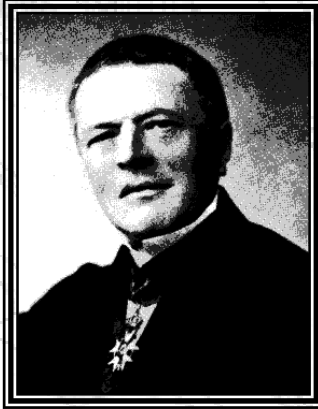




Equilíbrio Geral:
Teoria Pura, Teoria Aplicada e
Práticas Operacionais

Eduardo Amaral Haddad
*Professor Titular do Departamento
de Economia da USP*



Antoine Augustin **Cournot**, 1801-1877

"So far we have studied how, for each commodity by itself, the law of demand in connection with the conditions of production of that commodity, determines the price of it and regulates the incomes of its producers. We considered as given and invariable the prices of other commodities and the incomes of other producers; **but in reality the economic system is a whole of which all the parts are connected and react on each other.** An increase in the income of the producers of commodity *A* will affect the demand for commodities *B*, *C*, etc., and the incomes of their producers, and, by its reaction, will involve a change in the demand for commodity *A*. **It seems, therefore, as if, for a complete and rigorous solution of the problems relative to some parts of the economic system, it were indispensable to take the entire system into consideration. But this would surpass the powers of mathematical analysis and of our practical methods of calculation, even if the values of all the constants could be assigned to them numerically.**"

Cournot, Researches into the Mathematical Principles of the Theory of Wealth (1838), translated by Nathaniel T. Bacon (New York, 1929), p. 127.

