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## New Keynesian economics: Between equilibrium and disequilibrium

Adriana Gafencu  
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**NEW KEYNESIAN ECONOMICS  
BETWEEN EQUILIBRIUM AND DISEQUILIBRIUM**

**A Thesis**

**Presented to the**

**Department of Economics**

**and the**

**Faculty of the College of Business Administration**

**University of Nebraska**

**In Partial Fulfillment**

**of the Requirements for the Degree**

**Master of Arts**

**University of Nebraska at Omaha**

**by**

**ADRIANA GAFENCU**

**July 1994**

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THESIS ACCEPTANCE

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## **ABSTRACT**

In an attempt to explain and forecast the behavior of economic variables and of the economy as a whole, each school of economics creates its own system of paradigms, premises and models. The New Keynesian school of thought developed from the traditional Keynesian insights tries to offer additional explanations, based on microeconomic foundations, for such phenomena as economy-wide fluctuations of output and prices and for the persistent high levels of unemployment that economies experience.

The task of New Keynesian economics is to explain the rigidities of prices and wages that keep the economy from reaching a full-employment equilibrium. The essential features of New Keynesian macroeconomics are the failure of the classical dichotomy and the absence of the Walrasian features of the economy -- the market-clearing equilibrium. But starting from these, the literature that bears the label "New Keynesian" is extremely broad and offers multiple visions of how the economy behaves.

The purpose of the present thesis is to synthesize the works that have been accomplished within the New Keynesian theory, in order to underline the common points and solutions suggested by this school, trying to provide a more precise and clear image of the theories built on New Keynesian premises; some results of empirical testing of New Keynesian models are included. The research also intends to reveal the differences in opinions, the unsolved questions, and criticisms to the New Keynesian theory. These provide roots for further research, theoretical developments, and empirical testing.

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"When you create you will always have to absorb contradictions. Because nothing is clear or obscure, incoherent or coherent, complex or simple, except the human being. Everything just exists. And when you try to find your way amid things with your awkward language, and to think of your future actions, you will not be able to find anything that is not contradictory."

Antoine de Saint-Exupery

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## 1. INTRODUCTION

In one way or another, explicitly or implicitly, every school of economics, almost every work in the field of economics employs the notion of economic equilibrium - or disequilibrium. Economics tries to understand, explain and forecast the behavior of economic variables, of the economy as a whole. Combining deductions from axiomatic principles and inference from empirical observations, various models are obtained, delivering specific implications. Whether those implications do or do not appropriately explain the observed economic phenomena guides researchers either to build on an underlying model, changing and eliminating restrictions in order to improve it, or to search for new models, based on different premises, potentially more consistent with observed reality. Such is the complexity and variety of the economic reality that models are built accepting restrictive premises and hypotheses. Each school of economics establishes its own system of paradigms and premises, no one being able to entirely explain the behavior of all the economic variables. The result is a huge array of opinions, which make difficult the understanding and the practical appliance of the macroeconomic theories.

A short review and synthesis of the main schools of thought in macroeconomics<sup>1</sup> could be helpful for the future understanding of the problems which constitute the subject of the present thesis.

There are two major traditional schools of thought in macroeconomics, classical and Keynesian. Classical economics emerged as an alternative to an earlier orthodoxy, mercantilism (sixteenth century). While mercantilists support the belief that the wealth and power of a nation depend on its stock of precious metals, and the belief in the need for state action to direct the development of the economy, classical economics emphasizes the importance of real factors in determining the wealth of a nation and underlines the optimizing tendencies of the free market in the absence of state control. The stress on real factors leads classical economics to explain the growth of the economy as a result of increased stocks factors of production and advances in technology, money being just a means of exchange with the role of facilitating transactions. The classical approach to macroeconomics is built on Adam Smith's basic assumption of the "invisible hand": people pursue their own economic interests, and as long as there are free markets, prices will adjust quickly to balance supply and demand, leading the economy to an equilibrium. The main features of classical macroeconomics are the supply-determined nature of real

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<sup>1</sup> The term macroeconomics originated in the 1930s, referring to the study of economics at an aggregate level. The key variables envisioned by macroeconomics include total output in the economy, the aggregate price level, employment and unemployment, interest rates, wage rates, and foreign exchange rates [Froyen, 1993]. The purpose of macroeconomics is to determine the levels of these variables and changes over time in the same variables. Of particular interest is the way in which macroeconomic variables are affected by government policies.

output and employment (classical vertical supply curve), the assumption of perfectly flexible prices and wages, perfect information about market prices for all agents of the economy, full-employment equilibrium in the economy, reached through perfect competition and market clearing, and noninterventionist macroeconomic policy. The self-stabilizing mechanisms of the economy in the classicalists' view are (1) the interest rate, which keeps shocks in sectoral demands from affecting aggregate demand, and (2) the system of perfectly flexible prices and money wages, which keep changes in aggregate demand from affecting output. The fact that real (supply-side) factors are the only ones that determine real variables leads to the classical dichotomy between real and nominal variables, and so to the neutrality of money proposition. As a conclusion, in the classical approach, markets adjust almost instantaneously to equilibrium (market-clearing equilibrium), and business cycles are the free markets' best response to economic disturbances, so that there is no reason for government interventions.

Keynesian economics developed on the background of the world depression of the 1930s, with an unprecedented length and severity of economic decline. In contrast to the classicalists, Keynesians do not believe in the ability of free markets to adequately respond to shocks. The basic idea of Keynesianism is the rigidity of wages and prices; since wages and prices are sticky, they cannot quickly adjust to market-clearing levels. The acceptance of the assumption of price and wage rigidity implies that the economy can move away from its general equilibrium level for significant periods of time. While the classical aggregate supply curve was assumed to be vertical, the Keynesian aggregate

supply curve slopes upward to the right, as a result of the stickiness of the money wage and the failure of market participants to correctly perceive the real wage. Output and employment are no longer completely supply-determined; aggregate demand can affect output as well, and demand management policies are important. While in the classical approach the aggregate demand schedule depends only on the level of the money stock, in the Keynesian approach the aggregate demand depends also on the levels of fiscal variables, investments, as well as other variables. The interest rate does not completely insulate aggregate demand from changes in sectoral demands. This difference between classicals and Keynesians in the determinants of aggregate demand leads to different explanations for the sources of instability and the role of policy in stabilizing the economy. In the Keynesian view, the instability of investment demand is the major cause of cyclical fluctuations in income, and fiscal policy can be used to stabilize aggregate demand even when investment demand is unstable. At the policy level, Keynesian theory states that involuntary unemployment<sup>2</sup> exists and, without government interventions, any adjustment of the economy back to full employment is slow and involves cycles and overshooting. Keynesian theory allows money to play a role in the business cycle (assigning an important role to the current level of nominal wages); it is also anti-market-clearing equilibrium and interventionist.

The monetarist approach was born in an attempt to attach greater importance to

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<sup>2</sup> Involuntary unemployment appears when in the labor market there are people willing to work at a lower wage than at the existing level and are not able to do so.

the money supply. In the classical approach money did not matter at all, except for the price level. In the Keynesian approach money was one of a number of important determinants of the level of economic activity. In the Keynesian view of the quantity theory of money<sup>3</sup>, velocity was not constant or independently determined, but exogenously determined outside the system. Monetarists (whose main proponent was Milton Friedman) considered the velocity of money as being highly stable and determined independently of the other endogenous variables in the equation. As a consequence, changes in the quantity of money can affect prices. The main monetarists assumptions are that the supply of money is the dominant influence on nominal income; in the short run, the supply of money influences real variables such as output and employment, but in long run real variables are determined by real, not monetary factors; economic instability is primarily a result of government interventions; stabilizing money growth removes the major source of instability. While Keynesians consider fiscal policy actions as having significant and sustained influence on the level of economic activity together with monetary policy, monetarists believe that monetary policy is the most important, and they are noninterventionists, in that they advocate fixed money supply growth rate rules as opposed to discretionary policy.

The widespread involuntary unemployment and the fluctuations in aggregate

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<sup>3</sup> The starting point for the quantity theory of money is the equation of exchange, which relates the volume of transactions at current prices to the stock of money times the turnover rate of money (velocity). The equation of exchange is  $MV = PQ$ , where  $M$  = the quantity of money,  $V$  = velocity of money,  $P$  = price, and  $Q$  = level of output.

demand as a source of short-run changes in aggregate economic activity of the 1930s required a new theory in order to be explained. A single explanation of both phenomena was developed over the next three decades by the "neoclassical synthesis": there is only a sluggish adjustment of prices in money units to imbalances between supply and demand. The classical dichotomy between nominal and real variables failed, because it was nominal wages that were slow to adjust. However, markets for goods and labor remained Walrasian, assuming perfect competition, absence of externalities, and perfect information. But in a competitive setting environment there are numerous incentives that lead economic actors to respond to imbalances between supply and demand by adjusting prices. Thus, Walrasian behavior was seriously questioned, leading to the collapse of the neoclassical synthesis and the splitting of macroeconomics into two streams.

The first school abandoned the premises of both the neoclassical synthesis and those of Keynesian macroeconomics. This theory -- Real Business Cycle theory -- accepts the classical dichotomy and denies the existence of significant involuntary unemployment.

The second school attempted to give a description of the microeconomics of unemployment and price rigidities in order to provide adequate theoretical foundations for Keynesian macroeconomics. According to this school -- New Keynesians -- the classical dichotomy fails and so does the assumption of a continuous Walrasian equilibrium in the labor market.

As we have seen, underlying macroeconomics as separate research field are the phenomena of economy-wide fluctuations of output and prices and sometimes persistent high levels of unemployment. For more than 200 years, there have been two basic opposing views of macroeconomic behavior, classical and Keynesian economics. The modern versions of these can be referred to as the New Classical economics and the New Keynesian economics positions.

The New Classical economics developed as opposition to the Keynesian theories in the setting of the high inflation and unemployment of the 1970s. The central idea of New Classical economics is that stabilization of real variables (such as output and employment) cannot be accomplished through aggregate demand management policies, as Keynesians state, because in the classical model aggregate demand depends only on the level of the money stock, and money is neutral even in the short-run. New Classics reject the Keynesian difference between the short run and the long run analysis of the effects of aggregate demand on output and employment. In the short run, according to the Keynesian theory, output and employment are jointly determined by aggregate supply and demand, and the economy will not be at a full employment equilibrium level; in the long run, Keynesians do not deny that the economy could reach full-employment equilibrium. New Classics modify and reinforce the traditional classical model based on individual optimizing behavior and the market-clearing assumption by incorporating



the concept of rational expectations<sup>4</sup> in place of the classical assumption of perfect information. The assumption of rational expectations implies that policy actions and their results can be anticipated. Systematic monetary policy can generate only expected price inflation or deflation, and cannot affect unemployment (only unexpected inflation could temporarily lower unemployment below its natural rate level.) Therefore, systematic and predictable changes in aggregate demand policy cannot affect real output and employment. Only unanticipated changes in aggregate demand policies could have effects on real variables, which does not provide a role for macroeconomic stabilization policies because they can be anticipated.

Within the same New Classical orientation is the theory of Real Business Cycle, which is often considered as a second generation of New Classical models. Real Business Cycle theory is based on the same classical assumptions that agents optimize and that markets clear quickly, but the theorists pay more attention to the microeconomic behavior of economic variables. The business cycle is viewed as an equilibrium phenomenon in which there is no persistent involuntary unemployment. The difference between New Classicals and Real Business Cycle theories resides in the causes of fluctuations in output and unemployment. Real Business Cycle theories assume that large and sudden technological changes can occur in the economy, which explains economic

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<sup>4</sup> According to the rational expectations hypothesis, economic agents form expectations about future changes in economic variables based not only on past information, but on all the available relevant information. This includes past and present information, as well as predictions about future events; rational expectations yield a forecast with random errors. Individuals use this expectations intelligently, avoiding systematic errors.

recessions. Fluctuations in output and employment reflect changes in the amount people are willing to work, and therefore are voluntary. In the Real Business Cycle approach, monetary policy is completely irrelevant for economic fluctuations. New Keynesian theory developed in an attempt to revitalize the traditional Keynesian insights and to find additional explanations for involuntary unemployment, based on microeconomic foundations. The label "New Keynesian" is attributed to Michael Parkin in 1982 [Gordon, 1990], who originated the term "New Keynesian Theory". One of the first uses of the label "New Keynesian Economics" in a scholarly article is by Laurence Ball, N. Gregory Mankiw, and David Romer, in 1988. The Keynesian economics of the 1990s shares the spirit of the Keynesian economics of earlier decades. Like their predecessors, New Keynesians question the relevance of the Walrasian paradigm in explaining the economy's booms and busts. They accept the fact that persistent unemployment and economic fluctuations are central and continuing problems; recessions and depressions represent market-failure on a grand scale. The principal aim of New Keynesian economics is to explain how Keynesian results can be reconciled with the neo-classical principles of utility and profit maximization. In the Classical model all wages and prices are perfectly flexible; an increase in the money supply will lead to a proportional increase in wages and prices, leaving the level of output unchanged (price and wage flexibility neutralizes the effect of the money supply increase on the actual levels of output and employment). A large number of Keynesian models are staggered-wage models which force each firm's pay scale to wait for its appointed time to adjust

to the higher money supply. As a consequence, the average wage level does not jump at first by enough to push up the price level sufficiently to neutralize the increase of the money supply. In a continuous time model the average wage level would be unable to jump at all. Real cash balances, the corresponding demand price for capital goods, and hence the level of employment will increase as long as the price level remains short of reaching the neutralizing level.

The task of New Keynesian economics is to explain why changes in the aggregate price level are sticky, that is, why price changes do not mimic changes in nominal GNP. Sticky prices imply that real GNP or output at the firm level is not an object of choice by firms or individual workers but rather externally determined. Thus, New Keynesian economics is about the choices of monopolistically competitive firms that set their individual prices and accept the level of real sales as a constraint, in contrast to New Classical economics in which competitive price-taking firms make choices about output.

The essential feature of New Keynesian macroeconomics is the absence of continuous market clearing; Keynesian models are by definition non-market clearing models. But beyond this, the literature that bears the label "New Keynesian" is extremely broad and offers multiple visions of how the economy behaves. Within the same school of thought, New Keynesians disagree with each other on many important economic and policy questions. The real issue should not be, however, the consensus or disagreement among theorists, but explaining the behavior of the real world. Another interesting aspect related to the New Keynesian theory concerns the economy's state in

such models: is this state equilibrium or disequilibrium? Many economists refer to new classical models as equilibrium business-cycle models, so that the word 'equilibrium' has almost been co-opted as meaning the opposite of the term 'Keynesian'. But the opposite of equilibrium economics is disequilibrium economics. Should the Keynesian models with low-employment equilibrium or gradual adjustment of prices be considered as models of economic disequilibrium? The answer to this question depends to a large extent on the models which are included in the New Keynesian "basket", but also on the acceptances given to the notion of economic equilibrium, as well.

