

# **Ciclos e crises económicas**

Aula 21 e 22

Frisch, RBC, ciclos sem  
explicação

# A geração econométrica

- Dezembro de 1930, fundação da Sociedade Econométrica

**I. Fisher   R. Frisch   J. Schumpeter**



# The Econometric Society

An International Society for the Advancement of Economic Theory  
in its Relation to Statistics and Mathematics



*A l'occasion du centenaire de la naissance de*  
**Léon Walras**

*les membres soussignés de la Société Internationale d'Econométrie tiennent à exprimer leur reconnaissance à l'Université de Lausanne pour le service qu'elle a rendu à la Science, en dotant d'une chaire l'enseignement de la théorie de l'équilibre économique, et en lui imprimant un éclat qui a largement contribué à son rayonnement dans le monde.*

*Irving Fisher*

PRESIDENT

16 DÉCEMBRE 1934.

FRANÇOIS DIVISIA · VICE-PRESIDENT

CHARLES F. ROOS · SECRETARY  
COLORADO COLLEGE COLORADO SPRINGS COLORADO U.S.A.

ALFRED COWLES 3RD · TREASURER

## OTHER FELLOWS

LUIGI AMOROSO ROMA  
OSKAR N. ANDERSON SOTIA  
ALBERT AUERIT PARIS  
PASCAL BONINSEgni LAUSANNE  
ARTHUR L. BOWLEY LONDON  
CLÉMENTZ OLSON PARIS  
GUSTAVO DEL VECCHIO BOLOGNA  
GRIFFITH C. EVANS HOUSTON, TEXAS

RAGNAR FRISCH OSLO  
CORRADO GINI ROMA  
GOTTFRIED HABERLER GENÈVE  
HAROLD HOTELLING NEW YORK  
JOHN MAYNARD KEYNES CAMBRIDGE, ENGLAND  
WESLEY C. MITCHELL NEW YORK  
HENRY L. MOORE CORNWALL, NEW YORK  
UMBERTO RIGGI GIZA  
JACQUES RUEFF PARIS

ERICH SCHNEIDER DORTMUND, GERMANY  
HENRY SCHULTZ CHICAGO  
JOSEPH A. SCHUMPETER CAMBRIDGE, MASSACHUSETTS  
J. TIMBERGEN SCHEVENINGEN  
FELICE VINCI BOLOGNA  
EDWIN B. WILSON BOSTON  
WŁ. ZAWADSKI WARSZAWA  
F. ZEUTHEN KOBLENHAFEN

## OTHER MEMBERS

**ALGERS**  
GEORGES HENRI BOUSQUET

**ARGENTINA**  
ALEJANDRO E. BUNGE  
CARLOS E. DIEHLERAIT  
ALEJANDRO E. SHAW

**AUSTRALIA**  
MAURICE H. BELZ  
TORLIEV HYTTEEN

**BELGIQUE**  
PAUL BRÛLE

**BLGARIYA**  
IVAN BAINOFF

**CANADA**  
R. H. COATS  
ALEXANDER J. COOK

**ČESKOSLOVENSKÁ  
REPUBLIKA**  
KAREL ENGLIS  
JAROSLAV JANKO  
IRICH A. KARVAS  
DOBROSLAV KALIN  
PETR BASTOKIN  
FRANTISEK SCHWARZ

**CHILE**  
JULIO GIROZ  
ROBERTO VERGARA

**CHINA**  
C. C. CHANG  
WARREN CHEN  
FRANKLIN L. HO  
K. F. KING  
D. K. LIU  
T. SHENO  
C. SUN  
L. K. TAO  
T. Y. TSAH

**DEUTSCHES REICH**  
ARNO ARON  
GEOIG HALM  
ARTHUR HANAU  
WILHELM KROPHARDT  
OTTO KUHNÉ  
PAUL LORENZ  
HANS RICHTER-ALTSCHAFFER  
ROBERT STICHT  
ARTHUR SPIETHOFF  
RUDOLF STICKEL  
WILHELM VIEUGELIS  
ERWIN VON BECKHATH  
OTTO VON MERING  
HEINRICH VON STACKELBERG  
W. WARTENSCHMIDT

**EGYPT**  
COSTANTINO BRESCIANI-TURRONI  
JAMES IRELAND CRAIG

**ENGLAND**  
R. G. D. ALLEN  
C. F. BICKERDIKE  
E. H. PHILIPS BROWN  
C. DOUGLAS CAMPBELL  
B. V. DAVE  
MORITZ J. ELIAS  
R. G. HADLEY  
FRIEDRICH A. HAYEK  
J. E. MEADE  
JAKOB MARSCHAK  
J. E. MEADE  
RÉDVERS OPIE  
LIONEL C. ROBBINS  
D. SCHUMACH  
HAROLD C. SCOTT  
JOSHUA C. STAMP