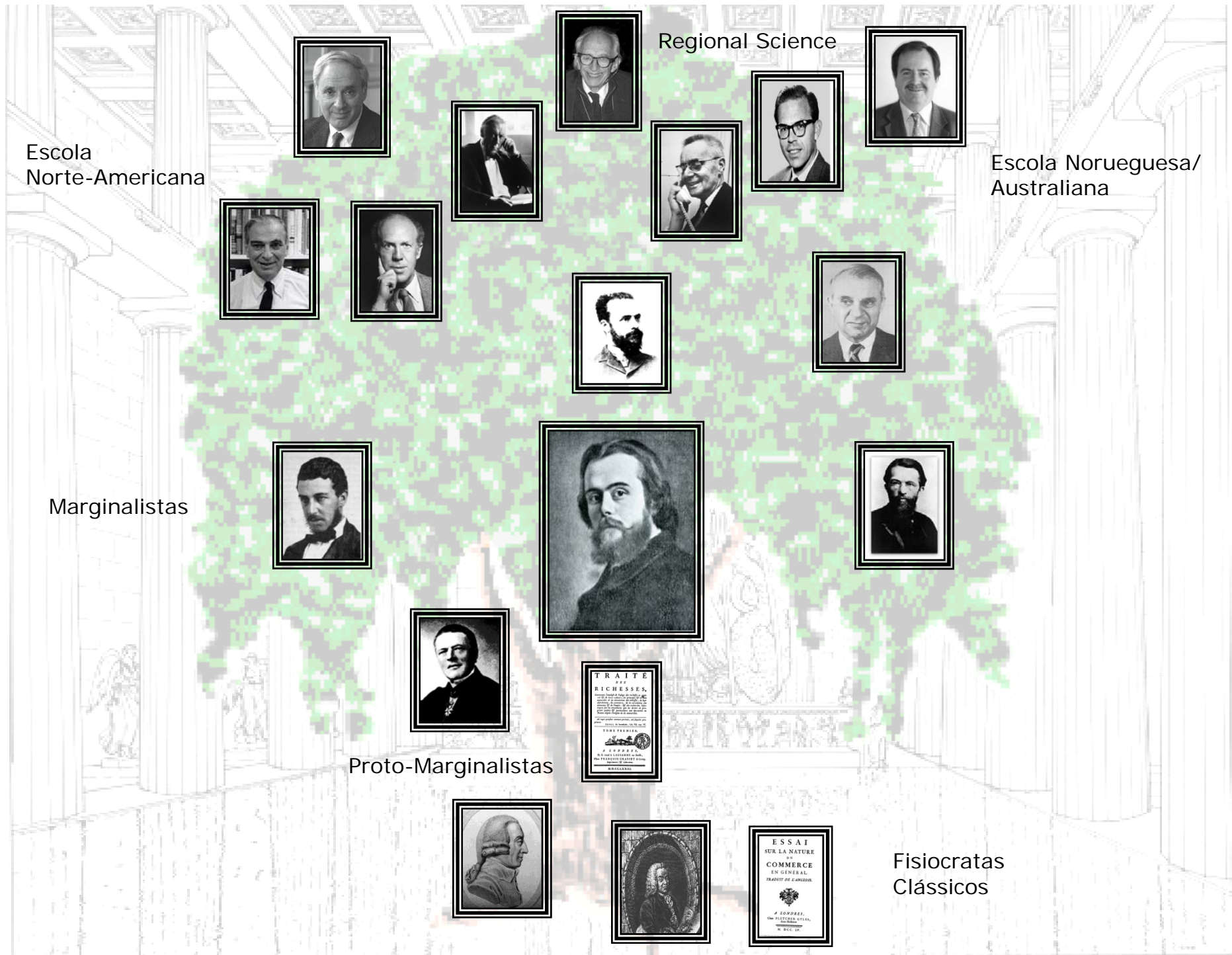


Roteiro

- Genealogia dos modelos de equilíbrio geral
- Predecessores
- O “Pai” da teoria de equilíbrio geral
- A esfera da teoria pura
- A esfera da teoria aplicada
- A esfera das práticas operacionais



Genealogia dos modelos de equilíbrio geral



Regional Science

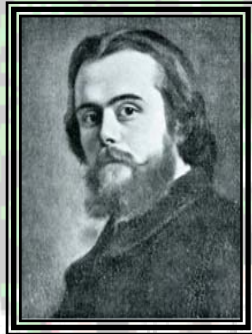
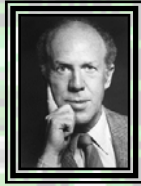
Escola Norte-Americana

