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## NOTES ON THE THEORETICAL AND POLITICAL MEANING OF THE MPS MODEL (1966-1970)

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### *Introduction*

In his influential Presidential Address Milton Friedman *claimed* the “revival of belief in the potency of monetary policy” (AER 1968, 5). Friedman even argued that the pendulum “may well have swung too far, that now ... we are in danger of assigning to monetary policy a larger role than it can perform ...” (1968, 6, 8)<sup>1</sup>. Friedman’s PA well testify the changing view on money and monetary policy that occurred over the 1960s. Nonetheless, his *complaint* appears quite surprise because he was among the main responsible of the rediscovery of money. Friedman’s awareness appears surprising also because in the mid-60s ‘orthodox’ Keynesian economics still was the mainstream, at least looking at the most important large-scale macroeconomic models. They were, in fact, all built along traditional Keynesians lines (because a direct or indirect outgrowth of Lawrence Klein’s view) thus focusing on real variables and fiscal policy - Samuelson (1975) referred to this period as the *Klein era*.

In addition, the late 1950s and early 1960s saw the emergence of the modern theory of finance (Gurley and Shaw 1960) whose attention on the primary role of financial intermediaries undermined the role of money supply and challenged the use of monetary policy as a stabilizing device. The Radcliffe Report (1959), as well, supported debt management policy rather than monetary policy.

My paper investigates the political and theoretical reasons that led to the building of the FRB-MIT-Penn (FMP, also MPS) macroeconomic model and its role in the Keynesian and Monetarist debate of the 1960s and early 1970s.

The main features of the model has been already discussed within the history of macroeconomic modelling by Bodkin *et al.* (1991) and with reference to Modigliani’s contributions to economics by Szenberg, Ramattan (2008). These reviews, however, do not discuss the historical and theoretical context in which the model developed, from which my narrative starts. The FMP model was sponsored by the Federal Reserve who asked Modigliani in the mid-1960s to build a macroeconomic model with forecasting and economic policy purposes. It was both the first

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<sup>1</sup> “It is hard to realize how radical has been the change in professional opinion on the role of money. Hardly an economist today accepts view that were the common coin some two decades ago.” (Friedman 1968, 6).

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macroeconomic model of the Fed and the first Keynesian model devoted to analyze in depth the behavior of monetary and financial variables and their linkages with the real sector.

Today it is considered representative of the state of knowledge in the late 1960s and early 1970s and the “apotheosis” of the neoclassical synthesis (Fisher 1988, Blanchard 2008, Goodfriend and King, 1997 among others).

The paper is organized as follows. The first part deals with the origin of the collaboration between the Fed and Modigliani and the political and theoretical meaning of the macroeconomic model. The second part reconstructs the role of the model in the Keynesian Monetarist debate looking at two aspects: the methodological dispute involved and at the stability issue and the definition of medium run, which represented the necessary premise for the implementation of stabilization policies.

### 1. *The historical and theoretical context*

In his narrative about the Fed postwar monetary policy Robert Hetzel (2008) distinguishes between the *stop-go monetary policy* (1965-1979) which (implicit) objective was a low stable unemployment and the *lean against the wind policy* (1955-1965; 1979 -) which main task was prices stability. The *stop-go* era is described as the result of the Keynesian belief that the inflation was a real phenomenon and that “fiscal policy and direct intervention by government in price setting should substitute for monetary authority to control inflation and business cycles” (2008, 58). The postwar Keynesian skepticism towards money had confined monetary policy to the subordinate role of accommodating fiscal policy by the commitment of supporting the prices of government securities through a low and stable interest rate (the *peg era*).

It was with the outbreak of the Korean War and the budget deficits constraints, that the Fed initiated a slow but progressive raise of the short term interest rate leaving the bonds market without the Fed support (Stein, 1969, 277, Meltzer 2003.... see also Mehrling 2011). The 1951 Treasury-Fed Accord definitely *liberated* the monetary authority from the Treasury policy thus re-gaining its control over interest rate (Mehrling, 2011, 54-55).

The Fed first attempt to pursue countercyclical monetary policy began with the 1953 recession (after the Korean war), and in response to the 1956 revival of inflation, challenging for the first time the Keynesians orthodoxy about the relevance of monetary policy and the non-monetary character of inflation (Hetzel 2008, 55).

In 1955 Paul Samuelson in his testimony before the Joint Economic Committee, supported a fiscal and monetary policy mix (easy money to stimulate investment and budget surpluses to provide the savings) to sustain economic growth and full employment (Stein 2008, 36, 3, see also Samuelson 1955). The same year, during the joint meeting of the AEA and the AFA, the New York Fed explicitly

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endorsed the goals of the *Employment Act* pointed out the importance of the Fed for achieving them, and asked for the academic help: “your study and your published finding” (quoted from Mehrling, 2011, 56). The economic advisers of the Kennedy administration (Galbraith, Harris, Samuelson and Tobin) believed that the economic problem was to achieve high and rapid economic growth to maintain full employment through fiscal and monetary policy, “with the former being the senior partner in the combination”.

As noticed by Stein (1969, 382), once monetary policy had been re-incorporated into Keynesians thinking the distinction between Keynesians and non-Keynesians ceased to be relevant. As Friedman stated in the mid-1960s: “We are all Keynesians now and nobody is any longer a Keynesians” (*Time* December, 1965, p. 65 quoted from Stein 1969, 381-82). Thus, in the 1960s money matters again and the issue became that of integrating “the new appreciation of money with the largest institutional and intellectual framework of macroeconomics” (Mehrling 2011, 60). The attempts followed different lines. Friedman moved in the direction of the restatement of the quantity theory of money, whereas Keynesians looked at financial variables with money becoming only one among many substitutable financial assets, partly incorporating Gurley and Shaw theory of finance. This new Keynesian view undermined, once again, the Fed’s ability to control the money stock, questioning the relevance of the monetary system because the increasing influence of financial intermediaries.

The first attempt to understand the role of money and monetary policy on empirical grounds was represented by the building of the FMP model, to which Ando and Modigliani began to work since the mid-1960s. The Fed econometric model was especially conceived to analyze and to quantify the impact of stabilization actions, particularly monetary policy, on aggregate demand with half of its behavioral equations containing fiscal and monetary policy variables (it was the model with the largest number of policy variables). As mentioned above, with the *1951 Act* the Fed had gained an increasingly independence from the Treasury policy. Moreover, since the mid-1950s leading Keynesians, such as Paul Samuelson, opened to the possibility of a monetary and fiscal policy mix (see Samuelson 1955), but there were no econometric models connecting the financial and the real sectors, and the Fed had not its own model. As pointed out by Gramlich and de Leeuw in the early report on the FMP model, it was built “because no existing model has its major purpose the quantification of monetary policy and its effects on the economy” (1968, 11)<sup>2</sup>.

On the other hand, the Fed’s just regained political authority was undermined by the spread of the monetarists’ view that ascribed to monetary policy a major responsibility for business fluctuations

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<sup>2</sup> Rasche and Saphiro (1968, 124) also explained the construction of “yet another quarterly econometric model” because, differently from the existing ones, its specific purpose was to incorporate explicit policy instruments for those in charge with responsibility for stabilization policy (particularly of monetary policy).

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and denied that monetary policy should be concerned with unemployment. The Fed authority was also questioned by the emergence of the modern theory of finance that focused on the role of financial intermediaries rather than of money supply to influence economic activity. Along with monetarists, it supported a constant money growth rule, although for opposite reasons.

Finally, the Radcliffe Report (1959) also challenged the role of money supply to influence aggregate demand arguing that they had no direct effects on spending. By contrast, liquidity (of which money supply was part) was crucial. Since the most important source of liquidity were financial institutions, which lending depended from the level and structures of interest rates, its control must be the focal point of stabilization policies. As for traditional Keynesian thought, according to the Report, debt management policy was the most effective stabilization device, however through its influence on interest rates, rather than monetary policy. Central banks could play only a minor role, influencing them through changes in expectations.

To confront these new challenges, and because the Fed increasing responsibility in reaching economic targets (full employment) a more rigorous approach to monetary policy was needed. This would explain the search for a closer connection with the academia as emerges by the Fed's establishment of the Academic Consultants meetings in 1964 that should replicate the Treasury consultant meetings launched by Seymour Harris in 1960 (see Lee Bach 1964, Modigliani Papers - MP).

### *1.1 The MPS model and the theoretical context*

The collaboration with the Fed for the building of the FMP model gave to Modigliani the opportunity to test empirically his monetary view, already advanced in 1944 and re-affirmed with the 1963 article. Since the beginning of his studies Modigliani appears interested to analyze the links between the monetary and the real side of the economic system. In his influential 1944 article he opposed to Hicks' (1937) focus on the liquidity trap a monetary explanation (and solution) of involuntary unemployment. He already challenged the Keynesians orthodoxy arguing that unemployment equilibrium originated from a disequilibrium in the money market rather than from a lack of investment or a fall in the propensity to invest, and thus it required an increase of money supply<sup>3</sup>.