**ESPAÑA**  
OLEGARIO FERNÁNDEZ BAÑOS

**FRANCE**  
ETIENNE ANTONELLI  
GÉRAUD BARDET  
ALFRED BARRIOL  
F. BOMPAIRE  
EMILE BOREL  
MENTOR BOUNATIATION  
K. CHAYRIEU  
G. DARMOIS  
DE RUFFEL DE PONTEVES  
MAURICE FRÉCHET  
A. GAILLOT  
R. GIBRAT  
E. J. GUMBEL  
J. HADAMARD  
MAURICE HÉLIE  
MAX HERMANT  
HUBERT  
ADOLPHE LANDRY  
PH. LE CORBIER  
LOUIS MARLIO  
JACQUES MORET  
CHARLES MOURIER  
EMILE PICARD  
GASTON PIROU  
CHARLES RIST  
GASTON ROULLEAU  
RENE ROY  
FRANÇOIS SIMIAND  
HENRI TRUCHY  
ROBERT WOLFF

**INDIA**  
BALKRISHNA  
PRAPHULLACHANDRA BASU  
B. DAS GUPTA  
L. C. JAIN  
W. T. McLEAN

**ITALIA**  
RICCARDO BACHI  
RODOLFO BININI  
GINO BORGATA  
GIUSEPPE BUFANO  
ATTILIO CARIATI  
FRANCESCO C. D'ANNA

**KONGERIGET  
DANMARK**  
WERNER FENCHEL  
CARL IVERSEN  
IVAN JANZEN  
HANSE BOJLE  
J. STEFFENSEN  
HENRY THIRSKVIST  
HARALD WESTERGAARD

**KRALJEVINA  
YUGOSLAVIA**  
AL BILMOVIC

**MAGYARORSZÁG**  
JENO ANDREICH  
CHARLES GOLZACHER  
CHARLES JORDAN  
JULIUS KERNÉNY  
BELA KENEZ  
JULIUS LEADGER  
S. ALEXANDER SIPOS  
EDWARD THIELS  
STEPHEN VARGA

**NEDERLAND**  
O. BAKKER  
W. J. DE LACROIX  
W. J. DE VOOYS  
J. G. GOUDRIAAN, JR.  
L. HAMBURGER  
J. G. KOOPMANS  
F. W. THOOFT  
WILLEM L. VALEK  
E. C. VAN DORP  
W. G. VERBESCHUIJ  
G. M. VERRIUN-STUART

**NIPPON**  
RYUICHI HAYAKAWA  
SEIJIRO TAKAGI  
YASUNORI KAKATA  
S. TOBATA

**NORGE**  
POUL HEEGAARD  
GUNNAR JAHN  
HENRIK PALMSTRÖM

**PHILIPPINE ISLANDS**  
EMERSON ROA  
EZEQUIEL S. SEVILLA

**OSTERREICH**  
HANS MAYER  
KARL MENGER  
LUDWIG V. MISES  
OSKAR MOGENSEN  
EWALD SCHMANS  
ERICH SCHIFF  
KARL SCHLESINGER  
RICHARD STIEGLER  
GERHARD TINTNER  
EMANUELE UGOLINI  
OTTO WEINBERGER

**RZECZPOSPOLITA  
POLSKA**  
ZYGMUNT LIMANOWSKI  
J. PIEKALKIEWICZ  
STANISLAW SWIANIEWICZ  
ALEKSY WAKS  
FERDYNAND ZWEIG

**SOUTH AFRICA**  
S. HERBERT FRANKEL  
F. E. GELDENHUYS

**SUISSE**  
MICHEL ANGELO BRESSO  
ARIKO BORDIN  
LOUIS V. FURLAN  
WALTER KULL  
GEORGES KOVOT  
HANS STAHEL

**SUOMEN TASAVALLA**  
K. T. JUTILA

**SVERIGE**  
GUSTAF AKERMAN  
JOHAN AKERMAN  
GOSTA BAGGE  
K. G. HAGSTROM  
ERIK LINDAHL  
F. I. LINDBERG  
GUNNAR MYRDAL  
SVEN D. WACKSELL

**UNITED STATES**  
CARL L. ALSBERG  
EUGEN BERTSCHUL  
MONTGOMERY D. ANDERSON  
SEYMOUR L. ANDREW  
ANDREW A. AYRES  
ARTHUR L. BAILEY  
RAYMOND F. BENTLEY  
ERNEST L. BOGART  
WALTER C. BOGERTMAN  
KARL BRANDT  
THEODORE H. BROWN  
JOHN B. CANNING  
HARRY C. CARVER  
THOMAS H. CHAMBERLAIN  
G. L. CHRISTENSON  
J. M. CLARK