Escola Norueguesa/Australiana

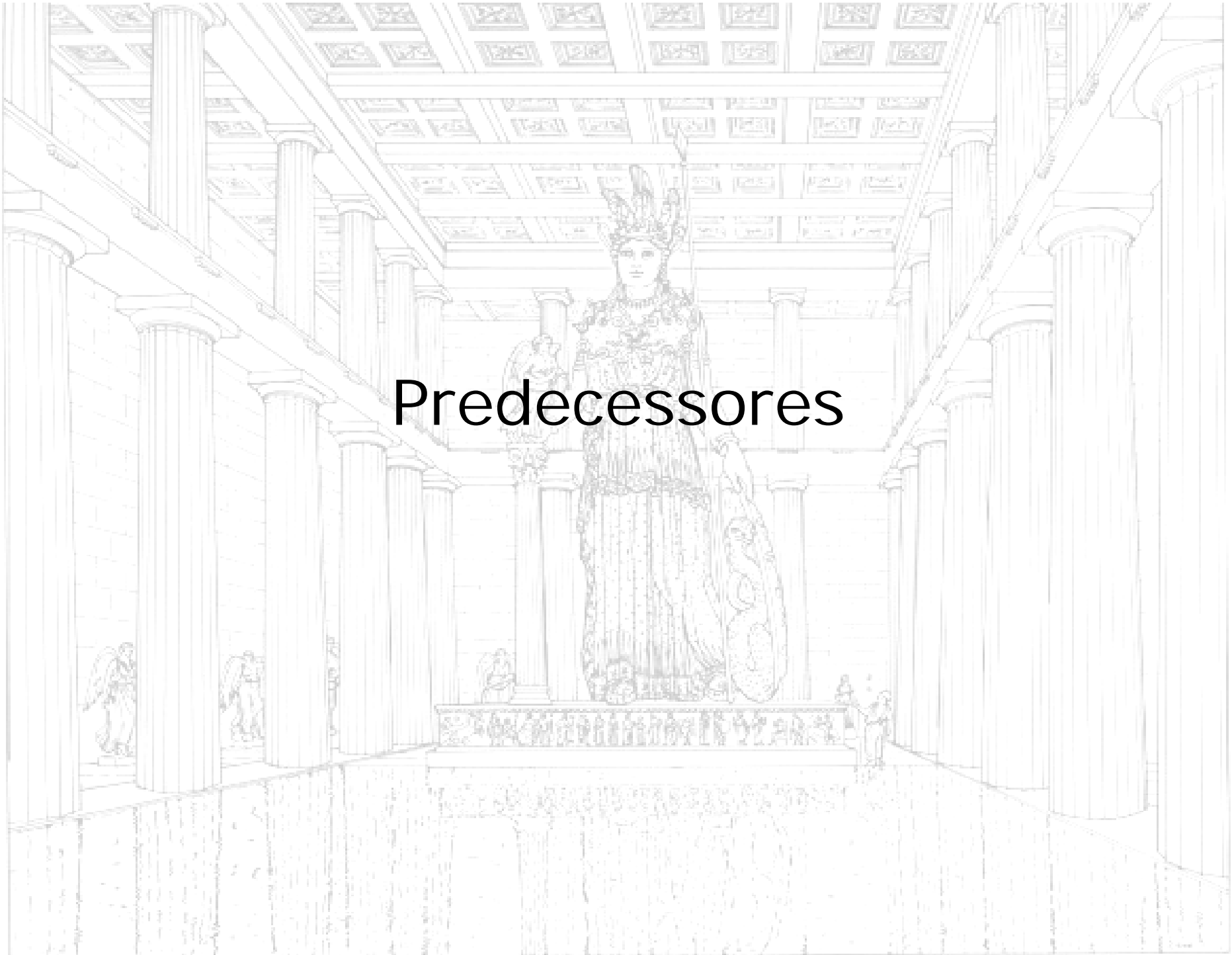
Marginalistas

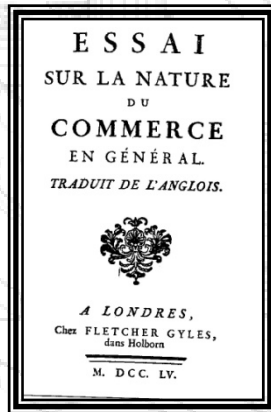
Proto-Marginalistas

Fisiocratas Clássicos

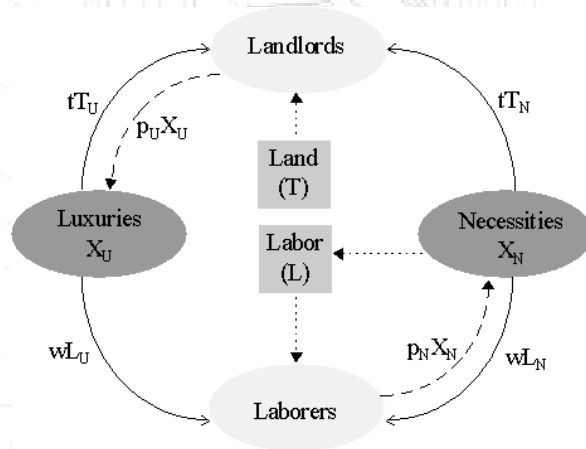


Predecessores





Richard Cantillon, 1680?-1734



"Cantillon was the first to make this circular flow concrete and explicit, to give us a bird's-eye view of economic life. In other words, he was the first to draw a *tableau économique*."

Schumpeter, History of Economic Analysis (1954), twelfth printing, (Oxford University Press, 1981), p. 222

Figure 1 – Cantillon's system
(<http://cepa.newschool.edu/>)



François Quesnay, 1694-1774

TABLEAU ÉCONOMIQUE.

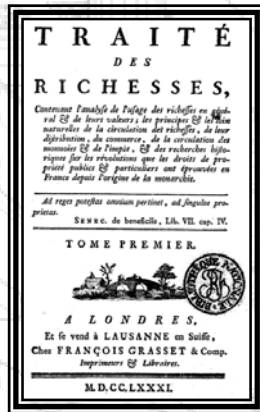
Objets à considérer, 1^o trois sortes de dépenses; 2^o leur source; 3^o leurs avances; 4^o leur distribution; 5^o leurs effets; 6^o leur reproduction; 7^o leurs rapports entr'eux; 8^o leurs rapports avec la population; 9^o avec l'Agriculture; 10^o avec l'industrie; 11^o avec le commerce; 12^o avec le reste des richesses d'une Nation.