The purpose of the present thesis is twofold. First, the paper is intended to be a synthesis of all the works (or at least a large number) within the New Keynesian theory. This is not to be a simple gathering and survey of materials, but an analysis of relevance of all the significant common points of the New Keynesian economics, as theoretical and methodological developments. The results allow a clear distinction of the most recent economic theoretical developments and a synthesis of the most important New Keynesian premises and paradigms. Furthermore, the research reveals the differences in opinions, and particular points of view, which allow a distinction between the different currents of the main New Keynesian stream of thought and provides a more precise and clear image of the theoretical economic models built on New Keynesian premises. Second, the practical significance of the theoretical New Keynesian models is analyzed, along with an analysis of the empirical testing that was done and the results for policy implications. Suggestions will be given for further empirical research and

theoretical developments.

Several other attempts to synthesize New Keynesian theories have been made [Rotemberg, 1987, Mankiw and Romer, 1991, Vane and Snowdon, 1992, van Ees and Garretsen, 1993]; they focused either on the theoretical premises of the New Keynesian school, or on the evolution of Keynesian theories, or on the differences between New Classicals and New Keynesians. They contain only the main theories labeled as New Keynesian, those that are the most well known; none of them is exhaustive and none of them contains all sub-streams of New Keynesian macroeconomics. There are theories from which only certain parts could be considered New Keynesian, and there are as well mixed New Keynesian theories. The intention of the present thesis is to include all these theories and proposed models, with their main assumptions, including those that are contradictory. The final product is a synthesis of the New Keynesian features of macroeconomics and of New Keynesian theories and models, together with areas of applicability and restrictions in the real world. The particular structure of this synthesis, the synthesis of all contradictions and criticisms of New Keynesian economics, the "map" of the traditional and recent macroeconomic theories, and especially the flow chart for New Keynesian theories are the main results of the research. These theoretical results could be useful for a better understanding of the most recent developments in macroeconomics and could provide new directions of research for theoretical and applied macroeconomics.

The thesis is structured into ten chapters. Chapter 1 is an introduction whose

main purpose is to offer a short overview of macroeconomic theories and their evolution, providing a historical fit for the subject of the present thesis. Chapter 2 synthesizes the main features of the analyzed macroeconomic school, New Keynesian economics. In chapter 3 the differences in mathematical and graphical approaches among the main macroeconomic models are presented, in an attempt to distinguish the New Keynesian formal models from classical, traditional Keynesian, New Classical and Real Business Cycle models. The next four chapters are dedicated to the analysis of the main streams of the New Keynesian theory, grouped according to the markets that have been mainly envisioned: labor market (chapter 4), output and goods market (chapter 5), capital and credit market (chapter 6), and coordination failures theories (chapter 7). Chapter 8 presents some of the mixed New Keynesian theories and other theories that are not entirely New Keynesian, but can bear the same label. Chapter 9 presents some findings of the empirical testing done with New Keynesian models, and their effects for policy. Finally, chapter 10 is dedicated to the conclusions of the present thesis, with the results of the study, the common points and the synthesis of New Keynesian theories, the contradictions and criticisms of the New Keynesian school, the flow chart of New Keynesian approaches to macroeconomic theory. Some limitations of the thesis and directions for further research are also included in this last chapter. The list of all works cited and consulted is presented in bibliography.

## 2. MAIN FEATURES OF THE NEW KEYNESIAN ECONOMICS

New Keynesians place a great emphasis on microeconomic foundations for the macroeconomic theory. Much effort of New Keynesian economics is aimed at showing how wage and price rigidities -- central problems -- arise from the microeconomics of wage and price setting. There are two questions whose positive answers link together the New Keynesian theories. First, the classical dichotomy fails, because prices are sticky. Therein, fluctuations in nominal variables like the money supply can influence fluctuations in real variables like output and employment. Second, real market imperfections in the economy are crucial for understanding economic fluctuations, because imperfect competition, imperfect information, and rigidity in relative prices are central to understanding why prices are sticky.

The New Keynesian economics begins with Keynes' basic insights (1) the persistence of unemployment, (2) fluctuations in unemployment, (3) clear distinction between savings and investments, and (4) disturbances in demand underlying the cyclical behavior of macroeconomic aggregates. But New Keynesians recognize the need for a more radical departure from the neoclassical framework, and for a much deeper study of consequences of imperfections in different markets. If a single theme that unites New Keynesian economics were to be selected, than it would be the belief that economic fluctuations do not reflect the Pareto efficient response of the economy to changes in tastes and technology, but rather market failures on a grand scale. The essential feature

of New Keynesian economics is the absence of continuous market clearing. This market imperfection is caused by the failure of wages and prices to adjust instantly to equilibrate supply and demand. In response to a decline in nominal demand, the aggregate price level will decline less than proportionately over a certain period of time, causing the actual price level to be above the equilibrium price level consistent with the maintenance of the initial equilibrium level of real output. This too high price level is perceived as an imposed constraint, since the level of output actually produced will not be voluntarily chosen by firms and workers. The nominal demand is not sufficient to lead to adequate real sales at the actual price level. The decline in the nominal demand and the absence of full price adjustment generate the constraints imposed by the economic system on each agent; these constraints are indirectly a result of the agents' own failure to sufficiently reduce their prices. This is the central ingredient of price stickiness [R. Gordon, 1990]. Another central theme of New Keynesian macroeconomics is that accurate empirical predictions are necessary but not sufficient conditions of an acceptable theory, which must have microeconomic foundations in the behavior of utility-maximizing and profit-maximizing individual agents.

Two important distinctions must be considered in the analysis of the New Keynesian economics, (1) between price setting in output markets and wage setting in labor markets, and (2) between nominal rigidity and real rigidity. Nominal wage and price rigidity refer to the failure of agents to adjust the nominal wage or nominal price in response to a change in nominal demand. Real wage and price rigidity refer to the



failure of agents to adjust their relative price or the real wage rate in response to a real shock. Real price/wage rigidity does not necessarily entail nominal price/wage rigidity. Indexing all prices to changes in nominal demand within the economy will preserve all real prices/wages whilst enabling perfect adjustments in nominal wages and prices to changes in demand [Hargreaves, 1992].

Real rigidities are explained in New Keynesian theories as the stickiness of a wage relative to another wage, of a price relative to another price, or of a wage relative to a price. The sources of nominal rigidities are related to the absence of full (optimal) indexation (wages, prices) in the presence of supply shocks or to menu costs (small costs required by changes in prices).

Despite the variety of opinions, approaches, and strands, three main analytical approaches can be distinguished within New Keynesian economics [van Ees and Garretsen, 1993]. The first approach focuses on the explanation of nominal and real price rigidities in labor and goods markets in order to solve the problems of sub-optimal levels of output and employment and the non-neutrality of money. These phenomena are explained by finding microeconomic foundations for price and wage stickiness that originates on the supply side of the economy [Taylor, 1979, Azariadis and Stiglitz, 1983, Yellen, 1984, Akerlof and Yellen, 1985, Mankiw, 1990, Lindbeck and Snower, 1991, Leslie, 1992, Leslie, Main and Reilly, 1992, Romer, 1993]. The second approach concentrates on the transmission between real and monetary variables, recognizing the imperfections in capital markets and including additional financial assets besides money;

this creates much more scope for interdependencies between real and financial variables, which can affect the level of real economic activity [Ball and Chechetti, 1988, Greenwald and Stiglitz, 1988, Berger and Udell, 1992, Hillier and Ibrahimo, 1993, Lewarne, 1994]. The third approach rejects the hypothesis of a unique natural rate of unemployment, which allows the economy to be characterized by multiple bootstrap<sup>5</sup> equilibria or indeterminacy of equilibria (under certain assumptions of maximizing agents, rational expectations and flexible prices.) The common features of these last New Keynesian models will be self-fulfilling expectations or path-dependent equilibria<sup>6</sup> [Gordon, 1990, Ball and Romer, 1991, Greenwald and Stiglitz, 1993, Romer, 1993].

New Keynesian theories focus on different markets -- output and goods market, labor market, capital market. Each of these markets could be viewed as a New Keynesian stream, and different strands or sub-streams can be distinguished within each of these three main New Keynesian streams. On the output and goods markets stream distinct sets of approaches concentrated on price rigidities in terms of adjustment costs, menu costs, imperfect competition, incomplete or asymmetric information. The second set of theories, on the labor market side, focused on implicit and explicit labor contracts,

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<sup>5</sup> A bootstrap process is a self-generating or self-sustaining process. Bootstrap equilibria due to coordination failures can arise in general equilibrium search models in which the auctioneer is no longer assumed to establish optimal exchange arrangements. The establishment of the equilibrium prices is still the auctioneer's task, but agents are no longer told to whom they should trade [van Ees and Garretsen, 1993].

<sup>6</sup> The self-fulfilling nature of equilibria and thus the self-fulfilling nature of expectations appear as a consequence of the fact that the level of economic activity depends on the efforts of all economic agents, but this positive interdependence cannot be communicated.

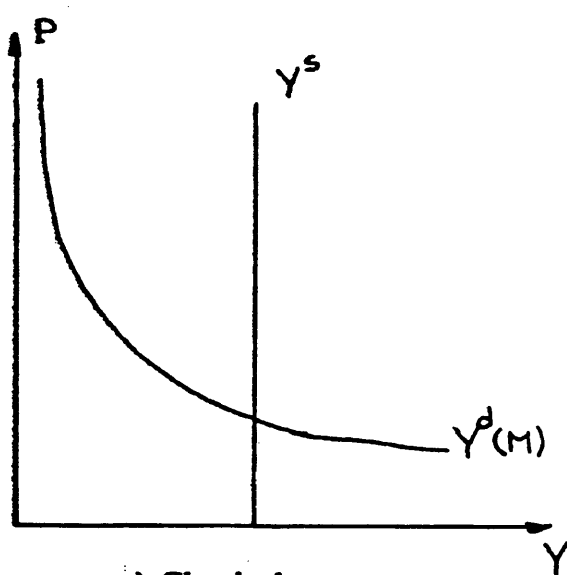
search and efficiency wages, bargaining, staggered wage adjustment, and insider-outsider theories. On the capital market the New Keynesian theories have stressed the roles of credit rationing and equity rationing. A fourth and more recent set of theories under the same label of New Keynesian consists of coordination failures theories.

All the theories summarized are not necessarily mutually exclusive. There are even New Keynesian approaches that combine two or more theories from different streams; this is one of the reasons that it is hard to gather and structure all the different theories to which the label "New Keynesian" was attributed.

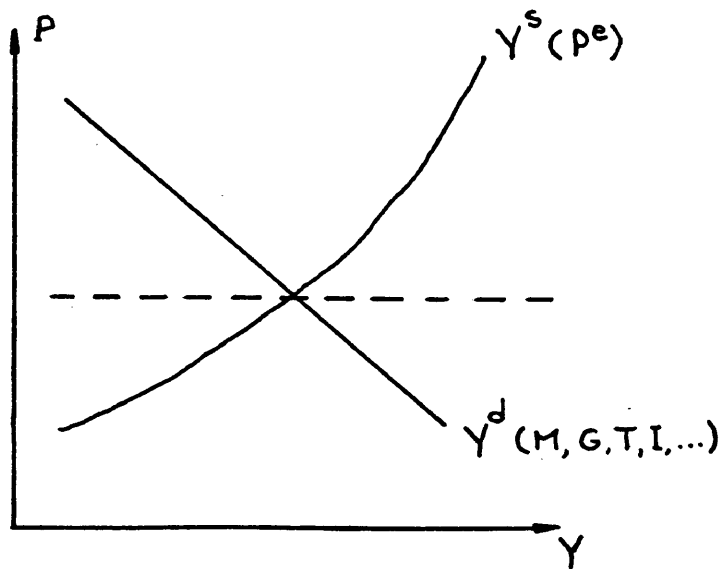
### 3. NEW KEYNESIAN MODELS IN COMPARISON WITH OTHER MACROECONOMIC MODELS: KEYNESIAN, CLASSICAL, MONETARIST, NEW CLASSICAL, REAL BUSINESS CYCLE

The main schools of macroeconomic thought, with their essential theoretical premises and features, were presented in the first chapter of the thesis. Based on those assumptions and premises, the corresponding graphical and mathematical models can be analyzed, in order to underline the differences among models belonging to different schools.

Transposing the main features of the classical, traditional Keynesian, and New Classical models into a graph, the following graphical representation results (figure nr.1, a-d).



a) Classical



b) traditional Keynesian

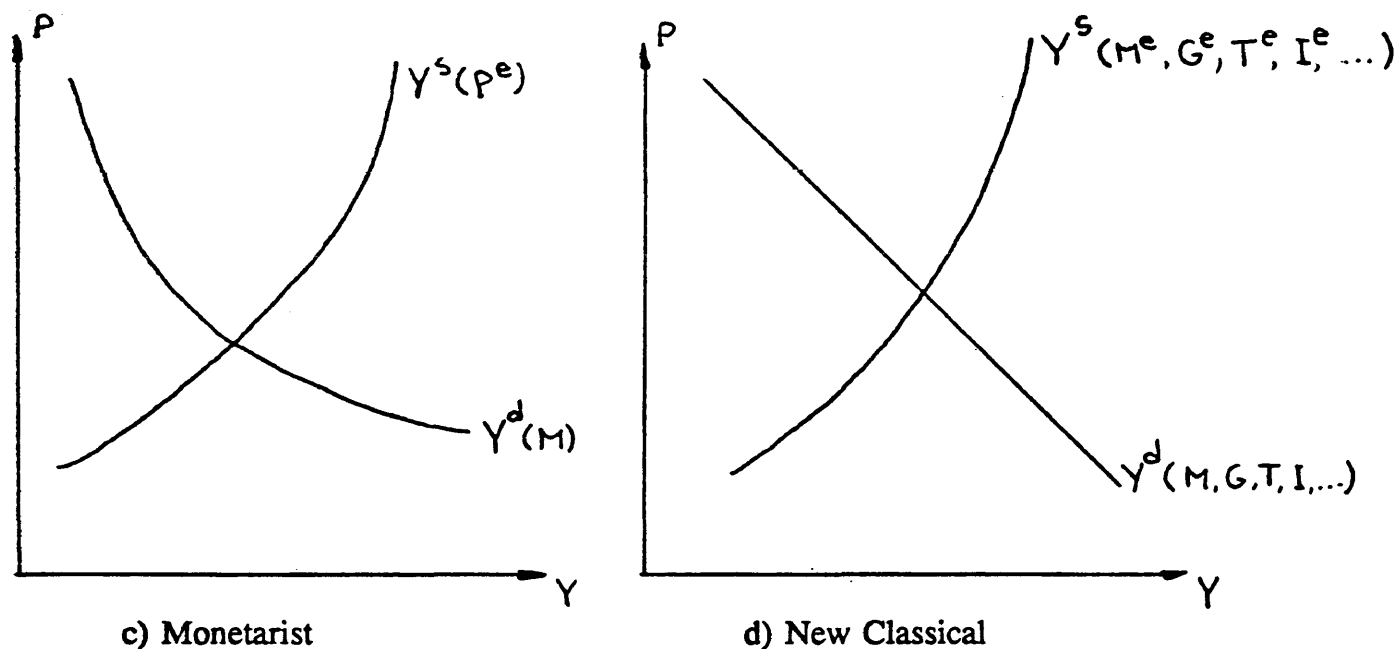


Figure nr.1: Macroeconomical models - graphical approach

Since output is completely determined by supply factors in the classical model, this will result in a vertical aggregate supply curve. Labor supply and labor demand depend only on the real wage, nominal wages are perfectly flexible. Based on the quantity theory of money (AD is a function of M - money supply), the aggregate demand curve determines the price level at market-clearing equilibrium (figure nr.1a).