Under this perspective, the MPS model represented an attempt to fill a lacuna within the traditional Keynesians view and early macroeconomic models that only concentrated on real variables and fiscal policy. As Modigliani explained, the MPS model was built "along Keynesians lines - but our

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<sup>3</sup> "The statement that unemployment is caused by lack of investment or that a fall in the propensity to invest or an increase in the propensity to save will decrease employment, has become today almost a common place...the low level of investment and employment are both the effect ... of a basic maladjustment between the quantity of money and the wage rate" (1944, 75-76; see also Rancan 2016). *Modigliani also recalled that he was very happy to know that Gerard Tinter would like to test empirically his 1944 model (Modigliani 2001).*

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sort of Keynes, where money is very important” (2001, 100). Modigliani aimed to challenge the idea that for Keynesians money did not matter. Therefore, the model especially intended to demonstrate the influence of monetary variables on real ones, highlighting the anti-cyclical role of money. Most of the large-scale models of that time were inspired by Lawrence Klein who did not believe in the investment’s interest elasticity (see Klein 1947)<sup>4</sup>. The Klein-Goldberg model (1955) and the Klein’s Postwar Quarterly model (1964) were devoted to analyze the functioning of the real sector and the impact of fiscal policies with the money market that played a minor role. When monetary policy effectiveness was discussed the Keynesians models mainly concluded in favor of fiscal policy, as in the case of the Brookings model according to which “monetary policy shifts must be substantial if the course of the economy is to be changed, at least in a recessionary situation”<sup>5</sup> (see Bodkin *et al*, 1991, 96, 104, Intriligator, 1978, 452).

Finally, as later discussed, the FMP model could represent the answer to Friedman and Schwartz’s 1963 challenge to investigate empirically the role of money in business cycles and its transmission mechanisms, and to Friedman and David Meiselman (1963) empirical dismissal of the Keynesians income determination model at the origin of the Monetarists and Keynesians dispute.

## 2. *The origin of the MPS model*

The growing attention to monetary theory and policy is well testified by the 1962 conferences on *Monetary Economics* organized by Lee Bach at Carnegie Tech and sponsored by the National Bureau Committee, devoted to reexamine the role of money on economic activity (Bach, 1963, 3)<sup>6</sup>. The Conference on monetary economics held two sessions, one devoted to policy issues the other on theoretical ones. The former session discussed the results of the 1958 Commission on Money and Credit established by the Committee for Economic Development (chaired by Karl Brunner), devoted to investigate the main developments of the monetary and financial systems.

The *theoretical* session hosted the papers of Friedman and Schwartz, Modigliani, and Duesenberry. Its focal point was Friedman and Schwartz’s empirical study devoted to provide factual evidence on the crucial role of money stock in business fluctuations rather than changes of autonomous expenditures, anticipating the results of their forthcoming *Monetary History of the United States*<sup>7</sup>. They, however, only sketched the channel through which money supply affects the real economy

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<sup>4</sup> See for example Ackley 1963, Klein 1964, Klein-Goldberger 1964 etc.

<sup>5</sup> Fromm and Taubman evaluated the welfare implications of fiscal and monetary policy, with the latter having the high ranks on a utility basis essentially because it tends to increase the government surplus while the fiscal policies decrease it (Bodkin *et al*. 1997, 106).

<sup>6</sup> A conference on similar topics was organized also by...

<sup>7</sup> Similar conclusions were published by Friedman and Meiselman in their report to the Commission on *Stabilization policies* (1963) which initiated the so-called radio station debate with Ando and Modigliani (FM AM debate) on which I will return later.

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referring to its direct influence on prices (because cash balances and real assets substitution) rather than through changes of interest rates as argued by the Keynesians. Friedman and Schwartz however admitted to have “little confidence” in their knowledge of the transmission mechanism, concluding that this was “the challenge our evidence poses: to pin down the transmission mechanism *in specific enough detail ...*” (1963, 55 emphasis added).

According to Bach (1963), Friedman and Schwartz’s rediscovery of money and the emerging agreement on portfolio analysis, although through different adjustment mechanisms, could lead to a rapprochement of the Monetarists and the Keynesians views (1963, 3-4). Once the active role of money and credit on economic activity had become largely accepted what remained to understand was the mechanisms by which it affected real variables. Thus, the attention shifts on the theoretical and empirical explanation of these channels of influence, and the need of empirical researches was acknowledged by all the participants to the conference<sup>8</sup>.

At the same session Modigliani discussed his *Monetary Transmission Mechanisms* article. Modigliani’s paper is especially known as an updated version of his early 1944 Keynesians model, particularly with regard his dispute with Patinkin on the real balance effects. In the second part of the paper Modigliani analyzed the modus operandi of monetary and fiscal policy through the standard IS LM apparatus<sup>9</sup>. The article was an outgrowth of monograph on the theory of money within a general equilibrium framework Modigliani initiated to write since the 1950s but he never published. These notes were especially stimulated by his classes on monetary economics (at Carnegie) and by Patinkin’s attempt to integrate the Walrasian and the Keynesian systems through the real balance effect (*see Modigliani to Dreze...MP*, see also Modigliani 1963, footnote). Although strictly connected with the debate of the 1950s Modigliani anticipated the main issues under dispute with Monetarists in the 1960s discussing the effectiveness of monetary and fiscal policy<sup>10</sup>. Nonetheless, differently from the subsequent debate on stabilization policies that focused on their anticyclical role, Modigliani analyzed their effects within a long run perspective that is in terms of output utilization, as between private consumption, public consumption and capital formation. From this perspective he concluded that “the case for a currently balanced budget, and hence for relying on monetary rather than on fiscal policy as a first line of defense in counteracting shifts in the forces controlling aggregate demand, is somewhat stronger than might have appeared some time ago” (1963, 97).

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<sup>8</sup> Minsky acknowledged that the non-existence or primitive monetary and financial sectors of the Klein-Fromm and of other models is a deficit that should be corrected... The MPS model was a first attempt to fill this lacuna.

<sup>9</sup> According to Mehrling (2014) Modigliani had moved to the MIT called by Samuelson to face the emergence of the monetarism counterattack.

<sup>10</sup> It has to be noticed that in his Ph.D thesis (of which the 1944 was part) Modigliani devoted a large part to discuss and compare the effect of fiscal and monetary policy to reduce unemployment arguing in favor of this latter.

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Finally, in the last section of the article Modigliani rejected the dichotomy between the income-expenditure model and the quantity theory of money emphasized by Friedman. According to Modigliani, the two approaches might be integrated through the recognition that money affects income through both changes in the demand for money and a reduction of the cost of capital<sup>11</sup>. Modigliani 1963 model will become the theoretical framework from which the design of the MPS model initially moved.

Due to Bach counseling activity with the Fed (from the late 1940s)<sup>12</sup> the Carnegie conference also represented the starting point of an intense and regular collaboration between monetary economists and the Fed. In 1963 Bach launched the so called Academic Consultants' Meetings held every four months at the Fed Board at Washington through which monetary issues were jointly discussed by academic and the Board's economists.

### *2.1 Origin of the model: the Academic Consultants' meetings*

The Fed increasing responsibility for economic policy targets required closer relationships with academic economists to pursue a more scientific and rigorous approach to monetary policy, and to reduce the distance between monetary theory and practice (as already asked in the mid-1950s).

In 1963 the Fed Governor Chesney Martin asked Back to arrange a series of informal discussions on monetary economics between a small group of academic monetary economists and the Board. As Back explained to Modigliani

“The Board feels that has not active contacts with academic economists. While this plan has some parallel with the Treasury Consultants' meetings ... the discussion more sharply focused on issues which are of direct responsibility of the Board, to discuss immediate current policy issues and some major issues of analysis and policy” (Back to Modigliani, November 1963).

The purpose of the meetings were to provide the Fed Board with information and counsels from leading academic economists and also to permit the economists to gain a better feel of the problems facing the Board. The sessions should be on practical and not technical issues, because at the Board “they are rather allergic to what they consider theoretical and up with clouds discussion” (Bach to

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<sup>11</sup> See also Minsky's comment to FS's paper. According to Minsky, the belief that money was important was not inconsistent with the acceptance of the modern income expenditure approach to business cycles (1963).

<sup>12</sup> It was Bach (Dean of the Graduate school in Business Administration – GSIA- since 1949) to ask Modigliani to join him at Carnegie in 1952 to reinforce the study of monetary, mathematical and quantitative economics. They will be colleagues until Modigliani moved in 1961 to Northwestern and then the MIT. Bach as well moved to Stanford in 1963.

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Modigliani, January 8, 1964). Modigliani will become one of the most active participants to these meetings along with Duesenberry and Okun among others and, since 1965, Friedman and Meztler<sup>13</sup>. Since the beginning both Keynesians and Monetarists claimed the lack of scientific (they meant quantitative) approach to monetary policy. According to Duesenberry (1964), although the Board tries to approach their task in a scientific spirit “we cannot speak with the authority derived from a wealth of solid experimental evidence” (MP). Modigliani especially remarked the need to know the *modus operandi* of monetary policy and denounced the lack of empirical research arguing that the knowledge was based on fragmentary evidence and “on speculation, causal observation of behavior and more or less informed guesses...*quantitative evidence and analysis are non-existent* (March 1965). Friedman (October 1965) as well denounced the vagueness of policy discussion ... with policy directives qualitative in character (and he referred to the 1930s as the most dramatic example).

Quite contemporary, in the beginning of 1964, at the Fed Division of Research and Statistics Modigliani launched in accordance with Governor Martin an empirical seminar series for a better coordination of empirical research (Robert C. Holland to Modigliani, Jan 20, 1964). According to Governor Martin these empirical seminars must become regular “for a better understanding of our problems and, I hope, for a better formulation of our monetary policy” (Feb 4, 1964). Both the Academic Consultants meetings, which established closer relationships between the Fed and monetary economists, and the empirical seminars launched by Modigliani, probably represented the departure point for the design and the building of the FED econometric model. In the research project Modigliani submitted to the SSRC in the fall of 1966 he makes explicit reference to the empirical work already initiated at the Board.

