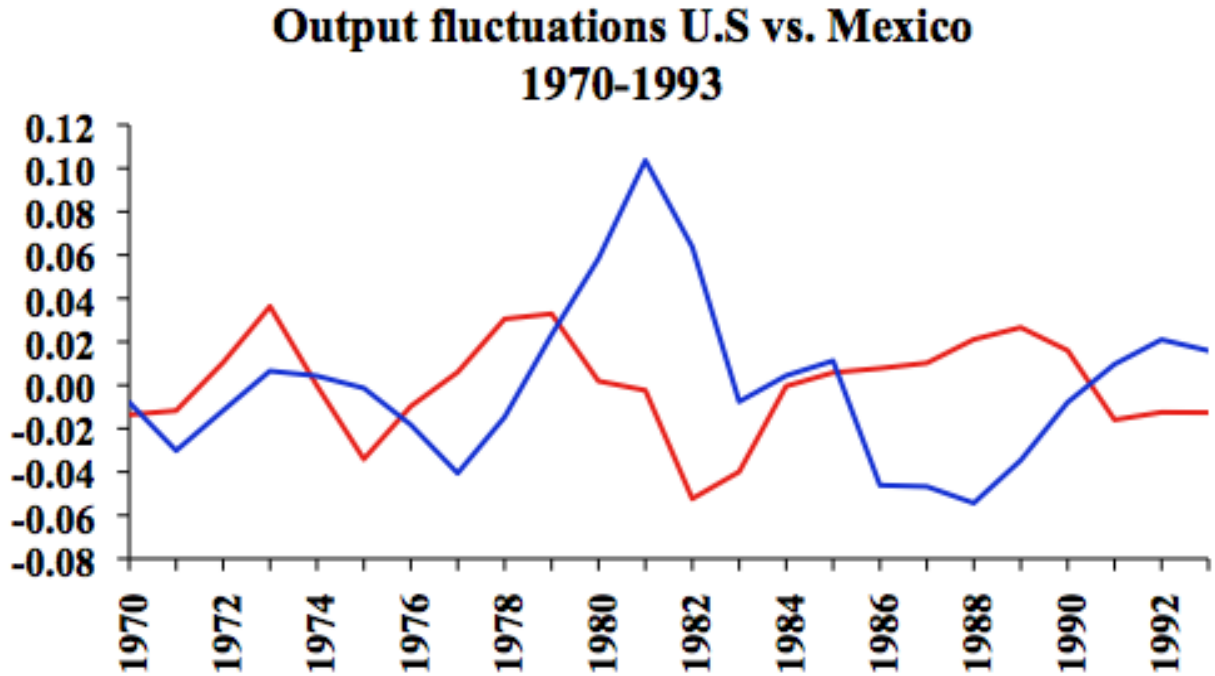

Figure: De-trended (HP filtered) US GDP vs Mexico GDP (blue: USA, red: Mexico) 1970-1993. Own calculations