The extreme Keynesian model is one in which aggregate supply has no role in output determination, which implies that the supply curve is perfectly horizontal (the opposite of the classical case). Money wages are sticky and adjust only slowly and

incompletely. In a complete Keynesian model, although the demand side plays the decisive role, both aggregate supply and aggregate demand influence output; the aggregate supply curve is upward-right sloping (and a function of the expected price,  $P^e$ ) in the short-run, and approaches the vertical case on long run. Aggregate demand is a function of not only monetary factors, but of other variables as well: government spending ( $G$ ), taxes ( $T$ ), and investment demand ( $I$ ) (figure nr.1b).

There is no fundamental difference between the Monetarist and the Keynesian model on the supply side. The aggregate demand curve is similar to the classical one, with money having a dominant influence on aggregate demand (figure nr.1c).

New Classical model's aggregate demand curve is similar to the Keynesian one, but the difference between the two models consists on the degree to which aggregate demand affects the level of real output; according to the rational expectations hypothesis, systematic changes in aggregate demand are anticipated by rational agents and do not affect the level of real output. Rational expectations are included in the supply curve, which is assumed to be a function of the expected level of the money stock ( $M^e$ ), and also the expected values of government expenditures, taxes, investments, and other determinants of aggregate demand (figure nr.1d).

A graphical representation of the New Keynesian model would be very similar to the traditional Keynesian one, and to the New Classical model, at the same time. The difference between New Classical and New Keynesian is based on different mechanisms that explain the monetary nonneutrality, which lead to different conclusions about

equilibrium and the level of employment in economy (misperceptions in the New Classical market-clearing equilibrium, with only voluntary unemployment, price and wage rigidities in the New Keynesian disequilibrium or low-equilibrium model, with involuntary unemployment)(see chapter 1.)

The same models can be presented using a mathematical approach; the equations included in such models have to describe both the supply and the demand side of the economy, and the equilibrium conditions of the system. A first equation included in the model reflects the equilibrium on the product market -- total expenditures as a function of income (aggregate demand) equal income (aggregate supply):

$$Y = C(Y - t(Y)) + I(r) + G , \text{ where:} \quad (1)$$

$Y$  = level of output (aggregate supply);

$C$  = consumption in the aggregate demand, as a function of disposable income  $Y - t(Y)$ ;

$t$  = taxes;

$I$  = investments in aggregate demand, as a function of real interest rates  $r$ ;

$G$  = government expenditures in aggregate demand.

This equation reflecting the product market equilibrium condition is usually labeled as the IS curve<sup>7</sup>.

A second equation is needed in order to determine a single equilibrium level of

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<sup>7</sup> The IS curve represents the pairs of income levels  $Y$  and interest rates  $r$  that keep the product market in equilibrium, in the sense that planned investment plus government purchases equal planned saving plus tax revenue at the given level of income.

income and interest rate, and this will describe the money market:

$$M/P = L(r) + k(Y), \text{ where: } \quad (2)$$

$M$  = supply of money;

$P$  = price level;

$L$  = speculative demand for money<sup>8</sup> as a function of real interest rate;

$k$  = transactions demand for money<sup>9</sup> as a function of income.

The sum of the speculative and transactions demand for money gives the total demand of money. This equation reflecting the equilibrium in the money market is known as the LM curve<sup>10</sup>.

A third equation included in the model describes the production function of an economy, relating the level of real output  $Y$  on the labor input ( $N$ ) and the fixed level of capital  $K$ :

$$Y = Y(N,K) \quad (3)$$

For the model to be determined, a fourth equation, describing the labor market,

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<sup>8</sup> As the name shows, the speculative demand for money is based on a speculative motive for holding money: since individual wealth can be allocated between money and bonds, a person will be inclined to hold more or less money depending on the interest rate on bonds. The speculative demand for money is also known as 'liquidity preference'.

<sup>9</sup> The transactions demand for money represents the money held in order to bridge the time gap between the receipt of income and the payments a person has to make, and it is a function of the level of income.

<sup>10</sup> The LM curve represents the pairs of interest rates  $r$  and income  $Y$  that keep the money market in equilibrium with a given level of the money supply  $M$ , and a given price level,  $P$ .



is necessary. This equation will reflect the equilibrium between the supply of labor and the demand of labor on the labor market:

$$P f(N) = P^e g(N), \text{ where:} \quad (4)$$

$P$  = price level;

$f(N)$  = aggregate demand for labor<sup>11</sup>;

$P^e$  = expected (perceived) level of prices;

$g(N)$  = aggregate supply of labor<sup>12</sup>.

The expected level of prices  $P^e$  can be written as a function  $p(P)$ , and the complete model becomes:

$$\text{Product market (IS curve): } Y = C(Y - t(Y)) + I(r) + G \quad (1)$$

$$\text{Money market (LM curve): } M/P = L(r) + k(Y) \quad (2)$$

$$\text{Labor market: } P f(N) = P^e g(N) = p(P)g(N) \quad (3)$$

$$\text{Production function: } Y = Y(N, K) \quad (4)$$

We already saw what are the differences in aggregate supply and aggregate demand among the retained classical, Keynesian, monetarist, New Classical, Real Business Cycle, and New Keynesian models. We will see now what are these differences

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<sup>11</sup> The aggregate demand for labor,  $f(N)$  is a function of wages and prices:  $f(N) = W/P = w$ ,  $W$  being the nominal wage,  $w =$  real wage. It has a negative slope, due to the diminishing marginal productivity of labor.

<sup>12</sup> The labor supply curve relates the quantity of labor supplied to the perceived real wage ( $w^e$ ):  $g(N) = W/P^e = w^e$ .

when the analysis uses a mathematical model. Using this simplified model, the crucial difference appears between the classical (traditional classical, New Classical) and the Keynesian group of models (traditional Keynesian, New Keynesian).

In the case of the monetarist model, the difference consists in the assumption made about money supply and demand, both having a zero interest rate elasticity. Instead of the equation number (2) in the previous model, the monetarist model contains the following money market equilibrium condition:

$$M = (P/v) Y,$$

where  $v$  is the fixed income velocity of money. The monetarist model assumes that the demand for money does not depend on interest rates; the LM curve in this case is vertical.

Real Business Cycle models have a different production function in the model (equation 4). This new production function is  $Y_t = z_t f(N_t, K_t)$ , where  $z_t$  stands for shocks to the production process (technological shocks, environmental factors, changes in the availability of raw materials, changes in government regulations that affect productivity [Froyen, 1993].) The capital stock,  $K$ , is not fixed, given anymore but chosen each period by the representative agent.

Characteristic to the classical model is the perfect flexibility of prices and wages, with labor supply depending only on the real wage. If we consider the expected level of prices as a function of past level and prices and predictions (rational expectations) of future prices,  $P^e = p(P)$ , then  $p'$  can have values between zero and one. In the extreme

classical case, due to the assumption of perfect flexibility, there is a full adjustment of expectations (perfect foresight), which means that  $p' = 1$ . In the extreme Keynesian case, prices and wages are sticky, the labor supply function depends only on the nominal wage, and there is no adjustment (complete money illusion); therefore,  $p' = 0$ . The model is a simultaneous one (all equations are needed in order to solve the model), but the assumption of  $p' = 1$  is the one that dichotomizes the model (classical dichotomy between real and nominal sphere).

When  $p'$  has values greater than zero but less than one, there is some degree of money illusion in the model, and the labor supply depends on both real and nominal wage; the length of the period of adjustment differs. Some New Classical models, Real Business Cycle models and some New Keynesian models can be found in this category. The difference between New Classical and New Keynesian consists in the explanation of adjustment (when accepted, in the New Keynesian case) and the length of time for the adjustment to occur (as described in chapter 1.)

## **4. LABOR MARKET**

Many resources in New Keynesian economics were allocated to explaining the behavior of the labor market. Labor market is viewed, most often, as a main reason for explaining why the economy departs from the Walrasian ideal. Two main issues can be distinguished in the New Keynesian research on the labor market: (1) existence and persistence of unemployment, and (2) the cyclical behavior of real wages and unemployment. Several sub-theories have been developed, and they focused on implicit contracts and sticky wages, efficiency wage models, staggered wage adjustments, and insider-outsider theories.

### **4.1. Implicit and explicit labor contracts**

One New Keynesian explanation for the labor market failure is that labor contracts specify in advance the nominal wage at which firms will be able to purchase labor. Therefore, the response of the wages to market changes will be sluggish, causing stickiness; if the nominal wage is not able to respond to economic disturbances, then monetary policy that does systematically respond to them can be a powerful tool for stabilizing the economy, despite the assumption of rational expectations. Since nominal wages are sticky, real wages can be controlled through the effects of monetary policy on

the price level. An increase in the money supply will increase the price level, and then the aggregate demand. The level of employment can be controlled, and thus the level of output. The conclusion is that fixed nominal wages give the monetary authority control over the real wage and hence control over employment [Mankiw, 1990]. The models based on the assumption of labor contracts and informal agreements of firms with employers are known as 'implicit contracts' models.

Implicit contract theories view the employment relationship as a long term attachment. Firms seek to maintain the loyalty of a well trained work force, so they try to enter into written (explicit) or unwritten (implicit) understandings with their workers. This 'invisible handshake' [Vane and Snowdon, 1992] provides each worker with assurances concerning the terms of the working relationship under an array of possible circumstances. Asymmetric information is essential for the functioning of implicit contracts. The trading of such contracts is explained by the fact that third parties do not have information about other people's income or employment status; only the employer has this information, but he does not have information about other job opportunities or about other types of income that employees might have [Azariadis and Stiglitz, 1983].

Workers are considered to be more risk-averse than firms with respect to fluctuations in income across states of nature. Because complete external insurance of income fluctuations is impossible, firms will negotiate income risks in addition to labor services. The result is that real wages not only coordinate labor decisions but reflect an insurance component, as well. As a consequence, real wages no longer equalize

marginal labor productivity and the marginal rate of substitution between consumption and leisure [van Ees and Garretsen, 1993].

Another line of research in the area of implicit contracts focuses on the enforceability of contracts. The solution to the enforcement problem is a reputation mechanism. When firms agree to keep real wages stable over time, workers, in return for this insurance, accept a real wage which is lower on average than it otherwise would have been. Firms try to preserve their reputation in the labor market, so they will try to honor such unwritten rules.

A criticism often arises against this explanation of wage stickiness. It is argued that contracts which fix nominal wages are inconsistent with rational individual behavior; individuals have rational expectations and if they expect prices to increase or decrease, it seems irrational for them to sign contracts that fix their nominal wages. Also, the extent to which reputation effects can enforce the fulfillment of implicit contracts is questioned.

#### **4.2. Efficiency wage models**

An imperfection on the real side of the labor market that could be an explanation of rigidities is that productivity is affected by wages and therefore firms have a reason not to cut wages in response to an excess supply of labor. This is the efficiency wage hypothesis, which states that labor productivity depends on real wages [van Ees and

Garretsen, 1993]. One of the reasons for this assumption is the imperfect monitoring of workers. Firms' ability to monitor workers is imperfect, so firms will pay wages above the market-clearing level for fear not to have their workers engaged in behavior that might cause them to lose their jobs. The models based on this explanation are called 'shirking' models (low wages encourage workers to work less and to take more on-the-job leisure.) [Yellen, 1984]. A second reason for efficiency wages is the 'fairness' of workers: workers' efforts depend on the way they are treated by the firm, and wages are a measure of their perceptions of fairness. Firms are willing to pay higher wages in order to have a more productive and loyal work force, so they will not reduce wages in face of persistent unemployment. Due to the fact that these models are based on social conventions and principles of appropriate behavior, they are often called "sociological models" [Yellen, 1984]. A third explanation for efficiency wage behavior is found in the labor turnover models, based on the assumption that quit rates are a decreasing function of paid wages. The payment of an efficiency wage reduces the costs associated with hiring, firing and training new workers. The formal structure of the labor turnover model is similar to that of the shirking model. A fourth explanation of the efficiency wage hypothesis is provided by adverse selection models. These models suggest that there is a positive correlation between workers' abilities and reservation wages. By paying higher wages, firms not only attract the best workers with a better productivity but also prevent voluntary quitting. If the productivity effect of the wage premium is significant, then supply and demand forces in the labor market will not reach the market-

clearing equilibrium.

Although from theoretical point of view efficiency wage models are able to explain the behavior of labor markets, the empirical evidence for their support is not conclusive. It is also argued that efficiency wage models cannot independently explain fluctuations in the business cycle [van Ees and Garretsen 1993].