VICTOR S. CLARK  
GERHARD COLM  
MORRIS A. COHEN  
ANDREW T. COURT  
A. E. CRATHORNE  
FREDERICK E. CROXTON  
DONALD H. DAVENPORT  
G. R. DAVIES  
EDMUND E. DAY  
HENRY S. DENNISON  
EDWARD T. DEVINE  
HAROLD F. DODD  
PAUL H. DOUGLAS  
ACHESON J. DUNCAN  
LIONEL D. EDIE  
MORDECAI STRAUSS  
MARION FISH  
DAVID FRIDAY  
THORNTON C. FRY  
RAYMOND GARVER  
EDWIN F. GAY  
ELIZABETH W. GILBOY  
JAMES W. GLOVER  
F. W. GRAFF  
FRANK W. GRIFPIN  
ALVIN H. HANSEN  
EDWARD W. HERVELY  
C. F. HIRSHFIELD  
WILLIAM JAFFE  
REGINALD L. JONES  
KARL G. KARSTEN  
EDWARD P. KAUTZKY  
HENRY KELLER, JR.  
J. O. KELLER  
TRUMAN L. KELLEY  
WILLIAM I. KING  
RICHARD L. KOZELKA  
THEODORE I. KREPS  
EMIL LEDERER  
WASSILY LEONTIEF  
ALFRED J. LOTKA  
FRED R. MACALLAN  
FRITZ MACHUP  
HENRY J. MALKARY  
C. MARSHALL  
EDWARD S. MASON  
LEWIS S. MAYERKOPF  
JOSEPH MAYER  
HERBERT A. MEYER  
FREDERICK C. MILLS  
H. BOWWILL  
BRUCE D. MUGGETT  
CHARLES P. NEILL  
HANS NEISSER  
WILHELM F. OGGIBURN  
F. A. PEARSON  
CHESTER A. PHILIPS  
FAIRFIELD E. RAYMOND  
STUART A. RICE  
HENRY LOUIS RIETZ  
MALCOLM C. RORTY  
FRANK A. ROYCE  
ALEXANDER SACHS  
MAX SAKS  
HORACE SECRIST  
W. H. SHARP  
I. SHOHAT  
CARL SNYDER  
W. BLAIR STEWART  
FRANK W. TAUSIG  
VLADIMIR P. TIMOSHENKO  
H. R. TOLLE  
HERBERT TOUT  
EDMUND E. TIA  
D. I. VINGBERG  
VICTOR S. VON SZELISKI  
GEORGE E. WARREN  
FREDERICK V. WALGH  
ELIZABETH W. WALSON  
ROBERT M. WOODBURY  
E. W. WORTHING  
HOLBROOK WORKING  
SLAVCHO ZAGOROFF

# Sociedade Econométrica

# (fundada em 1930)

# 1ª conferência da Sociedade Econométrica (1931, Lausanne)



# Probabilidade na economia

$$y_t = b x_t + \varepsilon_t$$

Sendo  $y$ ,  $x$  e  $\varepsilon$  vetores  $n$ -dimensionais

Vários tratamentos diferentes da probabilidade nos estudos teóricos e aplicados em ciclos

*exemplos:*

*Kenneth Arrow (Nobel 1972) e  
EMH (Eugene Fama, Nobel  
2013)*



“It is my view that most individuals underestimate the uncertainty of the world.(...)

Some of my colleagues had the responsibility of preparing long-range weather forecasts, i.e. for the following months. The statisticians among us subjected these forecasts to verification and found they **differed in no way of chance**. The forecasters themselves were convinced and requested that the forecasts be discontinued.

The reply read approximately like this: **‘the Commanding General is well aware that the forecasts are no good. However, he needs them for planning purposes’.**”

Kenneth Arrow, 1992  
(ganhou o Nobel em 1972)

# Duas grandes etapas no programa econométrico

- 1) análise de ciclos e ressonância (Frisch): **termo aleatório como “choque” ou “estímulo”**
- 2) sistema de equações simultâneas e equilíbrio geral (Marschak, Lange, Tinbergen): **termo aleatório como “erro”**



