KEYNES IN ITALIAN ECONOMETRIC MODELS DURING THE SEVENTIES. THE EXPERIENCE OF PROMETEIA AND CONFINDEUSTRIA

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Keynes in Italian econometric models during the Seventies. The experience of Prometeia and Confindustria

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Abstract
The aim of this paper is to highlight the intellectual influence of Keynes in the building of Italian econometrics and how our scholars tried to find a way out from the stagflation occurred in Italy during the Seventies. We have chosen two case studies: the model designed by PROMETEIA, the think tank belonging to the University of Bologna, and DYANMOD, the main model of Confindustria (Confederation of Italian Industries). Although the Keynesian thought crucially influenced their structure and functioning, they managed to explain also the oil-shock-induced supply side effects, showing an unexpected degree of innovation within Keynesian thought. Furthermore, these models were conceived to join the larger Project LINK by Lawrence Klein, in order to connect the economies of many OECD countries. Given our microeconomic foundations, the main conclusions traced by these models were the focus on balance of payments equilibrium, capital accumulation and public finance constraints, thus asking for economic policies that could guarantee growth and disinflation.

JEL Codes: B23, B31, E12, E65.

Keywords: econometrics, oil shock, Lawrence Klein, John Maynard Keynes, neoclassical synthesis, Nino Andreatta, Guido Carli.

Introduction
During the 1970s, we can observe a general effort in designing econometric models in order to guide policy decisions, to make coherent proposals, to affect or disprove policy making, and even to exert it. Italy is no exception. In order to illustrate this, we have chosen two case studies: the model designed by PROMETEIA, the think tank belonging to the University of Bologna, conceived under the supervision of Nino Andreatta; DYANMOD, the main model conceived within Confindustria (Confederation of Italian Industries), designed in particular by Massimo Tivegna with the help of Lawrence Klein.

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The choice we made derives from different motivations. Firstly, as we will see, although the Keynesian thought crucially influenced their structure and functioning, they managed to explain also the oil-shock-induced supply side effects; secondly, these models were also conceived to join the larger Project LINK by Lawrence Klein, in order to connect the economies of many OECD countries, thus observing the consequences in changes among interrelated variables.

We will describe these models, analyzing their making, main features, originality, pros and cons; then we will outline their utilization, in order to stress the main results given by economic simulations, including how much their policy suggestions were actually followed by public authorities; finally, some concluding remarks will be traced.

While there is a lot of internationally renowned literature about the reception of Keynes in Italy and his relation with econometrics (see for example AA.VV. 1984 and Louçã F. 1999), a study about his thought within Italian econometric models does not exist, thus allowing to investigate on it. Nevertheless, the first part of this work will be dedicated to the analysis of these issues; as we will see, while the initial target of Keynesian demand control gradually lost prominence, the simulation of other economic policies assumed more relevance.

More precisely, the aim of this paper is to highlight the intellectual influence of Keynes in the building of Italian econometrics and how our scholars tried to find a way out from the crisis occurred at that time in Italy. Indeed, Keynes’ ideas gained importance but our microeconomic foundations and the synthesis made by Klein mitigated them, thus showing an unexpected degree of innovation within Keynesian thought.

Moreover, in recent years, also the recognition of a specific role of think tanks in the relationship between economic knowledge and policies has gained ground and growing interest worldwide (Cockett 1994; McGann 2010; McGann & Weaver 2000; Rich 2004). Therefore, another specific goal is to stress the features of modern think tanks born during the Seventies that, through theoretical analysis supported by econometric researches made also by Italian scholars, tried to stem and/or to advise parties, tackling politicians with technicians.

1- The cultural roots of Italian econometric models

The origin of our econometric models can be found within Tinbergen’s and Klein’s pioneering works (Tinbergen J. 1939 and Klein L. R. 1950), even with several controversies about the incompleteness, unsuitability and pretense of knowledge of econometrics (Keynes J. M. 1939 & 1940, Theil H. 1963 and Tinbergen J. 1940; see also Louçã F. 1999 for a summary of this debate); the starting point in Klein’s models was the formulation, based on Keynes’ General Theory, of a
general system that could serve as a reasonable, realistic approximation of the workings of a modern capitalist economy like that of the United States (Klein L. R. 1954 & 1966). His initial contribution was the reading of Keynes offered in his doctoral thesis. Klein maintained that the lesson of Keynes consisted essentially in the demonstration of the possibility of an equilibrium characterized by underemployment of resources, in particular labor. That is, there is no guarantee that with a positive interest rate, savings and investments will be equal (also because, according to Keynes, capital depends on income and not by investment, this latter depending on the marginal efficiency of capital, where the interest rate is just an objective variable); thus output and employment will be determined on the demand side, with a labor supply curve consisting solely in a “set of virtual points which are never observed” (Klein L. R. 1947, p. 117), regardless of the flexibility or rigidity of prices and wages. Klein suggested that it is not necessary, in order to obtain the result of involuntary unemployment, to assume on the supply side that workers suffer from “money illusion”, as Keynes himself apparently did. In general, even retaining the assumption of a neoclassically specified labor market (e.g. rigidity of money wages), in the Keynesian framework one gets an underemployment equilibrium. But in this case another equation is needed to determine the absolute level of prices and wages (with the quantity of money essentially serving to determine the interest rate) (Visco I. 2014, p. 616).