### **4.3. Staggered wage adjustments**

A possible microfoundation for nominal wage rigidities is offered by the staggered wage adjustment theory, the most influential work that rationalizes nominal rigidities in New Keynesian labor market analysis. According to this hypothesis, wages are not adjusted (through either bargaining or informal arrangements) at the same time, but they are staggered over time [Taylor, 1979]. Even when individual wages or prices adjust frequently, the overall level of wages will adjust only slowly. If, for example, money supply decreases, leading to a decrease in aggregate demand and the price level, the economy will maintain its potential output only if nominal wages fall by the same amount as prices fell. But with the assumption of staggered labor market adjustments, not all nominal wages will fall at the same time. Workers whose contracts expire first would have lower real wages than workers whose contracts will expire later. As a result, the first group of workers will not be willing to reduce their nominal wages, leading to an even more sluggish nominal wage adjustment process. The staggering of individual



wages setting will cause a sticky overall adjustment of nominal wages.

#### **4.4. Insider-outsider theories**

According to the insider-outsider approach to real wage rigidity there are two distinct entities which create rigidities: insiders, who are experienced incumbent employees, and outsiders, who are either unemployed workers or people working in the casual or secondary labor market [Gordon, 1990]. Insiders have certain advantages, due to the fact that their jobs are protected by a variety of labor turnover costs which would make their replacement costly. They can transform this advantage into a real market power, being able to influence the turnover costs by cooperating among themselves. Outsiders do not have the same protection, and it will be difficult for them to find jobs, even if they are willing to accept a lower wage than the insiders. This structure causes involuntary unemployment.

The insider-outsider theory can be strengthened by taking into consideration the power of trade unions, without suggesting a rationale for unionization. The theory can explain the stickiness and wages, the persistence of unemployment, differences in variability of employment across industries and countries, labor market segmentation, and the interindustry wage structure [Gordon, 1990].

## **5. OUTPUT AND GOODS MARKETS**

### **5.1. Costly price adjustment, imperfect competition, monopoly like behavior, and menu costs**

Perfect competition, one of the crucial assumptions of new Classical models, implies that prices adjust quickly to market clearing levels. Unlike New Classical, New Keynesian macroeconomics is based on the assumption of imperfect competition in product markets. The immediate effect of assuming imperfect competition is the emphasizing of price-setting behavior of firms and the shifting away of the attention from the labor market to the output market. The models based on this assumption, such as mark-up pricing models, show that both aggregate demand and supply disturbances have large and persistent effects on output and employment [Naish, 1993]. Several consequences of the imperfect competition assumption can be noticed. Most of the time there are adjustment costs associated with nominal price changes, and this will cause prices rarely to be perfectly flexible. The informational requirements of rational pricing behavior tend to be larger, since the firm not only has to know the exact shape of its demand and cost curves, but it has to also predict their position each period, in advance of deciding its price; this supposes the solving of a general equilibrium problem each period, including the prediction of the price behavior of all other firms, and the prediction of the future values of all macro variables that determine the position and

shape of the aggregate demand curve. Unlike competitive markets, the individual losses suffered by firms when deviating from fully rational pricing policies are often very small, which can make a simple backward looking pricing rule close to being optimal. Related to the assumption of imperfect competition will be the problems of menu costs and costly price adjustments. Monopolistic competition and menu costs cause prices to be sticky, once they are set. Since one of the central features of the traditional Keynesian economics is the rigidity of nominal wages and prices, one stream of New Keynesian economics seeks to explain price rigidities. The models in this stream assume that firms are imperfectly competitive, and that they face small barriers to nominal price flexibility; the complementarity between real and nominal rigidities is analyzed in these models, as well.

In David Romer's opinion [Romer, 1993], the New Keynesian theory made greater progress in understanding the microeconomics of labor and unemployment than in understanding the microeconomics of price rigidities. Starting from the failure of the neoclassical synthesis, Romer investigates the various models that tried to explain this failure, that is, to find whether imperfect price adjustment could be derived from realistic assumptions about the microeconomic environment. A variety of non-Walrasian theories of the operation of markets have resulted from previous works: implicit contract models, bargaining models, and efficiency wage models, which have been already described in chapter 4. In Romer's opinion none of these models provide an explanation of failures of the classical dichotomy because they focus only on real imperfections of the labor

market. But any microeconomic basis for failure of the classical dichotomy has to analyze the nominal frictions as well. Otherwise a purely nominal disturbance would leave the level of real variables unchanged. The only explanation that Romer finds is that -- admitting the importance of the failure of the classical dichotomy to explain fluctuations in aggregate activity -- nominal frictions that appear small at the level of individual firms and households have a large effect on the macroeconomy.

Much effort in New Keynesian theories has been devoted to examining the behavior of monopolistically competitive firms who face small menu costs when they change prices. The menu costs approach and the related near-rational behavior approach explicitly address the possibility of nominal price rigidities as a response to shocks in commodity demand. Menu costs are small lump sum costs determined by the time taken to think about and plan the price changes, the resources required to make and post new price lists, the time taken to inform customers, and any annoyance and problems caused to the customers by these price changes. These models shift the search for nominal rigidities from the labor market to the goods market. They can explain, based on rigorous microeconomic foundations, the failure of price setters to restore equilibrium. Monopolistically competitive firms do not have much incentive to lower their prices in response to a decline in demand for their goods. The benefit to the firms from keeping prices unchanged is much smaller (second order) than the benefit for the society from a price cut (first order)[Hargreaves, 1992]. However, the small menu costs that firms are faced with make them maintain the old prices, despite the social loss from the price

stickiness. Sticky prices can be privately efficient and socially inefficient at the same time. An advantage of the models with menu costs is the fact that they do not imply a countercyclical real wage. Once price rigidity is used to explain the response of the economy to changes in aggregate demand, real wages can be procyclical or acyclical [Mankiw, 1990].

The concept of near-rational behavior provides the microfoundations of the menu costs approach. Near-rational behavior is non maximizing behavior in which the gains from maximizing rather than non maximizing are small in a well-defined sense. Agents' optimal choice implies indifference at the margin; an agent who does not react (is inert) to a shock makes an error which is of first order (proportional) and suffers a loss which is proportional only to the squared deviation of that error (second order) (envelope theorem) [van Ees and Garretsen, 1993]. But on an economy-wide scale, the consequences of these errors are of first order. This is how small deviations from optimal individual choices have a high impact on the economy as a whole, causing relatively small menu costs to result in relatively large fluctuations in output and employment. Very small transaction costs of decision making or changing prices can account for large fluctuations in real economic activity.

David Romer [Romer, 1993] analyzes such a model with menu costs. He starts from the incentives of individual firms to change their prices when aggregate output change and uses the marginal revenue-marginal cost diagram (figure nr.2).

Romer begins his analysis with the economy in the equilibrium state, where the

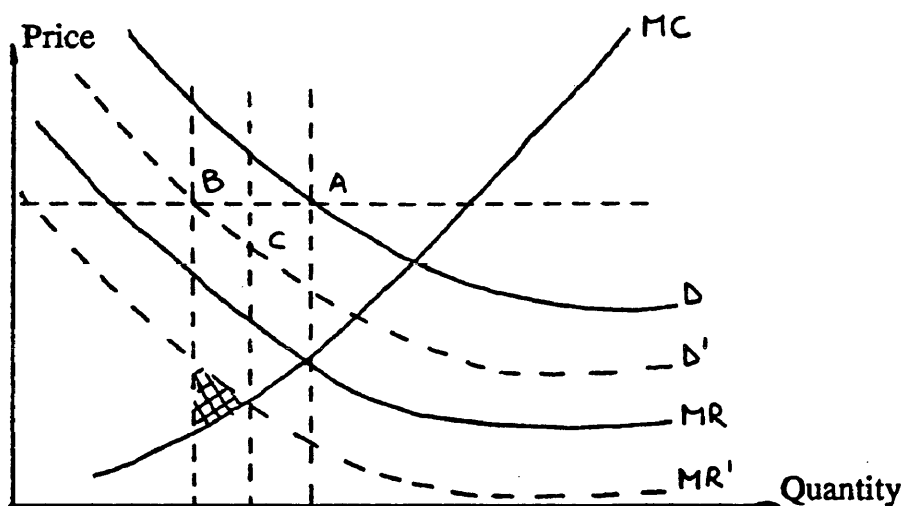


Figure nr.2: Marginal revenue - marginal cost diagram

representative firm produces at the point where marginal revenue equals marginal cost (A). If the economy-wide output decreases, then the demand for the firm's product, at a given price, is lower. Therefore, the marginal revenue curve shifts downward. If the price remains unchanged, then the firm's output will be determined by the new demand curve at the existing price (B). For this level of output, because marginal revenue exceeds marginal cost the firm has an incentive to reduce its price and thus increase its output. Changing the price, the firm will produce at the point where the marginal cost curve intersects the new marginal revenue curve (C). The firm's additional profit gained by reducing the price and increasing the output can be represented as the shaded triangle in the diagram. The firm is willing to hold the price unchanged only if this area is very small. The crucial point of Romer's theory is that the firm's incentive to reduce its price may be small despite the possible significant fall in demand. The explanation is that the

firm's gains from reducing the price are small even when the shift in the demand curve is large. If this assumption is accepted, then the behavior of all the firms facing this kind of small frictions in price adjustment can lead to large real effects of an aggregate demand disturbance. A negative aggregate demand shock may result either in a fall in aggregate real output, if firms do not adjust their prices, or mostly in lower prices if adjustment takes place. What determines a firm's incentive to change its price? We need to know the responses of marginal cost and marginal revenue to the downturn in aggregate demand. As Romer shows, when less output is produced, less labor is demanded; considering an upward-sloping labor supply curve, the decline in the labor demanded determines a decrease in the real wage, and hence in the marginal cost. If the marginal product of labor rises rapidly as labor input decreases, the marginal cost curve is steep even when the real wage is constant. Therein, as the decline in the marginal cost becomes greater, the firm's incentive to reduce its price also becomes greater. On the other hand, the more the marginal revenue curve shifts downward, the smaller the firm's incentive to lower its price. When the demand elasticity of the firm at its existing price does not change with a change in aggregate output, the marginal revenue is unaffected by the change in economy-wide output. If the elasticity of demand falls with the decline in aggregate output, the marginal revenue shift is larger. This framework allowed Romer to demonstrate that simply adding imperfect competition and small barriers to price adjustment to the mainstream world view of the 1960s is not enough to provide a microeconomic basis for the opinion that aggregate demand shocks are central to

economic fluctuations. A complete model of large real effects of nominal disturbances should consider both nominal frictions and real rigidities.

A near-rational model with wage and price inertia was built by George Akerlof and Janet Yellen [Akerlof and Yellen, 1985]. The model is able to explain the non neutrality of changes in the nominal supply of money in the short run, based on the assumption that firms' inertial wage-price behavior is near-rational. The losses suffered by firms that behave suboptimally, adjusting prices and wages very slowly, are very small relative to the consequences of their first-best policy. Very small means being of second order in terms of the policy shocks that create a disturbance from a long-run, fully maximizing equilibrium. The model has three basic features: (1) sticky wage and price behavior, which means that following a shock to a long-run equilibrium in which all agents exactly maximize, a fraction  $\beta$  of agents maintain the same nominal prices and wages, while the remaining agents exactly maximize; (2) price stickiness is a near-rational policy in response to a shock of a long-run equilibrium with full maximization; and (3) the economy is monopolistically competitive, and involuntary unemployment can occur. The main parameters of the model are the elasticity of output with respect to labor input ( $\alpha$ ), the elasticity of demand for each firm ( $\nu$ ), and the fraction of nonmaximizers ( $\beta$ ). For each set of parameter values, table nr. reports the percentage difference between the profits of maximizers and nonmaximizers for changes in the money supply, which respectively produce five percent and ten percent increases in employment.



Table nr.1: Percentage loss in profits due to nonmaximizing behavior for different percentage changes in employment, elasticity of output with respect to labor input ( $\alpha$ ), elasticity of demand ( $\nu$ ), and proportion of nonmaximizers ( $\beta$ )

	5% change in employment			10% change in employment		
	$\beta=0.25$	$\beta=0.5$	$\beta=0.75$	$\beta=0.25$	$\beta=0.5$	$\beta=0.75$
$\alpha=0.25$						
$\nu=1.5$	0.084	0.023	0.011	0.309	0.088	0.043
$\nu=3.0$	0.220	0.059	0.028	0.808	0.226	0.107
$\nu=5.0$	0.298	0.079	0.036	1.090	0.303	0.142
$\nu=20.0$	0.408	0.107	0.049	1.496	0.410	0.189
$\nu=100.0$	0.443	0.116	0.052	1.623	0.442	0.203
$\alpha=0.5$						
$\nu=1.5$	0.088	0.024	0.012	0.330	0.092	0.045
$\nu=3.0$	0.295	0.080	0.038	1.109	0.306	0.146
$\nu=5.0$	0.459	0.122	0.057	1.726	0.471	0.222
$\nu=20.0$	0.768	0.201	0.091	2.892	0.774	0.356
$\nu=100.0$	0.888	0.231	0.104	3.343	0.889	0.405
$\alpha=0.75$						
$\nu=1.5$	0.046	0.012	0.006	0.175	0.045	0.021
$\nu=3.0$	0.207	0.054	0.025	0.796	0.209	0.097
$\nu=5.0$	0.397	0.103	0.048	1.533	0.402	0.186
$\nu=20.0$	0.974	0.251	0.114	3.769	0.979	0.447
$\nu=100.0$	1.304	0.334	0.151	5.046	1.304	0.591

(From George A. Akerlof and Janet L. Yellen - A Near-Rational Model of the business Cycle, with Wage and Price Inertia, in *New Keynesian Economics*, edited by Gregory Mankiw and David Romer, M.I.T., 1992.)

The results show that for five percent changes in employment, all values, but one, even for values of  $\nu$  (elasticity of demand) as large as 100, are less than one percent. For changes in employment of ten percent, the same differences are mainly less than one percent for low values of  $\nu$ , and the maximum reaches 5.05 percent. Over the course of the business cycle, a quarter of all firms could fail to correct a policy that caused a five percent loss in profits. These results support the assumption that changes in aggregate demand can cause significant changes in equilibrium output, and that those economic agents who are not maximizing can make at most only small gains from altering their behavior [Akerlof and Yellen, 1985].

## 5.2. Staggering of wages and prices

Another New Keynesian explanation of the stickiness of wages and prices is the result of an additional friction in nominal adjustment: not all prices and wages are changed simultaneously. The staggering and overlapping of intervals in which individual prices or wages are fixed introduces a critical element of realism into New Keynesian economics [Gordon, 1990].