### *3. The building of the model*

According to Modigliani recollection (2001) in 1964 the Fed asked him to build an econometric model for the US economy for forecasting and economic policy purpose (see also Bodkin et al., Szenber Ramattaran 2008). The model was completed in 1970 with the collaboration of Albert Ando, his former student at Carnegie, and was still being maintained in the late 1980s (Szenberg, Ramattaran 2008). It was the first large scale econometric model of the Fed, initiated under the governorship of Martin and especially sponsored by Daniel Brill (the Director of the Division of Research and Statistics) and by Frank de Leeuw (from the Fed Board), both already involved in the design of the Brookings model’s financial sector. Governor Sherman Maisel, a Keynesians appointed by Johnson

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<sup>13</sup> The starting point of each discussion was the Economic Report of the President and the outlook for the subsequent year, in particular regarding its implications for monetary policy.



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in 1965, also support the project<sup>14</sup>. Modigliani recalled that the Fed decided to drop out the project quite soon deciding that the model should be conceived and understood by the academia as an independent tool of economic policy, whose results should not reflect the Fed's view. Therefore, the model should be developed outside the bank by a consortium of universities, becoming the result of a research team formed by economists of the Fed Board and academic economists (MIT and the University of Pennsylvania through Ando's co-responsibility)<sup>15</sup>. The Fed financed the project through the SSRC with the implicit agreement that the MIT should be the main responsible (Modigliani, 2001).

However, in *Modigliani Papers* (MP) there is no evidence about this narrative. In the several memoranda Ando wrote for the Board of Governors and for the SSRC, he always referred to the research project Modigliani submitted to the SSRC in 1966 as the starting point for the building of the econometric model. According to Ando's reports, the SSRC established in 1966 a subcommittee on *Monetary Channels* that independently decided that to advance the knowledge it would be essential to construct an integrated model to study the complex interactions of forces through which monetary and fiscal policy affects the real economy. At about the same time the Division of Research and Statistics came to a similar conclusions and began the construction of the econometric model for its own. After discussions it was agreed that the two efforts be merged with the Fed Board which decided to finance the SSRC project until the completion of the model in 1970 (Ando, *MP*)<sup>16</sup>.

The model changes various names along with its various sponsors, from FRB-MIT to FMP (Fed-MIT-Penn) with the inclusion of Albert Ando from the University of Pennsylvania and finally MPS (MIT-Penn-SSRC) with the disappearance of the Fed's name and the end of its financial support in 1970 with the completion of the model. The model was then assigned to the Wharton inc., that became responsible for its maintenance (updating) and distribution to public (universities and other institutions) and to private organizations.

As for the Brookings model, and because its large size, the building of the MPS model was organized around various research areas, each one assigned to members of Modigliani's "informal group" (as

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<sup>14</sup> Along with Bach, also Daniel Brill played a crucial role in convincing Governor Martin that the Fed needed "more expert" economists, and for opening the Research Division to outside academic consultants (Schnidman, MacMillan, 2016, 35-37).

<sup>15</sup> Another explanation lies on Arthur Burns' skeptical attitude (he had a NBER education) towards large scale models (Szenberg, Ramattan, 2008). It would explain the stop of financing in 1970 when he began Governor. The Fed financed the project through the SSRC with the implicit agreement that the MIT should be the main responsible (Modigliani, 2001).

<sup>16</sup> The research should last 20 months but it ended in 1970 because delays in estimating monetary and real variables, simulations and as later discussed, because coordination problems between the Fed and the academia. On the reasons behind the Fed decision to leave the research seems to be that to Arthur Burns' (who succeeded Martin in 1970) skeptical attitude toward large scale models (*he had NBER education ..*), see Szenberg, Ramattan 2008).

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he labelled it), formed in large part by MIT PhD students such as Charles Bischoff (who was the main responsible for the investment sector), Richard Sutch (for the financial sector), Robert Shiller (for the theory of interest and expectations) and Dwight Yaffe (on credit rationing) and George de Menil (PhD on wage determination). Robert Rasche from the University of Pennsylvania was the closest collaborator of Ando. Since 1968 Arnold Zellner (from the University of Chicago) collaborated with Ando for the implementation of simulation programs.

From the Fed Board the most active economists were Edward Gramlich, Robert Enzler and Frank de Leeuw. Ando was especially concerned with the real sector and the impact of fiscal policy, on which he had worked for the Brooking model and for the Treasury, whereas Modigliani and de Leeuw were devoted to the design of the financial sector and were, with Ando, the main responsible for the entire structure of the model. Modigliani and Ando supervised each contribution both from the academia and from the Fed and, as appeared from their correspondence and from Ando's reports and memoranda, he was the main responsible in organizing and coordinating the research teamworks. The model estimations and simulations were carried out contemporaneously at the University of Pennsylvania (under Ando and Rasche responsibility) and at the Fed by de Leeuw and Gramlich.

### 3. 1

As appears from Ando and Modigliani's correspondence the relationships with economists from the Fed Board were close<sup>17</sup>, nonetheless substantial coordination problems emerged during the building of the model. In a letter to Daniel Brill (January 10, 1969) Ando claimed that "a lack of good organization is beginning to interfere with our work on the substantial problems, and it is going to get worse as time pass unless we establish a procedure for coordinating our work". Ando referred to the co-existence of *two models in operation*, one at the Board and the other at the University of Penn and MIT. According to him, it was "largely accidental" and due to the academia and the Fed different purposes. Economists from the "academic side were inclined to postpone the work involved in putting together the model and concentrated on improvements of each equation, whereas de Leeuw and Gramlich must have a functioning system as soon as possible" (Ando to Brill...MP). Looking at the Academic Consultant Meetings, for example, clearly emerges the pressure and attack to the Fed expansionary and volatile monetary policy (considered the main cause of the inflationary process of the late 1960s), from economists as Friedman and Metzler. The Fed urged data and forecasts to support its actions. Thus, the Fed version had been already functioning since November 1967 while

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<sup>17</sup> In one of the several letters de Leeuw wrote to Modigliani during the building of the econometric model he expressed ...

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the MIT Penn version became operational for practical purpose only the year later (Ando Report, 1969, MP).

Ando explained that in the process of putting together an operational system a number of decisions had to be made such as exact definitions of variables, names and so on, therefore, although the University of Penn and the Fed used the same computer programs they had been adapted to each specific needs and facilities with the result that the two programs became no more interchangeable. Consequently, the two versions could not be merged to take advantage of “some of the excellent work done at the Board and vice versa” (Ando to Brill).

Economists from the Fed and the academia agreed that there should be only one model, even if differences to what are the best specifications of some of the sectors should be maintained. Nonetheless, the possibility of comparative analysis of alternative formulations should be made possible through the adoption of common computer programs for estimations and simulations and the establishment of a common set of variables and definitions. This task was assigned to Robert Rasche. Ando also suggested the identification of a project manager, located at the Board, with the tasks of designing the *minimum basic model* from which all different versions should be obtainable by substitutions of subsystems. The manager should be also responsible for the comparative analysis of competing specifications (“under the overall guidance”) and should prepare reports on each alternative specifications, he was also responsible for simulations, forecasting and other experiments<sup>18</sup>.

Finally, Ando referred to the “superiority of the Penn MIT version” arguing that the natural course of actions is to adjust the Fed version and organization to the Penn MIT model. He then asked to enlarge the collaboration with other academic economists. He referred to the increasing number of academic economists who asked to have access to the work done (description, complete program package...) to carry on their own analysis and simulations. All material had been already provided selectively to Yale, Princeton and Chicago... Finally Ando arose the issue of establishing the procedure by which the model could be made available to business firms (particularly banks who showed an increasing interests on the model), and a procedure for its continuous updating.

#### *4. The FMP main features*

##### *4.1 The financial sector*

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<sup>18</sup> To avoid all internal communication problems, duplications efforts, failure to standardize methods, data and notations Ando also suggested publishing a quarterly newsletter containing agreements reached on the development of the model and updated inventory of analytical studies related to the model.

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The FMP model produced several self-contained papers concerning specific theoretical and empirical contributions to various sectors and aspects of the model, about policy simulations, its ability to fit data and forecast. Differently from the Brookings model, a monograph devoted to discuss its main features was never published although Ando and Modigliani worked on it since 1970 to 1975 (on this I will return later).

As clearly emphasized in the research project Modigliani submitted to the SSRC the most relevant effort in the building of the model concerns the design of the FMP financial sector and its links with the real one. The financial sector counted the greater number of behavioral equations becoming “the most elaborate financial sector of any econometric model so far constructed” (Szenberg, Ramattan 2008, 136). As noticed above, it was conceived as an integration of the Brookings model that, although its extended financial sector its connections with real variables remained “relatively weak” (Bodkin et al., 1991. 98). The Brookings model financial block, built by Brill and de Leeuw became the nuclear part of the FMP model (Bodkin *et al.*, 1991, 96).

