Understanding the Evolution of World Business Cycles

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- **Global linkages have been increasing**
  - Volume of trade has increased over time
  - Volume of financial flows has increased substationally over the past 15 years
- Can we find evidence of changes in business cycle comovement over time?
- We are **not** directly linking 'globalization' with business cycles

- **Empirical Studies**
  - Results are inconclusive
  - Heathcote and Perri (2002)
  - Doyle and Faust (2002a, 2002b)
  - Helbling and Bayoumi (2002)

- **Some robust facts**
  - Average output volatility has gone down.
  - Average investment volatility has gone down.
  - Average consumption volatility has not changed much.

Our Contribution: To understand the evolution of world business cycles over time by estimating common dynamic components in main macroeconomic aggregates

- Are there changes in the characteristics of G7 business cycles over time?
- How do the relationships between macroeconomic aggregates within countries and across countries vary across historical episodes?
- What are the sources for these changes?

Methodology: A Dynamic Factor Model

- Unobservable Index Model
  - Index of Common Economic Activity

- A common factor, f_0, accounts for all comovement among a collection of variables.

$$y_{it} = a_i + b_i f_{0t} + \varepsilon_{it}$$

  - Factors and errors are autoregressive processes

- Estimation of these models is nontrivial. There are a number of competing approaches
  - We use the method developed in Otrok and Whiteman (IER, 1998) and Kose, Otrok and Whiteman (AER, forthcoming)

$$O_t^{US} = b_{US,O}^{G7} f_t^{G7} + b_{US,O}^{Country} f_t^{US} + \varepsilon_{US,O,t}$$

$$C_t^{US} = b_{US,C}^{G7} f_t^{G7} + b_{US,C}^{Country} f_t^{US} + \varepsilon_{US,C,t}$$

$$I_t^{US} = b_{US,I}^{G7} f_t^{G7} + b_{US,I}^{Country} f_t^{US} + \varepsilon_{US,I,t}$$

$$\vdots$$

$$O_t^{Japan} = b_{Japan,O}^{G7} f_t^{G7} + b_{Japan,O}^{Country} f_t^{Can} + \varepsilon_{Japan,O,t}$$