US-Mexico output fluctuations

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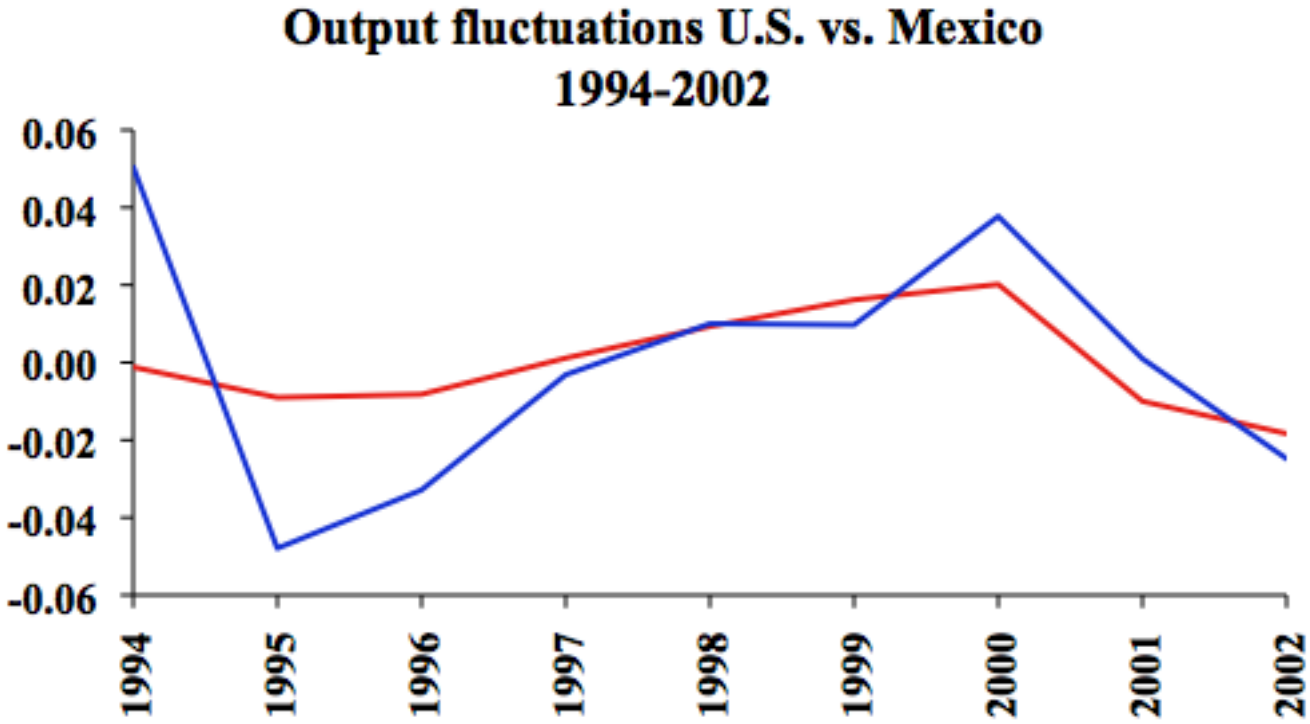

Figure: De-trended (HP filtered) US GDP vs Mexico GDP (blue: USA, red: Mexico) 1994-2002. Own calculations.

Trade-Comovement and Business Cycle Theories

Standard Business Cycle Theory has a problem accounting for the increased correlation due to increased trade.

- Kose & Yi, 2006
- Arkolakis & Ramanarayanan, 2009 (Scandinavian Journal of Economics, "Vertical Specialization and International Business Cycles Synchronization")
  - Propagation of shocks through trade is very weak.
  - Is it something else? (e.g., the financial system etc)

Conclusion: Trade and Business Cycles

Trade integration implies BC-comovement of countries.

- Is this good or bad?
- It is an important question given globalization, economic integration of European Union etc.

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- Gains from increased specialization and trade.
- Economic upturn of one country propagates to others.

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- Gains from increased specialization and trade.
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Negatives

- Harder to achieve risk sharing.
- Crisis of one country propagates to others.

What is the Cost of Business Cycles?

Lucas 2003: Macroeconomic Priorities

- What is the cost of Business Cycle Fluctuations?

  - Depends on a variety of factors: intensity of fluctuations, risk aversity, other preference parameters etc.

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  - Depends on a variety of factors: intensity of fluctuations, risk aversity, other preference parameters etc.

- How do we measure this magnitude?

  - Question: What is the effect on welfare if all consumption variability could be eliminated?
    - Consumer would prefer to minimize consumption fluctuation because she is risk averse.
  - Answer: Need to find what is the percent increase in his uncertain consumption in order to be indifferent with a deterministic outcome.

Utility Function and Risk Aversion

- What is the gain from eliminating Business Cycle Fluctuations?

  - Consider a representative consumer and the welfare gain from eliminating uncertainty in t years from now. Utility function:

$$U_t = \beta^t \frac{c_t^{1-\gamma}}{1-\gamma}$$

β: discount factor, γ: coefficient of risk aversion. The higher γ, the more averse you are to fluctuations in your consumption. If $\gamma = 0$, timing is not important.

Expected Utility

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  - Example: two states of the world, s_1 and s_2, with probabilites $\pi(s_1)$ and $\pi(s_2)$ where $\pi(s_1) + \pi(s_2) = 1$. Expected utility:

$$EU_t = \beta^t \pi(s_1) \frac{c_t(s_1)^{1-\gamma}}{1-\gamma} + \beta^t \pi(s_2) \frac{c_t(s_2)^{1-\gamma}}{1-\gamma}$$

where $c_t(s_1) \neq c_t(s_2)$: consumption in the two states of the world.