The staggered price-setting assumption that contributes to price inertia supposes that firms set prices at discrete points in time and hold them constant for an interval (contract interval). The fact that there are rarely situations of continuous price-setting,

with the exception of a few financial and primary commodities markets, gives realism to this theory. Discrete pricing will constitute a source of price inertia for the period of time that prices are fixed. A change in the money supply which had not been anticipated at the time prices were set will not affect the price level until the next price-setting. When price changes are also staggered across firms, the general level of prices will exhibit a strong degree of stickiness; the period of price adjustment can extend far beyond the time taken by all firms to reset prices.

The desired price change of any individual firm in response to a monetary shock is smaller when other firms do not adjust, this form of partial individual adjustment being built in by staggered price-setting [Hargreaves, 1992]. A simple example can demonstrate this statement. Suppose that firms set their prices for a period of one year, with different groups of firms acting each month, that the full equilibrium values of prices are those established in December, and that there is an unanticipated increase in the money supply in January; then the following scenario will take place. Only the firms that set their prices in January would be able to adjust instantaneously. But firms are reluctant to have their prices and wages deviate greatly from the prevailing level, and especially they do not wish their prices or wages to get far out of line with others', because this could put them in a situation of relative competitive disadvantage; this leads those firms that could fully adjust their prices and wages to make only small changes in prices. The general price level will increase slightly, but not as much as the full adjustment would have required. Next month, when another group of firms will have

the opportunity to adjust their prices and wages, they will do this at a slightly superior level, but still not the full adjustment, and so on. The process of adjustment continues until the last group of firms adjust their price in December, and again with less than the percent of change in the money supply (which is the shock). One year after the shock, despite the fact that each firm had the opportunity to fully adjust to the shock, the price level will not be adjusted by the full percent required to leave all real variables unchanged. The adjustment of the general price level will spread over a number of years even though each individual price is fixed only for one year.

### **5.2.1. Imperfect information**

One explanation of the pattern presented above turns on the informational difficulties which firms face when trying to distinguish a real from a nominal shock in demand. The appropriate adjustments depend on the nature of the shock -- nominal or real. Firms will face the problem of deciding whether the shock is nominal or real, so each firm will be more willing to set prices after all the others in order to take benefits from the useful information provided by other price changes. Obviously, it will not be possible for all firms to wait for changes, so staggering can emerge as a solution to this information game between firms.

Because of the lack of perfect information individuals may confuse movements

in the overall price level (which should not affect their decisions) with movements in relative prices. This will lead to unanticipated inflation, which will cause individuals to assume that the relative price of things they produce (and possibly their real wage) have increased. This incorrect assumption will result in an increase in the quantity supplied, including labor.

An advanced model with staggered price setting that uses the assumption of imperfect information was built by Laurence Ball and Stephen Cecchetti [Ball and Cecchetti, 1988]. In this model, firms have imperfect knowledge of the current status of the economy and gain information by observing the prices set by others. Therefore, each firm has an incentive to set its price shortly after other firms set theirs. The information about the previous price setters' estimates of the underlying shocks improves the current firm's estimates, with staggering as the possible equilibrium outcome.

A different approach with imperfect information is the problem of 'trust' and the costs of price adjustment [Hargreaves, 1992]. According to this approach, besides firms imperfect knowledge, there is another dimension to the costs of price adjustment. This is based on the fact that unexpected and inappropriate price changes may undermine the trust upon which certain mutually beneficial economic relationships are founded. Trust has to be built through the actions of the firm, and this will heavily depend on the circumstances in which a firm changes prices and by how much. Both consumers and producers have to observe that under the terms of the implicit agreement over price setting a change in price is warranted. Price adjustment does not depend solely on firms

acquiring the information about pre-setting, but also on consumers acquiring the same information. Prices are usually negotiated, and both parties will agree to the changes in prices only if both have acquired the same information. This is how delays in price adjustments can occur.

As a synthesis, there are several aspects of the information problem that have a direct impact on the staggering of prices and wages: (1) it is difficult to predict the behavior of other agents in the economy as a response to a nominal shock; (2) it is difficult to know whether other agents in the economy are abiding by implicit agreements in which trust plays the primary role; and (3) there is an information difficulty with respect to distinguishing nominal from real shocks. All these factors can cause prices and wages to be staggered.

There is one aspect of this theory that raises criticisms, and this is that confusions in the distinction between nominal and real shocks cannot last long enough to cause the staggering of prices.

### **5.2.2. Sectoral shifts**

The sectoral shift theory (initially derived from the new classical approach to business cycle) focuses on the costly adjustment of labor among different sectors: it is costly for labor to move from one sector of the economy to another following a certain sectoral shock. When changes in demand occur in a particular sector, they will

determine the movement of individual workers among sectors. These movements require a period of search and retraining for new jobs, and therefore they will lead to high unemployment periods. The sectoral shift approach states that recessions are periods during which there are more sectoral shocks and thus more of such adjustments occurring. And more adjustments lead to increased unemployment [Jeff, 1989].

### **5.2.3. Fixed wages and prices**

One of the problems that New Keynesian theories tried to solve is the reaction of different markets when prices are fixed at non market-clearing levels. If prices are fixed and cannot adjust, then quantities have to adjust. But the behavior of the economy will crucially depend on precisely which markets are experiencing excess demand and which are experiencing excess supply [Mankiw, 1990]. Two different regimes can cause unemployment (excess supply of labor). If firms can sell all they want in the goods market, then unemployment will arise because the real wage is too high for all of the labor force to be profitably employed; this is the so-called 'classical unemployment'. If firms are unable to sell all they want at the going price (fixed too high), they will have to cut back on their resources usage, including labor, and thus causing unemployment ('Keynesian unemployment'). A graphical representation of the two unemployment regimes can be suggestive (figure nr.3).

As we mentioned earlier, when prices do not adjust in response to a monetary shock, then quantities must adjust. The wrong (fixed) nominal price level leads to an

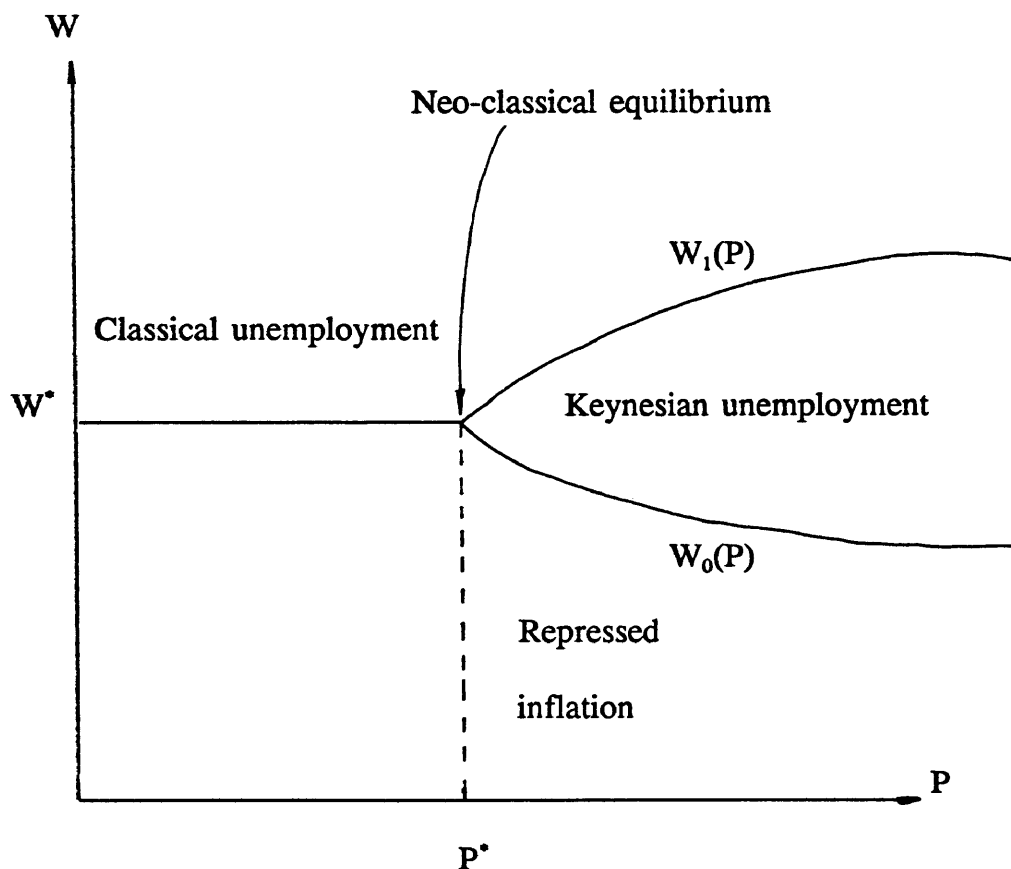


Figure nr.3: Fixed prices and unemployment

(Adapted from Jeff Frank - The New Keynesian Economics: Unemployment, search and contracting, Wheatsheaf Books, 1986)

inadequate aggregate demand reflected in sales-ratios at the firm level (the quantities that the firm can sell, at the equilibrium output level). Associated with this level of output there is an optimal number of workers,  $N$ . For each sales-ratio there are



associated values of the real wage,  $w_0$  and  $w_1$ ; for real wage rates between  $w_0$  and  $w_1$  employment is determined by the sale-ratio at  $N$ , for real wage above  $w_1$  employment is limited by the marginal product of labor below  $N$ , and for wages below  $w_0$  labor supply limits employment below  $N$ . The diagram associates each level of price  $P$  with its IS-LM equilibrium and the appropriate values of the real wages  $w_0$  and  $w_1$  (for different sales ratios.) The classical unemployment occurs when the real wage is above the relevant  $w_1$  values, so that the real wage limits employment (below its equilibrium value) along the marginal product of labor curve. Keynesian unemployment occurs when the sales-ratio determines the level of output. When the real wage is below  $w_0$ , the labor supply limits employment, and this is the case of repressed inflation.

A dilemma appears in this approach, and this is the fact that it is not known whether the key to the unemployment situation is found in the labor market (wages are fixed at a too high level) or in the output market (prices are fixed at a too high level).

### 5.3. Customer markets

Customer markets are characterized by the absence of a Walrasian auctioneer setting market clearing prices. Firms set their own prices and they have imperfect knowledge and incomplete information. The main explanation for the stickiness of prices consists of the firms' behavior towards their customers. Each firm has a 'stock' of

existing customers and tries to maintain their loyalty [Vane and Snowdon, 1992]. Therefore, firms are unwilling to change price frequently because such behavior would encourage existing customers to search the market for alternatives. Firms will avoid frequent price adjustment due to demand disturbances in order to maintain their good reputation. This non-varying price policy is a form of insurance contract with customers. Another reason for the reluctance of firms to cut prices is the fact that, given the assumption of incomplete information, such a price cut could be interpreted by customers as a reduction in the quality of the product (since prices are quality signals.) This explains the stickiness of prices.

## 6. CAPITAL AND CREDIT MARKET

Capital market imperfections derive from imperfect information. Asymmetries of information exist between managers of firms and potential investors, and between lenders and borrowers in credit markets; this may create another type of stickiness. The informational asymmetries can give rise to credit and equity rationing [Greenwald and Stiglitz, 1988]. Equity rationing implies that if firms wish to have more capital, to invest or to increase production, they must borrow funds. Even when they are able to do this, firms expose themselves to considerable risks, including the risk of not being able to pay their debts, which means bankruptcy. The consequences of these risks are exacerbated by the absence of future markets. Firms will not be able to sell the goods that they plan to produce until they have produced them, which means they cannot sell their output at the time of production. But every production decision is a risk decision that managers and equity holders must bear.

At certain moments in time, considerations of potential risk limit the amount that firms are willing to produce; at other times, firms' access to capital is limited, and there is credit rationing. Borrowers are likely to have good information about the quality of their investment projects and about the payoffs from these investments. Lenders, however, do not have the same quality of information as borrowers; their lack of information and uncertainty can lead them to ration credit when monetary policy is restrictive. The credit rationing prevents interest rates from changing in a way that

brings the demand for loans into line with the supply of loans. Excess demand appears, and lenders will allocate loans directly, instead of allowing those willing to pay the highest interest rate to obtain the loan. The reasons that suppliers of capital do not raise interest rates in the presence of the excess demand for capital are similar to the reasons that firms do not cut their wages in the presence of an excess supply of labor: increasing interest rates might lower the expected return to the supplier of capital, either because of selection effects (the mix of applicants changes adversely) or because of incentive effects (borrowers are induced to undertake riskier actions.)

The key feature of most credit-rationing models is that the probability of loan repayment is a function of the loan rate, whereby increases in the loan rate cause a decrease in the probability of repayment [Lewarne, 1994], based on two arguments. The first approach is based on symmetric ex ante information, when both the lender and the borrower have the same information about the expected return of an investment project. If the interest rate increases, then the interest cost of borrowing increases and makes more difficult the repayment of both principal and interest out of a given return of the project. The second approach is based on information asymmetries between the borrower and the lender. Borrowers can be grouped in 'safe' and 'risky': safe borrowers have investment projects with low risk but also low rates of return, while risky borrowers have projects with high risk, but also high rates of return. While the borrower knows what kind of project he has, this information is not available to the bank. An increase in the loan rate will gradually eliminate safe borrowers out of the market, leaving only risky

borrowers. This creates an adverse selection problem, as well as a moral hazard one. The adverse selection is due to the fact that the banks will not be able to distinguish safe from risky borrowers, but they will know that an increase in the loan rate will cause safe borrowers to drop out faster than the risky ones, therefore leading to a decrease in the probability of aggregate repayment. The moral hazard problem appears as soon as borrowers have to select between safe and risky projects once they received the loans. If the loan rate increases, a shift from safe to risky projects takes place among borrowers, because they will prefer to pay the higher interest rate on the loan and at the same time lower the probability of repayment.

The consequences of the credit rationing approach are that when the money supply decreases, the ability to lend is directly affected, so fewer loans will be made and the economic activity will suffer (a fact has to be mentioned, that investments will decrease not because of the effect of interest rates, but because of the credit rationing.)

Because of credit rationing and unexpected redistributions of wealth, small changes in the economy will propagate and lead to large shocks in the aggregate demand. Investors will not be able to obtain sufficient credit and consumers will not be able to purchase as much as they would. The failure of credit markets to work efficiently causes further declines in output.

## 7. COORDINATION FAILURES THEORIES

In a purely Walrasian economy any departure from normal output -- the prevailing level of output under full price flexibility -- either boom or recession, leads to lower welfare. In New Keynesian models there is an asymmetry between demand-driven booms and demand-driven recessions. The booms increase welfare and recessions lower it.