The other important source of inspiration was Goldfeld’s econometric model of commercial banking behavior (1966). Goldfeld’s departure point was Tobin’s unpublished monetary notes<sup>19</sup>. Goldfeld’s aim was to analyze the banks’ portfolio behavior, its link with investment and consumption and the impact of monetary policy, under a quantitative perspective. His model anticipated many of the FMP features such as the representation of banks as rational profit maximizing entities whose investments decisions under uncertainty (concerning future yields and maturities) are an important source of money supply. In Goldfeld, as for the FMP model, short and long run interest rates represented the major link with the real sector with two term-structure equations reflecting the consolidated behavior of the financial system. Finally, differently from Tobin’s skepticism about monetary stimulus (see Dimand, 2013), Goldfeld concluded that the portfolio approach did not weakened the impact of monetary policy: “the quantitative impact of monetary policy on national income is quite significant. This would suggest that monetary policy is capable of playing a more important role in stabilization than heretofore generally assumed ...” (1966).

Because the crucial role of interest rates in the monetary transmission mechanism, the MPS model devoted a major attention to the theory of interest rates determination. The most original contributions appeared in a series of articles, in particular Modigliani and Sutch 1966 and 1967 and Modigliani and Shiller 1973 regarding the long run interest rate, and Modigliani, Rasche and Cooper (1970) for the determination of the short run interest rate. From the contributions it appeared especially evident the increasing attention on the role of expectations explained by the inflationary process initiated in the late 1960s and the recognition of the relevance of financial (stochastic) variables (in particular of

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<sup>19</sup> Goldfeld did not provide precise reference...

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assets returns). The problem of how to measure unobservable variables (expectations) making them consistent with data represented an important stimulus in the development of expectations formation models.

Modigliani and Sutch (1966)<sup>20</sup> suggested a model for the determination of the maturity structure of yields – incorporated in the MPS model - that combined Hicks’ “Risk Premium Model” (1939) with Culberston (1957) “Market Segmentation Hypothesis”. In Modigliani and Sutch’s model the yield structure was controlled by the Hicksian principle of the equality of expected returns modified by the risk premiums. But, following Culberston’s model, Modigliani and Sutch agree that traders had not necessary a preference for short period returns (as for the LCH). As for the segmentation hypothesis, different traders have different habitats, i.e. might have funds that they intend to keep invested for  $n$  periods (1966, 183). It followed that the spread between the long rate and the short rate should depend primarily on the expected change in the long rate, but it was also influenced by the supply and demand of long and short term securities to an extent reflecting the prevailing risk aversion, transaction costs, and facilities for effective arbitrage operations.

To estimate empirically the “habitat hypothesis” Modigliani and Sutch faced the problem of how to transform unobservable expectations into observable data. Their departure point was de Leeuw’s idea, developed for the Brookings model, according to which expectations on future yields were both regressive (à la Keynes), i.e. the market expects the interest rate to regress toward a normal level (based on past experience), and extrapolative i.e. an increase in the interest rate led to an expectation of a further rise and vice versa, as suggested by Duesenberry (1958). A combination of both hypothesis led to a model of expectations formation in which “the prevailing expectations of long-term rates were the result of the extrapolation of very recent changes and the regression toward a long term normal level” (p.12). Then, to sidestep the problem related to the explanation of the long term rate in terms of its own lagged value, Modigliani and Sutch expressed the expected long rate as an approximation of the weighted average of past short rates<sup>21</sup>.

The Modigliani and Sutch’s model on the determination of the term structure of interest rates was later refined by Modigliani and Shiller (1973). The paper was an outgrowth of Shiller’s PhD dissertation on *Rational Expectations and term structure of interest rates* (1972, under Modigliani’s supervision) in which expectations of future changes in prices enter in the determination of long run

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<sup>20</sup> Modigliani and Sutch’s model was developed to test empirically the success of the Kennedy *Operation Twist* (1961) aimed at reducing the spread between long term and short term maturity, through the Fed open market and the Treasury debt management operations, to encourage capital inflow.

<sup>21</sup> Finally, because the distributed lags on previous long rates were not of the exponentially declining type, its estimation was carried out for the first time by the Shirley Almon technique (under experimentation by Bishoff). According to Modigliani and Sutch it had the advantage to be very flexible imposing very little a priori restrictions on the lag structure (1966, 11).

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yields. Modigliani and Shiller's shift of attention from nominal to real interest rates determination is explained both by the inflation process of the late 1960s and thus to distinguish between real and nominal variables and by the emerging of the RE approach. One of their aim was, in fact, to demonstrate the consistency of their term structure model with the REH. According to MS, the evidence showed that the distributed lags of their term structure equation were consistent with rational expectations (1973, 34). The relation between the long rates and the past short rates and prices estimated in the process of fitting the term structure equation was in fact similar to the relation that would hold if the long rates were an average of expected future rates. Moreover, since their term structure equation fitted the current long term closely, it was also demonstrated that past rates and prices were the two major variables on which markets based their forecasts of the future course of short term interest rates (1972).

The introduction of changes in prices expectations provided an important feedback mechanism from the real sector to the monetary one and, as discussed below, create the conditions for a greater instability of the economic system.

In summary, the financial sector was characterized by a chain of relationships among interest rates that extended their influence on the real sector through rental rates and the rate of return on equities. In particular, the discount term affected the short term money rate and the money supply. In turn, short term interest rate entered in the determination of the long term rate that had a direct influence on the rental rate, and thus on investment demand, and an indirect influence on output and employment thorough the market value of equities and, thus, on wealth that, because the LCH influenced households expenditures.

#### *4.2 The FMP model and the Yale school*

Modigliani (*et al.*)'s interest structure model was especially criticized by James Tobin. Although Ando and Modigliani considered the FMP financial sector (particularly the 1975 version discussed at the 1972 Brooking conference) an attempt at implementing empirically the Yale portfolio model (see also Bodkin *et al.* 1991, 113 and Mehrling 2010, 211), Tobin emphasized their different frameworks. According to Tobin the AM's model did not obey to none of the three "Yale precepts" (which underlined his GE approach) i.e.: *i.* an explicit balance equations of supply and demand specified for every asset with interest rates or asset prices that adjust to clear the market; *ii.* every behavioral sector adjusted those items in the balance sheet that it controls; *iii.* all the asset demand and supply equations of a behavioral sector are explicitly specified and all contain the same list of variable (Tobin, 1975, 565). Instead, Tobin pointed out, in the MPS financial sector "the form of each equation, the list of

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variables in it, the lags, all have been adjusted to get the best explanation case by case. Variables have been omitted when they were statistically insignificant or conceptually remote” (1975, 566). On this ground, Tobin especially rejected the term structure approach for the determination of yields because the assets supplies played only a minor role.

AM explained these main differences by the different aims of their models - to explain each entries in the balance sheets of various sectors, and to investigate the connections between the financial and real sectors respectively, and by empirical estimation problems. This practical reason justified, in particular, the interest structure approach - to reconcile the need of considering securities of various maturities with data availability – and their excess demand approach (because the impossibility to have data about all assets supply and demand)<sup>22</sup>.

### *4.3 The real sector*

Whereas the design of the financial sector was in large part an original development of the Brooking model, the building of the real sector appears strictly an outgrowth of Modigliani’s study over the 1950s, to which the augmented Phillips curve was added in the late stage of the model construction. In the abovementioned monograph Ando and Modigliani was writing, they emphasized that the theoretical counterpart of the MPS real sector has “strong similarities with more sophisticated version of Keynesians macromodels such as one given by Modigliani in 1962” (they supposedly referred to Modigliani 1963 – which model was discussed at the 1962 conference on monetary economics).

The most important blocks of the real sector were represented by the equations explaining wage, price, consumption and investment behavior which derived from the assumptions of a Cobb-Douglas production function with unity elasticity of substitution, ex post fixed proportions of production factors, and an oligopolistic commodity market (1972, 253-54). As in Modigliani’s 1944 interpretation of Keynes’s theory, he still believed that the way the economic system responded to a demand shock essentially depended on the response of wages and prices (Modigliani 1986, 9). If prices and wages were flexible, in the sense that they quickly responded to positive or negative excess of demand, the output remained unaffected: change of wages and prices produced a variation of the real money supply consistent with full employment. By contrast, under wage rigidity a demand shock

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<sup>22</sup> Theoretical differences referred to Ando and Modigliani’ s dismissal of Brainard and Tobin’s (1963) “adding up constraint”. They argued that big corporations followed a satisfying behavior that led them to have residual asset or liability in their balance sheet because it simplify their decision process ... and of Tobin’s  $q$ . It was replaced by the expected profitability of production activities using new capital. The introduction of the putty-clay assumption made meaningless the concept of reproduction cost if technology and factors prices change. In other words, in the FMP model investment decisions depended on the comparison of the expected rate of returns on capital and investment costs (i.e. long run interest rate).

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must resulted in a contraction of output. In addition, prices and wages behavior had important feedbacks on the monetary and financial sector because the rate of change of prices, by influencing expectations, contributed to the determination of real interest rates. Although its crucial role, the wage and price sector was introduced endogenously only in a second stage of the model building through the incorporation of the Phillips curve (de Menil, Enzler 1970). The rate of change of money wage was a function of change of price and of unemployment rate (taking care of the wage price spiral) whereas the Bain-Sylos-Modigliani oligopolistic model (Modigliani 1958) explained prices as the result of a constant mark up on long run average costs, to a level reflecting entry preventing considerations (see also Modigliani 1963)<sup>23</sup>.