Risk Aversion

- We will proceed below ignoring the discount factor (does not affect results)

- The utility function we consider has constant relative risk aversion
  - To see this, notice that relative risk aversion is given by

$$\begin{aligned} R(c) &= -\frac{c \times U''(c)}{U'(c)} \\ &= -\frac{c \times (-\gamma) c_t^{-\gamma-1}}{c_t^{-\gamma}} \\ &= \gamma \end{aligned}$$

Risk Aversion: An Example

- Individuals are risk averse as long as $\gamma > 0$. This means that they prefer the safe consumption than the risky one.

- Formally

$$EU(C) < U(EC)$$

  which is true as long as U is concave $\Longrightarrow \ \gamma > 0$.

- Example: Consider two states $c(s_1) = 1$, $c(s_2) = 2$ with $\pi(s_1) = \pi(s_2) = 0.5$ and $\gamma = 0.5$. Then

$$\begin{aligned} 0.5 \times \frac{1^{0.5}}{0.5} + 0.5\frac{2^{0.5}}{0.5} &< \frac{(0.5 \times 1 + 0.5 \times 2)^{0.5}}{0.5} \Longrightarrow \\ 0.5 \times 1 + 0.5 \times 2^{0.5} &< (0.5 \times 1 + 0.5 \times 2)^{0.5} \end{aligned}$$

Lucas 2003: Calculating the Gain

- What is the gain from eliminating Business Cycle Fluctuations?
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    - Imagine that we could provide him with certainty $\tilde{c}_t = E\left(\bar{c}\varepsilon_t\right)$. What is the utility difference (say λ) that the consumer would experience?
    - This λ is the gain from eliminating business fluctuations.

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- What is the gain from eliminating Business Cycle Fluctuations?

Find λ such that

$$\underbrace{\frac{\left[\tilde{c}_t\right]^{1-\gamma}}{1-\gamma}}_{\text{utility under certainty}} = \underbrace{E\frac{\left[(1+\lambda)\, c_t\right]^{1-\gamma}}{1-\gamma}}_{\text{expected ut. under uncertainty}} \Longrightarrow$$

where $\bar{c}\varepsilon_t$ is consumption with $\bar{c}$ a certain component and ε_t a stochastic component.

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Find λ such that

$$\underbrace{\frac{\left[E\left(\bar{c}\varepsilon_t\right)\right]^{1-\gamma}}{1-\gamma}}_{\text{utility under certainty}} = \underbrace{E\frac{\left[\left(1+\lambda\right)\bar{c}\varepsilon_t\right]^{1-\gamma}}{1-\gamma}}_{\text{expected ut. under uncertainty}} \Longrightarrow$$

$$\frac{\left[\bar{c}E\varepsilon_t\right]^{1-\gamma}}{1-\gamma} = \left(1+\lambda\right)^{1-\gamma} E\frac{\left[\bar{c}\varepsilon_t\right]^{1-\gamma}}{1-\gamma} \Longrightarrow$$

$$1+\lambda = \frac{E\varepsilon_t}{\left(\left(E\left[\varepsilon_t\right]^{1-\gamma}\right)\right)^{1/(1-\gamma)}} \geq 1$$

where the last inequality follows from concavity (related to what we argued above for the utility)

Lucas 2003: The Numbers

- What is the gain from eliminating Business Cycle Fluctuations?

  - Simple calculations (log normal distribution) imply $\lambda \simeq \frac{1}{2}\gamma\sigma^2$
    Putting numbers:

    - σ : In the US data 1947-2001 standard deviation of log consumption is 0.032.
    - γ : Macroeconomics and finance literature uses 1 to 4.

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  - Using these numbers:
    Gains from Eliminating Business Cycles
    $\simeq \frac{1}{2}\gamma\sigma^2 = \frac{1}{2} \times 4 \times (0.032)^2 = 0.205\%$ of consumption

    - Is this number too small?

Lucas 2003: The Numbers

- Gain $< \frac{1}{2}\gamma\sigma^2 = \frac{1}{2} \times 4 \times (0.032)^2 = 0.205\%$ of consumption

- Is this number too small?
Extremely small!