In his "New Keynesian Synthesis" Romer [Romer, 1993] analyzes, using a model of firms' incentives to adjust prices, the situation in which real rigidities are so strong that the incentive to reduce the price in response to a contraction of economy-wide output is zero. As a result, when output contracts, the intersection of the new marginal revenue and marginal cost curves (which gives the price) might have an even lower corresponding level of output than the amount actually demanded at the old price. The firm's reaction would be to respond to the negative aggregate demand shock by an increase in price, reducing its output even further. This will result in more than one possible equilibrium level of output; the models with multiple, welfare-ranked equilibria are called coordination failures models.

Coordination failure theories state that fluctuations in aggregate output and in welfare may be driven not by extrinsic shocks, but by changes in confidence and failures in coordination games between agents. When individuals have doubts about the behavior of other agents in response to a nominal demand shock, this nominal shock will appear

to be a real shock to the individual agent. This is the mechanism that connects real with nominal wage and price stickiness. It highlights coordination aspects of wage and price changes because the individual incentive to change price or wage in response to a shock in the nominal demand increases with the number of other actors in the economy adjusting their prices and wages. Hence a certain degree of real stickiness may forestall price and wage adjustment when few are expected to adjust but it will not prevent the adjustment if many are expected to adjust, and this is how the issue of coordination arises. Many other aspects of wage and price setting involve solving coordination games.

A source for coordination failures consists in "thick-market externalities" [Gordon, 1990]. This theory assumes that markets function better when many individuals are economically active. Another source is that production under increasing returns is more attractive when demand is high and therefore actions that affect others' demand have externalities and cause multiple equilibria. If coordination failure is linked with nominal rigidities arising from small nominal frictions [Ball and Romer, 1991], there can be multiple equilibria in the degree of nominal rigidity; equilibria with greater price flexibility can often be Pareto-superior, so that the price rigidity itself can be a coordination failure.

Closely related to coordination failure theories are 'sunspots' and 'self-fulfilling prophecies', whose central idea is the fact that variables of no extrinsic importance (the sunspots) can have real effects when the economy does not possess a unique equilibrium. [Frank, 1986].

## 8. MIXED NEW KEYNESIAN THEORIES

In the attempt to eliminate some of the limitations of certain theories and to improve the models and the results that these models can provide for the empirical world, New Keynesian approaches were incorporated in mixed theories. They resulted in original approaches that can be also grouped under the label "New Keynesian".

James Tobin [Tobin, 1993] tries to relate New Keynesian economics to the traditional Keynesian theory, arguing for a more appropriate incorporation of the old Keynesian insights. Keynesian models continue to prove useful in empirical applications, forecasting and policy analysis, and macroeconometric models are mostly built on Keynesian frameworks. Tobin states that Keynesian macroeconomics neither asserts nor requires nominal wage and/or price rigidities, but shows just that markets are not instantaneously and continuously cleared by prices. He argues for the validity of the major propositions of old Keynesian macroeconomics.

Tobin reanalyzes in this article the most important traditional Keynesian tenets. Situations of pervasive excess supply occur, markets are not clearing at prevailing prices; the effective constraint on employment is the aggregate demand for goods and services, and the effective constraint on employment is the amount of labor required to produce that output; business cycles are fluctuations in aggregate effective demand, carrying output and employment in their wake.

Tobin tries to set the place of a "new old Keynesian" theory; he is the advocate



of the traditional imperfect flexibility. In his opinion, even if money wages and prices were more flexible, even if excess supplies of labor were to lead more rapidly to cuts in money wages, this greater flexibility would not prevent or cure unemployment. Given a contractionary shock in aggregate demand, deflation of money wages and prices would not restore real demand to its full employment value.

A special contribution of Tobin's model is the relevance of the problematic stability of price adjustment. Tobin uses a graphic representation with the log of the price level ( $\hat{p}$ ) on the vertical axis and the expected price deflation or inflation ( $x$ ) on the horizontal axis (figure nr.4)

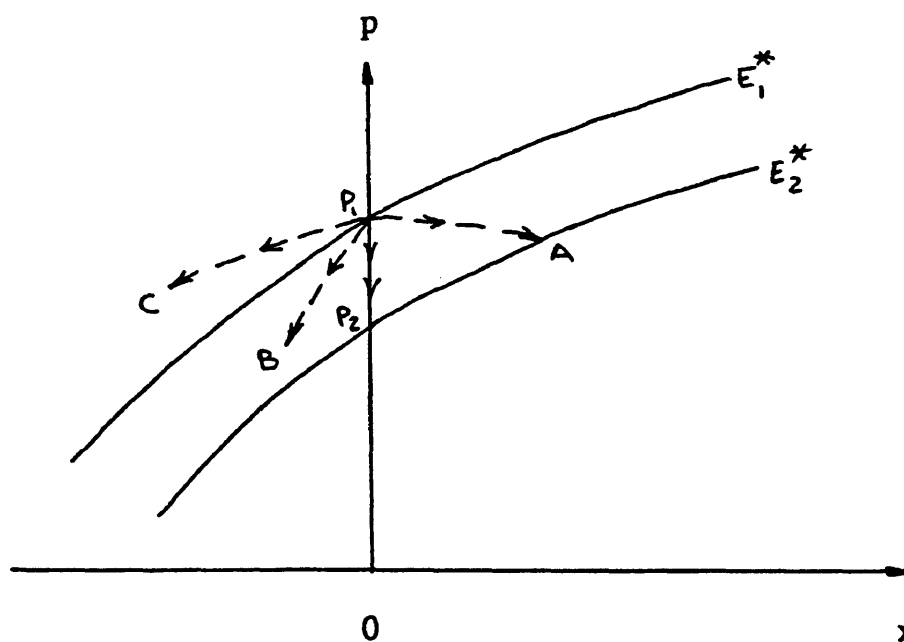


Figure nr.4: Stability of price adjustment

The upward sloping curve  $E_1^*$  plots combinations  $(x, \hat{p})$  of expected price change and

price level that generate the same aggregate demand  $E$ . Demand is negatively related to the price level and positively related to its expected rate of change. In given circumstances, a higher curve refers to a lower demand  $E$ , and a lower curve to a higher demand. The curvature of the  $E^*$  loci reflects the assumption that the "Keynes effect" of increases in real money balances in lowering interest rates declines as those balances increase and interest rates fall. Points left of  $E_1^*$  are positions where real demand  $E$  is lower than  $Y^*$ , that is Keynesian unemployment. Points below  $E_1^*$  are positions of excess demand.

The analysis starts in the initial state of full employment equilibrium,  $E_1^*$ , where demand is equal to full employment output,  $Y^*$ . A discrete one-time negative shock to real demand shifts the isoquant for  $E = Y^*$  down to  $E_2^*$ , so that the new equilibrium inflation rate and price is  $(0, p_2)$ . To restore equilibrium the price level must fall from  $p_1$  to  $p_2$ . There are three possible scenarios: (1) Walrasian, with an instantaneous precipitous vertical descent; (2) path B, in which the real balance effect is strong enough to overcome the negative effects of the deflation and the new equilibrium may be attained by a damped cyclical process; (3) path C, in which the price level effect is too weak to win out, and the gap of  $E$  and  $Y$  below  $Y^*$  is increasing. The likely scenario is a path like B or C. From the possible specifications of the short-run dynamics of this model, Tobin agrees with the Keynesian one: (1) production increases when desired purchases exceed actual current output, but not by the full amount of the gap; (2) nominal prices follow expectations plus or minus a "Phillips curve" adjustment to the difference between

actual and full employment output; (3) price change expectations adapt to the difference between actual and expected inflation or deflation.

Another approach belongs to King [King, 1993], who analyzes what happens to the traditional and New Keynesian IS-LM models when rational expectations are incorporated. If an increase in the money stock for aggregate demand raises demand and lowers both real and nominal interest rates in the IS-LM model without expectations, the results are uncertain when rational expectations are considered (figure nr.5).

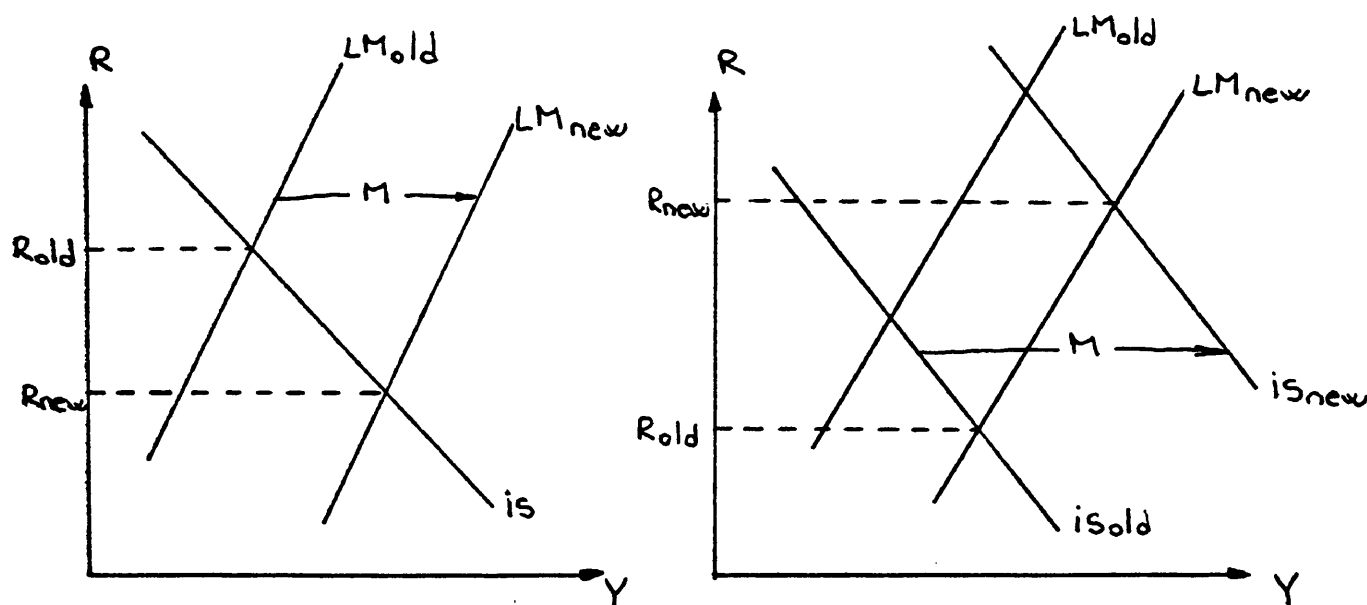


Figure nr.5: Traditional and New Keynesian IS-LM models with rational expectations

Investment is sensitive to expected future demand (known in old Keynesian literature as "induced investment", and changes in money may signal sustained increases in demand.

Therein, real interest rates rise. Increases in money signal higher future price levels, so nominal rates rise. As we can see from the second figure, the influence of expectations on investments could make the IS curve shift enough so that both real and nominal rates rise.

In King's opinion, a refinement of the IS specification requires rational expectations to be incorporated in consumption and investment theories, not as exogenous variables, as in Keynes's work, but as endogenous variables. Rational expectations models of consumption imply that all variables useful for forecasting income and interest rates should enter into the consumption function, with an IS curve dependant on everything, without any useful exclusion restrictions. With a rational expectations investment function of the neoclassical form, persistent changes in demand for final output (determined by persistent changes in the monetary stock) lead to quantitatively major shifts in the investment demand schedule at given real interest rates. These effects are important enough to increase real interest rates with a monetary expansion, so that the IS curve effect outweighs the direct LM curve effect.

King's conclusion is that new dynamic theoretical models, with rational expectations incorporated, should be developed to take the place of the IS-LM model.

In Greenwald and Stiglitz's [Greenwald and Stiglitz, 1993] opinion the main explanations of the imperfections are the costly and imperfect information, the market failures in labor and capital markets. As all the New Keynesians, the authors agree on three propositions: (1) during certain periods an excess supply of labor exists at the

prevailing level of real wages; (2) there are marked fluctuations in the aggregate level of economic activity; and (3) money matters, although monetary policy is not always effective. It is agreed that the principal task ahead of New Keynesians is to incorporate micro-foundations in their models in order to explain markets imperfections. But, in contrast with those New Keynesians who argue that nominal price rigidities are essential, Greenwald and Stiglitz argue that increased flexibility of wages and prices might exacerbate the economy's downturn, trying to explain how price flexibility contributes to macroeconomic fluctuations and to unemployment. Greenwald and Stiglitz [Greenwald and Stiglitz, 1993] offer an alternate interpretation of labor market and involuntary unemployment. Describing the possible reasons for sticky real wages (efficiency wages, insider-outsider theory, imperfect competition, and implicit contracts), the authors suggest another explanation, provided by the theory of the risk averse firm. They translate the shift in the aggregate supply curve of output as the economy goes into a recession into a shift in the firm and aggregate demand curves for labor.

The models that Greenwald and Stiglitz develop are based on three basic premises: (1) risk averse firms; (2) a credit allocation mechanism with credit rationing, risk averse banks; (3) new labor market theories, including efficiency wages and insider-outsider models. The first two building blocks are used to explain how small shocks to the economy can lead to large changes in output, while the last one tries to explain why those changes in output result in unemployment.

An important contribution brought by the authors is the distinction made between

equity financing and debt financing of a firm, unlike the traditional Keynesian theory where this difference was not considered. If finance comes from equity, the firm shares risk with those who provide finance, and has no fixed obligation to repay. But when finance comes from debt, the firm has a fixed obligation, and can be forced into bankruptcy if it fails to meet that obligation. Therein, firms will tend to be risk averse if they do not have ready access to equity finance, and they need debt finance. However, despite the advantages of equity, firms finance a relatively small fraction of their investment with new equity issues. The reason is the imperfect, asymmetric information of markets. Owners of firms do not have perfect information about the value of their firms. When the market overvalues their shares, those firms will be most anxious to sell additional shares, that is to issue equities. Hence, issuing equity will be treated as a negative signal, and the market values of the firms will tend to decline.

Firms are often uncertain about the consequences of their actions ("instrument uncertainty"), and they will be sensitive to the risk associated with any action, including inaction. The factors that influence the risks firms face and their willingness to assume those risks are: the overall state of the economy, the firm's liquid asset position, and changes in the price level. A firm's cash position is affected by profits, and since profits are a residual, small changes in prices may have large effects on profits, and thus on firm liquidity. Moreover, since almost all debt is denominated in nominal terms, changes in the price level may have large effects on firm real liquidity and real wealth. Thus, when the economy goes into a recession, the riskiness of production increases, and

firm's willingness and ability to bear risk decreases. To maintain the same level of economic activity, with the reduced cash flow from lower profits, firms should borrow more. But increased debt leads to a higher probability that future returns will not be sufficient to meet the fixed obligation. This is how the theory of the risk adverse firm developed by Greenwald and Stiglitz explains why each firm's supply curve, and hence the aggregate supply curve, should shift markedly as the economy goes into a recession. It is also given an explanation of the process by which shocks to the economy are amplified in a world with flexible wages and prices using the theory of risk averse banks in credit markets. Similar to the risk averse firms, banks act in a risk averse manner. This risk averse behavior of banks will magnify an initial negative economic shock, and make recessions deeper and longer.

