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THE LIMITS OF POLICY MAKING:
An analysis of the consequences of boundedly rational Government using the Swedish micro-to-macro model (MOSES)

by

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THE LIMITS OF POLICY MAKING

- an analysis of the consequences of boundedly rational Government using the Swedish micro-to-macro model (MOSES)

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"You cannot require the facts to conform to your assumptions".
J.M. Keynes

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Abstract

Complexity of the economic system makes it impossible for policy makers to control fully the outcome of their policies. This is particularly so when it comes to policies that influence prices and the dynamic coordination mechanisms of an economy, and especially those that regulate the long and short run (intergenerational) tradeoff of economic welfare. Hence, a boundedly rational Government has to attend not only to the intended outcomes in their policy model but also to the unintended side effects in the wider model of the real economy. In this paper this reality is defined to be the Swedish micro-to-macro (M-M) model, which is sufficiently complex to make all standard macro forecasting and policy models biased predictors of M-M model

performance, if you make the estimation period sufficiently long. Using the model forecasting set up of Antonov-Trofimov (1991) and simple rules of thumb we make Government attempt to control certain objective variables of the Swedish M-M model economy. We study goal satisfaction and side effects. The objective policy variable targeted is unemployment, that Government attempts to keep at the low Swedish rate through public hirings, on the basis of various forecasts and using different model specifications. One side-effect that we study is the consequence on economic growth over a very long period. We find that Government generally fails to forecast and to attain its unemployment target. It has to learn, which it sometimes can. (In the short and the medium term Keynesian demand effects might even temporarily increase macroeconomic growth). In the process of doing good Government, however, sometimes creates very bad effects on very long-term macroeconomic performance. The M-M economy is, nevertheless, very robust in the long term, showing few signs of fatigue or lowered performance, despite huge Government deficits, high (endogenous) interest rates and a rapidly growing public sector share of the economy. One reason for this is the softening effects of an endogenously deteriorating exchange rate, and slow market adjustments. Thus a seemingly benevolent Government can slowly change a once wealthy economy into a relatively poor state by consistently, year after year, aiming for very short-term policy targets. In the very long run (beyond 25 years) macroeconomic growth is significantly affected. Hence, the social costs of maintaining an unreasonably low open unemployment rate for a long time will be carried by the next generation.

Since these bad long-term effects depend on the inability of Government – using inadequate forecasting tools – to understand long-term dynamics of the economy, the conventional policy conclusion changes to: Do less.

There is a discussion about how we should interpret very long, historic simulations by quarter for up to or more than 50 years.

1. Policy making in a plannable or an experimentally organized economy – an introduction

In a well-known paper Lucas (1976) argues that government should be very restrictive in attempting to correct undesired developments in the economy (fine tuning) in order to make it possible for agents to form rational expectations.

Rational expectations in Lucas', and in our interpretation are such that agents will (eventually) learn to be right in expectation. Studies addressing this problem have all been quiet on the time dimension of the "rational learning" process and assumed zero or negligible learning costs such that these transactions costs do not influence the position of the exogenous equilibrium of the model. This paper uses a micro(agent)based-macro simulation model of the Swedish economy in which firms form expectations about their market environment which is affected by policies, and learning is costly in the form of the costs of mistakes at both the agent level and the macro level (policy or non-market failure). Since business mistakes on the part of agents occur through exits and/or through mistaken investment, production and hiring decisions, the costs of mistakes are not computable in advance. We will inquire into the time dimension of the learning processes and what happens when agents strive systematically for a perceived equilibrium that does not exist, or rather, that goes away the closer to the perceived equilibrium the economy operates.

Static equilibrium thinking has a very strong tradition in economics. Real business cycle theory is a typical example of this. In real business cycle theory the business cycle appears as an equilibrium phenomenon, not as a disequilibrium (as in earlier traditional keynesian theory) to be corrected. But stabilization policy is motivated by the ambition to stabilize the environment of risk averse people to create more welfare. Hence, in this new theory, this increase in welfare is achieved by destabilizing the economy, i.e., by creating disequilibrium, rather than by stabilizing the economy. A problem of making welfare and stabilization analysis compatible emerges. We will address that briefly.

Since practically all analytical attempts we have looked at are carried out in the context of an underlying "environmental" equilibrium model, they all tend to come out with the same rather nice results, if the problem of asymmetric and costly information can be explicitly taken care of. To avoid such intellectual pitfalls we will use a true disequilibrium model as reference environment for our analysis, namely the Swedish micro-to-macro model MOSES (Eliasson 1978, 1985, 1991, Taymaz 1991), or rather a model environment in which no standard concept of equilibrium applies. All models that operate in real space are of course equilibrium models in some sense. They are selfregulating, and rather robustly so in particular operating domains. The selfregulating mechanisms can, however, be disturbed, for instance by policy.

The Swedish micro-to-macro model corresponds to what we (Eliasson 1987, 1991) call an experimentally organized economy for which there exists no estimable macro- sector- or micro-based approximate model capable of giving unbiased forecasts for more than a limited period. Hence, such approximate forecasting devices – due to the underlying non-stationarity of the economic processes – will lead to systematic business mistakes or successes, depending upon circumstances. For the agent (firm) of the model, this means that it will have to learn to cope with mistakes, that are not predictable in the sense that if they can repeat their business decisions over and over again they will be right in expectation (Eliasson 1990). The situation will be the same also for the central policy maker, which, however, faces an additional fundamental problem. Its policy action significantly influences the entire economy. For the central policy maker it will, hence, be even more difficult (Eliasson 1991) to predict the consequences of its actions, since there will exist no empirical model capable of capturing the responses of all agents to its policies, and the modification of policies needed to cope with these responses etc. When agents are not passive recipients of Government policy, but play games with the Government, which then, in turn, has to play games with the agents, the whole idea of a better or fully informed central Government, with perfect overview, will have to be abandoned. Central Government rather runs the risk at any time of making things worse by enacting a fundamental policy mistake, with large negative consequences for the entire economy. The conclusion is, hence, that rather than collect more data, to learn to predict better, it should do less.

For the policy analyst the consequences may go even deeper. The relevant question is no longer to investigate under what circumstances traditional forecasts give unbiased results, but what results standard methods give under empirically relevant conditions.

2. The necessity of boundedly rational agents, including central Government

The experimentally organized economy, in which our policy experiments are staged, is represented by the Swedish Micro-to-Macro (M–M) Model MOSES (see next section). There are a number of special problems that this model allows us to investigate.

a. The selection problem: The standard equilibrium model is characterized by a mathematical solution, a point or an exogenous function with certain nice welfare characteristics, on which the economic system, if it gets there will come to rest. There is a large class of mathematical models that can be solved for a unique point or a function. Due to their analytical tractability and capacity of yielding nice policy conclusions, these models have taken over economic method, notably at the expense of important economic phenomena such as institutional change; (institutions are represented by fixed coefficients). One could easily argue – and we do – that institutional change is a much more relevant and important phenomenon in economics both in the short and the long run, than the classical quantity and price interaction of the general equilibrium coordination model. Allowing for selection phenomena, like mergers and acquisitions of firms, Schumpeterian creative destruction, gradually changing legal institutions etc. easily move economics into hopeless methodological terrain, and such drifts in emphasis have therefore been resisted by the classically trained part of the profession. We argue here, that what they do is important, but not that important, and that new numerical techniques now available make it unnecessary to confine analytical attention to methods and problem that may be less relevant and maybe not even important. The model we are using includes some selection – institutional change as endogenous phenomena, notably exit and entry of firms, and this is sufficient to illustrate, vividly the problem we have just addressed.

b. The Swedish micro-macro model features bounded rationality as a necessary property (Eliasson 1990). Bounded rationality among agents creates particular instances of unpredictable behavior of the entire economic system, which ex definitione creates boundedly rational behavior of agents. This phenomenon is mathematically very close to non-linear systems dynamics and chaos. But with bounded rationality a necessary phenomenon of firms and individuals, all agents, including Big Government become boundedly rational agents. The whole notion of the perfect information economy, and the fully informed policy maker goes out the door.