- Research has argued that gains from eliminating 10% inflation about 10 times higher
- Gains from higher capital accumulation $> 2\%$.
- Gains from Trade (Arkolakis, Costinot, Rodriguez-Clare 2012) for the US: 0.7%-1.4%.
- Each of these calculations gives a number almost an order of mangitude larger than the gains from elliminating high frequency flucuations.

Large Recessions

So Why do we Care about Fluctuations so Much?

Answer: mostly care about large fluctuations of output.
Major recessions could reduce GDP growth & propagate major shocks across countries.

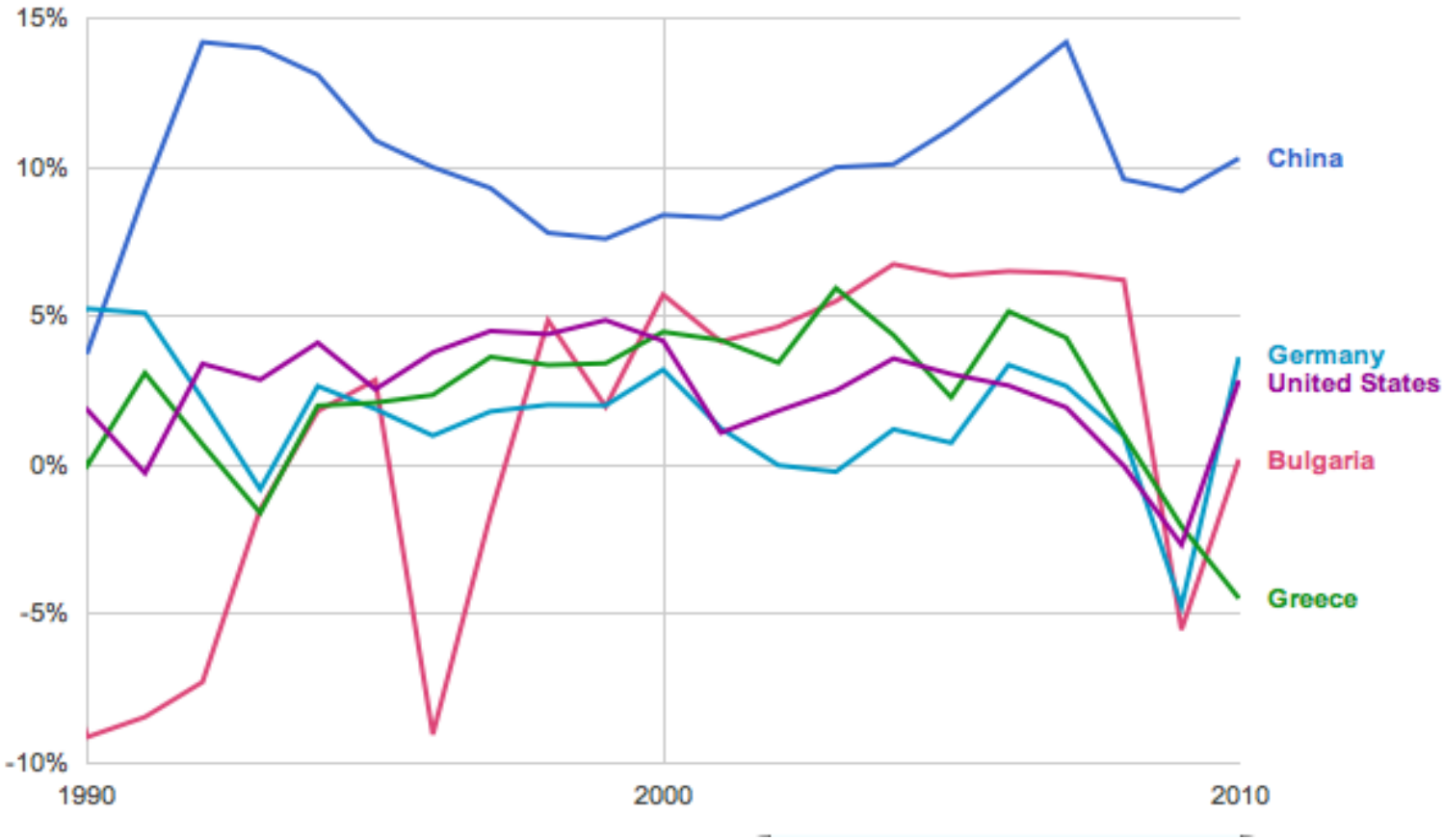

Figure: real GDP growth (source World Development Indicators)

So Why do we Care about Fluctuations so Much?