The risk averse firms theory does not apply to all the firms. There is a significant number of firms who take advantage from equity finance and whose market value does not decrease by the issuing of new shares. Another weak point of the theory is the fact that it does not provide an explanation of why debt contracts are denominated in nominal terms, to support the statement that "small changes in the price level have large effects on firm real liquidity and real wealth, since almost all debt is denominated in nominal terms." [Greenwald and Stiglitz, 1993].

Since both efficiency wage and insider-outsider theories of wage formation aim to explain why wages are sticky and may be set above their market-clearing level, Assar Lindbeck and Dennis Snower [Lindbeck and Snower, 1991] developed a New Keynesian

model that combines these two theories. Constructing a simple model of wage determination that includes the salient features of both the efficiency wage and insider-outsider theories, Lindbeck and Snower conclude that the two theories do not reinforce once another.

Insider-outsider and implicit contract theories have also been jointly analyzed in New Keynesian models. Derek Leslie [Leslie, 1992] shows that these two theories are complementary and an integrated approach could enrich both; implicit contracts ignore important institutional detail, whereas insider-outsider theory benefits from a systematic treatment of uncertainty, which implicit contracts theory can provide.

The complementarity between strategic interactions and real rigidity, with important implications for New Keynesian economics, was analyzed by E. Alvi [Alvi, 1993]. The concept of strategic complementarity assumes that higher action (the strategy variable) by other agents can induce an agent to change his actions in the same direction. Alvi demonstrates that there is a strong similarity between strategic complementarity and real rigidity, and that strong strategic complementarity involves a high degree of real rigidity (and vice versa). If strategic complementarity is strong, a change in prices performed by some firms may lead other firms to change their prices accordingly, which determines a highly rigid relative price. A further step is made by Alvi by integrating nominal rigidity, due to near-rationality and menu costs ideas, with strategic complementarity, and real rigidity [Alvi, 1993]. Both strategic complementarity and real rigidity aggravate nominal rigidity and lead to significant monetary non-neutrality.



## **9. EMPIRICAL TESTING OF NEW KEYNESIAN MODELS AND EFFECTS ON POLICY**

A theory generally has a descriptive character and envisions the essential features of a phenomenon. Models, as formal representations of ideas and relative knowledge about a phenomenon (theory of phenomenon) are the instruments used to support the theory on which they are based. Models are built as a system of hypotheses about the essential elements and laws of a certain theory, usually translated into a rigorous mathematical language. A theory is valid if the models built on that theory are able to explain the behavior of the endogenous variables (or the large majority of these variables, at least) in the past, and also to predict the behavior of the same variables in the future. In the analysis of the evolution of macroeconomic thinking, one approach in evaluating different theories is to show how well the theories have accorded with reality and how well these theories have been able to predict the behavior of certain macroeconomic variables.

A possible criterion for the evaluation of a theory could be the internal approach to paradigm shifts [Colander, 1988]. This approach suggests that the acceptance and use of a certain macroeconomic theory are a function of researchers' needs and incentives: the need to publish articles, the need for good dissertations topics, the need to teach. According to this criterion, New Keynesian school is in the same position as New

Classicals from the point of view of article publishing<sup>13</sup> but in a better position as far as teachability is concerned<sup>14</sup>. This internal approach in judging a school of thought is interesting and it certainly has a lot of truth in it. However, no matter how rich in research subjects and teachable a theory is, if its models are not tested using empirical data, and if these tests fail, the theory ceases to be alive.

It is difficult to test complete and complex macroeconomic models in real life, because economies are not laboratories in which experiences can be effectuated. Most of the time only parts, equations of a certain model have been tested using empirical data, and the interpretation of the experience is still complicated and does not offer significant results to entirely support one theory or another.

"Compared to the outburst of theoretical research on New Keynesian economics in the 1980s the amount of empirical work has been relatively modest" [van Ees and Garretsen, 1993]. Not many empirical tests of New Keynesian models were found; this is due to an objective and a subjective factor, as well. The fact that most of the New Keynesian models are partial, focusing on only one market or explaining an isolated phenomenon, the general difficulties of data collecting and testing a macroeconomic

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<sup>13</sup> The 'article criterion' refers to the fact that students need topics for their papers and dissertations, which have to be simple enough to be accomplished but also sufficiently difficult to impress advisers; professors need subjects for the articles they are required to publish. An internal evolution is necessary for the theory to continue to provide such research topics [Colander, 1988].

<sup>14</sup> A theory will have a lasting effect if it is teachable and can be integrated into text books; this is how a theory can continue to have influence over time [Colander, 1988].

model at a large scale, the larger number of theoretical developments in comparison with practical approaches constitute the objective factor. The subjective factor regards the limited available time for the research; more results of empirical testing of New Keynesian models could have been found through a much deeper research on applied economics, since not all studies contain an explicit "New Keynesian" label in title or content. Only two studies were retained, on the reason of their comprehensive view of the models tested.

A way of testing New Keynesian beliefs would be the survey of the business cycles facts, to see if there is a similarity between the real behavior of business cycle facts and their predicted behavior according to the New Keynesian theory. In this approach, one of the business cycle facts that can be analyzed is employment. New Keynesians believe that aggregate demand shocks are the primary source of business fluctuations. Such shocks will determine fluctuations in output in order to meet the demand; therefore, firms will employ just as much labor as necessary to produce the needed output, and thus, employment will fluctuate in the same direction as output, being procyclical. The real wage should also be procyclical according to the New Keynesian theory. As we have seen in chapter 4.1. there is an exception to this rule: in menu costs and imperfect competition models real wages can be counter- or a-cyclical. Investment spending and other spendings on durable goods are assumed to be procyclical and very volatile. This is explained by the frequent reassessments in investors' expectations about

the marginal product of capital<sup>15</sup>. Whenever cycles are caused by fluctuations in the LM curve, investments will also be procyclical (a monetary expansion or contraction will reduce, respectively increase the real interest rate, and will increase, respectively decrease both output and investment). Government purchases are assumed to be procyclical in New Keynesian theories. Also, monetary nonneutrality (caused by price stickiness) causes money to be procyclical and leading. Inflation, in New Keynesian models, is predicted to be procyclical and lagging.

If a survey of these business cycle facts showed that their behavior was similar to that predicted by New Keynesian theories, this would constitute strong evidence to support the New Keynesian approach to macroeconomics (although it might not reject other approaches).

Laurence Ball, Gregory Mankiw, and David Romer [Ball, Mankiw, and Romer, 1988] developed a model based on the New Keynesian assumption of nominal rigidity in prices caused by menu costs; this model was used to test the prediction that the real effects of nominal shocks are smaller when average inflation is higher. The effect of average inflation on the output-inflation trade-off is one of the distinguishing features of New Keynesian from New Classical models. New Classical theories state that average inflation is irrelevant to the output-inflation trade-off, because only the variances of random variables affect the uncertainty that economic agents face, means having no

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<sup>15</sup> Keynes considers these frequent changes in expectations as 'waves of investor optimism and pessimism' [Abel and Bernanke, 1992], which he calls "animal spirits".

effect. New Keynesian theories of nominal rigidities predict that high inflation makes the Phillips curve<sup>16</sup> steeper. Ball, Mankiw, and Romer examined the variation of the trade-off between output and inflation across countries. A sample of 43 countries was selected, and data for inflation and output for the period 1948-1986 were used. The results of the study showed that the trade-off is affected by the average rate of inflation, providing evidence to support New Keynesian theory.

A New Keynesian model similar to the one originally developed by Ball, Mankiw, and Romer [1988] was tested by Robert Defina [Defina, 1991], using data for 43 countries for the period 1949-1986, in order to provide international evidence for the New Keynesian theory of the output-inflation trade-off. The model is based on the menu costs assumption, which allows nominal shocks to have real effects (as we saw in chapter 5.1.) According to this model, the degree to which nominal shocks affect output varies inversely with the level of trend or average inflation; as inflation increases, it causes more frequent price adjustment, which means less rigidity, so nominal shocks should have smaller real effects. The study yielded results that support the New Keynesian theory: average inflation had a negative and significant impact on the output-inflation trade-off.

Bruce Greenwald and Joseph Stiglitz [Greenwald and Stiglitz, 1988] examined alternative macroeconomic theories and tried to find circumstances in which these theories yielded markedly different predictions, and especially to find which of these

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<sup>16</sup> The Phillips curve shows an inverse relation between inflation and unemployment.

theories better performed in predicting the behavior of certain macroeconomic variables. A number of stylized facts about business cycles were chosen as crucial tests in this analysis. These stylized facts were organized around the markets for goods, capital and labor, and the alternative theories analyzed were Real Business Cycle, traditional Keynesian and New Keynesian. The results are presented in table nr.2.

The authors used data from Citibank Citisource Database for the period 1967-1986, for United States, Japan, West Germany, Great Britain, and Australia. The theories were tested in order to see how well they are able to explain the behavior of the business cycle facts. Real Business Cycle theory was able to explain only partially the nature of output fluctuations and investment fluctuations, and it was not able to explain price rigidities on the goods market, cyclical movements in wages, hours, and employment, unemployment and layoffs (see also beginning of chapter 8 for the behavior of business cycle facts). New Keynesian theories were able to completely explain all business cycle facts retained for analysis, except for price rigidities and cyclical movements in wages, hours, and unemployment, which they explained only partial. Although no model succeeded to completely explain all data, New Keynesian theories -- especially those that concentrate on imperfections in the capital, goods, and labor markets arising from incomplete and costly information -- seem to provide the best explanations.

Table nr.2: Success of alternative theories in explaining basic characteristics

Characteristic	Real Business Cycle	Traditional Keynesian	New Keynesian
<b>Goods market</b>			
Nature of output fluctuations	partial	partial	yes
Common magnitude of output fluctuations	yes	no	yes
Price rigidities	no	partial	partial
<b>Capital market</b>			
Investment fluctuations	partial	partial	yes
<b>Labor market</b>			
Cyclical movements in wages, hours, employment	no	no	partial
Unemployment and layoffs	no	yes	yes

(From Greenwald and Stiglitz, "Examining Alternative macroeconomic theories", Brookings Papers on Economic Activity, 1988)

An interesting further step would be to determine how volatility in major macroeconomic variables could affect some of the theories of major schools of macroeconomic thought, especially real business cycle theory and Keynesian theory. Analyzing business cycle volatility in some developed market economies during the

period 1870-1986, Morris Altman [Altman, 1992] found that business cycles were prone to much less stability before the Great Depression than after the Second World War. The volatility estimates for each of the GNP series that Altman analyzed revealed that business cycles in the 1870-1928 period were relatively much more volatile than those in the 1947-1986 period. The results are consistent with the view that increased government intervention, either through discretionary fiscal or monetary policy or through the development of built-in or automatic stabilizers, might have contributed to the reduction in the cyclical volatility. Evidence for the dampening in the severity of business cycles makes it much harder to support the real business cycle theory; therefore, the evidence that Altman presents speaks more in favor of Keynesian theory and also against real business cycle theory. However, if significant conclusions have to be drawn, further empirical research has to be done.



## **10. CONCLUSIONS**

"History is nothing else but an unique upholstery. The eye of the human being cannot distinguish of it more than a back of a hand... Many things are told about the model of the upholstery. Some people are convinced they can see the model. Some people see what they were taught to see. Some people remember to have seen the model, but they forgot it. [...] Some people are convinced that there is nothing to be seen. Some people" [Thornton Wilder, 1967].

### **10.1. Solutions and common points in New Keynesian theory**

As we have seen along this incursion into the New Keynesian school of thought, the main purpose of New Keynesian economics is to explain short run fluctuations in the level of economic activity, persistent involuntary unemployment, and the non-neutrality of money based on microeconomic foundations and the assumption of non market-clearing equilibrium. The explanations focus mainly on the rigidity of wages and prices on short run, the transmission mechanisms between nominal and real variables, and

incomplete information and market imperfections. But there is an impressively large number of rationales for all these explanations; as Froyen states [Froyen, 1993], the New Keynesian literature is characterized by a "dizzying diversity" of approaches. However, a number of common features of New Keynesian economics can be distinguished:

- New Keynesian models are non market-clearing models; economy can reach an equilibrium below the full-employment level;
- the classical dichotomy between real and nominal variables fails; therefore, fluctuations in nominal variables like the money supply can affect real variables such as output and employment;
- wages and prices experience a certain degree of rigidity; there is a distinction between nominal and real rigidities of wages and prices;
- there is imperfect competition and incomplete information on the output market;
- imperfections on the capital market strengthen the interdependencies between real and financial variables, which can affect the level of real economic activity even in the situation of completely flexible prices;
- variations in real output and inflation result from shifts in the aggregate demand;
- economic fluctuations do not reflect the Pareto efficient response of the economy to changes in taste and technology, but market failures on a large scale;
- both monetary and fiscal policies can have short-run effects on the aggregate demand;
- fiscal policy can have important effects on potential real output on long run;

- both monetary and fiscal policies should be used in order to move real output towards potential output.

If New Keynesian economics could be visualized as a complex construction describing the behavior of the economy, then this construction would be based on three pillars, each made from different columns (figure nr.6). The first pillar consists of all the theories trying to explain either nominal or real rigidities in the output market (price stickiness, monopolistic competition, menu costs, near-rational behavior, respectively imperfect information, customer markets, and prices as a quality signal), including theories that try to explain both real and nominal rigidities (coordination failures theories). A second pillar is constructed from theories that explain nominal or real rigidities on the labor market (staggering of wages, respectively efficiency wage, insider-outsider, implicit contract, and sectoral shifts theory). The third pillar explains real rigidities on the capital market (credit and equity rationing theories). The pillars are centered in such a way that the whole construction could be supported by only some of them (as a reflection of the fact that not all New Keynesian theories are needed to explain the behavior of the economy).