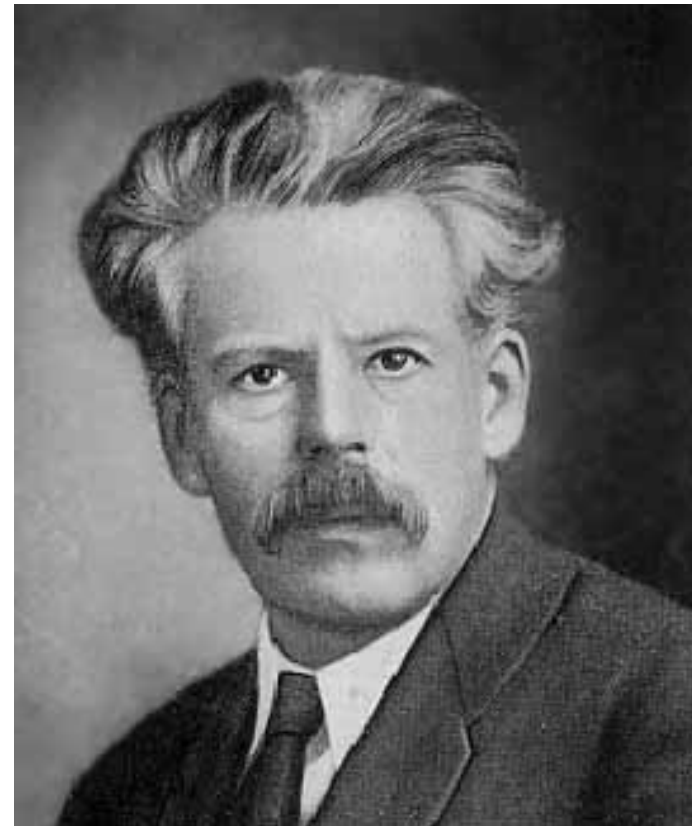
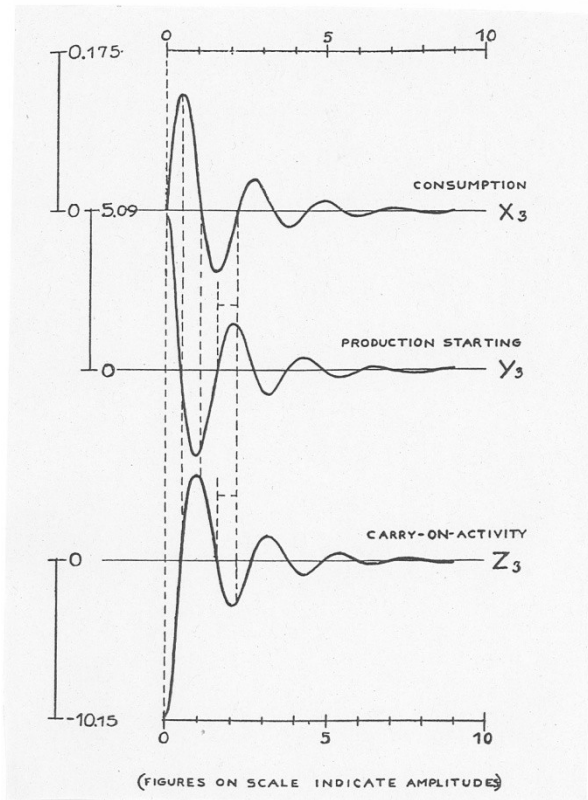
# Rocking horse (a founding metaphor for cycles)



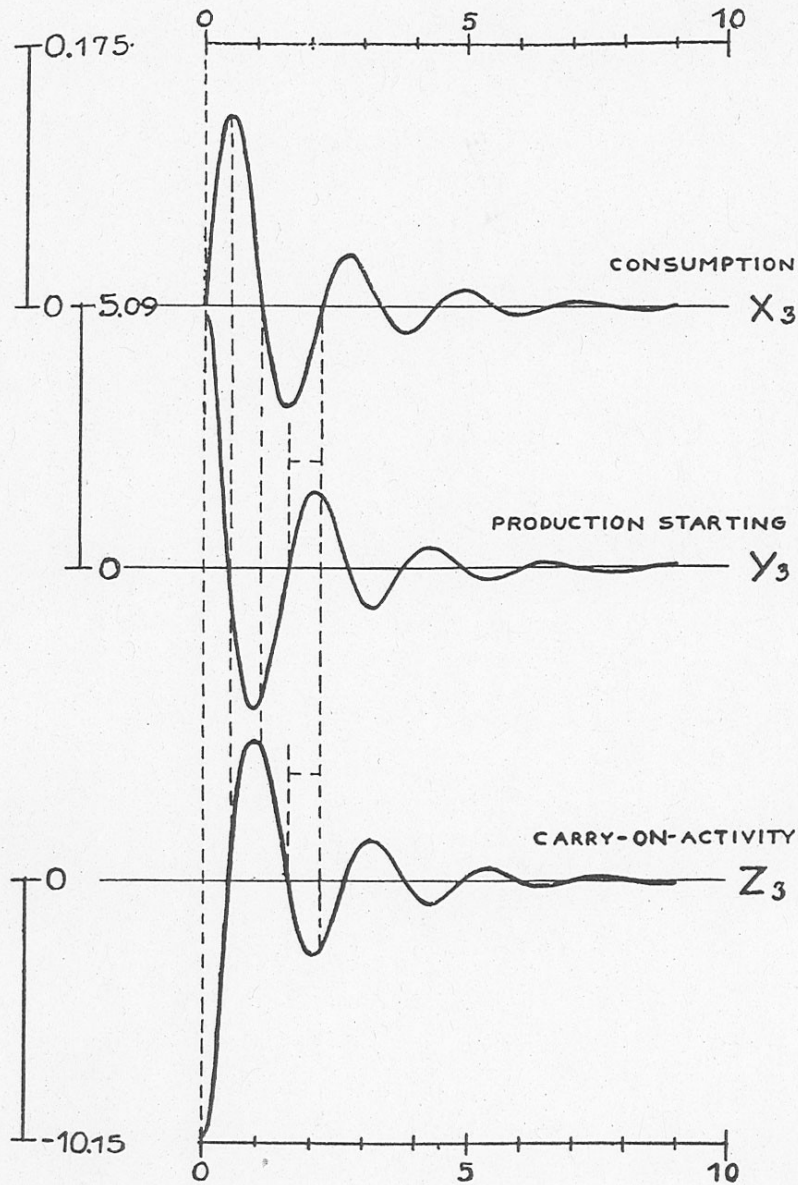
# O modelo do cavalo de balouço (Frisch, 1933)