The investment block was in large part the outgrowth of Bischoff's PhD dissertation on *A study of distributed lags and business fixed investment* (1968). Its most important feature was the adherence to the putty-clay hypothesis (incorporated in the FMP model because closer to reality than the neoclassical perfect substitution hypothesis), according to which once a specific technology satisfying the production function has been chose (to minimize costs), the capital invested in this technology becomes irrevocably specialized and produced output only by being combined with labor in the initially chosen fixed proportion. In other words, existing equipment could not be modified in response to changes in relative factor prices. The introduction of a putty-clay production function had relevant policy implications because it reduced the sensitiveness in the short run of investment demand to variations of interest rates, making the impact of fiscal stimulus stronger (especially because it delays the crowding out effects) and monetary policy weaker<sup>24</sup>.

The consumption equation behave in accordance with the LCH. The presence of wealth in the consumption function implied a direct channel of influence from monetary policy to consumption that went from the money market to the short term rate, to the long term rate, the market value of shares and hence to wealth (1972, 249-250). The resulting impact on aggregate output was estimated of the same order of magnitude as that resulting from the response of the components of gross investment, but relatively fast. Moreover, because current consumption depended from expected resources over life, short run variations in income, caused by shocks, appeared largely absorbed into saving. Thus, the LCH reduced the magnitude of the multiplier and the impact of fiscal policy.

Finally, the real balance effect, as the result of an increase of money supply, was estimated quantitatively minimal (as already supposed in the 1963 article).

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<sup>23</sup> In the 1963 model wages were rigid up to the point of full employment and thus prices could as well be regarded as exogenous (because proportional to fix wages)... Tella and Tinsley were already trying to endogenize the wage price sector in 1967 (see their MPS's preliminary report, 1967).

<sup>24</sup> According to Hall (1977, 90, endnote 25) the hypothesis had been proposed for the first time by Leif Johansen in "Substitution versus Fixed Production Coefficients in the Theory of Economic Growth: A Synthesis", *Econometrica*, 27 (April, 1959). Phelps introduced the label *putty clay*.



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To summarize, the model was structured along Keynesians lines with the real output controlled by aggregate demand, whereas the money supply affected real demand almost exclusively by way of interest rates and affected the price level only through its effects on income. Underlying the short run dynamics were a neoclassical growth model with the system moving toward a golden age path (on which I will return later).

#### *4.4 The model's policy implications*

As already noticed, the MPS model was especially conceived to evaluate the impacts of stabilization policies with half of its behavioral equations concerned with fiscal and monetary variables (Ando, Modigliani, 1969). Under this point of view, the model represented an important device to confront with the Monetarists controversy.

Early results on the impact of fiscal and monetary policy were discussed by Rasche and Saphiro (1968), de Leeuw and Gramlich (1968, 1969) and Ando and Modigliani (1969)<sup>25</sup>.

Ando and Modigliani's (1969) report focused on the response of GNP to an increase in government expenditure through the standard multiplier accelerator mechanism, whereas Gramlich and de Leeuw (1969) concentrated of the effects of open market operations. Both models showed one to three years fiscal policy effects (similar with the results of other Keynesians models) and monetary effects appreciably larger (similar to the S. Louis model) but after long delays. Monetary policy worked more slowly because it took time for open market operations to be translated into changes in long term interest rates and even more time for them to influence investment because the putty clay behavior of equipment. Both models also showed that the impacts of such policies depended on initial conditions, especially with regard to inflationary potential.

Similar results had been already advanced by Rasche and Shapiro (1968, 145) in their first report, arguing that: "those who are convinced that money matters will be encouraged with the 12 quarters multiplier of 10, but proponents of aggressive monetary policy as an instrument of cyclical stabilization will be disappointed to note that it takes almost 2 years for 50% of this effect to be realized. Only 17% after one year. The multipliers for [fiscal policies] are smaller, but the time paths are remarkably different [fiscal policy actions] attain 75% of their 12 period effect after 3 and 2 quarters respectively".

In their conclusion, Gramlich and de Leeuw (1969) appeared quite cautious arguing that it was difficult for monetary and fiscal authorities to conduct fine tuning stabilization operations, thought

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<sup>25</sup> In a letter to Modigliani Ando explained to be disappointed by Rasche and Saphiro paper (he re-wrote it) and partly by de Leeuw-Gramlich 1968 paper because the model and the results were still too uncertain....

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they could be successful against more persistent exogenous swings. In 1974, although for different reasons (estimation of expectations) Ando arose doubts on the feasibility of fiscal policy.

Finally, and curiously enough, the MPS model, which originated from a strong belief in the power of monetary policy and was devoted to demonstrate that money matter seems to reach opposite conclusions. Robert Hall (1977, 62) founded in the MPS all contentions that “skeptics about the interest elasticity of investment point to”: lags in putting capital goods in place, the putty clay assumption and the dependence of investment from long run interest rate...

### *5. The Keynesian and Monetarist empirical debate*

The MPS model entered in the debate with Monetarism directly through a comparison with the monetarists’ single equations results, and indirectly by the study of the stability properties of the economic system as the necessary premise for the implementation of stabilization policies.

According to Mehrling (1998) the postwar monetary debate was merely an empirical debate about the slopes of the IS and LM curves rather than on fundamentals, because Keynesians and Monetarists adopted the same theoretical framework and spoke the same GE language<sup>26</sup>. The central issues were those of estimating coefficients and parameters to simulate the impact of stabilization policies. A growing literature testing the forecasting ability of Keynesian macro econometric models and the Monetarist single equation approach, as well as their ability to track past data, appeared since the beginning of the 1970s (see Gramlich 1971, Ando 1974, Gordon 1971 and 1974, Cooper and Fisher 1970, Benjamin Friedman 1979 among others).

Although the dispute revolved around quantitative evaluations of the relative strength of monetary and fiscal activities, the debate was first methodological, concerning the most appropriate methods to reveal the relationships between money and income. As pointed out by Gramlich: “the main areas of disagreements stem not from the fundamental question of which coefficients are to be estimated ... *but how best to be estimated*” (1971, 508).

Keynesians and Monetarists did not really spoke the same GE language at least under an econometric point of view. The ‘sterile’ discussions around structural models *versus* reduced form estimations reflected a Walrasian *versus* a Marshallian approach to economics (see Hoover 2004, Bordo, Schwartz, Erich Pinzón-Fuchs, 2016)<sup>27</sup>. This section concentrates on Friedman and Modigliani different approaches to econometric modelling as a consequence of the different role they assigned to the study of economics. This is evident by the different purposes they ascribed to structural models

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<sup>26</sup> However, leading Keynesians and Monetarists economists such as Tobin (1972, 1974) and Brunner and Meztler (... 1972) believed that the main contentions were also theoretical ...

<sup>27</sup> See Bordo-Schwartz (2004) emphasis on this distinction. According to them the final synthesis achieved with the New Keynesians economics was possible because Brunner and Meztler adoption of the GE language.

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and to the direct estimation approach (Erich Pinzón-Fuchs, 2016 had already discussed the structural vs reduced form approach with reference to Friedman and Klein in the 1940s and 1950s).

The Keynesian and Monetarist controversy also shows that whereas on the one side there were important progresses during the 1960s in terms of more and more sophisticated econometric (statistical) techniques, such as non-linear estimation technique, new methods of lag distributions, methods of spectral analysis, increasing ambitious of model builders (especially thanks to the use computer), on the other econometric models still suffer the lack of adequate comparative testing “both to find superior model characteristics and to test their different economic theoretic properties” (Klein, 1971, 418). This lacuna appears particularly evident since large part of the dispute concerned the most reliable econometric method by which to estimate crucial parameters and to derive policy implications and, most important, by which to attest the superiority of the monetarism paradigm over the Keynesian one (and vice versa).

The methodological debate appeared crucial also because it implied the defense of a specific macroeconomics and econometric research program (the structural approach had been already abandoned by the Cowles Commission under Koopmans’ directorships), as became evident with the advent of the NCE (see Lucas and Sargent 1978).

As mentioned above the FMP model gave birth to several PhD thesis and papers on single aspects of the model and contributed to improvements and applications of new econometric techniques (as for the Almon technique for estimating distributed lags, under experimentation by Bishoff), thus driving the research in macroeconomics and econometrics. One of the reason explaining the FMP model closer attention to its theoretical structure was to provide the academia with a useful pedagogical tool. As Ando pointed out in various reports, the model was thought to “provide a better research vehicle for academic economists and a more convenient teaching device in graduate schools” (MP).

The Keynesians and Monetarists methodological debate developed along two main lines. Modigliani and Ando first adopted Friedman’s direct estimation language to show that using alternative specifications (such as a different definition of autonomous expenditures) the single equation model led to contradictory results. Once the unreliability of this methodology was established, Ando and Modigliani used their large-scale model as a ‘true’ representation of the real world to test both the Keynesians and the Monetarists’ contentions. On the other hands, Monetarists especially criticized the lack of tests on the reliability of structural models and concentrated on their disadvantages because important channels may be omitted or incorrectly estimated, and because structural changes should modify basic relationships (see Keran 1969, Carlson 1974). Finally, the needs of further research

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along Keynesians lines, i.e. with reference to the analysis of the monetary transmission mechanisms was partly recognized.