Moreover, Klein tried to offer some microeconomic foundations to underpin the aggregate consumption, liquidity preference and investment functions, also borrowing the labor demand and supply functions from neoclassical economics; he considered the Keynesian assumption that labor supply was a function of nominal rather than real wages and concluded that this was not the reason why, in Keynesian theory, the economy did not return automatically to a full-employment equilibrium. In designing models, Klein kept the specification based on the hypothesis of rational behavior of firms and households, observing that “the profit-maximizing [and utility-maximizing] equations of micro-economics hold in analogy for the macro-system if the aggregates of the latter system are properly measured” (Klein L. R. 1947, p. 199). Here, he made use of his own theory of aggregation on whose basis, starting from a state of microeconomic equilibrium and a corresponding expression in macroeconomic terms, the aggregates of the latter are obtained endogenously in such a way as to ensure full consistency between the two theoretical formulations; therefore, an analogy between micro and macro relations occurred under which the aggregates must be constructed in such a way as to take account of variations in the distribution (Visco I. 2014, p. 613-614).

Klein’s models were structural, in the sense that economic theory plays a relevant role in the specification of the equations. The approach was systemic: the models were composed of
interdependent, possibly non-linear equations and considerable attention was paid to institutional
details. Apart from economic theory – heavily influenced by Keynes, but with increasing concern
over the years for supply constraints and relative prices – Klein believed that special attention
should be paid to the complexity of economic systems (Visco I. 2014, p 620).

However, the merit of having been able to transform and adapt those models to the experience
of an economic system characterized by serious problems of dualism and structural unemployment
is certainly a choice of some Italian economists. Furthermore, we should not to underestimate the
role of suppliers of statistics that have been able to enrich the statistical support to fill the gaps
highlighted by model builders; finally, we must acknowledge some enlightened policy makers for
encouraging all of this and then used econometric models as an aid to their decision making.
Indeed, apart from the purpose of increasing knowledge on the functioning of the economic system,
these models were build aiming at an important goal of assisting decision-making that required the
identification of the different relevant variables affecting policy as targets and instruments. The
timing is crucial within the decision making process and the intervention must be compatible with
the behavior of a phenomenon or an economic system studied by the econometric model; indeed,
this latter has the task of providing policy makers a framework in which the decisions have to be
placed, adjusting the spontaneous evolution of the system.

Within this process the correct model specification plays a vital role, and the econometrician, in
setting its research strategy, has to decide whether to select among variables only those that fit
coherently in the quantitative scheme analyzed or if in the absence of information he can make use
of “proxy” variables. The main consequence of this specification error is the biased estimate of the
equation parameters.

We should also always make clear what are the purposes for which econometric models are
built, namely: forecasting, simulations for economic policy, decision models or auxiliary for
economic history. For each of these purposes varies the statistical requirements in terms of
definition of the phenomenon, disaggregation and timeliness. A forecasting model will have a
modest disaggregation whereas it requires an effort of timeliness. A simulation model requires
instead a greater disaggregation and especially for variables that are compatible with the decision
process. Finally, a purely descriptive model requires a significant disaggregation and less
timeliness, in regard to the time necessary to grasp the actual changes in the structure of an
economic system.

In Italy the statistical scheme framework was provided by the national accounts except for the
foreign trade, employment and slight deviations in regard to certain variables of price and wage.
The first models used only annual data and then had gone to quarterly data; sources were mainly
ISTAT (National Institute of Statistics) or revisions of its data for annual data, whereas for the quarterly series the source adopted was those of ISCO (National Institute for the Study of Business Cycle). This could be applied to the endogenous variables, whereas exogenous variables presented a variety of sources: the Bank of Italy for financial variables, the UN and the OECD for international variables (Rey G. M. 1981).

The first Italian software for the “solution” of simultaneous equations was the Dynamic Model System (DMS), built by the IBM-CNUCE of Pisa in partnership with the Bank of Italy, used on the mainframe of the former; in 1970, this pioneering software allowed the M1BI solution, the first structural econometric model designed by the Bank of Italy under the supervision of Guido M. Rey. This was a “guide to action” model, focused on understanding the Italian economy, rather than on testing an economic theory; nonetheless, during the second half of the Sixties, the DMS allowed the Mosyl built by Paolo Sylos Labini to reach this second goal, thus validating his theory on oligopolies including the impact of trade unions’ and entrepreneurs’ proposals on prices, income distribution and investment from 1951 to 1966 (see Parenti G. (ed) 1974).