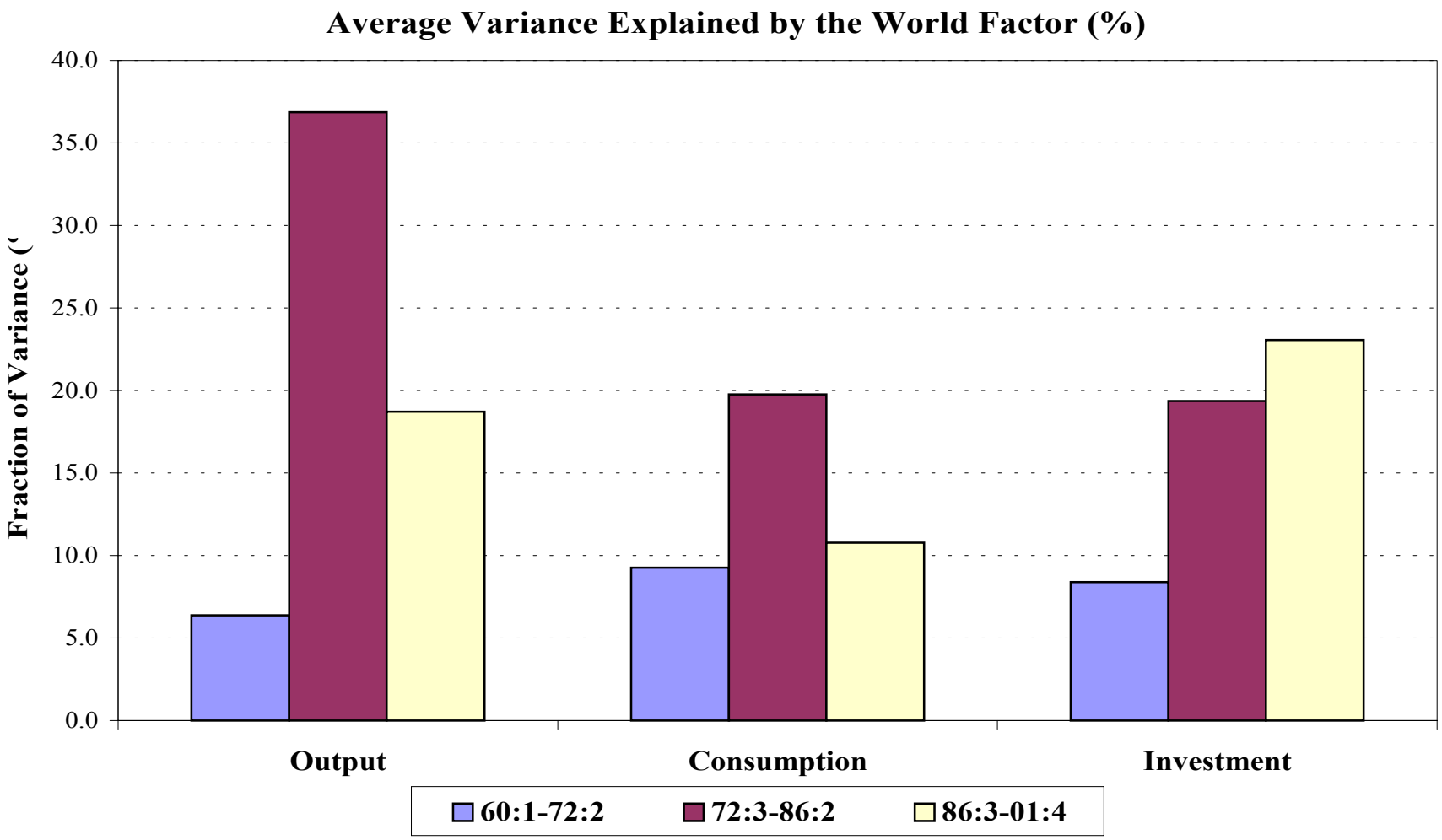
$$C_t^{Japan} = b_{Japan,C}^{G7} f_t^{G7} + b_{Japan,C}^{Country} f_t^{Can} + \varepsilon_{Japan,C,t}$$

$$I_t^{Japan} = b_{Japan,I}^{G7} f_t^{G7} + b_{Japan,I}^{Country} f_t^{Can} + \varepsilon_{Japan,I,t}$$