As discussed above, since the mid-1950s Keynesians became increasingly aware of the role of money and financial intermediaries for the economic activity and began to support a monetary and fiscal policy mix. However, their recognition of the role of money was not accompanied by the dismissing of the traditional income determination model. Moreover, the power of fiscal policy was still emphasized. Friedman and Meiselman (1963) called into question the Keynesian's position denouncing the inconsistency of the income expenditure model with an active role of money. They proved it by showing through statistical correlation that income was larger affects by changes in the stock of money rather than of autonomous expenditures (FM, 1963). However, Friedman and Schwartz (1963) contemporaneously acknowledged that historical record, which displayed a cyclical behavior of money in relation to that of the economy, was not decisive about the direction of influence (Bordo, Schwartz 2004, 225; see also Hahn 1970 who emphasized this ambiguity). Friedman and Schwartz sketched a possible transmission mechanism from money changes to prices, inviting towards further empirical investigations (FS, 1963). This research program was immediately took up by Ando and Modigliani through the design and the building of the MPS model. By contrast, Friedman decided to concentrate on collecting historical evidence to support his main thesis of a direct correlation between money and income. Friedman's choice of not investigating the monetary transmission mechanisms was one of the most distinctive features in the Monetarists and Keynesians debate, and appeared quite puzzling. Kevin Hoover (2004) explains Friedman's puzzle, who first invited to investigate the monetary channels of influence and then dismissed this research line, looking at his Marshallian approach to economic theory. According to Hoover (2004, *see also* Erich Pinzón-Fuchs, 2016) F. believed that a theory [and empirical models] needs to get to the essence of the matter (money and income fluctuations) and cannot be a "photographically accurate description of reality". "Causal link was the enemy of F." because "to think in causal language is to risk to losing focus" (Hoover, *see also* Erich Pinzón-Fuchs, 2016)<sup>28</sup>.

For Ando and Modigliani the opposite was true. Both, theories and particularly empirical models that use true data, must be a closer approximation of the real word. In particular, to understand the influence of monetary and fiscal actions on income, economic theory and econometric models should replicate the real structure and the real functioning of the economic system<sup>29</sup>. Friedman and Modigliani different approaches to the complexity of economic phenomena is evident in their choice

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<sup>28</sup> This point needs to be further comments since it seems to contradict Friedman's empirical work devoted to show the causal relation between changes of money and fluctuations of money income looking at historical record. On Friedman methodology *see also* Hirsch, de Marchi, 1986

<sup>29</sup> On Ando methodology *see* Ando 1963 (on the meaning of 'approximation') and 1981.

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of different econometric modelling methodology and the different role they assigned to empirical models: to look for and to test basic relationships, to investigate structural relationships concentrating on the transmission mechanisms of fiscal and monetary activities. As Ando pointed out in 1974: “It must be recognized that the central issues involved in the analysis of stabilization policies in general, and the Monetarists controversy in particular, are interactions among effective demands, conditions of financial markets, and the forces determining the level of prices and wages, and that a model in which these issues can be explicitly discussed and resolved will have to contain the specifications of all these sectors and hence be fairly large and complex ... One of the reasons why so much confusion has been generated in the literature on stabilization policies is the insistence of many theorists that impacts of these policies be analyzed within the context of small, simple models” (542).

It was Friedman who first drove the controversy on empirical basis with the aim of proving by statistical correlation the superiority of the QTM with respect the income expenditure model. In 1963 Friedman and Meiselman tested the relative stability of the velocity of money and the investment multiplier by correlating levels and differences of both money supply and autonomous expenditures with income. Their aim was to show that money supply was higher correlated than autonomous expenditures and, thus, attesting the greater influence of money on income. FM results were especially criticized by D. H. Hester (1964) and DePrano, Mayer (1965), Ando and Modigliani (1965). In particular, Ando and Modigliani rejected FM’s “clear-cut conclusions”, objecting their dataset (the inclusion of exceptional periods such as Great Depression and WWII) and their definition of autonomous expenditures. Ando and Modigliani showed that by using alternative specifications and by dividing the sample data to keep out exceptional periods, FM regression displayed opposite (Keynesian) results on the role of money and autonomous expenditures on income fluctuations. Ando and Modigliani especially emphasized their skepticism towards the use of econometric techniques to solve a theoretical dispute: “... from our tests, this model [income expenditure] comes out somewhat ahead of the ‘rival’, thought we do not doubt that with some ingenuity FM would be able to better the score for their favorite champion. We should like to make it clear, however, that we regard the game of who can produce the highest correlation as a very sterile one – except possibly for its entertainment value” (1965, 714).

They concluded arguing that autonomous expenditures and money supply are not mutually exclusive stabilization devices and that the two models were consistent, as already advanced in Modigliani (1963), once the QTM was read as a demand for money<sup>30</sup>. Therefore, the issue must not be which

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<sup>30</sup> On this consistency see also Johnson (1977) who argued that Wicksell inaugurated the income expenditure monetary mechanism without abandoning the QTM.

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model but “to buckle down the unended and unending labor of learning more about the structure of the economy ... in particular ... [the] still ill-understood channels through which money and the tools of monetary policy affect economic activity” (1965, 716). This should be the challenging task. A challenge that FM (1965) rejected in their rebuttal: “the central issue in dispute is not theoretical but empirical ... It is easy enough to construct an analytical system that embodied both relations” ... but the task is to establish which is the critical one and how satisfactory complex models are (1965, 10 and 31).

A comparison between the two methodologies, structural models and direct estimations, was one of the objective pursued by the building of the FMP model. In the research project Modigliani submitted to the SSRC he explicitly referred to the Monetarists controversy: “One especially interesting issue we hope to pursue is to devise method for testing Friedman view that ... there is little point in bothering with the analysis of individual channels and one should concentrate on highly aggregate type of analysis” (1966, MP) ...

de Leeuw and Kalchbrenner (1969), from the Fed Board, also used the Monetarists language to show the weakness of their empirical results, with reference to Anderson and Jordan single equation model (1968)<sup>31</sup>. The AJ results concerning the power of money and the null fiscal multiplier were particularly relevant since they confirmed FM’s (1963) contentions although taking account of Ando and Modigliani’s criticisms (AJ modified the dataset and the specification of autonomous expenditure). de Leeuw and Kalchbrenner questioned, however, the definitions of money supply and of fiscal variables because not statistically exogenous. They showed that by referring to alternative specifications (deleting borrowed reserves and currency from the monetary base to eliminate endogenous movements) their results contradicted those of Andersen and Jordan, reducing the monetary multipliers and reviving fiscal policy. In other words, DK showed, once again, that direct regression methods could lead to contradictory results. They especially arose the issue of *reverse-causality* because misspecification problems, particularly regarding the definition of exogenous variables, due to the lack of an explicit theoretical framework.

The DK’s claim of the inadequateness of the single equation approach to establish causal relationships were followed among other by Gramlich (1971) and, on theoretical grounds, by Tobin (1971)<sup>32</sup>.

Once dismissed the Monetarists’ methodology Modigliani and Ando concentrated on a number of experiments with the FMP model. Modigliani explained the choice of using the FMP as the only valid landmark for the study of stabilization policy because the only one in which the transmission

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<sup>31</sup> The St. Louis model was published in 1968. It was considered as representative of the Monetarists view. However Friedman never endorsed it.

<sup>32</sup> Granger (1969) reply to DK by showing the irrelevance of theory to establish causal relationships then followed by Sims (1972). On the Keynesians (Ando’s reaction) see Ando 1981.

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mechanism has been postulated by a theoretical framework. Simulations of fiscal and monetary policies and of Friedman monetary growth rule were carried out among others by Cooper and Fisher, ..., whereas Gordon (1970) compared the forecasting ability of the St. Louis, the FMP and Warthon models.

One of the most interesting experiment devoted to compare the reliability of the two alternative models was carried out by Modigliani (1971). Here he translated the Monetarists approach into the Keynesians language. In *Monetary Policy and Consumption: linkages via Interest Rates...*<sup>33</sup>, Modigliani discussed the crucial role played by the wealth effect (through the LCH) for the monetary transmission mechanism. Since this channel amplified the influence of money on real variable, the result concerning the role of money were close to that of the St. Louis model whereas the response to government expenditures remained “absolutely irreconcilable” (1971, 59). Therefore, Modigliani devoted the last section of the paper to test the reliability of the FMP and the AJ result through a quasi Monte Carlo experiment<sup>34</sup>.

Modigliani’s starting point was the use of the FMP model as the *true* description of a possible economic system (regardless if it was an adequate description of the real world), and the time series data generated by long run simulations as the response of the system to the path of exogenous variables. Then Modigliani run an AJ type equation using the simulation solution values as data to establish how far and in what direction the reduced form estimations differs from the *true* response implied by the model. The result, according to Modigliani, was unequivocal: the reduced form coefficients yield upward-biased estimations of the magnitude and speed of response of GNP to an exogenous change in money. He explained the upward biased by the fact that the supply of money was strongly positively associated with the movements of other *omitted* exogenous variables, which account for a substantial portion of the simulated change of GNP. In other words, the “reduced form attributes to change in M part of the effects of change in other omitted variables” (1971, 60)<sup>35</sup>.

The unreliability of the Monetarists approach was finally reaffirmed in Ando and Modigliani (1976), Modigliani’s American Economic Association PA (1977a) and in a seminar at the St. Louis Bank with Friedman (1977b) arguing that “you can get almost any answer, if you play around with that equation” because the many variables you left out (Modigliani 1977b, 8)<sup>36</sup>.

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<sup>33</sup> In “Consumer Spending and Monetary Policy ... Proceeding”, 1971.

<sup>34</sup> Modigliani explained that the experiment was needed because “measure of closeness of fit ... and the results of simulations of sector and of various partial mechanisms are relevant, though obviously not conclusive evidence in reaching a final assessment” (1971, 59).