The experience made with econometric models showed how conclusions often presented as alternatives to the traditional Keynesian models could be obtained from a typically Keynesian structure as those estimated for Italy. A considerable part of the changes introduced in Italian econometric models in those years have also been dictated by the increased importance that inflation had taken and the extent of changes in relative prices occurred during the Seventies (for a review of our main models see Valli V. 1993; for their technical evolution see Grassini M. 2011). This resulted in a greater articulation of price-wage sector within the models and a more detailed specification about the relationships in it, paying attention to the identification of the effects on aggregate demand of changes in relative prices, of production profitability and of Italian competitiveness in world markets. However, this evolution is also occurred in response to a need that was felt in the early Seventies, that is to use these models to analyze the effects of economic policies, other than traditionally Keynesian, directed to influence, rather than aggregate demand, the prices and costs system; we could say that Italian econometric models, although of Keynesian derivation, showed a higher attention to “supply side” (Crivellini M. 1981, pp. 290-291).

Actually, this peculiar feature has more distant origins because it can be ascribed also to the reception of Keynes’ General Theory in Italy that was, at a first moment (before WWII), underrated or even rejected; according to many Italian economists, it was negatively characterized by the presumption of presenting scientifically what were special cases, or behavior patterns peculiar to a specific culture as hypothesis representative of any Western economy: on the contrary, it was not susceptible of generalization; Keynes’ work, rather than a general economics treatise, was to be
considered at best a textbook on economic policy. The focus of criticism centered on the theory of the multiplier and the modeling which derived from it; Italian economists mainly disagreed with: the use of partial and short-term analysis, instead emphasizing the relative scarcity of capital with respect to labor and the relevance of the availability of savings, reaffirming the sequence going from savings to investments and the consequent need for price-level stability in order to maximize savings; the excessive aggregation procedure of economic variables, which denied microeconomic foundations; the determinism which was implicit in the operation of the multiplier that was able to manage, through budget policies, even those quantities not under its direct control, assuming an excessive faith in State intervention.

After WWII, along with the need of reconstruction, Keynes’ ideas gained importance but did not completely get through; a mode of reasoning by great aggregates was gradually accepted but through supply-side public intervention, thus generating a trade-off between investment and consumption, not accepting in the end the principle of effective demand as an explanation of underemployment equilibrium and the demand-management policies that ensued (see among others AA.VV. 1984; Bini P., Magliulo A. 1999; Duso A. 1978; De Cecco M. 1989; Fusco A. M. 1984; Magliulo A. 2003).

2- Prometeia

The University of Bologna (and in particular its Institute of Economics belonging to the faculty of Political Science) was, and still is, one of the main LINK Centers in Europe, after the invitation from LINK European Head Office in Belgium to join it; this University had the oldest and longest relation with Klein, brought to Bologna by Giorgio Basevi, in occasion of his definitive return to Italy after a long period abroad. The very first production of a regular forecasting activity on the Italian economy (as linked with the rest of the world) began with Prometeia, a spin-off of the University since the early Seventies; its activity consisted, and still consists, in preparing macroeconomic forecasts and then discussing them with sponsors and associates. The main architect of these meetings was Nino Andreatta 2 and Prometeia’s model was also used extensively by agencies of the Italian government to assess the impact on the economy of various fiscal

2 We have to remember that during the period taken into exam, he was minister of Budget and Economic Planning from 1979 to 1980 and minister of Treasure from 1980 to 1982. He was protagonist of the “divorce” from the Bank of Italy, which should have started the reduction of Italian public debt; this latter instead increased because Italy started to make debts on financial markets.
measures and possible alternatives, with Andreatta and other members of the Scientific Committee of Prometeia, acting as consultants (Tivegna M. 2014, pp. 323-324).

The structure of the model and its working

The model was quarterly based and studied short term forecasts; as this project aimed at connecting national econometric models, in order to carry out studies and economic forecasts both on the structure of international trade and on the transmission of inflation between different countries, the characteristics of the model were influenced significantly by these targets, in particular the degree of extension and the disaggregation of the foreign trade sector.

It had a strictly post-Keynesian theoretical structure; the real aggregate demand, influenced by several economic policy instruments, directly determined production and thus employment. The demand pressure exerted only a secondary influence on prices which, resulting from a mark-up mechanism, depended on costs trends, first of all labor cost. About monetary effects on the real sector, money supply influenced the main elements of demand, whereas it acted only indirectly on prices, by the effects that demand exerted on them.

Coherently with its Keynesian inspiration, the model left a primary role to real aggregate demand and its sub-elements (private domestic demand, foreign demand, public sector demand). Private consumption was the most relevant variable and it depended on disposable income; the latter variations were distributed, with a lag, over time, based on past observations, that determined habits and expectations. Consumption function also found its basic inspiration in the permanent income/life cycle theories, thus generating a hybrid version of it (D’Adda C. et al. 1976, pp. 23-27). In the short run the marginal propensity to consume (MPC) varied both according to income distribution and monetary policy (via bond’s interest rate and actual/desired deposits’ ratio); the distributive variable derived from the Kaldorian idea that MPC on labor income could be higher than that on other incomes, so that a redistribution of income in favor of wages positively affected consumption.