World is becoming increasingly integrated.

- Tighter trade links across countries make contagion more likely.

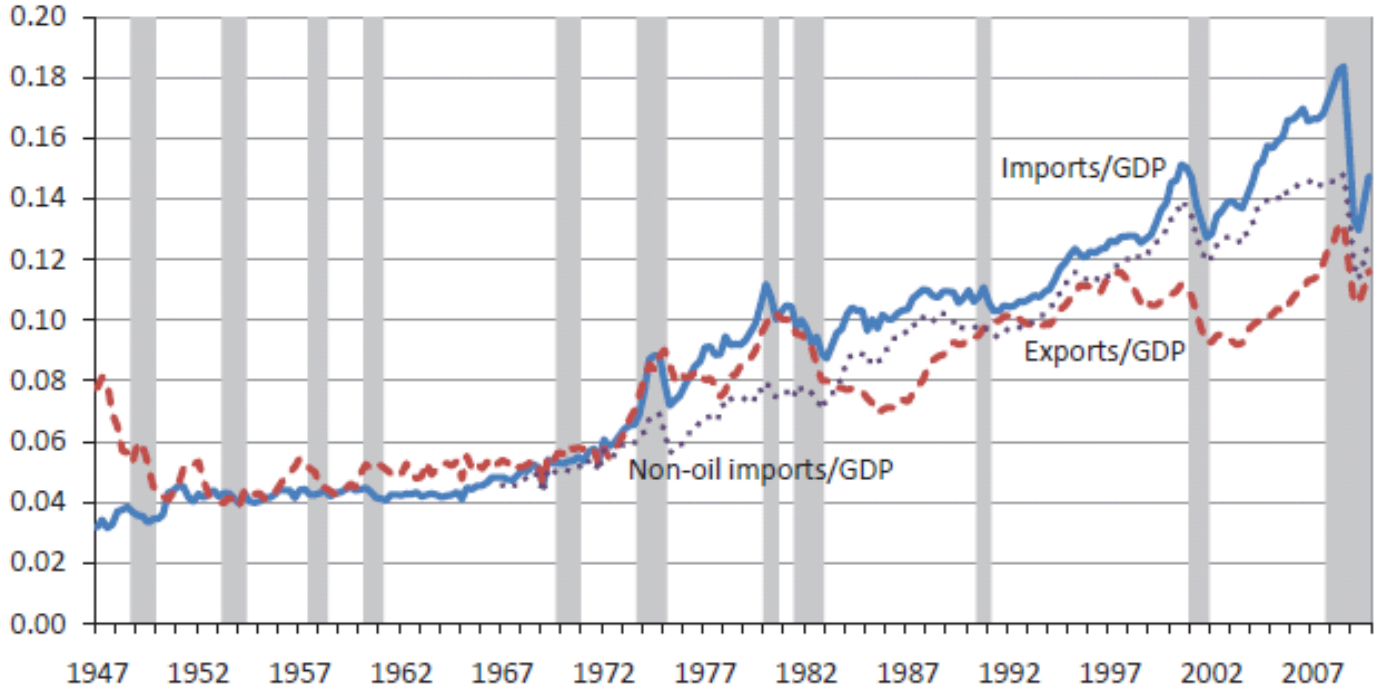

Figure: Post War US Trade to GDP (source: Levchenko, Lewis, Tesar '10)

What is the Welfare Cost of a Large Recession?

Similar to what we did before, we can reformulate the question as: "What fraction of annual consumption would a worker be willing to pay to set the current probability of encountering a Depression-like event to zero?"

- Turns out that large recessions are extremely rare events for developed countries (about once or twice every century).

What is the Welfare Cost of a Large Recession?

Chatterjee & Corbae, 2007 (Journal of Monetary Economics), compute the welfare costs of the great depression.

- Depends on the ability of smoothing consumption
  - If markets are complete, welfare loss is about 1%.
  - But with incomplete markets (recall: research on International Financial Markets), welfare loss might increase to almost 7%.