<sup>35</sup> Modigliani concluded that “it may eventually be possible to reconcile the implications of a carefully specify structural model whit those of carefully specified reduced form, though much empirical, as well as theoretical, work remains to be done toward that highly desirable goal” (1971, 66).

<sup>36</sup> Modigliani also referred to Benjamin Friedman study that showed how the St. Louis coefficients change if you move along the long run.

### 5.1 The Monetarists reactions

*The Monetarist reactions to the use of the MPS model partly anticipated the kind of critiques towards structural models that led to the new classical economics on the one side, and Sims' approach to econometric on the other.*

de Leeuw and Kalchbrenner (1969) suggested two alternative readings of the St. Louis model: as a multiple regression to measure the influence on GNP of exogenous variables (defined as those variables influenced by policy makers); as a reduced form of some underlying more complex and implicit model of the economy. By solving for the past endogenous variables, the system was reduced to a relation between each current endogenous variables and current and lagged exogenous variables. In this case, exogenous variables are those not affected by current economic development and that can be managed by policy makers. This latter reading prevailed among Keynesians, but it was rejected by Monetarists, at least from the St. Louis bank, because it ascribed to their model the purpose of analyzing the structure of the economy, a purpose they did not contemplate.

According to Keith Carlson (1974), the association of the A-J results with tentative acceptance or rejection of a particular model was unfortunate. Michael Keran (1969) and Carlson (1974) recognized that their single equation approach had a limited meaning and could not serve to discriminate between competing theories. Tests on rival economic theories could, in fact, be conducted only if alternative behavioral assumptions were made explicit, while the AJ equation did not develop and tests explanatory models of the mechanism through which monetary and fiscal variables affect the economy (Keran 1969). Quite the opposite. Since it did not specify any transmission mechanism, the model was consistent with a wide range of theoretical frameworks.

Carlson's (1974) article was a reaction to Modigliani's (1971) use of the FMP model as the true model by which to test the reliability of the St. Louis model. She rejected the estimation of the AJ equation with simulated values of GNP from the FMP model *as if* it was the 'real world' both because "the AJ procedure involves specific hypothesis about the relative power, timing and reliability of monetary and fiscal actions", and because there are no basis on which to establish that the GNP response to money generated by the FMP model may be classified as the true response. In fact, no tests from independent data sets for the MPS model had been conduct (Carlson to Modigliani, March 01, 1974). In a long letter to Modigliani Carlson explained "where we disagree" (March 1, 1974) by clarifying the methodological principles that separated the Keynesian and Monetarist approaches. She also assess the problem of testing the reliability of structural econometric models *versus* reduced form models. In doing so she refers to Johnson's (1970) critique to the Walrasian methodology and to



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Brunner's (1973) distinction between the pragmatic and the cognitive meaning of econometric models that anticipated part of the issues of subsequent new classical economics debate.

According to Johnson (1970) the debate on structural *versus* simple models initiated by FM (1963) rested on some fundamental principles not understood by Keynesians. Johnson (1970) argued that "in contrast to the more common view that the purpose of theory ... is to lay out the full structure of a Walrasian GE model in the detail necessary to produce an adequately good statistical fit", the test of good theory should be based on its *ability to predict something large from something small*, by means of a simple and stable relationships (Johnson 1970, 22 and Carlson to Modigliani March, 1974). Carlson also refers to Johnson's "hypothesis of invariance" according to which "behavioral relationships should be invariant to institutional and historical changes" (Although he did not refer to policy changes explicitly he was anticipating the Lucas critique). On these grounds, Carlson concluded that smaller scale models were less vulnerable to structural changes and allowed more explicit attention to the crucial impulse forces operating on the economy.

In his review of Hickman eds., *Econometric models of cyclical behavior* (1973), Brunner distinguished between the cognitive dimension of econometric models and their pragmatic claim. The former offers empirical hypothesis about the relevant structure of a specified economic process, the latter refers to the models forecasting ability. According to Brunner, these dimensions have been ambiguously interrelated, with the pragmatic claim interpreted as a confirmation of the cognitive claim. By contrast, "all hypothesis with essential occurrence of universal quantification structure and theoretical terms are unverifiable. They remain, however, confirmable" (1973, 932; see Hirsch De Marchi 1986). But their confirmation must satisfy specific logical requirements that forecasts do not satisfy. Brunner then criticized the widespread "numerological practice" of arbitrary changes of a model to improve its forecasting ability and emphasized the necessary strengthen of the cognitive dimension in economic work. He then concluded arguing that "the evaluation of the cognitive claim is particularly urgent at the present stage" ( ).

Finally, at the November 1970 Fed Consultants meetings Robert Gordon discussed a paper posing the question of "how should policy makers trust the models, and should they put more attention to some models than other?" (1970, 1)<sup>37</sup>. To solve the "great puzzle in macroeconomics" (large scale versus reduced-form models), he suggested that any model with substantial disaggregation presented a comparison of the comparative ability of alternative aggregate and disaggregate versions of equations to fit aggregate variables. If disaggregation does not lead to substantial improvements in the fit... "it is not worth the sizable costs imposed by bulky models". He then referred to the FMP

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<sup>37</sup> *Large-scale macroeconomic models, policy multipliers and the problem of forecasting*, Discussion paper. The paper was discussed by Modigliani.

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model arguing that “tests should be made of the relative simulation and forecast errors of the model with small and large financial sector” (Gordon, 1970, 31).

Finally Carlson, even admitting the need of further research within the Monetarists camp on the fiscal and monetary transmission mechanisms to “shed light on the meaning and significance of the monetarist propositions” (1974, 14), in the letter to Modigliani she concluded that “Policy decisions have to be made now, and cannot wait for a quantification and understanding of all of the channels of monetary and fiscal influence. Do you think the Chinese should have waited for full explanation of *how* acupuncture works before applying it?” (March 1, 1973)

The lack of common criteria to evaluate the reliability of alternative econometric models, the use of a different language (methodology) and of different specifications led to the inconclusiveness of the controversy, leaving to the political debate and to economic events the task of establishing the research line to pursue<sup>38</sup>, and preparing the way for the advent of the Lucas critique.

#### 6. *The stability of the economic system*

Friedman’s contentions against stabilization policy were based on the lack of precise knowledge about the channels and lengths through which monetary and fiscal activities worked. Therefore, policy interventions could translate into instability the inherently stability of the economic system.

One of Ando and Modigliani’s main task in the beginning of the 1970s was to investigate the stability properties of the MPS model through simulations of exogenous shocks. This effort does not clearly appear from their published papers (Ando and Modigliani 1969 anticipated part of the arguments). Although the dynamic behavior of the system towards a golden age path is only mentioned in Ando (1974) and Ando and Modigliani (1975), it should be the focal point of a monograph they attempted to write since 1970 to 1975. As Ando explained in its introduction, the main portion of the book is devoted “to fully describe the transition process from different golden age paths” by the specification of the short run dynamic characteristics of reactions behavior of all decision makers (MP).<sup>39</sup> As in Ando (1974), their starting point was the design of the theoretical system underlying the MPS model, to make explicit “the principles according to which most of the details of the model is formulated”<sup>40</sup>.

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<sup>38</sup> The reliability of large scale models suffered two severe blows in the late 1960s. At the 1969 Harvard conference it was demonstrate that they forecast badly only one or two quarters ahead even within their sample periods; moreover they did not predict the extent of the rise of nominal income in the year later the 1968 tax surcharge. Finally the supply shock of the 1970s....

<sup>39</sup> Of these attempts, it remains in *Modigliani Papers* the outline of the volume (), a quite long introduction and apparently chapters 1 and 2 (all wrote by Ando). The introduction is almost complete as for the representation of the long run model of the real sector and the dynamic of the short run model. Ando and Modigliani (1969) and Ando (1974) appears to be largely based on the monograph that Ando explicitly mentioned in his article.

<sup>40</sup> Whereas Ando 1974 theoretical system was general enough to assess the Monetarists contentions, the system laid out in the monograph made no reference to the controversy and was devoted to the analysis of the short run dynamic path and its connections with the Keynesians system.

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Ando and Modigliani remarked that differently from other large-scale models, the MPS model had “strong theoretical grounds and behavioral foundations” that, however, were difficult to see clearly because the complexity of the empirical counterpart. To make explicit the theoretical structure was functional both to the analysis of the dynamic behavior of the economic system and to establishing a more explicit link with the Keynesians theory.

The analysis of the dynamic process represented the necessary premise for the study of stabilization policies. If the system reacts to an external shock or it was unable within an acceptable time – they call it “*intermediate term*” – to return to its golden age path, then the existence of a policy space was attested. The transition process from a disequilibrium position to a golden path was identify with the medium run, defined empirically in terms of the time period relevant to policy decisions (length of stabilization policies)<sup>41</sup>. As explained “whereas in the very long run the model behave in accordance with the classical theory in the intermediate run – five to ten years – and thus for time periods relevant to policy decisions, we find that both fiscal and monetary activities have important effects on real GNP”. Ando (1974) also clarified that stabilization policies were not concerned with the shift from one golden age path to a preferred one unless the economy is so stable... , neither with their immediate effects. It follows that the time response characteristic of each behavioral equation becomes relevant along with the channels of monetary and fiscal policy.

