

Empirical Macroeconomics: Introduction

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Nobel Prize in Economics

- ▶ The Sveriges Riksbank Prize in Economic Sciences in Memory of Alfred Nobel 2011 was awarded jointly to Thomas J. Sargent and Christopher A. Sims "for their empirical research on cause and effect in the macroeconomy"



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Nobel Prize in Economics

- ▶ "The art of distinguishing between the cause and effect in the macroeconomy."
- ▶ That is, they develop methods for answering:
 - ▶ "How are GDP and inflation affected by a temporary increase in the interest rate or a tax cut?" (Sims)
 - ▶ "What happens if a central bank makes a permanent change in its inflation target or a government modifies its objective for budgetary balance?" (Sargent).
- ▶ But it is not simple to answer the above because:
 - ▶ "The expectations of the private sector regarding future policy affect today's decision about wages, prices and investments, while economic-policy decisions are guided by expectations about developments in the private sector."

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Sargent: systematic effects of economic policy

- ▶ Method to answer quantitative questions about the effect of policy rules.
 1. Develop a *structural macroeconomic model*: an accurate mathematical description of the economy. Note that parameters should not be affected by policy – preference parameters.
 2. Solve the model using *rational expectations*.
 3. *Estimate* the fundamental parameters.
 4. "The complete model can be used as "laboratory" to study the effects of different hypothetical "experiments".

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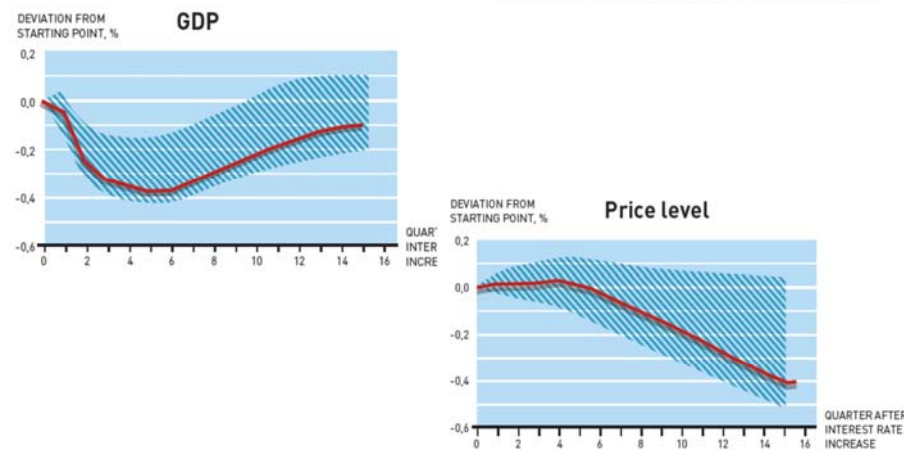
Sims: identification and analysis of macroeconomic shocks.

▶ Method proposed by Sims:

1. Estimate a reduce-form statistical forecasting model: Vector Autoregressive Model. Difference between predicted and observed is called a “shock”.
2. Extract “fundamental shocks” (an unexpected change (shock) that is independent of all other shocks). There is a methodology to identify structural shocks.
3. Proceed to impulse-response analysis. The impact over time of structural (fundamental) shocks to macroeconomic variables.

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Sims: identification and analysis of macroeconomic shocks.



Effects of an increase in the interest rate on GDP and the price level. The shaded areas show other statistically possible outcomes.

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History of Macroeconometrics

- ▶ 1950's – Tinbergen – Keynesian multiple-equation econometric models.
- ▶ 1960's – Cowles Commission – econometric methods: instrumental variables, full-information (system) methods.
- ▶ 1970's – Forecasting failure of large (500 equations) Keynesian models after the oil shocks.
- ▶ 1970's – Lucas Critique: Keynesian models are not forward looking, so their parameters are a combination of preference parameters and expected policy changes, so they are unstable.