c. The generational problem. The boundedly rational Government (policy maker) looks at one problem at a time (stabilization, allocation, distribution) using partial models. Within each model ("understanding") the problem is to what extent objectives can be achieved. If the necessary separability conditions hold, such policies make sense. Strong separability is conventionally assumed in finance theory. The micro-macro model refutes these separability assumptions. All three markets (labor, products, money) are interlinked. Even more important, the firms of the model are capturing rents from merging all these three market dimensions and the time dimension through their internal hierarchy. Hence, separability does not hold (by assumption) in any dimension. For instance, we ask the question: are financial markets preventing Government from lowering unemployment or the interest rate? Therefore the micro-to-macro model creates side effects that do not occur by assumption in the partial policy model. For instance, attempts to achieve an unreasonably low unemployment level over the next five to ten years may be at the social cost of lower growth and higher unemployment in the long term. What variables is Government interested in influencing? What are the restrictions?

d. Sustainability of policy: The most common modeling technique is to assume passive adjustment on the part of agents. Households and firms, however, eventually learn that they may be cheated upon by Government, and to some extent also how to avoid being cheated upon. Modeling complexity increases when agents, in our case firms, are playing games against the Ministry of Finance. Sustainability of policy is determined by the time it takes for agents to learn to play successfully against Government. The Government may then respond by suddenly changing the rules of the Game (e.g., instituting a tax reform), thereby raising the political uncertainty of the system and preventing agents from learning about the future course the economy is taking, thus lowering its efficiency. To some extent our simulations can be designed to illustrate this policy game.

e. International integration. Practically all policy models view the nation as a more or less controlled system, with well defined statistical limits. International integration, however, has not only limited the scope for policy action. It has made the statistical delimitations of the nation increasingly diffuse. Financial markets are the ultimate enemies of politicians. They are binding their hands such that they can no longer do as much good as they wish to do. International integration has therefore been restored by policy makers, however, not successfully in the long run. The ultimate analysis of the long and short-term trade offs would have to capture financial integration and the long term, notably the domestic effects of international movements of capital. Price (cost) sensitive exports and imports and the endogenous interest rate to some extent capture the economic importance of international integration through trade, production and through financial markets. The interest rate partly reflects the intergenerational wealth transfer problem. We study the possibilities for short-term Government to shift the adjustment burden (less unemployment now, less growth and more unemployment later) onto future generations in a more or less financially integrated world economy.

3. The model and experimental designs

In modeling information processing and policy making of Government relevantly we have to place the economic agents and Government in an explicit analytical environment in which their own learning methods of that environment not only are explicit but also allowed to influence the environment itself. In this respect we distinctly differ from standard learning theory (see Lindh 1992). We find it particularly important not to use – as in standard learning theory – an equilibrium model with costless learning of agents, which by assumption removes all important and difficult problems that face economic decision makers, notably the risk of making systematic mistakes, the effects of which cumulate over time. We do not have any problem in setting up such a difficult stage for the actors, notably Big Government, since once you allow learning of agents to systematically influence the economy with cumulative effects on the structures of the economy system, it acquires these properties of unpredictability, or non-existence of a rational expectations equilibrium. The Swedish micro-to-macro model MOSES has these properties that we find characteristic of an experimentally organized economic environment (Eliasson 1987, 1991). This model[1] features individual firms gathering information in markets and making decisions in explicitly modeled (experimentally organized) markets. The new feature added in this paper (using Antonov's-Trofimov's 1991 prior work) is to add the information processing of Government explicitly.

When viewed "from above" the MOSES system looks like an eleven sector Keynesian-Leontief model with certain dynamic feed back through demand and pricing mechanisms. In that respect everything is traditional, except the manufacturing sector, which is divided up into four markets (Raw materials, Intermediate goods, Durable goods, and Household consumption goods) and populated by individual real Swedish firms or divisions of large firms. While the macro mapping of the MOSES economy looks Keynesian, behavior at the micro level is, however, classical, with the very important exception that agents are striving uphill, and since no stable, exogenous equilibrium exists, the economy is in a constant "disequilibrium" flux, and constantly committing non-stochastic mistakes, and, hence, in principle not compatible with a neoclassical macro model. The constant micro disequilibrium state is an important mechanism behind economic growth. Pure economic factors explain how close to an upper technical limit the economy will operate.

The model has been estimated on, and calibrated against Swedish data (Eliasson-Olavi 1978, Eliasson 1985, chapter VIII, Klevmarken 1978, Taymaz 1991) and is currently initialized on a systematic micro-to-macro database for 1982 (see Albrecht et al. 1992).

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[1] Now fairly completely documented in Eliasson 1977, 1978, 1985, 1991; Bergholm 1989; Albrecht et al. 1989, 1992; Taymaz 1991.

The MOSES model has been constructed primarily to analyze industrial development. Therefore, manufacturing is modeled in greater detail than other sectors. Each sector of the manufacturing industry consists of a number of firms, some of which are real (with data supplied mainly through an annual survey), and some of which are synthetic. Together, the synthetic firms in each industry make up the difference between real firms and the industry totals in the national accounts. There are approximately 150 real decision-making units covering about 30 % of industrial employment and output, and about 50 synthetic units.[2]

Firms in the model constitute short and long-run planning systems for production and investment. Each quarter, each firm begins by forming price, wage, and sales expectations and a profit margin target. These expectations and targets are then used as inputs into the production planning process in which each firm sets a preliminary production/employment plan. The basic inputs to this planning process are (1) the firm's initial position (level of employment, inventories, etc.), (2) a specification of the feasible production/employment combinations (determined by past investments), i.e. the firm's production function, and (3) a set of satisfactory production/employment combinations.

The firm's initial (ex ante) production and employment plans need not be consistent with those of other firms in the model. If, for example, the aggregated employment plans for all the firms exceed the number of workers available at the wage levels the firms intend to offer, an adjustment mechanism is invoked to ensure ex post consistency and the necessary wage adjustments. In the case of labor, the adjustment takes place in a stylized labor market, where the firms' employment plans confront those of other firms as well as labor supply. The labor supply is treated as homogeneous in the model, i.e., labor is recruited from a common "pool" but can also be recruited from other firms. However, the productivity of labor depends on where it is employed. This process determines the wage level, which is thus endogenous in the model. In a similar manner, firms' production plans are revised after a market

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2 The 150 real decision-making units represent divisions within the 40 largest manufacturing companies plus several medium-sized firms.

confrontation in the domestic product market, and domestic prices are set. The rate of depreciation of the exchange rate is endogenously determined by the level of net exports.

There is also a capital market where firms compete each quarter for investment resources and where the rate of interest is endogenously determined by the supply of and demand for financial funds. Given this endogenous interest rate, firms invest as much as they find it profitable to invest, in view of their profit targets.

Other sectors in the model are a government sector, a household sector, and a foreign trade sector. There are also sectors for agriculture/forestry/fishing, construction, oil, electricity, services, and finance, although these are not explicitly modeled.

The exogenous variables which determine the potentials attainable in the model are the rate of technical change (which is specific to each sector and raises the labor and capital productivities associated with new, best-practice investment) and the rate of change of prices in export markets. The rates of change of these variables are held identical in all the simulations reported here. It should be noted further that firms which are unable to reach their profit targets or whose net worth becomes negative, exit from the industry.

We designed a set of simulation experiments to analyze goal satisfaction (to attain low unemployment rates by public hirings), and the side effects of this policy. We compared various experiments to the base run (BASE). In the base run, the Government has no unemployment target: it increases public employment at a constant rate of .21% per quarter. This is slightly higher than the exogenously assumed rate of increase of the labor force with its quarterly 1.03% entry and .86% exit (retirement) rates.

In the second experiment (SIMP1) the Government target is a <u>one percent unemployment rate</u>. This might seem extreme for most nations, but would have meant just a touch of extra ambition for Swedish policy makers during the 60s and the 70s. Both crude sequential policy rules and more sophisticated "Keynesian" forecasting techniques are used to achieve targets.