Since the theoretical system reproduced faithfully the properties of the econometric model (and vice versa)<sup>42</sup>, the dynamic behavior of the latter was approximately characterized by those of the theoretical system. Ando and Modigliani starting point was Solow neoclassical growth model in which they “attribute to all agents as much rationality as feasibly and ignoring problems of short-run adjustment process and those arising from market imperfections and rationing”. Uncertainty, Government and monetary activities were also excluded. Two important exceptions in the definition of the golden age model refer to the incorporation of oligopoly profits and unemployment. It was also remarked that although in the long run real variables were not influenced by money supply, it indirectly affects the unemployment level through it influences on the rate of change of prices and, thus, on the money rate of interest. In other words, the golden age path was neutral with respect to the level of money supply but not regarding its rate of change. This simple steady state model should serve as the reference point for the analysis of the short run dynamic process, which allowed for several golden age paths depending on initial conditions.

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<sup>41</sup> The study of medium run was attracting an increasing attention in the 1970s to establish the dynamic properties of the system (on Solow struggle in this direction see Assous 2015)

<sup>42</sup> See for example the constraints imposed to ...

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Once the long run basic model (*System S\**) was laid out, Ando and Modigliani introduced a series of complications such as Government taxes and transfers, a complex monetary and financial sector, expectations, and the putty-clay assumption to establish both a correspondence with the econometric model and to take care of the data generated by the US economy<sup>43</sup>. Then, they investigated how the characteristics of the golden age path of *System S\** was affected by these complications, and whether and how the specification of short run dynamics must depend crucially on these additional complications. The short run dynamic (that corresponded to the MPS model with full dynamic specification) was designed to assure that *System S* (i.e. the system with the additional complications) could be part of the more general *System S\** and still be able to generate the same golden age growth path. In other words, all additional complications were designed to preserve the homogeneity properties of the system in a way that it could still follow a golden age growth path.

As in Ando (1974), each equation of the theoretical system corresponds to an equation or to a group of equations of the MPS model, and were discussed in some detail.

The last part of the introduction was devoted to a comparison of the theoretical and econometric models with the Keynesians system. Ando and Modigliani defined the MPS model as “a more sophisticated version of Keynesians macro models such as Modigliani 1962” (they probably meant Modigliani 1963 he presented at the 1962 conference on *Monetary Economics*). As Ando and Modigliani explained the main differences concerned the kind of complexities (especially regarding the financial sector), the explicit treatment of oligopoly and oligopolistic profits, the adherence to the putty-clay assumption and the specification of the dynamic of the wage-prices determination through the incorporation of the augmented Phillips curve, to show “the causal chain through which a change in money supply leads to a specific change in the level of prices ...”<sup>44</sup>.

In a Chapter titled “*Short-run Dynamic Responses and Stability Characteristics of the MPS model*” Ando and Modigliani analyzed the short run dynamic properties of the MPS model by applying some exogenous shocks to the long run version of the model. These simulations were first carry out using “artificial long run data”, both to control initial conditions and because the shortness of sample period data. Then, they compared the results from artificial data with those of sample data.

A first experiment refers to a rise of export by 6% (because similar to a shock that occurred in 1958), under the hypothesis of a constant rate of growth of money supply. The response of the system was analyzed looking at the patterns of real and nominal income multipliers. These patterns showed that

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<sup>43</sup> The MPS model dealt with 13 taxes and transfers of Federal and State and local governments.

<sup>44</sup> Regarding the description of the financial sector, in the correspondence with Modigliani about the monograph, Ando referred to the paper they discussed at the 1972 Brookings conference (Ando, Modigliani 1975).

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the MPS model was dynamically unstable in the sense that its response to the exogenous shock over time was explosive rather than damped. The response of the system was in fact cyclical and the amplitude keeps getting larger in successive cycles (see also Ando 1974). The basic reason for the system instability was due to the dependence of the real rate of return on the expected rate of change of prices and of this latter on the past and actual rate of change of prices. As discussed above, in the MPS model the expected rate of change of prices was approximated by weighted averages of past and actual rates of change of prices. Therefore, when there was a strong demand in the real sector, and wages and prices rise faster than normal, their acceleration tended to lower the real interest rate because rising expectations, given the nominal one. Nonetheless, if money supply was given, the same pressure in the real market tended to rise nominal interest rates, so that the stability of the system critically depended on which one of these mechanisms prevailed (in their model the former mechanism prevailed). Their result appeared in sharp contrast with those of other large-scale econometric models because, according to Ando and Modigliani, these models assumed implicitly constant expectations of the rate of change of prices. Ando and Modigliani showed that under this assumption also the MPS model exhibited a similar behavior becoming much less volatile.

A deeper analysis of the reasons explaining the instability of the economic system and a discussion about the design of fiscal and monetary policy to control the economy was postponed to subsequent sections of the chapter (*I has been unable to find these sections*).

This analysis is partly undertaken by Ando (1974). Here he discussed the model behavior once the assumption of independent expected prices is removed. However, he acknowledge that the response of expected rate of change of prices to actual rate of change is “a very much unsettled question”, arguing that the estimates of this process incorporated in the MPS model “are probably the least reliable of all estimate in it. This is partly because it is extremely difficult to obtain any reliable data on expectation of rate of change of prices that are relevant for our analysis” (566-67). Moreover, since most of the functions involved were nonlinear, the response of the real rate of capitalization to a change in output depended critically also on initial conditions:

“the difficulty is that we seldom know the movements of the expected rate of change of prices, even approximately, let alone exactly... Thus, it becomes very critical to design the fiscal aspects of the stabilization policy judiciously. Not only is it possible for some fiscal actions to cause an unstable response from the economy. ... [and] only well designed further fiscal actions are capable of bringing the economy under control. Monetary actions may not be sufficient to control the economy under such conditions [as for the liquidity trap]” (p. 567).

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The inherently instability of the economic system was shortly discussed also in Ando and Modigliani (1975) arguing that without well designed stabilization policies it tended to exhibit fairly long cycles and might drift away from the desired path (1975, 560 see also Modigliani 1977).

To conclude, Blanchard (2008) referred to the MPS model as the “apotheosis” of neoclassical synthesis since it embodied successfully most of the contributions of Keynesians economists such as Hicks, Solow, Tobin and Modigliani himself in “an empirically based and mathematically coherent model”<sup>45</sup>. Therefore, by the early 1970s the synthesis appeared to have been highly successful and the research program laid down after the war to have been mostly completed (635-36, see also Fisher 1988, Blanchard 2008, Goodfriend and King, 1997 among others). The MPS model empirical results partly converges towards the Monetarists’ contentions as Modigliani himself largely recognized regarding the low income multiplier level, the low elasticity of demand for money to interest rate and the longest run response of the economy to stabilization policy (see Modigliani 1975, 1977 and especially 1986). Nonetheless, the meaning of neoclassical synthesis appeared to be changed with respect the 1950s. Patinkin had designed his neoclassical synthesis as a model integrating temporary disequilibrium states in the short run which, in the long run, automatically reached –through the real balance effects – equilibrium states. Against this conception, two kind of synthesis were considered in the 1940s and late 1950s. The first, advocated among others by Lange (1944), consisted in admitting that the bone of contention between Keynesians and Classical is not the existence of a long-run static equilibrium with unemployment but its stability properties. Lange argued that there could be theoretical and empirical situations in which classical equilibrium is unstable that is to say cases in which downward adjustments of money wages may be destabilizing and come with higher unemployment. Other authors, particularly Solow and Samuelson, resorted to the term synthesis as referring to the connection between short-run Keynesians analysis and long-run neoclassical growth analysis at both political and analytical levels. The neoclassical growth model was considered effective, assuming the implementation of proper fiscal and monetary policies. As such, it suffices for getting the neoclassical synthesis a model that integrates Keynesians and neoclassical theory, by assign to government the task of maintaining the economy at full employment. In this way, without assuming any short-run gravitational forces likely to push the markets into long-run paths, the Keynesians and neoclassical approaches were made compatible (see Assous 2015)<sup>46</sup>. The MPS model clearly follows this view. As for Solow, Ando and Modigliani short run dynamic toward the golden

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<sup>45</sup> See also Goodfriend and King 1997 and Mankiw 1990 on the MPS model as a model embedded the theoretical achievements of the 1950s and 1960s.

<sup>46</sup> I wish to thank an anonymous referee of a previous paper who called my attention on this.

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age path that was made possible by policy interventions, identifying this medium run, i.e. the time length necessary to the system to return to its long run equilibrium, with that of the effectiveness of stabilization policies.

### *Provisional conclusions*

The paper reconstructs the origin of the MPS arguing that it responds first to the Fed needs of a more rigorous and modern approach to monetary policy. Its building was certainly encouraged by the recognition of the Fed independent role in the design of monetary policy to reach both monetary and economic targets.

The model should also help to affirm the power of money and monetary policy that appeared undermined in the beginning of the 1960s by the advent of the new theory of finance and, for different reasons, by the rise of Monetarism.

Under a theoretical perspective, the model should fill a lacuna within the Keynesian econometrics models and it was largely used in the Keynesian and Monetarist debate. Nonetheless, especially because different econometric methodologies, the debate appears inconclusive leaving to the political debate and to economic events the task establishing the research line to pursue<sup>47</sup>, preparing the way for the advent of the Lucas' critique....

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<sup>47</sup> The reliability of large scale models suffered two severe blows in the late 1960s. At the 1969 Harvard conference it was demonstrate that they forecast badly only one or two quarters ahead even within their sample periods; moreover they did not predict the extent of the rise of nominal income in the year later the 1968 tax surcharge. Finally the supply shock of the 1970s....

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