Investment played a crucial role too, with monetary policy directly influencing the stock of capital by long-term bonds interest rate – that highlighted financing cost – and by credit rationing; the credit market crucially explained investments, and following Keynes, was seen as a place where a mismatch between customers and banks occurred (in terms of willingness to pay and loans, even if the former was higher than the latter after a restrictive policy), and where a cap existed to exclude requests that involved a greater loss of liquidity and/or a greater risk (D’Adda et al. 1976, p. 197 ss). Firms’ financial activities showed liquid form mostly, and were held for transaction purposes, thus positively responding to GDP increases and negatively to stock option costs, well represented
by the bank credit rate; the rationale of this hypothesis was the business-motive suggested by Keynes in his description of a liquidity incentive (D’Adda C., Fornasari C. 1980, p. 587 and Keynes 1936, pp. 195-196).

Moreover, there was a variable indicating the proportional excess of saving deposits to their desired level, and this was referred to the idea that in the short term a liquidity excess would have changed into demand for goods instead of demand for other assets; this mechanism laid on the inflationary expectations that had diminished households’ nominal financial wealth/disposable income ratio (anyway, this effect was still small; see D’Adda C., Fornasari C. 1980 & 1983). Monetary policy and changes in the general level of prices, could affect the level of consumption through the interest rate, through savings deposits and through changes in the national income deflator/consumer price index ratio. Disposable income at current prices was calculated on the basis of nominal national income and then it was translated in real terms through consumer prices; so the real disposable income – and real consumption – depended on the ratio between the national income deflator and the consumer price index. This made possible to take into account relative prices movements inside the different demand components and the aggregate weight they had.

By the supply side, keeping demand constant, the equation of this sector determined the volume of production, employment and all the variables connected to them, for example the degree of capacity utilization, hourly output, rate of unemployment; joined with these aggregates, wages and prices helped to define income distribution. It is important to say that, in line with the relevance of international trade in the model, the manufacturer sector played a key role, indeed the level of wages and relative prices were referred to it, assuming that other sectors would have adapted to it. The theoretical framework about wage setting was that of a negatively correlated Phillips curve; the rate of unemployment was a proxy of the excess of demand for labor, so it moved away from the Keynesian idea of a positive correlation between nominal wage and employment, although in line with Klein advances and with the Italian cost-push inflation during the Seventies, given by an increase in international procurement prices, and by higher domestic prices, a process that could be shut down only through a reduction in salary, via an aggregate demand restraint (this model was thus influenced by the neoclassical synthesis; see D’Adda C., Stagni A. 1981). It was coherent with the problem of Italian low productivity and the balance of payments constraint.

The way the model worked had a Keynesian view, indeed it allowed to fully illustrate the logic of Keynesian multiplier: after determining the volume of global demand, the monetary costs associated with that level determined general prices – compatible with the volume of demand – and, along with nominal wages, income quotas distribution. Assuming a given stock of capital, the volume of global demand determined on the one hand employment and on the other hand labor
productivity; so the wage determined by the level of employment contributed, along with productivity, to define labor cost (through the market structure that settled labor and the determination of mark-up on raw material costs), prices and income distribution.

The estimates given by the model

According to simulations made in the Sixties, Prometeia coherently confirmed that a Keynesian response to a wage shock would have not started an explosive inflationary spiral, thus providing support to the expansive action chosen by the Bank of Italy. It is important to highlight that beyond the interventions related to short term business cycle adjustments, during the Seventies monetary policy had fundamental changes in terms of ultimate goals – for example the shift from an intermediate interest rate goal to a quantity one, given by total domestic credit; the early Seventies showed a substantial continuity with respect to the Sixties, because interventions were based on the defense of firms’ profit, in order to maintain high rates of capital accumulation. After the parenthesis of 1974 restriction – in order to curb the deficit of the balance of payments and the inflation arising from 1973 depreciation of exchange rate – and the consequently excessive expansive measure of 1975, the final goal became, from 1976 to 1979, the replenishment of foreign exchange reserves almost canceled. The second oil shock was tackled by setting the final goal on inflation control through a monetary and a currency policies aimed at defending the lira, entered within the EMS. The inflation target, through the deactivation of the vicious circle that tied inflation and devaluation of the lira during the Seventies, remained a constant goal of the central bank during the Eighties.

About these two different approaches to Italian economy over the two oil shocks occurred, a counterfactual analysis was made through Prometeia’s model to show that better results would have been obtained applying the restrictive monetary policy to the first shock rather than the second one, because stricter exchange rate discipline would have lowered inflation without affecting the growth performance in the long run. This study underlined that with a more market oriented policy culture – in terms of labor cost, productivity, competition – it would have been possible to implement more virtuous policies in the aftermath of the first oil shock, as other European countries did; this was a quite severe critique because Italian economic policy in the Seventies was basically founded on the irrelevance of public budget constraint, on the dependence of monetary policy from budget needs and on a dirigiste approach to public interventions (Andreatta B., D’Adda C. 1985).