**propagação + impulso**

**E. Slutsky**



# O Modelo de Frisch (1933)



(FIGURES ON SCALE INDICATE AMPLITUDES)

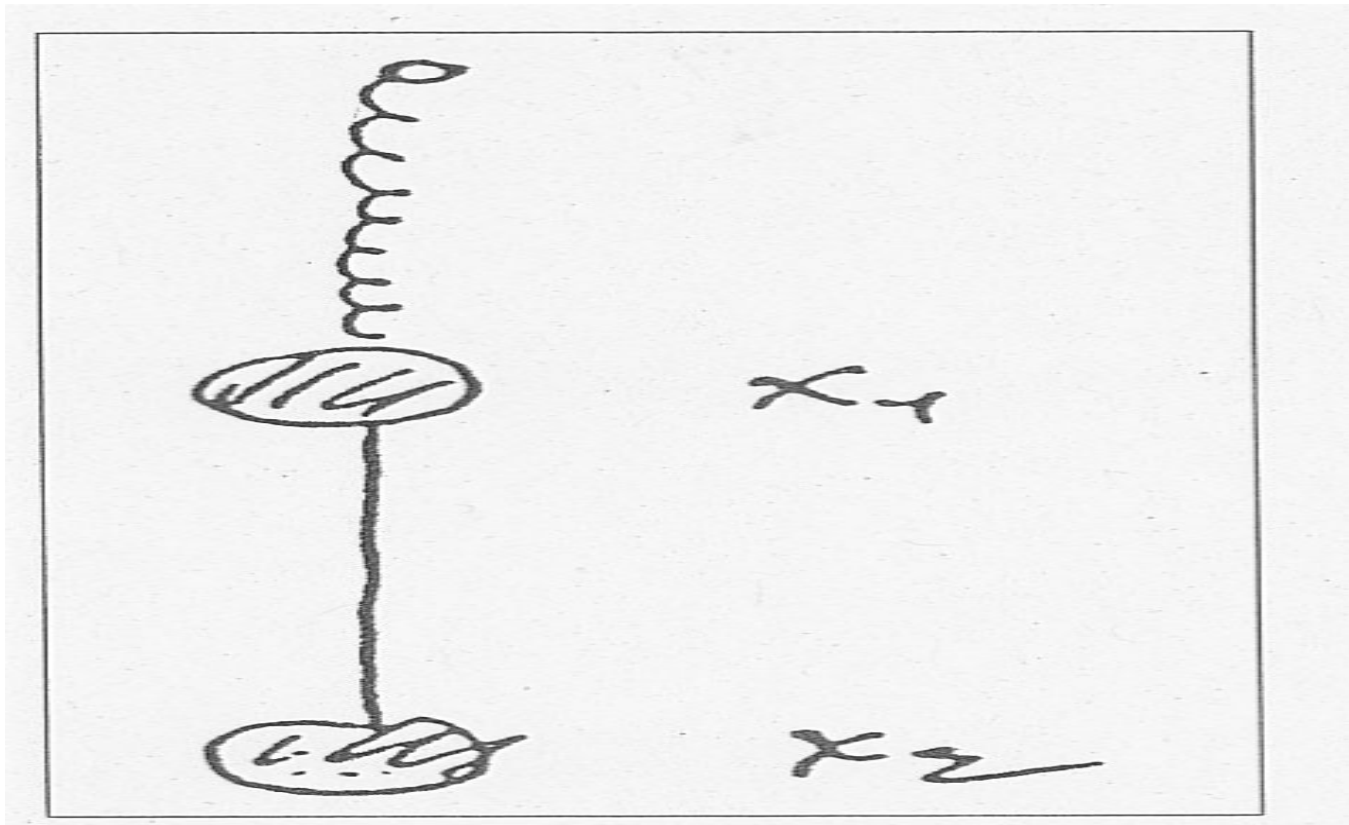
# Frisch 1933

The idea of erratic shocks represents one very essential aspect of the impulse problem in economic cycle analysis, but probably it does not contain the whole explanation. There is also present another source of energy operating in a more continuous fashion and being more intimately connected with the permanent evolution in human societies. The nature of this influence may perhaps be best exhibited by interpreting it in the light of Schumpeter's theory of the innovations and their role in the cyclical movement of economic life. Schumpeter