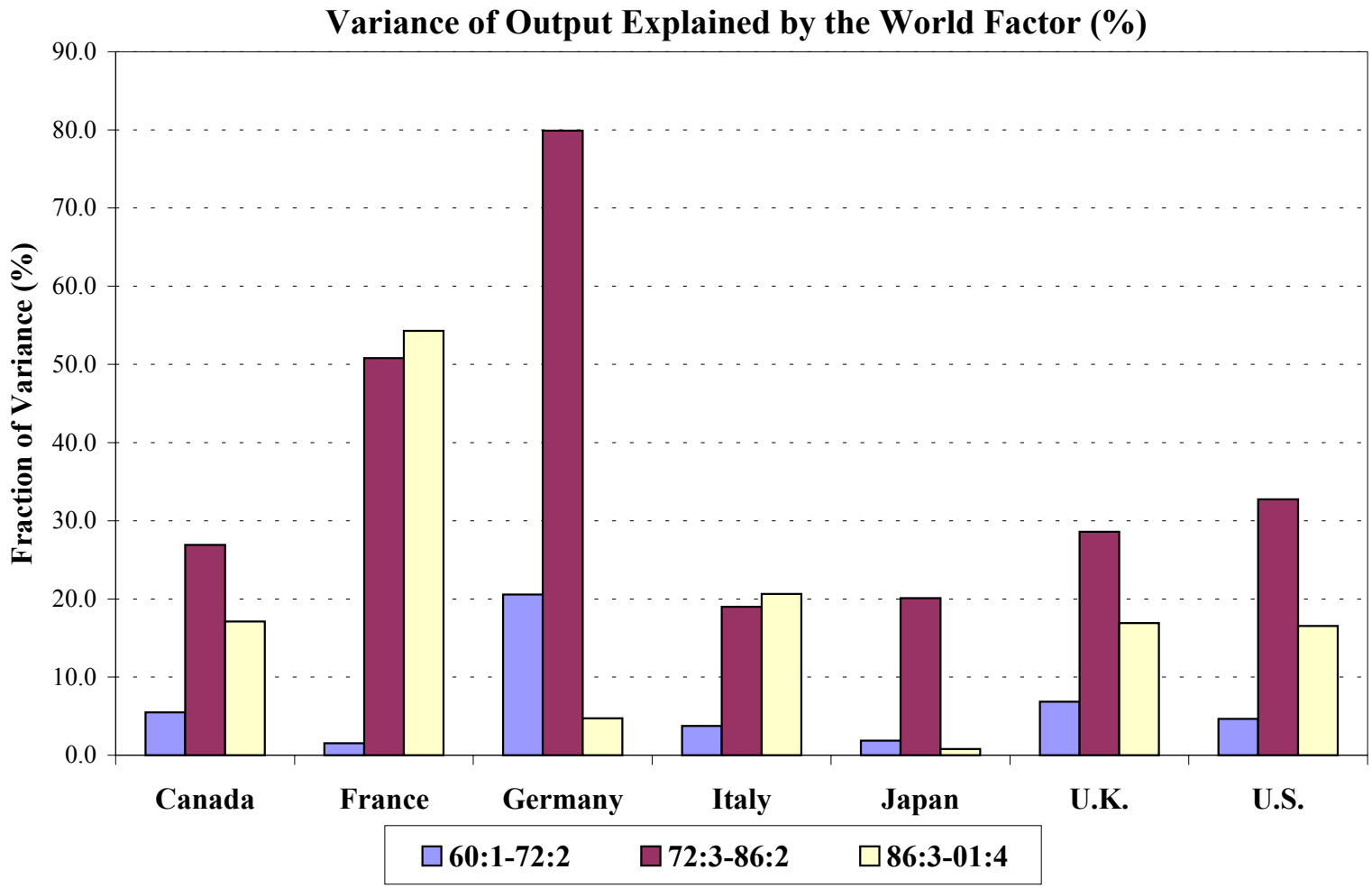
- **Estimate the Model for 3 time periods**

  - 1960:1-1972:2 Bretton Woods period
  - 1972:3-1986:2 Common Shock Period
  - 1986:3-2001:4 Period of Increasing Global Linkages