The third experiment (SIMP2) sets the unemployment targets somewhat higher, at 2 percent, or a touch above average Swedish performance during the last two or three decades.

In these two experiments (SIMP1 and SIMP2) the Government computes how many it would have had to hire to reduce the previous quarter unemployment to one or two percent, and hires as many people as would have been needed (in the experiments reported) to close half the gap, correcting for the underestimation mentioned above. In other words, the Government assumes that the previous quarter's unemployment rate will prevail in the next quarter.

There is a small technical detail to observe here. When the Government aims for one or 2 percent unemployment, using simple rules of thumb (including the "Keynesian" econometric model), it generally fails, through underestimation to achieve its targets. But, also the Government can learn to adjust its rules of thumb. We have looked at the target realization, over the longer term, and adjusted Government rules. This, for instance, means that when the Government acts on its predictions, it corrects its adjustments as if the target is zero percent rather than one percent. This error correction adjustment appears fairly stable. The problem is that Government has to observe this underestimation for some time before it knows what to do, and in the meantime it will commit errors. We have not bothered to model this Government learning explicitly. It should be noted, however, that this type of Government policy is rather simple. Suppose instead that the Government wants to achieve the same unemployment target by varying Government expenditures rather than through direct hiring of people. The precision in target achievement would then decrease and the necessary learning would be much more difficult.

In the fourth experiment, the Government uses the forecasts of a statistical bureau (SB) which has its own "Keynesian type" macro-model of the MOSES economy.[3] The SB collects data from the MOSES economy, and generates its annual forecasts of output, price, and wage changes. In this experiment, we replace the simple sequential policy rules of the Government with this policy model plus an estimated unemployment GNP relationship with an unemployment forecast. The unemployment target is 2%.

The Government forms its expectations "rationally" in the fifth experiment (RAT2), i.e., it "knows" (by ex post assumption) the necessary change in public hiring that achieves the unemployment target of 2% at the end of year. Computationally, Government's "rational" expectation is formed by simulating the same year for a number of iterations. (In our experiment, four times.) Although there is no guarantee that the exact level of public hiring is to be determined at the end of iterations, the Government is usually quite successful in attaining its unemployment target.

Finally, we perform two more base runs by changing the exogenous growth rate of public hiring. In the EQBASE run, the growth rate of public hiring was equal to .17% per quarter which is equal to the exogenous net growth rate of the labor force. In the ZEROBASE run case, the net hiring rate of the Government is equal to zero, i.e., the Government hires as many people as the number of retirees.

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[3] The macro-model is based on the following assumptions (for details, see Antonov and Trofimov 1991).

- Output prices are not flexible enough and the market is cleared by quantitative adjustments of supply and demand.
- Firms do not maximize profits, rather they are satisfied with "admissible" production plans, guaranteeing an expected profit margin.
- Wage adjustment depends on the growth of money supply and on the increase of employment.

The experiments can be summarized as follows.

Experiment	Unemployment target	Forecasting method	Net public hiring rate (per quarter)
BASE	none	none	.21%
EQBASE	none	none	.17%
ZEROBASE	none	none	0%
SIMP1	1%	adaptive	determined by forecasts
SIMP2	2%	adaptive	same
KEY2	2%	"Keynesian" SB	same
RAT2	2%	"rational"	same

Before we report on the results from experiments results it must be noted that the public hiring policy may have a significant impact on industrial performance via two main channels. The first one is through demand effects. A decline in the rate of unemployment achieved by increasing public employment will boost domestic demand. Second, the decline in the rate of unemployment may increase the rate of increase in wage rates since firms have to compete more intensively when hiring from each other. This may reduce their average profitability, whereas the intensified competition may cause a rapid elimination of less profitable firms. This evolutionary process may certainly increase the average productivity/profitability of surviving firms. Of course, if this process goes too far, cost overshooting that destabilizes the price system, killing many profitable firms, may occur and the effects are irreversible in the sense that exited firms are gone forever. The benefits of intensified competition due to increased wages will be noticed in the short run, although the problems of lost diversity, lower investment levels, and the big Government may reveal themselves in the long run. This is the basic short-run vs. long-run trade off.

It is finally important for understanding the interpretations to follow, that MOSES simulations represent the reference reality, the reality central Government is trying to understand, predict and control. Some may think, when comparing many different MOSES runs: why doesn't Government rather do this? It cannot, because it doesn't know what we know. It only has a few standard econometric models, estimated on MOSES data to learn from.

4. Simulation results

Different experimental set ups usually exhibit rather small differences in the medium and the long 20 year run or so, except for a changing cyclical frequency, and for certain parameter settings. Only in the very long (beyond 15-20 years) run, cumulative development differences show up exhibiting the path dependence of the model. If not noticed and/or left unattended for so long by Government, collapselike behavior at the macro level of the economy may occur for certain, not unreasonable parameter settings. In general, however, if policy makers are aware of the sensitive operation domains of the model economy, it is very robust.[4] The experiments have been chosen to illustrate this.

a) One percent unemployment target – crude sequential policy rules (SIMP1)

On the average the Government hits the target with fairly goal precision in this experiment. This run (called SIMP1) is compared with the BASE run in Table 1. In the BASE run Government hires people at the rate of .21% per quarter without setting any particular unemployment targets. The employment policy of the SIMP1 run reduces manufacturing growth somewhat in the first 15 years, but the non-manufacturing part of GNP increases instead. The negative effects take a very long time (second period; 15 to 30 years) to develop, showing negative growth rates for manufacturing. Instabilities in critical macro variables begin to develop in this period, compared to the BASE case. A growing Government deficit is appearing in both runs, but it becomes very large towards the end of the first period in SIMP1, a scenario in which the endogenous exchange rate depreciates strongly.

In the BASE case the Government deficit starts diminishing strongly in the second period, while it continues to increase in the SIMP1 experiment, driving up the interest

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[4] This is in contrast to earlier versions of the model, using the same specification and parameter settings, but being initiated on a much cruder (less diverse) database, and not including endogenous entry of firms. Then the model economy collapsed (or nearly so) much faster, as a result of rather small endogenous or exogenous disturbances. See Eliasson 1978b,c, 1983, 1984, 1991.

rate. Together with the high wage inflation, due to extreme public hirings, the forced exit of firms, and reduced new entry (because of unfavorable price (wage, interest etc.) circumstances) SIMP1 develops into an economy with a few, to begin with, productive but then less so, due to diminished investment, firms and a massive public sector (66 percent of GNP, 98 percent of labor force) and a steady Government deficit of 61 percent and a trade deficit of almost 50 percent of GNP. This economy is close to collapse already before year 30.

The seemingly positive "first period" policy results on GNP and manufacturing productivity growth apparently have been achieved by Keynesian (public hiring) policies. But the explanation is not typically Keynesian. The more job offerings in the market the less risky for individuals to quit jobs and to take their time looking for a new job. Labor will increasingly (because of policies) go to high profitability firms, capable of paying more,[5] thus increasing wages in the process forcing low performing firms to contract hirings or exit. Average productivity will increase in the process, because of the improved allocation of labor, provided the higher capacity to pay due to profitability also moves people to high productivity jobs which promotes macroeconomic growth.[6] This is not a typical Keynesian effect, but it can be occasioned by moderate Keynesian policies. We have studied these mechanisms in the model for a very long time (Eliasson 1978b,c, 1983). Provided excess demand policies are not excessive and provided innovative activities in the model (through investment and entry) are strong enough to keep up diversity of structure (the left, upper end of the Salter Curves in Figures 7. See also Eliasson 1991b and below) this policy works beautifully. If pushed too hard, cost overshooting, however, occurs and the economy begins to perform badly and/or collapse.

While the BASE case trots on nicely for at least half a century, and the Government deficit begins to decrease, the SIMP1 version of the model economy starts oscillating

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5 A similar result from theoretical analysis is presented in Axell (1990).