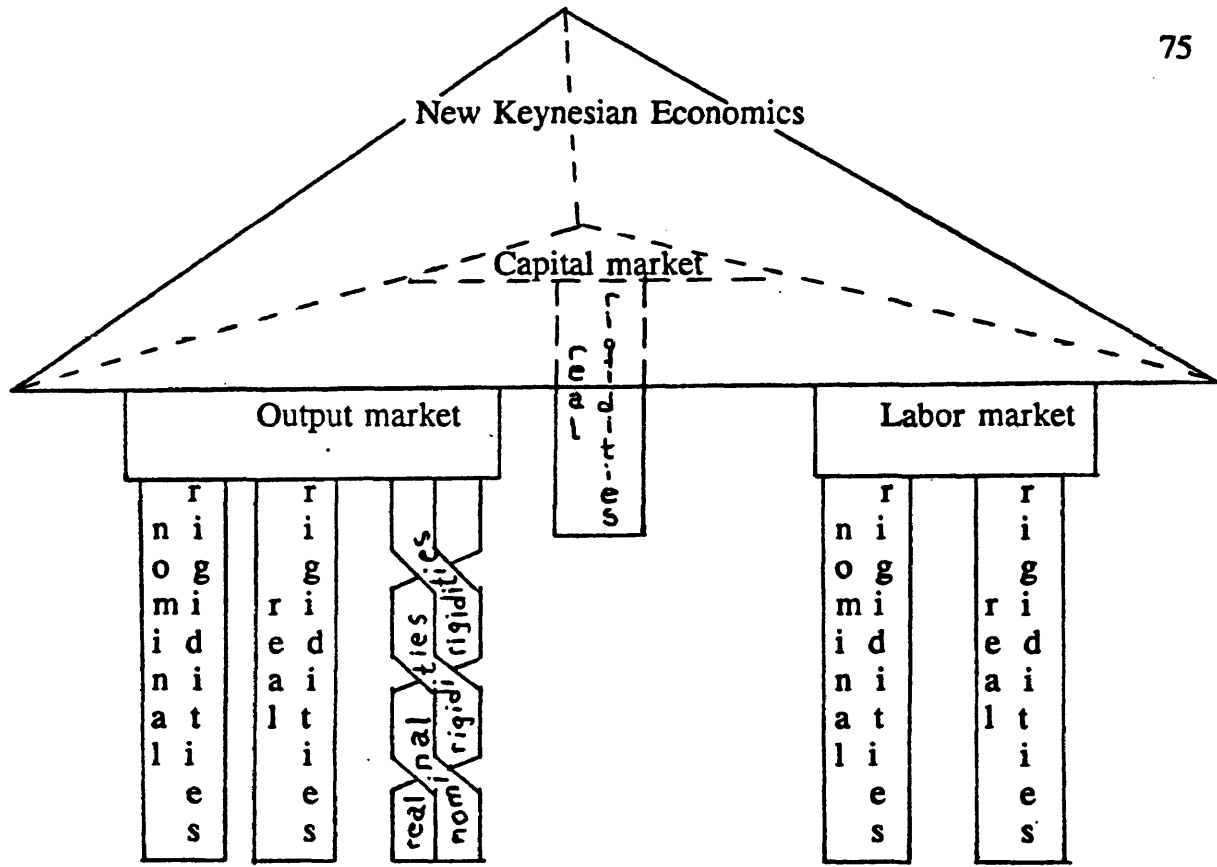


Figure nr.6: New Keynesian economics' pillars

## 10.2. Unsolved questions and criticisms

None of the macroeconomics school of thought is able to completely explain the behavior of economic variables over time and all of the business cycle facts. New Keynesian theory is not an exception; there are several unsolved questions and contradictions that lead to criticisms against New Keynesian economics, as we have seen

in each chapter discussing a particular New Keynesian stream. A short synthesis of these criticisms would be useful because further researches of the New Keynesian school should concentrate on these criticisms.

One of the criticisms raised against New Keynesian economics is that most theories focus only on specific aspects of particular markets [van Ees and Garretsen, 1993]. A valid macroeconomic theory should not have a partial view of the economy, concentrating on the behavior of a particular price or quantity variable on a particular market, but it should have a complete, integrative view of the entire economic system. Also, critics argue that New Keynesian economics has too many different streams and it is not a unified school of economic thought [van Ees and Garretsen, 1993].

Another question is whether price and wage rigidities as explained by the New Keynesian theory are necessary and sufficient for the analysis of the economy as a whole. Many critics argue that price stickiness cannot be explained by confusions about the price level due to incomplete and imperfect information. The argument is that these confusions cannot be large enough or cannot persist long enough to cause the large changes in output over the business cycle.

Criticisms were also directed towards those New Keynesian theories that explain the slow adjustment of wages in the labor market based on explicit and implicit contracts. It is argued that contracts that set nominal wages are not consistent with a rational individual behavior, especially when individuals expect an increase or a decrease in prices, and, therefore, there is no reason for workers to accept such contracts. Workers

and firms negotiate to share the risk of possible shocks in the aggregate supply or aggregate demand that would unexpectedly change the price level, so it is unlike for the workers to sign contracts that fix the nominal wage.

New Keynesians assume that one of the reasons for sticky wages and fluctuations in employment consists of the inefficiencies in the labor market. However, when workers hold lifetime jobs the wage paid during a certain period is not necessarily equal to the marginal product of labor, but can be an installment payment. Therefore, sticky wages do not necessarily imply that there has to be an unexploited gain or market inefficiencies.

One of the assumptions of the New Keynesian theory is that nominal wages are fixed and real wages are countercyclical, decreasing during expansions and increasing during contractions. In the real life, the pattern of changes in real wages over the business cycle does not confirm this assumption, being the opposite of the predicted one.

Critics do not agree with the explanation of price rigidity using the theory of monopolistic competition and menu costs. They argue that these menu costs cannot be large enough to justify the sluggishness of prices and to explain fluctuations at a macroeconomic level.

Another critique of the New Keynesian explanations of price stickiness is based on the expected rational behavior of economic agents to different incentives. It is argued that if market prices fail to adjust quickly to an equilibrium between supply and demand on a particular market, then all those that adjust quicker could obtain large benefits. This

is a strong incentive for a quick adjustment and for the exploitation of gains from exchange and specialization, and against the price stickiness.

New Keynesian theories state that prices and wages are sticky in the short run, but do not deny the fact that prices and wages end by adjusting in the long run, without explaining the differences between short and long run adjustments and without describing the mechanisms for such adjustments. New Keynesian theory has to improve its explanations for the behavior of economic variables on long run because the long run view of the economy is a weak part of New Keynesian economics.

Other criticisms concern the issue of the extent to which financial decisions explain fluctuations in aggregate output.

A question mark raises the theory of risk averse firms, which cannot be applied to all the firms. There is a significant number of firms who take advantage from equity finance and whose market value does not decrease by the issuing of new shares. Another weak point of the theory is the fact that it does not provide an explanation of why debt contracts are denominated in nominal terms, to support the statement that "small changes in the price level have large effects on firm real liquidity and real wealth, since almost all debt is denominated in nominal terms." [Greenwald and Stiglitz, 1993]. Greenwald and Stiglitz emphasize that firms must view all their decisions together, that the costs of adjusting prices must be put in juxtaposition with the costs of adjusting quantities. However, using the theory of risk averse firms, they focus especially on the uncertainty about the consequences of price and wage adjustments, but the consequences of output

adjustments could be important, as well. More attention should be paid to the imperfect competition assumption, important in explaining how firms set their wages and prices.

Robert King [King, 1993] argues that the debates among the numerous New Keynesian perspectives do not focus on the right point. In his opinion, New Keynesian should adequately consider in their models the role of expectations and dynamics. He considers that the Keynesian IS-LM model, as traditionally constructed and currently used, is a hazardous base on which to build positive theories of business fluctuations and to undertake policy analysis. King's essay does not concern the role of expectations on the aggregate supply side, but on the demand side, as it was standard in the old Keynesian tradition. However, he thinks that both old and New Keynesians views are at least incomplete: the IS-LM model does not provide enough guidance when rational expectations are considered; New Keynesians are separated in two strands that try to find explanations for two opposite assumptions, complete price stickiness and increased price flexibility, none of them being able to entirely explain the economic fluctuations. In King's opinion the right question is "Why are prices sticky in certain historical periods and rapidly adjusting in others?", thus trying to find a different, extended model which incorporates rational expectations.

All these criticisms seem to have the same "dizzying" diversity that New Keynesian theories have. In fact, the ultimate criticism raised against New Keynesian theories is this diversity of streams and lack of unity. Recalling the image of the New Keynesian construction built in chapter 10.1, this ultimate criticism concerns the diversity



of sub-pillars on which New Keynesian economics rests, which do not have the same "architectural style", and do not provide, therefore, a unique view of the economy's behavior.

**10.3. New Keynesian theories on the macroeconomics map**

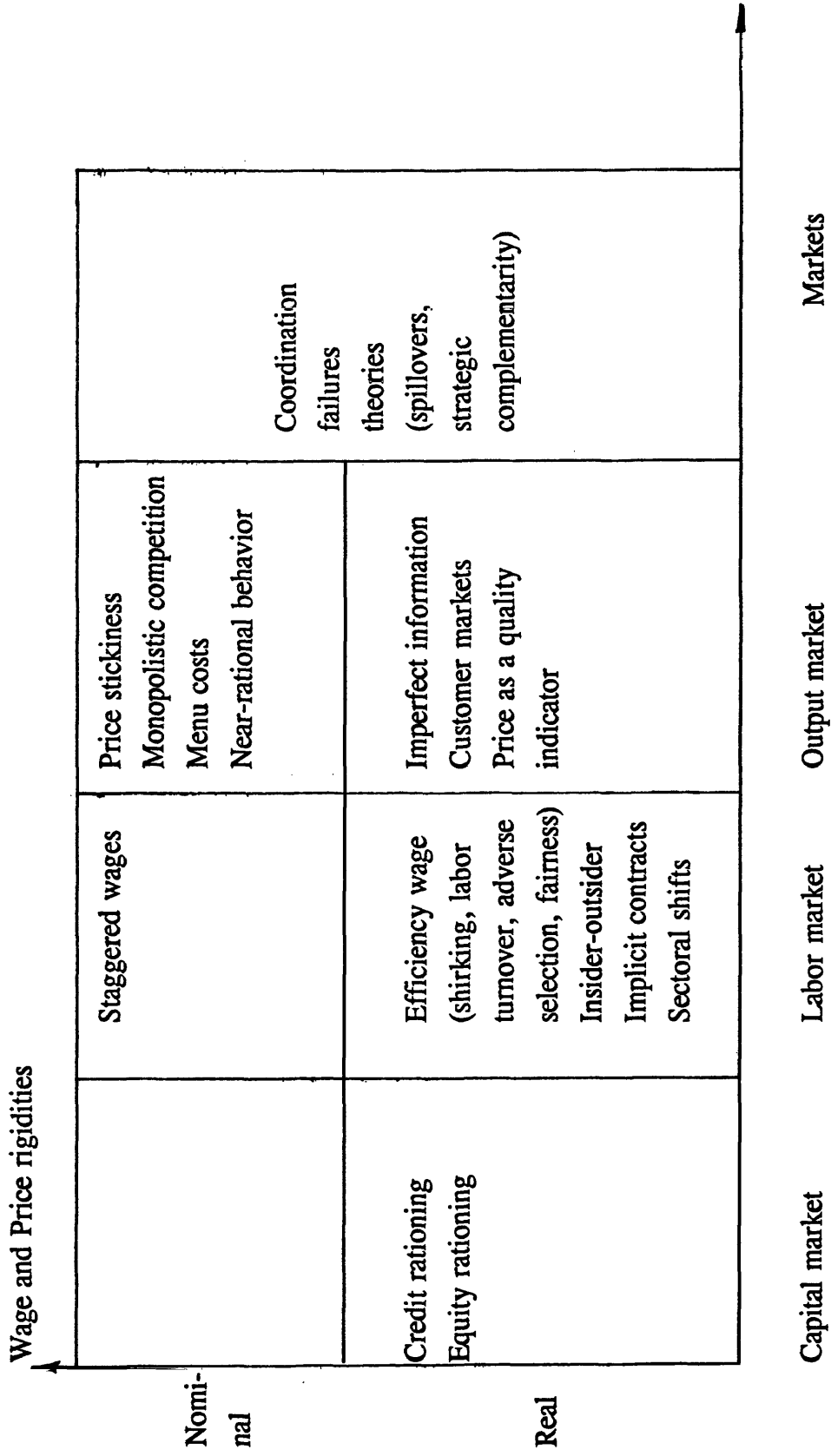
A possible classification of the schools of macroeconomic thought concerning the fluctuations of the economy was proposed by David Romer [Romer, 1993]. The criteria he uses are the classical dichotomy and the non-Walrasian features of the economy. Romer obtains the following diagram:

		Does the economy have important non-Walrasian features?	
		No	Yes
Does the classical dichotomy fail?	No	Real Business Cycle Theories	Coordination Failure Theories
	Yes	Traditional Keynesian and Monetarist Theories; Lucas Imperfect Information Theory	New Keynesian Theories

New Keynesian theory is the only one which rests on the belief that both failure of the classical dichotomy and non-Walrasian elements of the economy are essential to the business cycle. Also, only New Keynesian models provide an explanation of the importance of nominal disturbances to the real economy.

For a unitary vision of New Keynesian economics, a graphical synthesis of all New Keynesian theories would be suggestive. Such an attempt is presented in figure nr.7. New Keynesian theories were grouped according to the market on which their attention was particularly focused (horizontal axis) and to the nature of wage and price rigidities explained, real or nominal (vertical axis). Coordination failure theories were also included on this map. They focus especially on the output market, but they try to explain both real and nominal rigidities, as we have seen in chapter 6 of the thesis.

Figure nr.7 : Map of New Keynesian theories



#### **10.4. Further research**

The research for the present thesis is subject to certain limitations and constraints. First, the scope and complexity of New Keynesian economics could quite well be a subject for more extended research, from both time and resources point of view. Second, the subject is in a relatively new area, with many recent developments, but with many unsupported statements and assumptions, and contradictions as well. The thesis covers most of the theoretical aspects of New Keynesian economics, and some aspects related to the results of empirical testing of New Keynesian models. Until a certain unity of New Keynesian theories is reached, the question of equilibrium or disequilibrium in New Keynesian models remains an open one. Further research will include different types of mathematical models developed under the New Keynesian assumptions, as well as surveys of the behavior of different business cycle facts in real life; the results of these surveys and analyses, together with the results of empirical testings of New Keynesian models, can bring arguments to support New Keynesian economics or can reveal directions for further improvements.

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