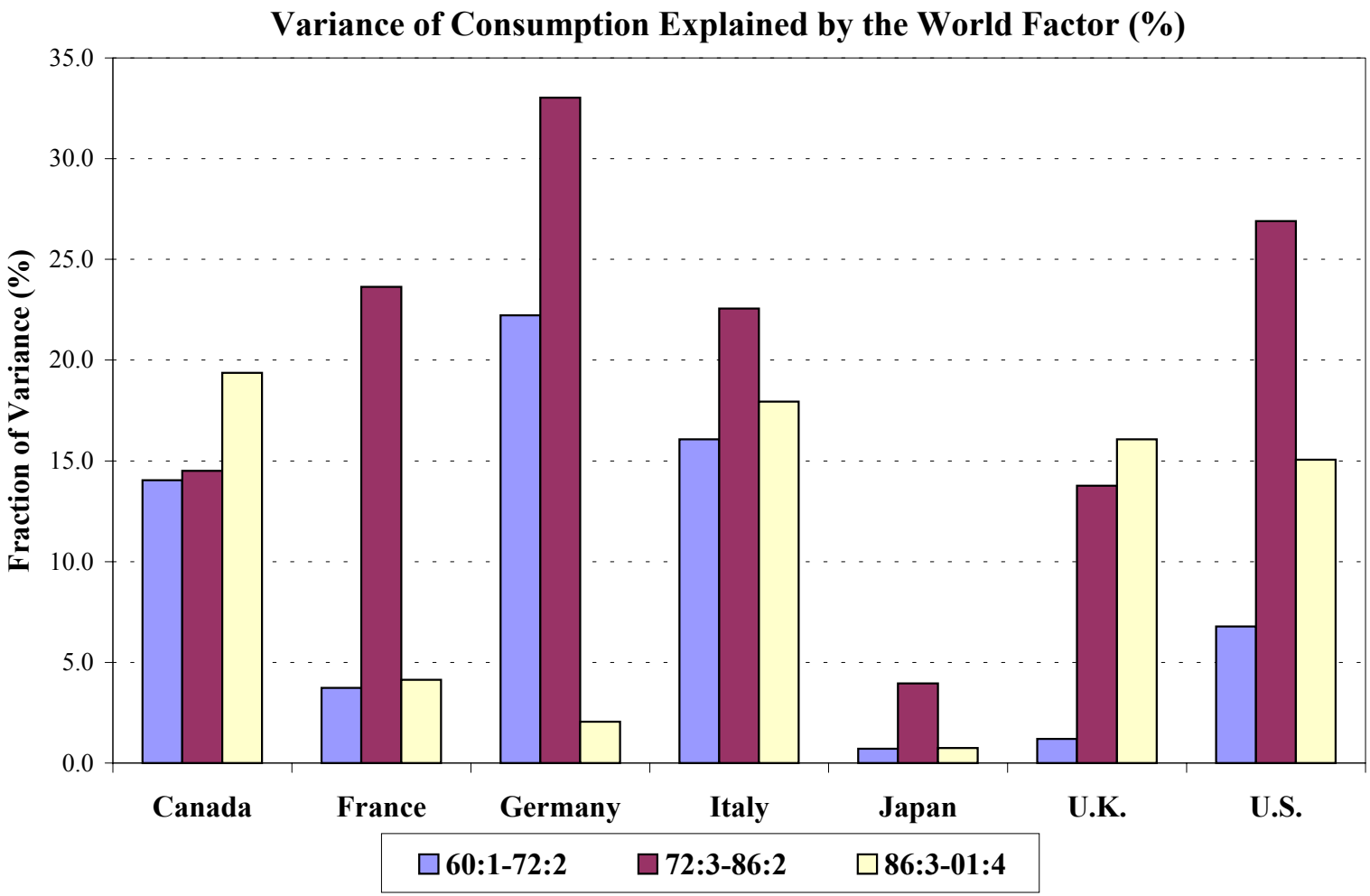
Average Variance Explained by the G7 Factor