6 This requires that neither the labor, nor the product or financial markets are disturbed. See Eliasson-Lindberg (1986).

and eventually collapses, with a government sector making up as much as 66 percent of GNP after 30 years.

b) Using a less ambitious unemployment target of 2 percent (SIMP2)

When public policy ambitions are softened somewhat to a 2 rather than a one percent unemployment rate, everything else the same, not very much happens to first period growth performance. The less ambitious employment target is reached both periods. The main difference is less of a deterioration in macroeconomic performance in the second period, smaller public deficits and trade deficits. Typically, the high demands on the financial system in SIMP1 to finance deficit Government spending, increased interest rates significantly. But a 2 percent unemployment rate for 30 years is still extreme, and the MOSES model economy, even though less so than in SIMP1, is steadily on its way to decline.

c) Using more sophisticated forecasting models to support policies

Antonov-Trofimov (1991) used a "Keynesian type" forecasting model, estimated continuously on data generated by MOSES to feed MOSES agents (firms) with forecasts. In this set of experiments we replaced the simple sequential policy rules of Government with this policy model, plus an estimated unemployment GNP relationship to provide Government with an unemployment forecast.

It does not help much to use a more sophisticated prediction model. All the bad systems effects of the earlier runs develop, as one would expect.

d) "Rational Expectations" (RAT2)

In this experiment, the Government forms its expectations "rationally" so that it has a good estimate of the exact level of public hiring that attains the unemployment target of 2%. In this case, the performance of the economy measured by GNP and manufacturing growth, manufacturing labor productivity, and unemployment rates looks pretty good in the first half of the simulation experiment, although its performance is as bad as that of the SIMP2 experiment in the second half.

e) Lower growth in public employment without any unemployment target (ZEROBASE and EQBASE)

Not even the BASE case fared excellently in the long run. We therefore reduced public hiring ambitions considerably to no increase in public employment at all (ZEROBASE), and kept the share of public employment in the labor force constant (EQBASE).

While employment in the BASE case stayed at a moderate ("natural") rate of some 5 percent throughout the 30 year experiments, it increased to 8 percent in the ZEROBASE run in the first period and then increased further to around 14 percent. Manufacturing output and productivity developed as in the EQBASE case, and a slight loss in output during the first period was concentrated on the other sectors. Hence, the high unemployment rate lowered wage increases, and increased competitiveness of exports. Over a 30 year period the public deficit practically vanished. It appears as if a constructive and acceptable policy alternative would fall somewhere between ZEROBASE and EQBASE, a less ambitious and diminishing Government, but a steady improvement of the economy except for employment!

It is interesting here to stop at this point and ask a few questions. Apparently the model generates scenarios that in the very long run correspond to some of the worries expressed in the economic debate, but the bad effects take a very long time in showing, so long that it is difficult to make myopic politicians and the current generation pay attention. But the next generation nevertheless pays.

On the other hand, if we enact suggested remedies, the goodies come in the very long run, but for this generation remains less real income for consumption and a higher unemployment rate.

The extremes simulated are ZEROBASE and SIMP1. SIMP1 is not an acceptable scenario although it is quite probable for reasons already stated. On ZEROBASE one may ask, why don't stimulate demand somewhat through public hirings rather than wait for so long for private production to pick up the unemployed. Isn't there some ways to make firms expand output and employment a little faster, without beginning to cumulate bad long term effects? Maybe we can learn something by figuring out more exactly how the bad very long term effects in SIMP1 were generated by the extreme short-run unemployment targets.

5. Forcing the economy to operate closer and closer to static equilibrium conditions

The experimentally organized economy of MOSES features agent's learning procedures explicitly and make business mistakes a normal cost of economic development. One property of this dynamic model is that a minimum diversity of economic structures is needed for a stable macro development (Eliasson 1978b,c, 1983, 1984, 1991). Competition forces badly organized agents to slow down growth or exit, thereby making firms more and more alike, if not countered by investment and new entry. We can enhance competition by speeding up the arbitrage processes in the model. If not countered by significant innovative entry, the diversity of structures in the model will be competed away and the macroeconomy will begin to exhibit signs of instability. Notably market prices will begin to behave erratically becoming increasingly worse predictors of next period prices, thus lowering the level of information in the economy, creating an increasing frequency of economic mistakes. Similarly diversity can be diminished through ambitious stabilization policies, reducing slack in the economy, increasing inflation and competing high cost producers out of business. In Eliasson (1983) it was suggested that increasingly ambitious Keynesian stabilization policies during the postwar period, indeed increased economic growth for several decades but eventually reduced diversity of structures sufficiently to make the economies very sensitive to disturbances of the oil crisis type in the 70s.

This increasing potential instability of the entire economy can be seen already in the development of rate of return distributions (shown in Figures 7) notably in the SIMP1 experiment.

A healthy economy maintains a diverse structure illustrated by the Salter distributions of ZEROBASE and EQBASE, year after year.

In SIMP1 Government policy has forced a large number of firms to exist, fewer firms to enter and flattened the distributions, creating all kinds of instabilities in the economy (cf Eliasson 1984a, 1991). On the other hand, through increasing competition for labor Government has made wage distributions become flatter and firm rents to be lowered and distributed more equally. The economy is increasingly beginning to look as we want it to look when in static equilibrium, and apparently this is not a stable and desirable situation for the economy to be in (Eliasson, 1983, 1984a, 1985).

This competition, however, forces the remaining firms to be more productive, something that is desired, but eventually at the expense of less employment and (!!!) less competition, since the number of firms decreases.

Competition is something that we wish to see, but perhaps not this form of competition imposed by excessive Government hirings, but rather competition among firms. Such competition in financial and labor markets is defined (Eliasson 1991) by the spreads in the rate of return (Figure 7) and labor productivity (not shown) distributions, the upper left firms exerting pressure all the way down, and the more so the more viable entry. Hence, the ultimate long-run limits of Government policy making, and the growth potential of the entire economy will be determined (Eliasson 1991b) by the nature of entry, broadly defined and including also innovative activity within firms.

6 Does it make economic sense to simulate the model 50 years by quarter?

Some may say that 50 year simulations by quarter do not make economic sense. We know, for instance, that weather forecasts beyond six or seven days are completely without "weather content" since the resolution of initial state measurements and the precision of calculations deteriorate quickly, because initial state and rounding errors, cumulate in the path dependent models that "weather forecasters" and we use.

This is all true when you make forecasts, or when you quantify effect-measurements. Ours, however, is a principally very different problem. We want to establish the existence of certain properties/effects in a numerically specified model of the Swedish economy. The problem is analogous to demonstrating the existence of certain properties in a theoretical model. If it can be shown that the initial state resolution and the precision of computing does not create the results that we treat as economic, then thousand year runs by month are economically meaningful. The particular problem we have to consider is whether the collapse of the entire economy after some 50 years is caused by particular "random" rounding errors in the computations, or by economic mechanisms in the model.

There are two strong reasons for expecting economic mechanisms to have caused the very long-run results, that we have interpreted. First, the macroeconomic collapses in some simulations are the result of systematic specification differences in the experiments, that carry an economic significance. In other simulations of equal length the collapses do not occur. Second, noise in the model simulations due to rounding errors generally do not create these types of effects. If it does anything, it would rather stabilize the macro economy (see Eliasson 1983).

This means that our micro-macro simulations, even though we are using an empirically calibrated model of the Swedish economy, in this particular analysis should be looked at as theoretical analysis aimed at establishing the existence of particular long-run phenomena. The fact that we are using a calibrated model, with empirically reasonable assumptions only lends more empirical credibility to the theoretical results. They may in fact be very relevant, as compared to some pure theoretical results that the reader may have happened to come by in some journals.

Let us take the unemployment target of one and 2 per cent as example. One percent is a very low unemployment rate, even by Swedish standards. We know that the calibrated M-M model somewhat "overpredicts" the unemployment level on average. We also know that the statistics that we calibrate against are influenced by particular Swedish circumstances like retraining programs, early retirement, etc. that are not represented in the M-M model, that also makes it difficult to compare Swedish unemployment data with, for instance, U.S. unemployment data. But one per cent is very low both for Sweden, the U.S. and in the M-M model, and we have been interested in the very long-run macroeconomic consequences of setting unemployment targets at unreasonably low levels for very long, not in particular in setting them at one per cent.