has emphasized the influence of new ideas, new initiatives, the discovery of new technical procedures, new financial organizations, etc., on the course of the cycle. He insists in particular on the fact that these new



# And what if the BC depend on related variables?

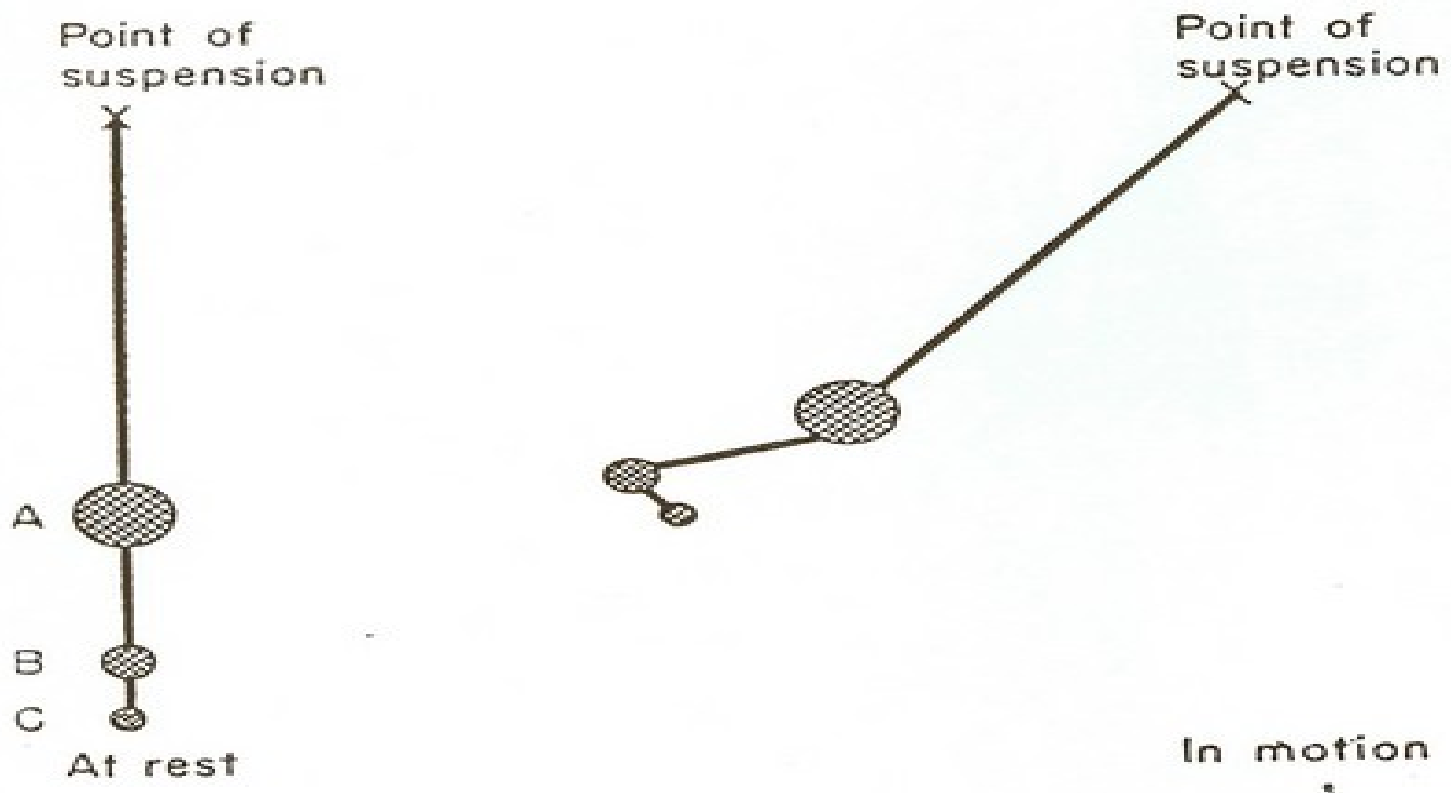
(a representation by Frisch of a double pendulum)



# Frisch: the three pendula by Marshall

Figure 4

Frisch' triple pendula,  
entending Marshall's views on the time dimensions



# **An illustration of endogenous and cumulative causality (1)**

The debate between Schumpeter and Frisch:

Mechanical models or superimposition of different wave movements (and endogenous causation)?