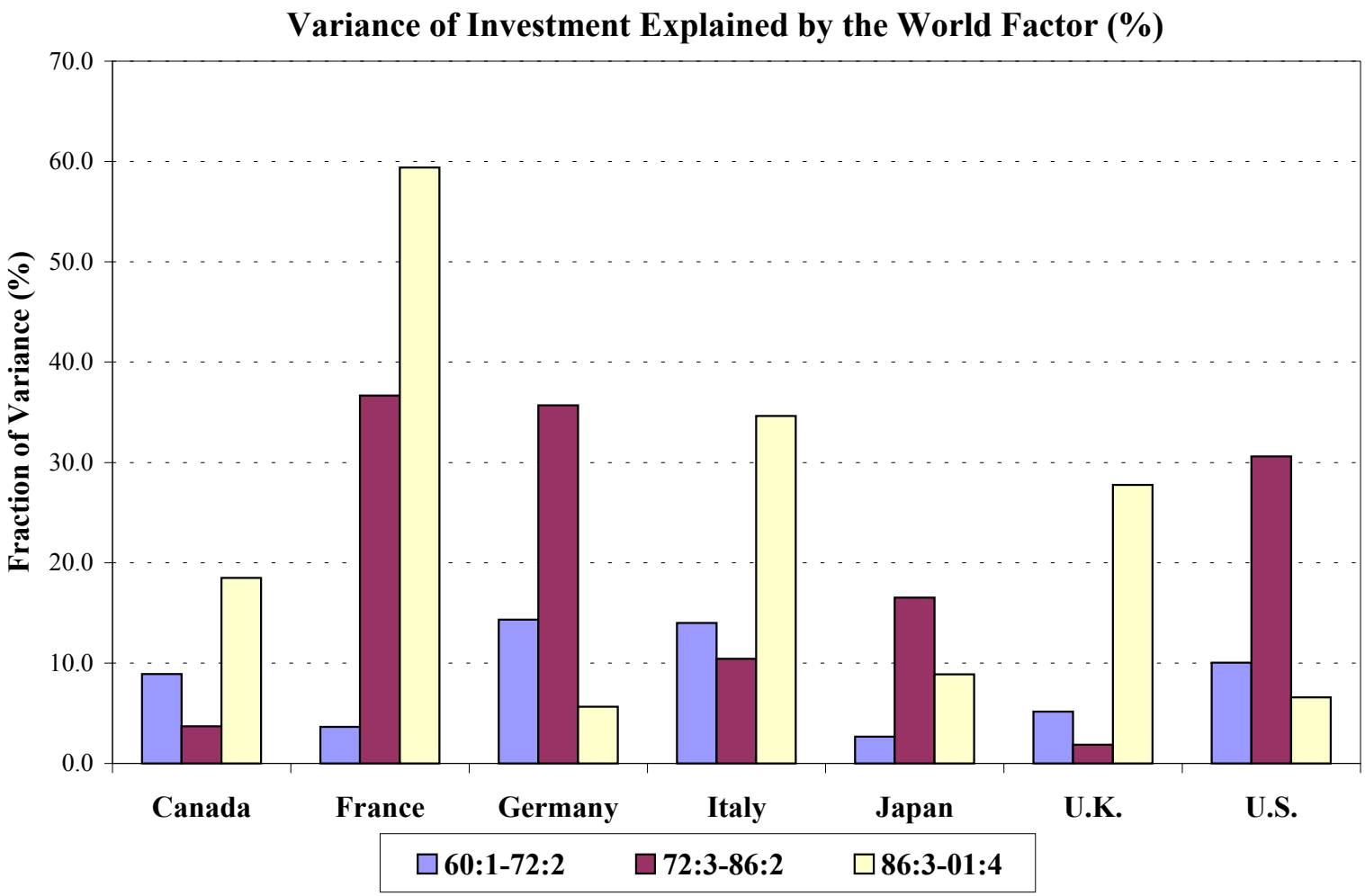
Variance of Output Explained by Factors in Each Period



Variance of Consumption Explained by Factors in Each Period



Variance of Investment Explained by Factors in Each Period



Investigating the Sources of the Changing Nature of International Business Cycles

- Link the dynamic factor model to a VAR (FAVAR) following Bernanke et. al. (2002)