Long-run simulations raise the problem of robustness of the model economy. The general experience of model simulations that we have is that the model economy gradually begins to exhibit tendencies towards collapse in the sense that the parameter domain for which structural diversity can be sustained narrows. The typical features of deteriorating robustness is a diminishing number of firms and gradually flattening Salter structures. The time needed for reaching this structural situation is, however, very long. In the first 15-30 years there is generally no problem. In the 25 to 50 year period the economy collapses in some experimental runs, and beyond 50 years, the parameter region with a sustained robust model economy probably is rather narrow, even though we have not yet investigated this matter systematically. This means that we have to distinguish between the long run, up to 25-30 years, and the very long run beyond that horizon.

There are also some other deep reasons for performing historic simulation experiments. Economic growth is a very long-run affair. Can there be a meaningful theory of economic growth? If the answer is yes, there also has to be a meaningful model of economic growth, and hence also historic simulations make economic sense. We argue (see Eliasson 1991) that a growth model to carry any explanatory value will have to be based on explicit representations of agent behavior in dynamic markets. Standard neoclassical growth theory is no theory of growth, since the underlying forces that move growth are all exogenous. The Swedish micro-to-macro model, using different parameter setting that regulate firm behavior and market dynamics create very different long-run macro trajectories. So what do these differences tell?

In fact, identical specifications of the existing state of technology, but different specifications of the nature of firm behavior and market dynamics can create variations in very long-run macroeconomic performance that are even larger than those observed among national economies around us. So apparently such economic explanations are more credible than neoclassical macro production function based analysis, where growth is simply a result of quantitative assumptions made about technical change. Government regulations and policies affect these market mechanisms that apparently can affect very long economic growth in this model. Hence, it makes economic sense to carry out very long-run simulations to study the fulltime dimension of economic policy.

We have concluded from our analysis that rather than collect more data and improve the model to make better forecasts to support policies, the Government should do less. To do less in this particular context means having a much less ambitious unemployment target. But we venture to suggest that this result generalizes to any ambitious government that is controlling a significant part of the economy's resources through the public sector. This may still sound like a contradiction. Why shouldn't Government rather use the MOSES model, which apparently tells a better story about the long-run consequences of policy making. Then policy can continue to be ambitious. Not so. This is where the objections to very long-run forecasts, or forecasts in general are relevant. The MOSES model may still give biased predictions of the real economy. But principally more important is that the simulations we have presented are not forecasts. They simply demonstrate that certain bad long-run consequences of policies are likely to occur under the reasonable circumstances of the model experiments. It gives no more advice than any other policy model of how to avoid these negative effects in the operational context of carrying out real policies.

The situation is even more serious for the policy advisor. In the experimentally organized economy of MOSES – in contrast to the standard general equilibrium model – controlled policy experiments are not possible. Hence, economic decision making at the macro policy level should be minimized, since even though a policy experiment (and it will always be an experiment) may turn out good results, there is always a significant risk that it may create something very bad.

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Table 1. Experiment results (Years 1-15)

	ZEROBASE	EQBASE	BASE	SIMP1	SIMP2	KEY2	RAT2
QTOP*	150281	152394	153153	156675	134675	146823	141347
TEC*	11662	11625	11917	11981	11536	11902	12052
Labor prod.*	389439	385954	394917	797181	520333	659736	547376
Average annual growth rates							
GNP	3.77	4.06	4.11	5.37	4.41	5.04	4.57
	0.74	0.69	0.75	0.72	0.58	0.83	0.67
Output	5.04	5.03	5.37	4.70	4.76	5.12	5.27
	1.34	1.54	1.40	2.12	1.57	1.80	1.66
Sales	11.23	11.26	11.57	10.96	11.00	11.36	11.49
	1.15	1.40	1.42	1.87	1.51	1.68	1.65
Prices	5.87	5.88	5.88	5.87	5.91	5.87	5.91
	0.53	0.53	0.52	0.54	0.55	0.54	0.54
Wages	6.57	7.85	7.93	14.04	10.28	12.46	10.56
	0.35	1.01	1.36	2.26	0.99	2.10	0.95
Profit margin	45.06	42.70	43.09	37.20	39.66	37.38	39.52
	6.16	3.79	3.75	1.72	2.06	1.37	2.44
Unemployment rate	8.04	5.19	5.28	1.06	2.24	1.85	2.14
	0.95	1.92	2.07	0.19	0.27	0.90	0.32
Exchange rate*	1.59	1.72	1.71	2.03	2.03	2.03	2.03
Interest rate	12.63	12.68	12.59	10.28	12.05	10.83	11.89
	0.87	0.57	0.56	1.26	0.69	1.74	0.95
Public deficit/income	-28.33	-29.96	-29.77	-42.48	-36.71	-40.56	-36.62
	6.18	3.93	4.24	4.34	0.84	1.90	0.80
Gov. share in GNP	35.33	36.29	36.22	44.75	40.99	44.00	41.02
	0.57	0.39	0.38	5.08	2.71	3.75	2.52
Trade def./GNP ratio	4.31	5.19	5.12	15.00	10.63	14.43	10.85
	2.23	1.27	1.38	6.02	2.62	4.57	2.63

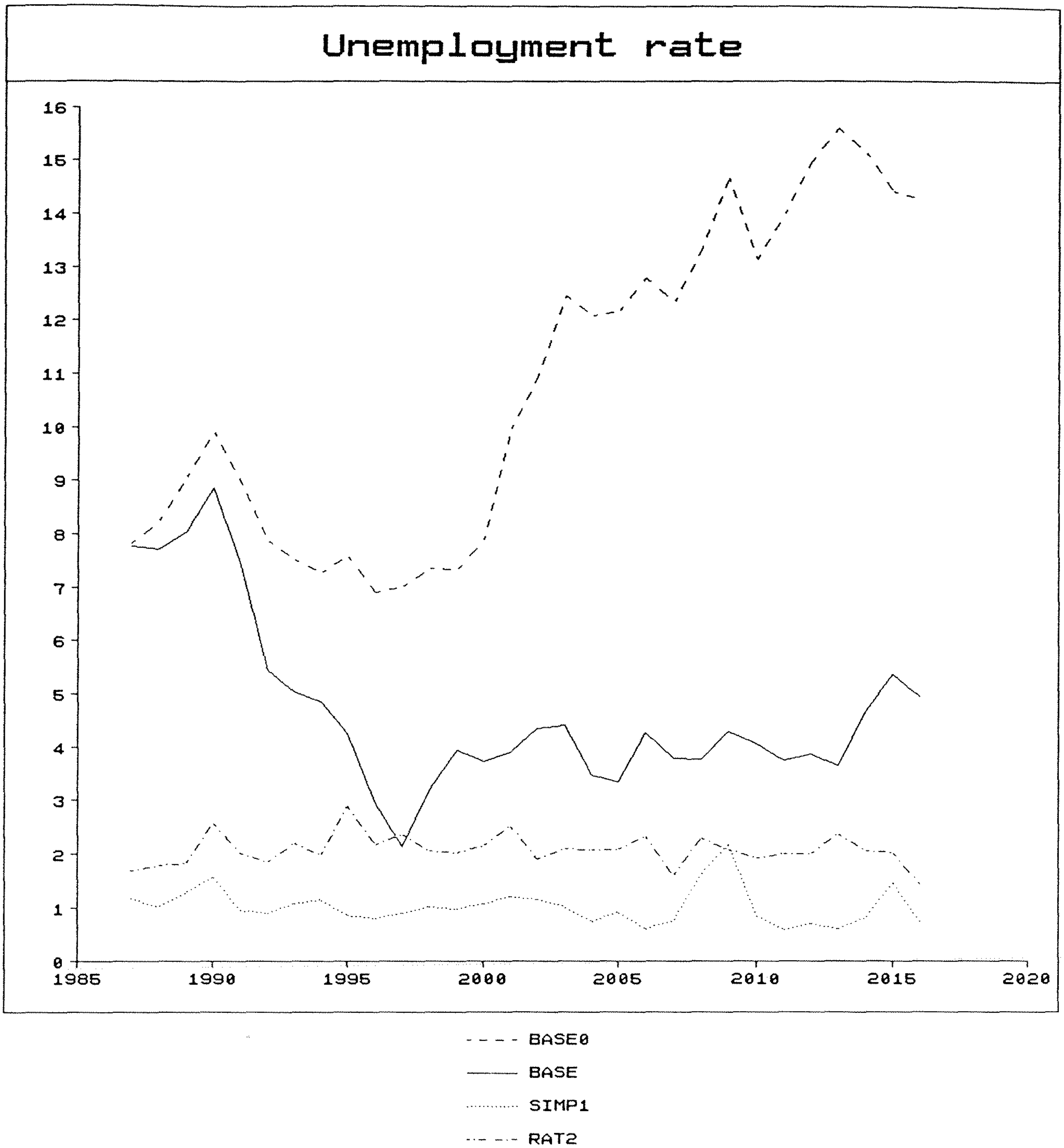
Note: The standard deviation of a variable over the period is shown in the second row.
* denotes the value at the end of the period.