DEPENSES		DEPENSES DU REVENU		DEPENSES	
PRODUCTIVES		Obligé prelevé, ou prélevé		STÉRILES	
advancées à l'Agriculture, &c.		aux dépenses primitives & aux dépenses actives.		advancées à l'industrie, &c.	
Avances annuelles pour produire un revenu de 600 francs par an	Revenu annuel de 600	Avances annuelles pour la consommation des dépenses stériles, comp. des avances primitives, &c.	Revenu annuel de 300	Avances annuelles pour la consommation des dépenses stériles, comp. des avances primitives, &c.	Revenu annuel de 300
600	600	300	300	300	300
300	300	300	300	300	300
150	150	150	150	150	150
75	75	75	75	75	75
37.10	37.10	37.10	37.10	37.10	37.10
18.15	18.15	18.15	18.15	18.15	18.15
9.7.6	9.7.6	9.7.6	9.7.6	9.7.6	9.7.6
4.13.9	4.13.9	4.13.9	4.13.9	4.13.9	4.13.9
2.6.10	2.6.10	2.6.10	2.6.10	2.6.10	2.6.10
1.3.5	1.3.5	1.3.5	1.3.5	1.3.5	1.3.5
0.11.8	0.11.8	0.11.8	0.11.8	0.11.8	0.11.8
0.5.10	0.5.10	0.5.10	0.5.10	0.5.10	0.5.10
0.2.11	0.2.11	0.2.11	0.2.11	0.2.11	0.2.11
0.1.5	0.1.5	0.1.5	0.1.5	0.1.5	0.1.5

REPRODUIT TOTAL 600^{fr.} de revenu; de plus, les frais annuels de 600^{fr.} et les intérêts des avances primitives du laboureur, de 300^{fr.} que la terre rend. Ainsi la reproduction est de 1600^{fr.} compris le revenu de 600^{fr.} qui est la base du calcul, abstraction faite de l'impôt prélevé, et des avances que l'usage de la reproduction annuelle, &c. Voyez l'Explication à la page suivante.

"Le *Tableau économique* renferme les trois classes [classe productive, classe de propriétaires, classe stérile] et leurs richesses annuelles, et décrit leur commerce dans la forme qui suit (...)"

Quesnay, *Tableau Économique des Physiocrates* (1758), Préface de Michel Lutfalla (Calmann-Lévy, 1969)



Achille-Nicolas Isnard, 1749-1803

"The first to attempt a (primitive) mathematical definition of equilibrium and a (also primitive) mathematical proof of that proposition was Isnard, who has as yet to conquer the position in the history of economic theory that is due him as a precursor of Léon Walras."

Schumpeter, History of Economic Analysis (1954), twelfth printing, (Oxford University Press, 1981), p. 217

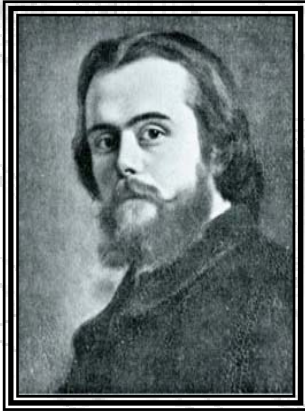
"In his *Traité des Richesses* (published anonymously in 1781), (...) Isnard addressed the determination of prices in an exchange economy. He set the problem out mathematically in a multi-good scenario as a system of equations, counting equations and unknowns, determining the numéraire, etc. Isnard's work was highly influential upon Léon Walras."