About the forecasts at the end of the Seventies the model systematically underestimated foreign prices and overestimated foreign demand, and these deviations from the actual values were due mainly to the exogenous trend of the former (which made consequently our competitiveness
underestimated), and to the misspecification of expectations, that did not catch the higher propensity to consume; anyway, these forecasts slowly adjusted to the actual values within a year. Therefore, Prometeia suggested a gradual appreciation from the beginning of 1979, because it seemed necessary to reequilibrate at least current account deficit (D’Adda C., Stagni A. 1981, p. 279 ss.; see also Prometeia various years).

According to the forecasts on the early Eighties and on government planning (Ministero del Bilancio e della Programmazione Economica 1980 & 1981), Prometeia provided quite more pessimistic estimates on Italian economic scenario, but still hopeful due to the stagnation occurring worldwide and to our productive troubles; apart from slightly different numbers (a GDP growth of 0,5% instead of 1% for 1982, 1,7% instead of 1,5% for 1983, an inflation rate at 14% instead of 20%), public finance was the area where more concerns were concentrated: while government thought of a reduction from 110 thousand billions to 68 public spending, Prometeia argued for 80. Moreover, inflation differentials among Italy and the major countries would have produced more negative effects on balance of payments; while government estimate for 1983 was over 12 thousand billions BoP deficit, diminishing them to 1000, according to Prometeia, which excluded extreme government actions, this deficit would have been 6000 thousand billions, ready to rise to 10 thousand in 1984 (Prometeia various years and Basevi et al. 1978).

3- Dyanmod Confindustria

This model was built within the Italian Industrial Association during the long-sighted view of Guido Carli’s chairmanship (about the eclectic reorganization of the Research Department of Confindustria (CSC) see Savona P. 2008 and Dafano A. 2014), who firmly believed in analytic coherence as a basis for decision making:

[...] I believe that one of the contributions [...] of modeling is to force us to understand or try to understand the behavior of the system in which we act, both as public operators and private one. But I believe that [...] decisions by authorities [...] thus have the necessity [...] to justify decisions, to inform public opinion about the objectives [...] to inform public opinion about the tools, to accept the necessary adjustments arising from criticism. [...] if who decides is not willing to make mistakes he does not decide [...]. But it is also true that if public opinion claims by those who take decisions that they should not make mistakes, the system would be condemned to paralysis [...] (Carli G. 1981, pp. 377-379)
The aim was to better understand real variables and their interaction with monetary ones; it was a yearly model and was based on objectives probabilities (or “frequency”), so it derived future expectations by past observation³.

The elaboration of this model was assigned to Massimo Tivegna, who came from the Bank of Italy and was brought to the Confederation by Paolo Savona; during 1979-1980 he was sent to the Wharton School, the most advanced econometric center at that time, in order to learn by the future Nobel Prize winner Lawrence Klein structural equation modeling, laid on large models of Keynesian derivation:  

_The use of a model within a business association such as Confindustria is mainly related to the possibility that it offers to evaluate and somehow influence the economic policy. For this purpose the structural approach typical of Keynesian macroeconometrics modeling is more useful than a “reduced form” approach, because it allows following in more detail the impulses of economic policy. The traditional Keynesian modeling can also incorporate patterns of supply and formation of expectations [...]. The normally quite large dimensions of Keynesian models set some theoretical difficulties in estimation and simulation, but allow you to provide decision makers with a vast data collection_ (Tivegna M. 1983, p. 195)  

The structure of Dyanmod and its stylized working

The specification of the model was decidedly Keynesian, both in terms of real sector, having a structure “of demand”, and the monetary side, having a “flow of funds” structure. The direction of causality between real and monetary variables was mainly from the first to the second, with feedback effects that were realized between mixed variables and credit ones (bank loans, bonds issuing) and not through monetary variables. Interest rates were almost all exogenous and the most relevant real variables were households consumption and private investment at constant prices. The model overcame the traditional dichotomy between the block of “real” equations and the “monetary” ones and featured an integrated system of equations; the deflator of household consumption held a prominent role because it went into the disposable income, contributing with this variable in explaining consumption, and it entered even into trade union index, setting wages and prices. Together with real GDP, it contributed to set the balance of payments payoff; moreover, from real GDP it also received a heavy effect through the production capacity used. The credit variables and the exogenous interest rates had a modest influence on investment but a significant

³ Dyanmod had been simulated both within-the-sample (1960-1978) and in forecasting mode up to 1985. The former was originally estimated by OLS (Ordinary Least Squares), afterwards also by LIVE (Limited Information Instrumental Variables Efficient), in order to have more consistent estimates.
effect on household consumption, by the flow of interest income, and a significant weight on the prices’ mark-up function; prices, however, were determined by the wage bill (Savona P. 1981, Tivegna M. 1984\textsuperscript{a}, Tivegna M. 1984\textsuperscript{b} and Bianchi C., Tivegna M. 1984).