Table 2. Experiment (Years 16-30)

	ZEROBASE	EQBASE	BASE	SIMP1	SIMP2	KEY2	RAT2
QTOP*	454640	391980	408493	41397	159049	53993	222153
TEC*	17992	19155	18840	22463	16143	19934	17895
Labor prod.*	722351	719729	729879	788204	825031	1011372	922739
Average growth rates							
GNP	3.77	4.06	4.11	5.37	4.41	5.04	4.57
	0.74	0.69	0.75	0.72	0.58	0.83	0.67
Output	3.11	3.29	2.83	..	1.80	257.43	1.16
	3.09	2.28	2.40	..	1.36	723.40	2.33
Sales	9.36	9.66	9.21	7.23	8.52	11.99	7.79
	2.25	2.05	2.07	23.12	1.79	16.26	2.13
Prices	5.87	5.99	6.01	8.00	6.54	6.81	6.49
	0.62	0.57	0.58	3.59	0.86	2.60	0.95
Wages	5.14	7.25	7.71	11.75	9.34	9.63	8.93
	0.58	0.82	0.64	1.45	0.20	1.23	1.01
Profit margin	70.69	57.07	56.54	8.48	50.29	31.01	54.28
	6.58	5.60	4.76	67.57	4.09	49.60	4.30
Unemployment rate	13.46	4.60	4.13	0.98	2.08	1.91	2.02
	1.31	0.70	0.54	0.43	0.20	1.07	0.24
Exchange rate*	1.17	2.06	2.20	3.73	3.73	3.72	3.72
Interest rate	8.59	12.68	13.37	22.33	21.60	23.33	21.95
	2.52	0.40	0.93	3.72	4.18	2.79	3.94
Public deficit/income	-2.21	-19.19	-21.92	-60.50	-41.86	-55.78	-43.86
	7.15	3.06	0.97	5.18	2.21	5.30	2.21
Gov. share in GNP	35.28	39.09	39.91	66.01	52.41	58.90	51.69
	0.68	1.07	1.65	13.85	4.07	4.92	3.57
Trade def./GNP ratio	-4.03	2.43	3.32	47.05	23.94	32.74	21.43
	2.29	0.87	1.04	28.93	6.05	7.62	4.77
Share of public emp.*	44.75	54.52	56.61	98.24	78.06	92.61	80.82
Share of private emp.*	41.01	39.45	38.44	1.01	20.33	5.69	17.75
Number of new firms*	72	54	57	24	52	37	51
Number of nullified firms*	42	50	52	176	69	154	80

Note: The standard deviation of a variable over the period is shown in the second row.
* denotes the value at the end of the period.
Labor force at the end simulation is about 2530000.

Figure 1



Unemployment rate
16
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0
1985
1990
1995
2000
2005
2010
2015
2020
BASE0
BASE
SIMP1
RAT2