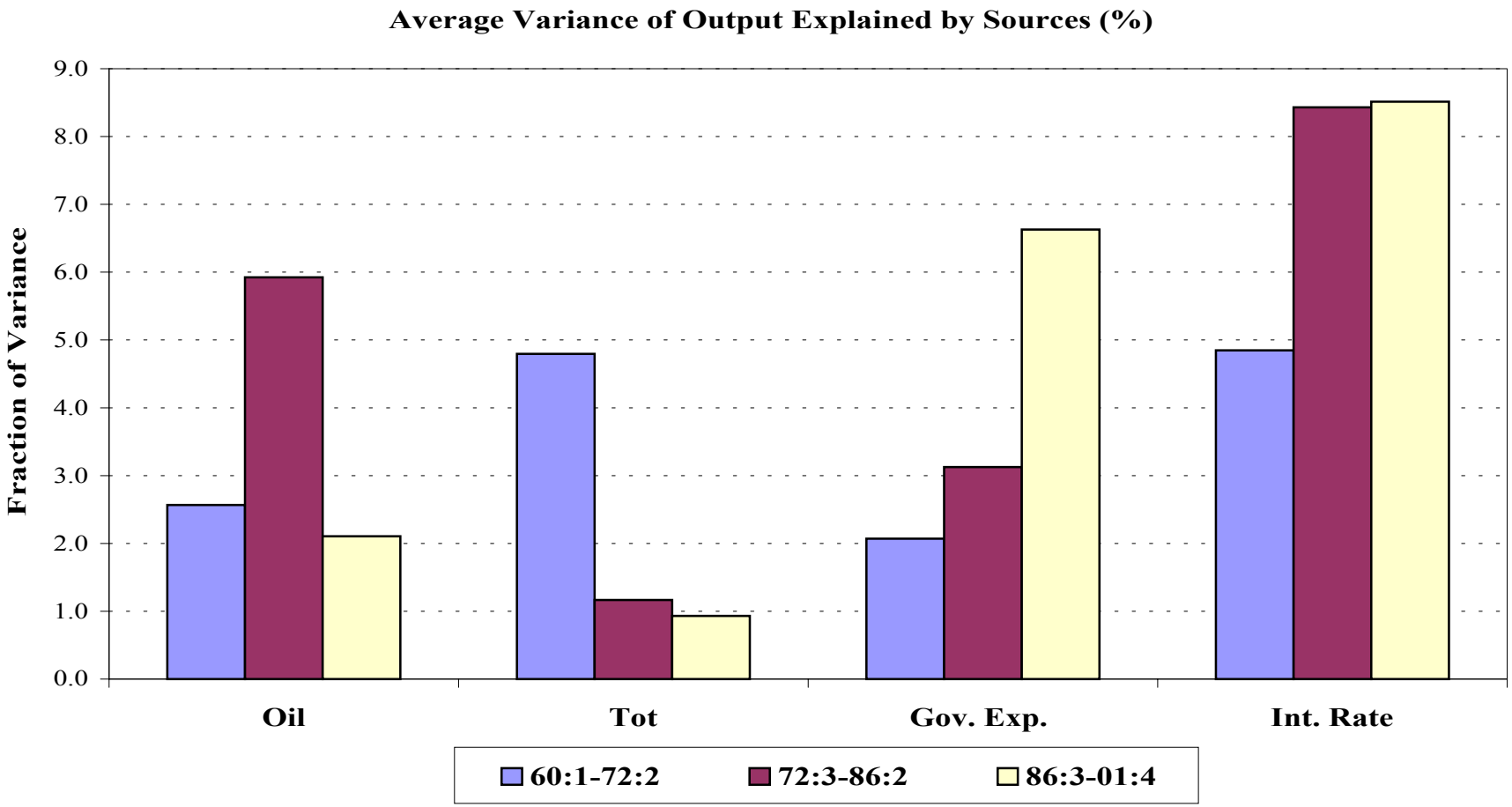
$$\begin{bmatrix} F_t \\ S_t \end{bmatrix} = \begin{bmatrix} \Phi(L) & A(L) \\ C(L) & D(L) \end{bmatrix} \begin{bmatrix} F_{t-1} \\ S_{t-1} \end{bmatrix} + E_t$$

$$Y_t = B^F F_t + B^S S_t + V_t$$

where $S_{i,t}$ is a vector of potential sources for comovement

  - We use oil prices, terms of trade, interest rates and government spending
- Two sets of results are of interest
  - Are the dynamic factors still important?
  - How have impulse response functions changed?

Average Variance of Output Explained by Sources in Each Period



Summary of Empirical Results

- **1960-1972**
  - Comovement across macro aggregates is generally low
  - Little of the comovement we do find can be explained by oil, terms of trade, government spending, interest rates or "productivity"
- **1973-1986**
  - Comovement is much higher
  - Interest rates are the predominant source of comovement for most countries,
  - Oil prices play a critical role in Japan and to a lesser extent the UK.
- **1986-2001**
  - Comovement falls from the second period
  - Productivity *may* be the source of comovement.

- **Interpretation of Results**

  – Increasing trade linkages could increase or decrease comovement (in theory)

  – Increasing financial linkages could increase or decrease output comovement (in theory).