As mentioned before, the two most important variables in the model were household consumption and private investment, both at constant prices. They determined a sizable portion of real and nominal GDP; this latter quantity determined nominal disposable income which then got back into consumption in real terms, after having been deflated by the household consumption deflator. This price variable was, therefore, also of basic importance and was heavily influenced by real GDP. This set of simultaneous relationships controlled, to a very large extent, the performance of the model. The monetary sector influenced this core system through interest rates, bank credit and long term credit. Interest rates entered the investment function directly (deviating from Keynesian construct which derived investment primarily from expectations on the cost of money); generated flows of interest revenue to the household sector – that entered the consumption function; generated flows of interest costs to business firms – that entered the consumption deflator and all price variables in general. Bank credit and long term credit entered the investment function directly and – as a multiplicand of interest rates – in the consumption deflator function. Bank credit was also an important argument in the inventory equation.

The feed-back from the real sector – and from this basic set of relationships, in particular – occurred basically through monetary base creation. This variable determined bank loans and bond subscriptions of banks; this latter variable, in turns, strongly influenced long term loans.

The import-export relations of Dyanmod played an important role because they determined a considerable part of monetary base creation (net of the sterilization of foreign inflows). Large errors in the balance of payments could disturb the monetary sector considerably. The import-export performance and the balance of payments were influenced, basically, by economic activity and, to a lesser – but significant – extent, by relative prices.

The labor market was basically exogenous in within-the-sample experiments and got fully endogenized only after 1977 (when the wage indexation mechanism became operational). There were no stochastic wage equations and so the economy’s wage bill was determined by wage indexation and by a smaller “autonomous” component. Wage rates entered as labor costs in price equations and thus had a powerful effect on final demand and economic activity; this latter variable and some kind of relative factor costs determined employment and then again the wage bill.

The two central magnitudes of the monetary sector were the monetary base and the total wealth of the public; the first quantity determined the expansion of bank loans and, to a smaller extent, of long-term-loans. The second quantity determined the demand for bank deposits and the demand for
long-term bonds by the public; this last variable – together with the subscription of bonds by commercial banks – determined long-term loans to the business sector.

The economic scenario outlined

The Reports on Italian industry made by CSC during the Seventies (Centro Studi Confindustria various years), highlighted that the favorable business cycle crossed by Italy in 1978-79 was a unique phenomenon due to the positive trend of our terms of trade; this situation was determined by exogenous factors and could not be reproduced by resorting to short-term economic policies. Italy was affected by structural changes that caused impairments to its setting in the international division of labor; the market, rather than other policies, seemed to react positively to shocks but its adjustment was slower than in other countries, thus justifying prompt public intervention.

The framework of Italian economic development of those years that emerged from the results of the simulations with Dyanmod and the type of reaction of the Italian economy to monetary policy, fiscal policy and income policy were consistent with the thesis of stagnation by low capital accumulation (this result got back to what had been stressed in Carli G. (ed) 1977). In particular, the following key factors of Italian stagflation could be identified: growth in labor costs above the productivity; the existence of the full wage indexation; the “squeezing” of profits; restrictive economic policies, mainly by monetary instruments, in order to prevent the discharge of costs entirely over prices, to reduce the deficit of the balance of payments and limit the devaluation of the exchange rate and to contain wage growth. The key factors of this thesis were made by modest stimulus to invest observed, by the attitude of restrictive monetary policies (to reduce domestic economic activity and inflation in order to protect foreign exchange reserves), by the reluctance of our monetary authorities to let the exchange rate devaluate.

Regarding investment, every cost-push shock given by an increase in import prices or higher wages, caused a domestic recession both for a fall in investment (less self-financing or activity) and for a fall in consumption (less real disposable income); the rising costs of labor and raw materials caused a rise in inflation which, via indexation, depressed the real disposable income of employees, despite the support of contingency: this drop in GDP combined with reduced consumption and investment caused a rise in unemployment which again acted in reducing consumption.

So higher oil prices caused, after a certain period, higher costs and a decline in GDP. In the interim higher inflation was immediately observed and this could cause a restrictive action by policy makers. If this had happened with monetary instruments, the already low level of economic activity would have been depressed further, without an appreciable result on inflation, whose descent could have been anyway constrained by the increase in financial charges.
An increase in public spending and debt caused an increase in economic activity and employment, but also more balance of payments deficit; this could lead afterwards to a restriction. If the increased spending was balanced with an increase in indirect taxes, a strong restrictive effect on GDP would be achieved; if the expenditure was balanced with an increase in direct taxes no effect would be obtained. If the higher spending was financed with bonds, increasing interest rates, only modest benefits on growth would be obtained but together with lower investment, higher consumption and higher inflation (here we can see a shift from Keynesian models, due the presence of some crowding-out effect).

A devaluation of the exchange rate had only temporary expansionary effects but it made domestic inflation increase to an extent as to make it possible, as a result, restrictive monetary measures with consequent recessionary pressures. A higher content of domestic expansion would be given by a stable exchange rate policy with the dollar and its depreciation against the European currencies, as in previous years. But the actual feasibility of this strategy was limited by the exchange rate arrangements in Europe and depended mainly on the relative strength of the dollar.