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History of Macroeconometrics

1980 – Sims – VAR models	
	1982: Prescott – RBC models: microfounded models based on optimising agents; parameters are computed via calibration.
1987 – Granger (Engle) – Cointegration: economic interpretation of common trends in macro variables.	1986 – Sims – Structural VAR Models: shocks are identified via economic-based restrictions.
1989 – Hamilton - Markov-Switching Models.	
1989 – Sargent, Stock+Watson-Dynamic Factor Models.	

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History of Macroeconometrics

- ▶ 2005 - Christiano, Eichenbaum and Evans –Dynamic Stochastic General Equilibrium Model estimated to mimic VAR impulse responses.
- ▶ 2007 – Smets and Wouters – Bayesian (estimated) Dynamic Stochastic General Equilibrium Model.
- ▶ 2008-2009 – Economic Crisis. Failure of DSGE models?
- ▶ Back to statistical models? New approach?
- ▶ Nope. Improve DSGE models by adding financial intermediation and incomplete markets.

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Empirical Macroeconomics Course

- ▶ Measuring the effect of shocks in macroeconomic variables – Business Cycles (no Growth Theory).
- ▶ Structural Models:
 1. Structural Vector Autoregressive Models: impulse-response analysis (Sims); forecasting:.
 2. Dynamic Stochastic General Equilibrium Models (DSGE): impulse-response analysis; forecasting. Both Real Business Cycle Models (RBC) and New-Keynesian Models. Frequentist estimation methods: calibration, generalised method of moments, and maximum likelihood.

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Empirical Macroeconomics Course

- ▶ Bayesian Methods. From Sim's Nobel Lecture:
- ▶ “The textbook frequentist view distinguishes non-random, but unknown, “parameters” from random quantities that repeatedly vary, or could conceivably repeatedly vary.”
- ▶ ”The Bayesian view treats everything that is not known as random, until it is observed, after which it becomes non-random.”
- ▶ Bayesian methods allow the use of prior information about the coefficients – obtained using prior estimation or calibration. Coefficient estimates are obtained by updating prior coefficients with observed data.

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Empirical Macroeconomics Course

1	09/01	Introduction to Macroeconometrics; Vector Autoregressions: specification, impulse responses and variance decomposition.	N; Lecture Notes. L, ch. 2-3. SW1.
2	16/01	Vector Autoregressions: estimation, inference, choosing autoregressive order, and granger causality. Introduction to Bayesian VARs: Minnesota prior.	Lecture Notes. L, ch. 2-3. K. C, 10.1-2;
3	23/01	Forecasting: ADL, and Large Bayesian VAR models for forecasting output growth and inflation.	SW2, BGR; Lecture Notes.
4	30/01	Structural Vector Autoregressions: short-run restrictions; long-run restrictions; sign restrictions.	Lecture Notes. L, ch. 9; Long: BQ, G; short: BM, CEE, EE; sign: U.
5	06/02	Real Business Cycle Model: solutions and approximations	DD , ch. 3.1 and ch 2;
6	13/02	Computing Business Cycle Stylised Facts with Hodrick-Prescott filter and Band-pass filters. Calibration: application to the RBC Model	DD , ch.6; C, 3.2; DD ch. 11.1-2; 11.4; KP, S.

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Empirical Macroeconomics Course

8	27/02	New-Keynesian Model: solutions and approximations.	DD ch. 3.2; I .
9	05/03	GMM estimation: Euler Equation, Taylor rule and the New-Keynesian Philips Curve	DD ch. 12.2, 12.3.1, GG , CGG ;
10	12/03	Maximum Likelihood estimation: application to the NK model.	DD ch. 13.1-2; 8.3-4; 13.6. I ;
11	19/03	Applications of Bayesian econometrics: model-based priors for VAR models; and estimation of DSGE Models (Smets-Wouters Model).	DD ch. 14.1-3, 14.6; IW , DS , SWo .
12	26/03	Revision; Presentation of Empirical Projects.	