Figure 2

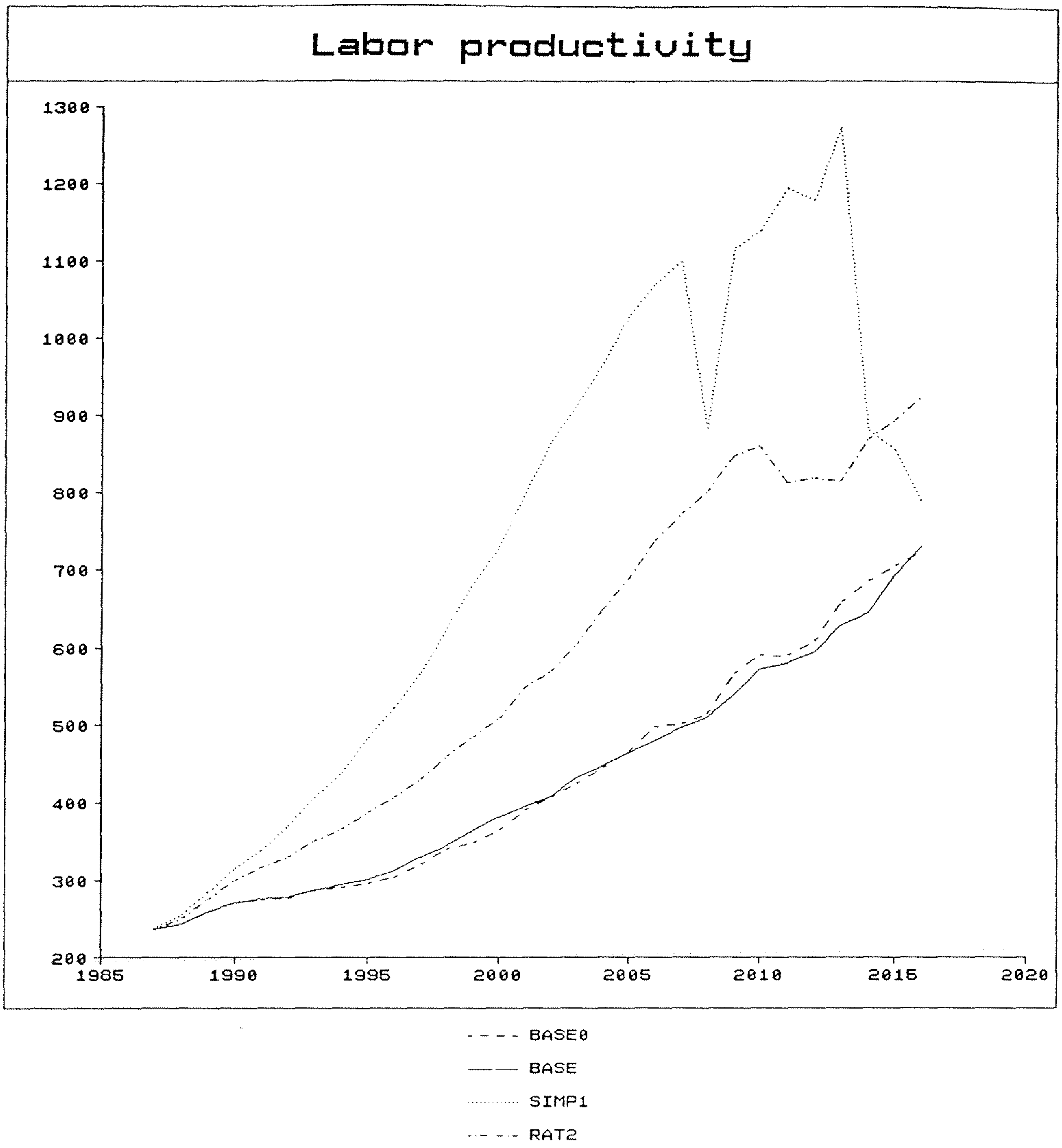
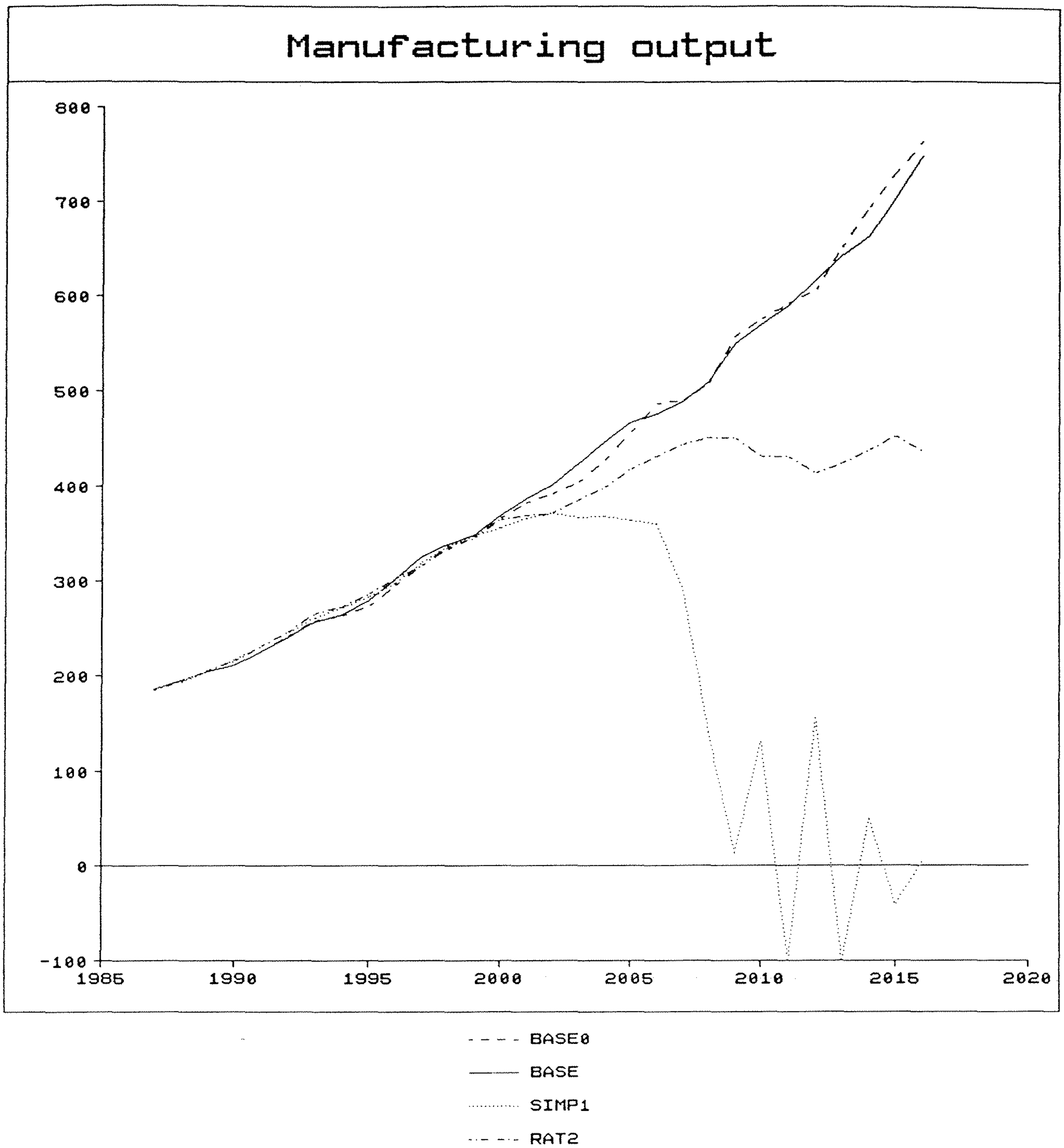
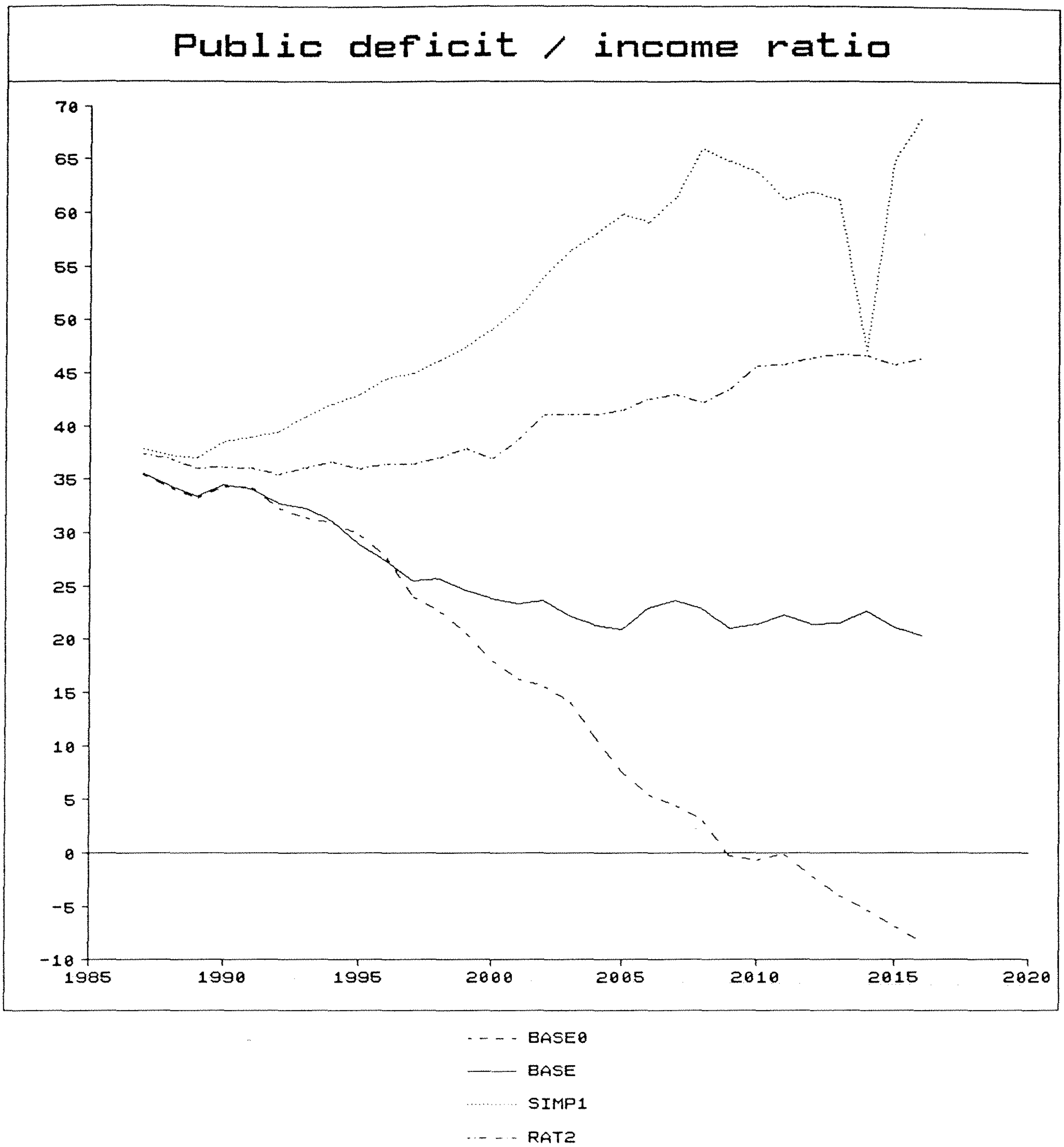

Labor productivity
1300
1200
1100
1000
900
800
700
600
500
400
300
200
1985
1990
1995
2000
2005
2010
2015
2020
BASE0
BASE
SIMP1
RAT2