Finally, the various forms of income policies could have positive effects on employment, on domestic demand and inflation but negative effects on the balance of payments, due to an increase in the deficit. This could have started policies to contain domestic demand to riequilibrate it, which inevitably would have deleted many of the benefits previously obtained.

Dyanmod was also used to evaluate the supply side policy carried on by the government in the early Eighties (Ministero del Bilancio e della Programmazione economica 1980, which partly got back from the results given by CSC, due to the fact that many scholars there joined the Ministry of Budget and Economic Planning in those years). It showed, although it had money inside real block but with endogenous features, a reversal in inflation rate despite the concomitant occurrence of a real growth increase; however, also current account deficit showed an increase. However, it warned that even in the absence of the Plan, the model predicted an increasing deficit of the balance of payments’ current account because of the deterioration in the terms of trade to which Italy was subjected. Nonetheless, these results showed that the chance to get through the Plan a higher rate of growth, lower inflation and a control of the balance of payments’ current account deficit, was still possible (Savona P. 1981 and Tivegna M. 1982).

In summary, Dyanmod was used by Confindustria to argue that Italy needed a strong disinflation policy mainly via the labor cost reduction (thus criticizing the sliding scale), a public spending restraint in order to start again capital accumulation and shift the development process from consumption to private investment, a sound and energy-saving industrial policy to reduce procurement costs, thus setting Italy within the EEC framework.
The legacy of the model

In 1978 Confindustria arranged the WEFA/SRI Fourth World Outlook Conference, with experts from all over the world; during those years a partnership agreement was reached with the CNUCE-CNR of Pisa (in order to calculate in particular the standard errors of multipliers and forecasts; see Bianchi C., Tivegna M. 1984), which allowed connection between the CSC computer (an IBM 5100 purchased ad hoc) and those of Philadelphia through the Italcable network “Dardo” and the international network “Tymuet” via satellite (Dyanmod also collected data from GIANO – the integrated management of the information about Confindustria’s associates – and was directly linked to LUISS University, the National Institute for foreign trade and the Deputy Chamber).

While the model was presented for the first time at the Bank of Italy’s SADIBA school in the October 1980, this meeting was repeated during the years after in order to be updated on modeling advances, and also Klein took part to it, acting as a coordinator: 

The partnership between Klein and Confindustria began at the end of the Seventies, shortly after the arrival of Guido Carli to the presidency of the organization. He wanted to bring in the main representative body of Italian business, methods of action based on Einaudi’s “learn to act” with the goal to dialogue with the institutions, using the methods of the institutions. The yearly model of Confindustria (DyAnMod, Dynamic Annual Model) was built [...] at the Wharton Econometric Forecasting Associates (WEFA), owned by the University of Pennsylvania, with the help of Klein and, above all, with all the facilities of his “modeling workshop”. From 1981 it was used regularly in bi-annual estimation seminars, that Confindustria still hold today, using a new quarterly model. DyAnMod also had important uses of economic policy, above all in the long debate on the sliding scale with simulations on various scenarios [...]. After the abolition of the sliding scale, by referendum, was maliciously said that it was also the model’s fault. “A good model for the bosses”, Klein said, from his democratic left perspective. Subsequently, the model was also used extensively in the debate on the various “maneuvers” that have occurred in the Eighties [...] (Tivegna M. 2013)

As we have already said, the model had a Keynesian specification, but gave more attention to the process of wage formation (especially via indexation) and to the block wage-price-productivity; it had a narrow monetary sector and the public one was not extended as would be necessary, given the ongoing working relationship that Confindustria entertained over the years with the Italian government on fiscal policies. This was fully taken into account in subsequent revisions of the model (Martelli A. 1981); an extensive review of the yearly model was carried out in the early Nineties, whereas in 2007, CSC has built a quarterly macro-econometric model, used mostly for business cycle analysis and for short-term monitoring taken by annual forecasts from the yearly model (Centro Studi Confindustria 1994 and Pappalardo C., Rapacciuolo C., Ruocco A. 2007).
The strategic choice of Klein-style specification was adopted in order to have a fairly disaggregated view of the Italian economy, especially within a period in which the different political and social actors were very active. The new orthodox modeling (VAR, the multivariate vector autoregression) very widespread at that time was considered to be too basic and without heuristic tools required for the major policy players as Confindustria, with interests in many sectors. The use of extended models for public policy prediction and analysis reached its peak in the Eighties; then these models were criticized and abandoned under the pressure of theoreticians of rational expectations and the empirical techniques connected to them, the VAR precisely (Tivegna M. 2014, p. 324. ss).

Dyanmod entered the Project LINK that aimed to integrate the major OECD economies in order to study changes, thus analyzing shock transmission, from one country to another. The LINK managed to explain the world GDP dynamic not as a simple sum of national GDPs, but taking into account the mutual influence among them; when the main international organizations (IMF and OECD above all) provided estimates about macroeconomic aggregates, they used the experience and techniques of LINK.