Informação extraída de:

<http://cepa.newschool.edu/het/index.htm>



O "Pai" da teoria de equilíbrio
geral



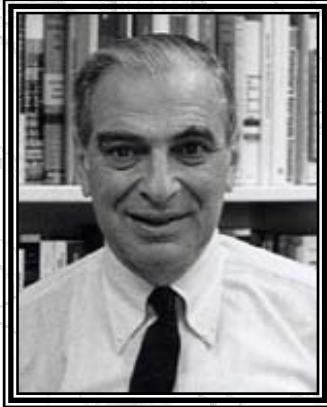
Marie-Ésprit Léon **Walras**, 1834-1910

“Théoriquement, toutes les inconnues du problème économique dépendent de toutes les équations de l'équilibre économique. Toutefois, même au point de vue statique et théorique, il est bien permis de considérer certaines de ces inconnues comme dépendant plus spécialement des équations qui s'introduisent avec elles dans le problème pour les déterminer. Et à bien plus forte raison a-t-on ce droit quand on passe du point de vue statique au point de vue dynamique et surtout du point de vue de la théorie pure au point de vue de la théorie appliquée et à celui de la pratique, vu qu'alors les variations des inconnues sont des quantités du premier ou du second ordre, c'est-à-dire des quantités non négligeables ou négligeable suivant qu'elles proviennent de variations dans les données générales ou dans les données spéciales.”

Walras, Eléments d'Économie Politique Pure (1874), Édition définitive revue et augmentée par l'acteur (Paris, 1952), p. 289.



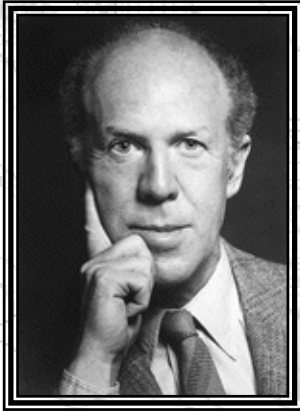
A esfera da teoria pura



Kenneth J. **Arrow**, 1921-

"It is natural and proper to ask whether this enquiry into an economy, apparently so abstracted from the world, is worthwhile. (...) There is by now a long and fairly imposing line of economists from Adam Smith to the present who have sought to show that a decentralized economy motivated by self-interest and guided by price signals would be compatible with a coherent disposition of economic resources that could be regarded, in a well-defined sense, as superior to a large class of possible alternative dispositions. Moreover, the price signals would operate in a way to establish this degree of coherence. (...) The proposition having been put forward and very seriously entertained, it is important to know not only whether it *is* true, but also whether it *could be* true. A good deal of what follows is concerned with the last question, which seems to us to have considerable claims on the attention of economists. If confirmation of the proposition we have been discussing has been found in particular formalization of the economy, it then becomes interesting to see how robust this result is."

Arrow and Hahn, General Competitive Analysis (1971), Holden-Day Inc. (San Francisco), pp. vi-vii



Gérard Debreu, 1921-2004

"The two central problems of the theory that this monograph presents are (1) the explanation of the prices of commodities resulting from the interaction of the agents of a private ownership economy through markets, (2) the explanation of the role of prices in an optimal state of an economy. The analysis is therefore organized around the concept of a price system or, more generally, of a value function defined on the commodity space. The first solutions of the two preceding problems were achieved by L. Walras and V. Pareto respectively, but neither the masters of the school of Lausanne nor their disciples for several decades gave a very rigorous account of their ideas."

Debreu, Theory of Value: An Axiomatic Analysis of Economic Equilibrium (1959), Yale University Press (New Haven), p. ix

A detailed black and white architectural drawing of a grand classical hall. The room features a high ceiling with a coffered pattern and is supported by a series of tall, fluted columns. In the center, a large, ornate statue of a female figure stands on a raised platform. The statue is dressed in a long, flowing gown and wears a tall, elaborate headdress. The floor is highly reflective, showing a clear mirror image of the statue and the surrounding architecture. The overall style is reminiscent of classical or neoclassical art.

A esfera da teoria aplicada



Wassily **Leontief**, 1906-1999

“Input-output was novel and inspired large-scale empirical work – and has been used for economic planning throughout the world – whether in Western, Socialist or Third World countries. It was also of crucial theoretical importance. Input-output inspired the analysis of linear production systems – which were instrumental in the development of modern Neo-Walrasian theory (...)”