# O debate entre Frisch e Schumpeter (2)

- “o ponto essencial da evolução”: endogeneidade da inovação e das transformações (acumulação de capital e aumento de produtividade)...
- ... ou exogeneidade dos “choques” sistêmicos
- ... e, se são exógenos, porque são aleatórios?

# Impulse + Propagation

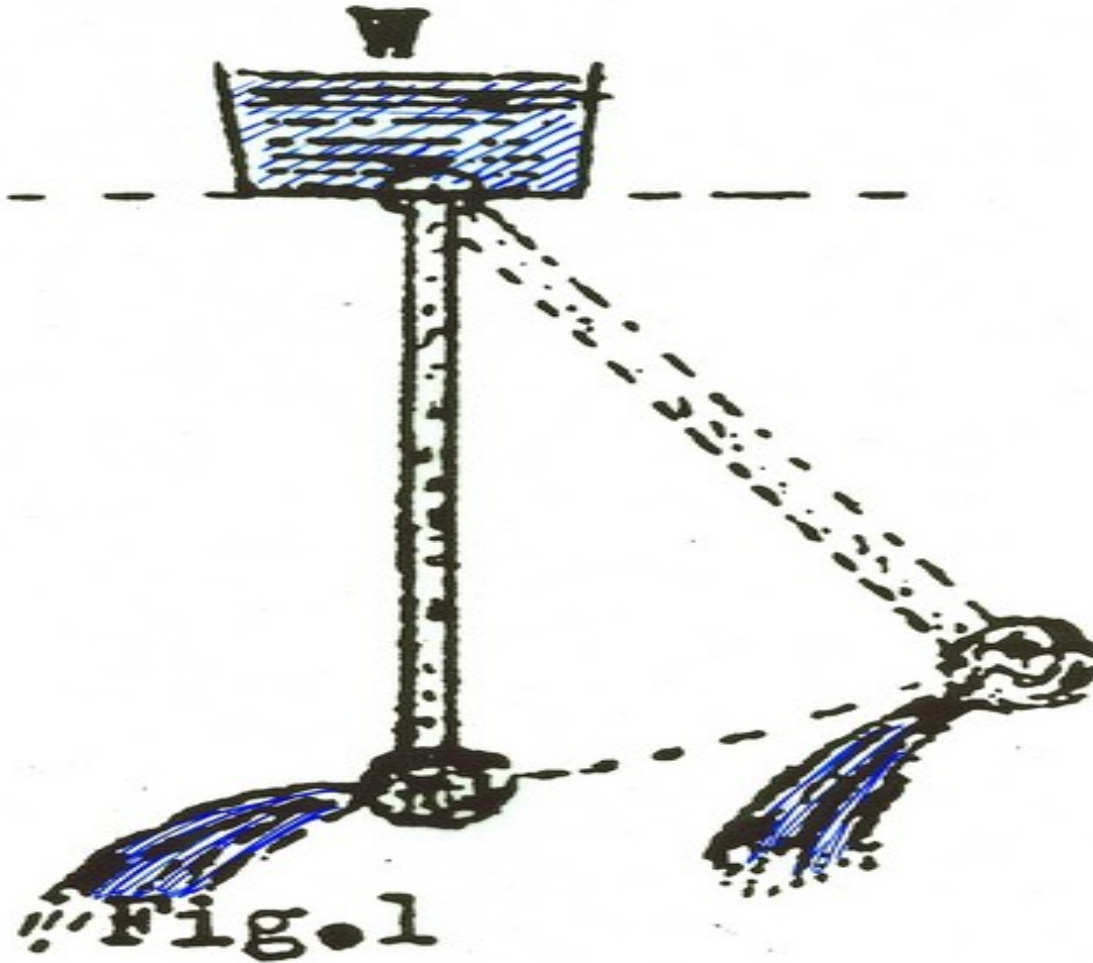
“I think I understand now your point about dynamics. Those things you mention: the more or less unpredictable innovations are those things that in my terminology would form the substance of the impulse problem, as distinguished from the propagation problem. Some other time I want to write you more fully about this.” (Frisch to Schumpeter, 28th May 1931)

# Reply by Schumpeter, June 1931

“This [the discussion of the nature of statics, ‘a problem à la pendulum’] would be all, if data did not vary except by influences which we could call influences “**from without**” or by “growth”. But there is an agent, within the economic world which alters data and with these the economic process: **entrepreneurial activity**, which I have elsewhere given the reasons for considering as something sui generis. (...)

It not only **destroys existing equilibrium**, but also that circuit-like process of economic life, it makes economic things **change** instead of making them **recur**.”