4- The Project LINK

It seems useful to stress just a few words about this project, where the two models analyzed had been included (this paragraph was made referring to Ball R. J. (ed) 1973, Evans M. K., Klein L. R. 1968, Klein L. R. 1974 & 2007, Klein L. R., Welfe W. 1983, Sawyer J. A. (ed) 1979, Waelbroeck J. L. (ed) 1976).

In a typical national econometric model there are export, import and possibly export price functions, often disaggregated by commodity groups; import prices are generally regarded as determined exogenously to each national econometric model – at least in the initial workings, leaving out their price in value that depends on the exchange rate. Linkage of the national econometric models through merchandise trade flows consists in solving the set of national econometric models simultaneously, recognizing explicitly that one country’s imports must be another country’s exports, and that one country’s import price must be a weighted average of the export prices of her supplying countries.

A direct way to achieve linkage is to disaggregate merchandise trade flows by origin and destination and to explain each of these bilateral flows separately. Therefore, the total world imports will clearly equal total world exports. However, this approach, while feasible in principle, is in general too complex to implement in a model in which a substantial number of countries are distinguished. If $n$ countries and regions are distinguished, the number of bilateral trade flows that
must be explained is approximately $n^2$ for each commodity group. A simpler way to achieve linkage is the trade share matrix approach, which is the approach adopted by Project LINK. Under this approach the explanation of the trade flows is decomposed into two stages; first, the import functions are used to explain total imports of different commodity groups in each country. Given the imports of each country, the trade share matrix is used to derive the exports of each country to each of its trading partner countries.

Regarding price determination and transmission of inflation, since country models were dynamic systems of Keynesian lineage, output was approximately determined by real effective demand. In most of the models inverted production functions determined employment as a function of output; wages were usually explained by a Phillips curve and prices by a mark-up hypothesis. In addition, import and exports were also a direct determinant of domestic prices in most cases. Money mattered for prices in most of the models because interest rates or liquid assets affected aggregate demand and hence the excess demand for labor and the rate of change of money wages and prices.

Regarding the coordination of international stimulus policies and their consequences in Italy during the second half of Seventies, the sluggish recovery performance showed need for domestic stimulus in our country, but it was restrained because of serious current account deficits; on the other hand, Italy benefited from stimulus and other policies introduced in the full LINK system. So could have Italy afforded to adopt expansive measures in an economic environment where other countries were simultaneously reflating? The government expenditures multiplier of Italy was approximately unity for both 1977 and 1978; a stimulative policy would have pushed up income. High income would have stimulated more imports, but this would have discouraged exports via prices; probably because exports included a large amount of consumer goods which could find foreign domestic markets when Italian income rose. Since imports increased and exports decreased, the trade balance was expected to be worse than before. Even though the unemployment level was rather high in Italy, the stimulative policies did not reduce it very significantly. The declines in 1977 and 1978 were 0,1 percentage point and 0.24 percentage point if a 5% sustained increase in government expenditures would have been implemented. Another surprising finding in the Italian study was that a 5% increase in government expenditures did not affect the rate of inflation at all; perhaps this was also because of the high rate of underutilization. Considering the economic conditions in Italy, LINK suggested only a 2% rise in government expenditures, allowed our country to apply some expansionary/reflationary policy actions and remaining within IMF constraints, although the former was restrained from expansionary actions by the latter.
5- Concluding remarks

The analysis made by econometric modeling during the Seventies highlighted that: 1) the Italian balance of trade was particularly sensitive to divergences in the domestic and international development rate, to the point that attempts to improve the balance of payments by acting solely on exports had no appreciable effects (if they were not joined by restrictive intervention over domestic demand); 2) the multiplier level over domestic income of the main fiscal variables (particularly taxes and transfers) was low in Italy, so that a policy centered on such variables encountered soon very strict limits of monetary and administrative-institutional kind; 3) however, even with the same deficit, the composition of expenditure and revenue of public administration had considerable importance (multipliers of direct expenditure were significantly higher than those of transfers, fiscalization of social security contributions, and direct or indirect taxes had different effects on demand, especially on the functional distribution of income and the inflation rate); 4) demand side policies had little direct impact on the inflation rate, whereas the latter variable was strongly influenced by international prices and the exchange rate of the lira; of course, this implied that the effects of demand on prices depended on the balance of payments and the foreign exchange reserves, that is, the ability to maintain a stable exchange rate (Crivellini M. 1981, p. 287).

In general, however, we can guess that, inside econometric methodology, the initial target of Keynesian demand control gradually lost prominence, instead assuming importance the simulation of other economic policies (price control, sliding scale changes, income policy) aimed at quantifying the effects of different behaviors of economic actors or institutional changes. This also happened as a result of the changed context of the Italian economy in which inflation and public debt control acquired an increasing relevance; it is also true that the original emphasis given to forecasting ability of the models and their goal was not anymore the foresight conceit but the attempt (always hard and praiseworthy) of explaining reality.

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