Informação extraída de:

*<http://www.econ.jhu.edu/people/fonseca/het/leontief.htm>
(Part of Gonçalo Fonseca's History of Economic Thought web site)*



Leif Johansen, 1930-1982

"The underlying model is in most respects an equilibrium construction (...) These few details are not meant even to give the flavor of the model. My goal is just to say something about Johansen the economist. **What is striking in this part of his work is its pragmatic approach. There is always the discipline of a formal model in the background.** It is too much to say that anything goes; but he is always willing to experiment, to listen to the data and their limitations, but to be as sophisticated in conceptual approach as they will allow, to relax an a priori constraint to see if doing so will improve the fit of model to reality. This pragmatic attitude is visible also in the *Lectures on Macroeconomic Planning*, which have that reassuring ability to suggest the controlling presence of analytical bones in the background while allowing for the cushion of common sense in applying them to the everyday problems of the real economy."

Solow, R.M., Leif Johansen (1930-1982): A Memorial, 1982

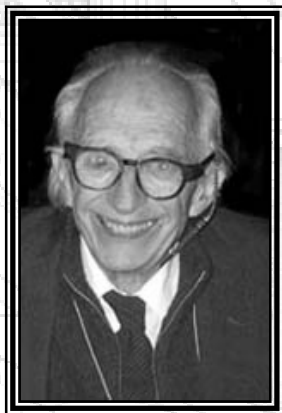
(On Leif Johansen's lifelong interest in the use of fairly aggregative – but still multisectoral – long-term models as a guide to macroeconomic planning)



Herbert E. **Scarf**, 1930-

"When cast in mathematical form the general equilibrium model becomes a complex system of simultaneous equations (...) for the determination of all prices and output levels in the economy. (...) the system is so complex that the existence of a solution can be guaranteed only by an appeal to fixed point theorems rather than by more elementary and constructively oriented techniques. As a consequence, general equilibrium analysis has remained at a level of abstraction and mathematical theorizing far removed from its ultimate purpose as a method for the evaluation of economic policy. The present monograph attempts to remedy this difficulty by providing a general method for the explicit numerical solution of the neoclassical model."

Scarf, The Computation of Economic Equilibria (1973), Yale University Press (New Haven), p. ix



Walter **I**sard, 1919-

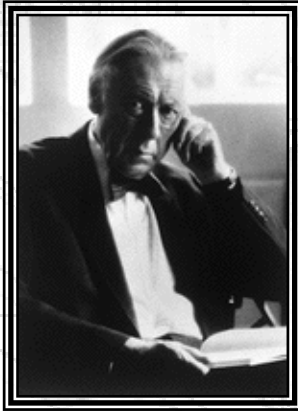
"The recognition of the **spatial element** in the formation of a general equilibrium in a complex space-economy already dates back to early work of Lösch, **I**sard and Samuelson (...)"

Van den Bergh et al. (Eds), Recent Advances in Spatial Equilibrium Modelling (1996), Springer-Verlag (Berlin), p. v

"The future will be characterized by computerized, multiregional, complex simulation models that endeavor to unravel the complex tapestry of **interregional interconnectedness**."

"Some **seminal contributions** by regional scientists to the development of an applied general interregional model for a pure space economy (...) As this book goes to press, **a study just completed by Haddad (1998) represents a major step forward.**"

Isard, Methods of Interregional and Regional Analysis, 1998, p. 397




Sir John Richard N. **Stone**, 1913-1991

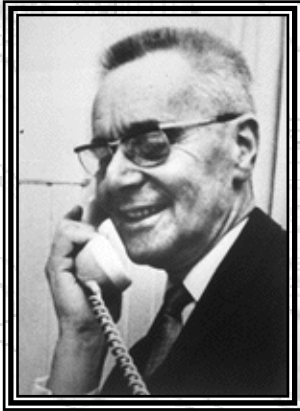
"(...) we shall try to trace the connection between social accounting on the one hand and economic theory on the other. Social accounting is concerned with a comprehensive, orderly, consistent presentation of the facts of economic life, in which the concepts, definitions and classifications adopted lend themselves to actual measurement and (...) correspond to those which appear in economic theory and so can be used for economic analysis. Thus even if we start from an empirical point of view we shall find ourselves listening to the suggestions of theory at every turn (...) The facts we present and the way we arrange them depend a great deal on considerations of theory."