# The Schumpeterian pendulum (Frisch's version)



S: FRISCH (1933-34)  
МАКРОДYNAMИКА

# Frisch: a non-stochastic view?

Frisch (1933, on his Schumpeter pendulum):

“if fully worked out, I believe that this idea will give an **interesting synthesis between the stochastic point of view and the point of view of rigidly determined dynamical laws**“

# Schumpeter on innovations

“I am not quite satisfied by your classification of the ‘innovations’ as part of the impulse problem (...), because this seems to coordinate them with events, which **come from outside** the economic system such as chance gold-discoveries. The problem with these is simply to discover the reaction of the economic system on them. (...) Now as I look at it, **any innovations are something different to impulses in this sense. They come from inside.**”

Or no cycles at all?

# Léon Walras e o ciclo como um lago, raramente perturbado por uma brincadeira de criança





# Robert Lucas: cycles no more



“My thesis in this lecture is that macroeconomics in this original sense has succeeded: its central problem of depression prevention **has been solved**, for all practical purposes, and has in fact been solved **for many decades**”

(Lucas, 2003, “Macroeconomic Priorities”, *AER* 93-1: 1-14)

# What is “modern macro”?

## The *New Consensus*

- **NC macro (RBC) + New Keynesian macro**
  - *RBC: technological shocks and fluctuations of  $Y$*
  - *NK: nominal rigidities (prices and wages)*
- **Synthesis:**
  - 1 intertemporal optimization with rational agents
  - 2 imperfect competition with costly price adjustments
  - 3 DSGE, dynamic stochastic general equilibrium

Como é que estes  
modelos usam o conceito  
de aleatoriedade de  
variáveis económicas?

# Mechanics (Lucas)

“One exhibits understanding of business cycles by constructing a model in the most literal sense: a fully articulated, **artificial economy** which behaves through time so as to imitate closely the time series behavior of actual economies”. (Lucas 1977)

# Lucas: toy economies

“On this general view of the nature of economic theory then, a ‘theory’ is not a collection of assertions about the behavior of the actual economy but rather an explicit set of instructions for building a parallel or analogue system—a **mechanical, imitation economy**. A ‘good’ model, from this point of view, will not be exactly more ‘real’ than a poor one, but will provide better imitations”. (Lucas 1980, 697)

# A mechanical economy: RBC, the dominant view in business cycles analysis

The RBC models represent a **stationary process** around a stochastic trend.

The **shocks** are thus considered as real and persistent on the supply side; long-run “innovations” of the trend affect the short-run cyclical behavior of the system.

# Assumptions of a RBC model

*(from Kydland and Prescott, 1982)*

competitive economy

rational expectations

money neutrality

technological shocks (explaining the cycles)

endogenous supply of labour, constant on the long run

# A RBC model

A RBC model:

$$y_t = A_t f(k_t, l_t)$$

$$k_{t+1} = (1 - \delta)k_t + y_t - c_t$$

$$U(c_t, 1 - l_t)$$

where  $A_t$  is a random productivity shock,  $1 = T$  is the number of hours available in the period,  $l_t$  is time spent working,  $1 - l_t$  is time spent as leisure and  $\delta$  is the depreciation rate. This model is essentially the Ramsey growth model except for (i) the random productivity shock (ii) consumers maximise utility by choosing consumption *and* leisure.



If a Cobb-Douglas is used, we have a highly persistent technological shock (for US data)

$$y_t = A_t k_t^\alpha l_t^{1-\alpha}$$

$$\ln y_t - \alpha \ln k_t - (1 - \alpha) \ln l_t = \ln A_t$$

Published data are available on  $y$ ,  $k$  and  $l$  and assuming factors are paid their marginal products it can easily be shown that  $\alpha$  is the share of capital income in output. Therefore it is possible to construct an estimate of  $A_t$ . Using US data gives:

$$\ln A_{t+1} = 0.95 \ln A_t + \varepsilon_{t+1}$$

$$\sigma_\varepsilon = 0.009$$

# RBC: more Slutsky than Frisch

“In contrast with modern business cycle theory, he [Frisch] emphasized damped oscillatory behavior” (Kydland and Prescott 1990), defining **equilibrium as a system of rest**. Moreover, in Frisch’s model there is **neither individual maximization nor a representative agent**.

By contrast, **Slutsky** proposed “an entirely different way of generating cycles” as the **sum of random causes**.

# Resumo

- **O que deve saber:**
  - Modelos de ciclos Juglar: modelo de cavalo-de-balouço e de pêndulos, comparados com random walk e EM Hypothesis
  - Interpretação dos choques aleatórios e do mecanismo de dissipação
- **O que deve ler:**
  - Louçã, F. (2001), *Intriguing Pendula*, Cambridge Journal of Economics, 55: 25-55 (no Aquila)