Stone, R. and Stone, G., National Income and Expenditure (1964), Bowes and Bowes (London), pp. 112

(On social accounting in relation to economic theory and analysis, I)



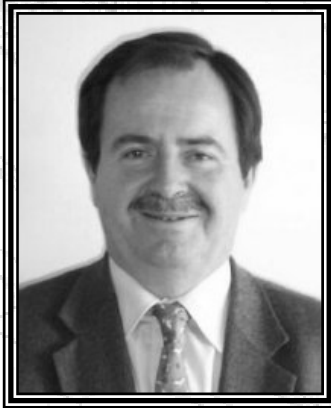
A esfera das práticas operacionais



Jan Tinbergen, 1903-1994

"I do think, however, that the utility of models goes beyond their didactic value. They are a real and essential element in the preparation of well-coordinated policies. But they cannot do this job all by themselves. Models constitute a framework or a skeleton and the flesh and blood will have to be added by a lot of common sense and knowledge of details. Again, as a framework they can be of vital importance. (...) A need generally felt by model builders and their critics is the need for refinement, that is, for the introduction of many more variables. In a way this experience again was a lesson also to economists in general, since often their arguments run in terms not showing this degree of detail."

*Tinbergen, Prize Lecture, Lecture to the memory of Alfred Nobel,
December 12, 1969*



Peter **Dixon**, 1946-

"To me, the most attractive feature of CGE modeling is that it enables us to think clearly about the **likely implications of events for which there is no direct experience in the historical record** (...) Since the 1970s I have been involved in a large number of counterfactual CGE studies. The power of the CGE technique to reveal plausible directions of change and to provide common sense quantification has continued to hold my interest for 30 years."

Dixon, Acceptance speech for Distinguished Fellow of the Economic Society of Australia, September 30, 2003



Opção por modelos EGC

O fenômeno a ser estudado envolve a interação de vários mercados?

O fenômeno a ser estudado envolve mudanças nos preços relativos da economia?

O fenômeno a ser estudado implica em impactos desagregados diferenciados (setores, regiões, grupos de famílias, etc.)?

É desejável explicitar os pressupostos utilizados, em um contexto explicitamente estrutural (problemas de identificação)?

Aplicações



Efeitos de alterações em...

- Impostos, consumo público e contribuições sociais;
- Tarifas e outras barreiras comerciais;
- Tecnologia;
- Preços internacionais;
- Custos de transporte;
- Políticas ambientais

... sobre

- Variáveis macroeconômicas;
- Variáveis setoriais;
- Variáveis regionais;
- Mercado de trabalho;
- Variáveis distributivas;
- Variáveis ambientais



Estado-da-arte

Características da estrutura numérica (coeficientes estruturais e parâmetros comportamentais) trazem incertezas para os resultados

- Enfoque sobre a estrutura numérica (preocupação crescente na literatura)
- Qual a influência dos parâmetros utilizados sobre os resultados obtidos?
- Análise de sensibilidade sistemática
- Análise de sensibilidade estrutural
- Estimação de parâmetros-chave para calibragem (determinação da estrutura numérica)

Papel de formas funcionais

- Confiança excessiva em formas funcionais não-flexíveis
- Abordagem experimentalista vs. Abordagem conservadora (“tratabilidade”)



Estado-da-arte

Custos de transação no espaço

Dinâmica intertemporal das decisões das famílias e investimento

Integração de modelos

Boa prática

- Mecanismos de funcionamento, análise de sensibilidade sistemática, interpretação dos resultados

“Síndrome da caixa-preta”

- Modelos operacionais como **bens públicos**

A solução do “problema de Cournot”

“But this would surpass the powers of mathematical analysis and of our practical methods of calculation, even if the values of all the constants could be assigned to them numerically.”

Odisséia 8, 73

μοῦσ' ἀρ' αἰδον ἀνῆκεν αἰδε'μεναι κλε'α ἀνδρῶν

E a Musa levou o aedo a cantar a glória dos homens