Figure 3



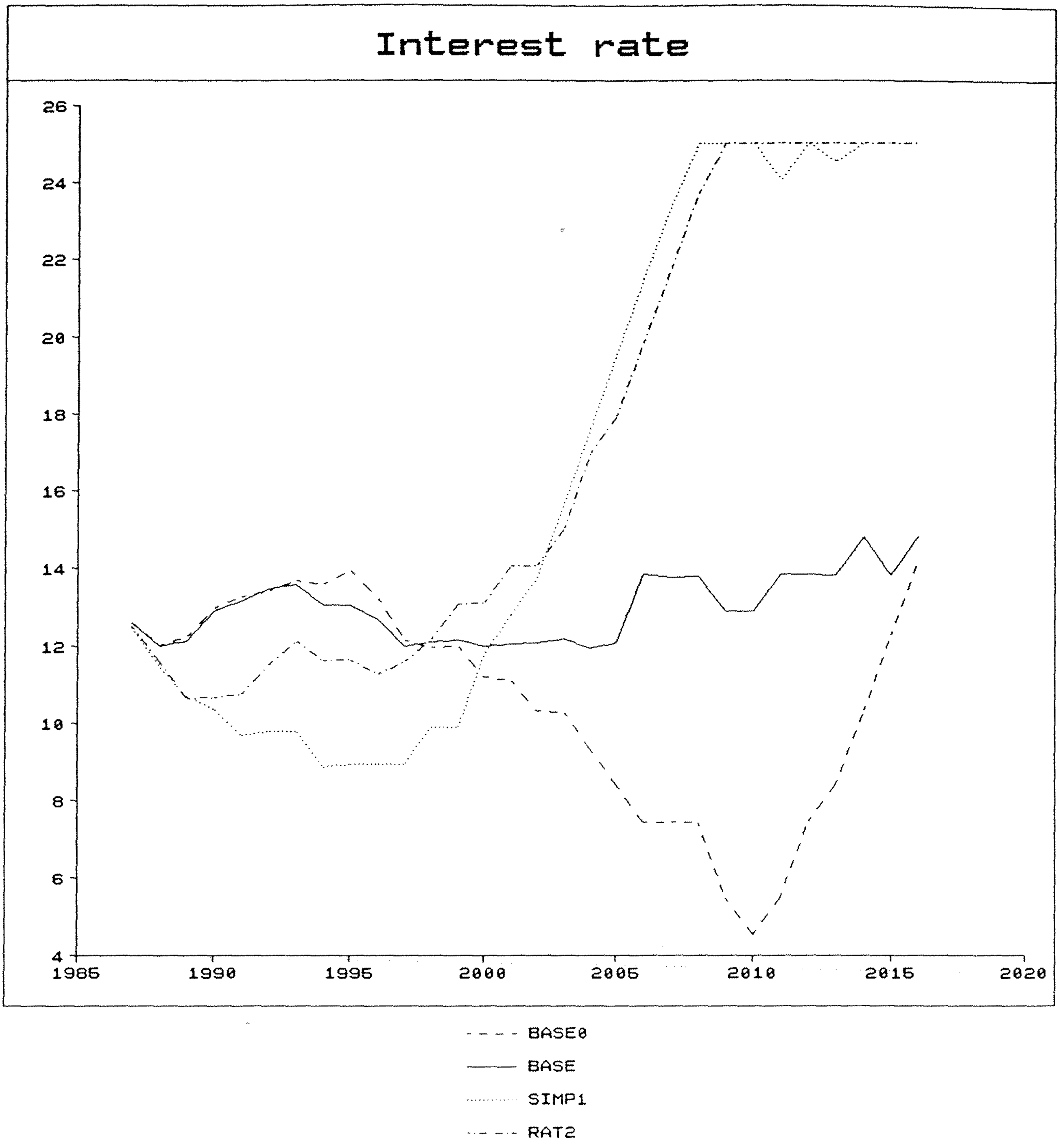
Manufacturing output
800
700
600
500
400
300
200
100
0
-100
1985
1990
1995
2000
2005
2010
2015
2020
BASE0
BASE
SIMP1
RAT2

Figure 4



Public deficit / income ratio
70
65
60
55
50
45
40
35
30
25
20
15
10
5
0
-5
-10
1985
1990
1995
2000
2005
2010
2015
2020
BASE0
BASE
SIMP1
RAT2

Figure 5



Interest rate
26
24
22
20
18
16
14
12
10
8
6
4
1985
1990
1995
2000
2005
2010
2015
2020
BASE0
BASE
SIMP1
RAT2

Figure 6

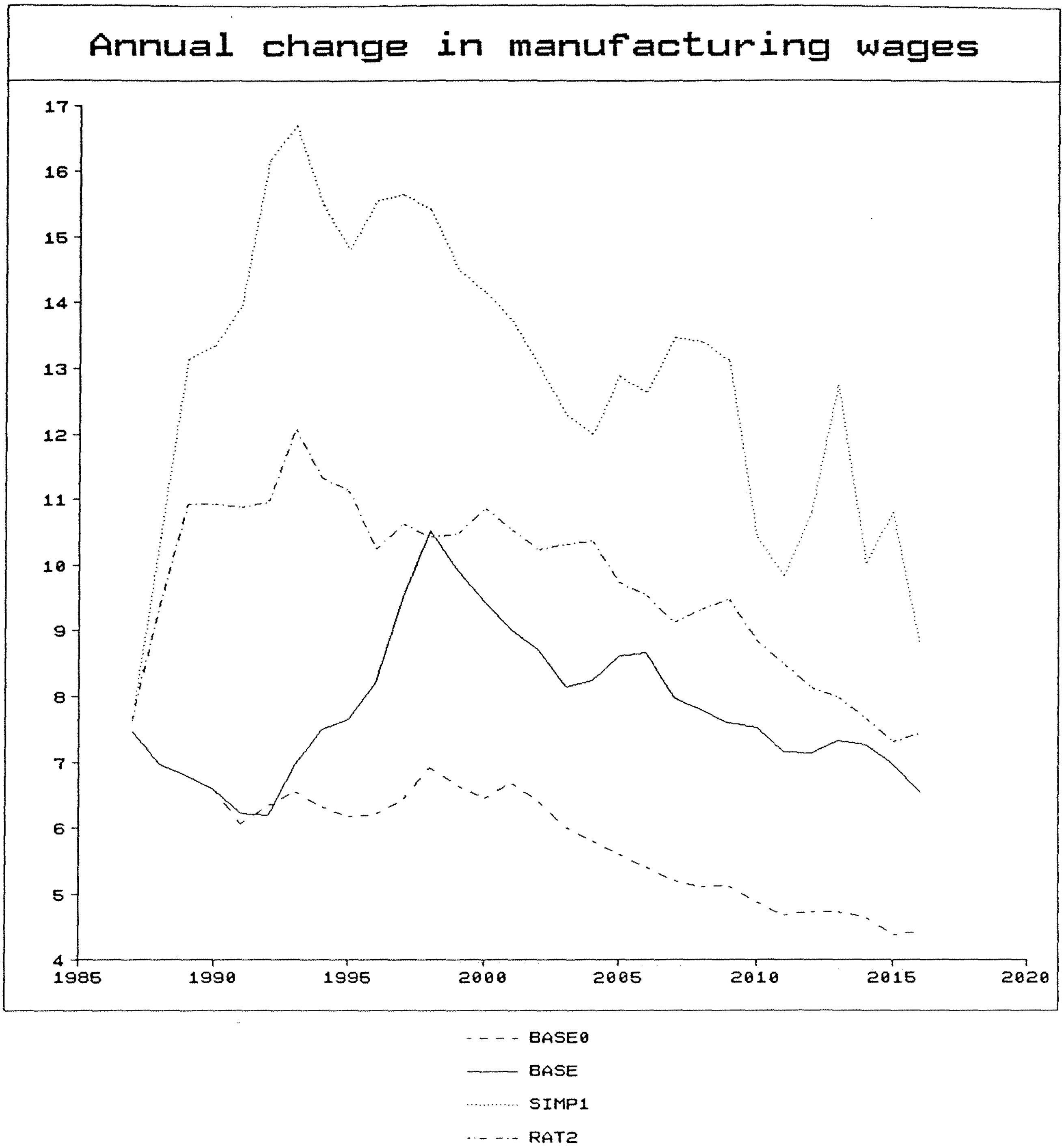
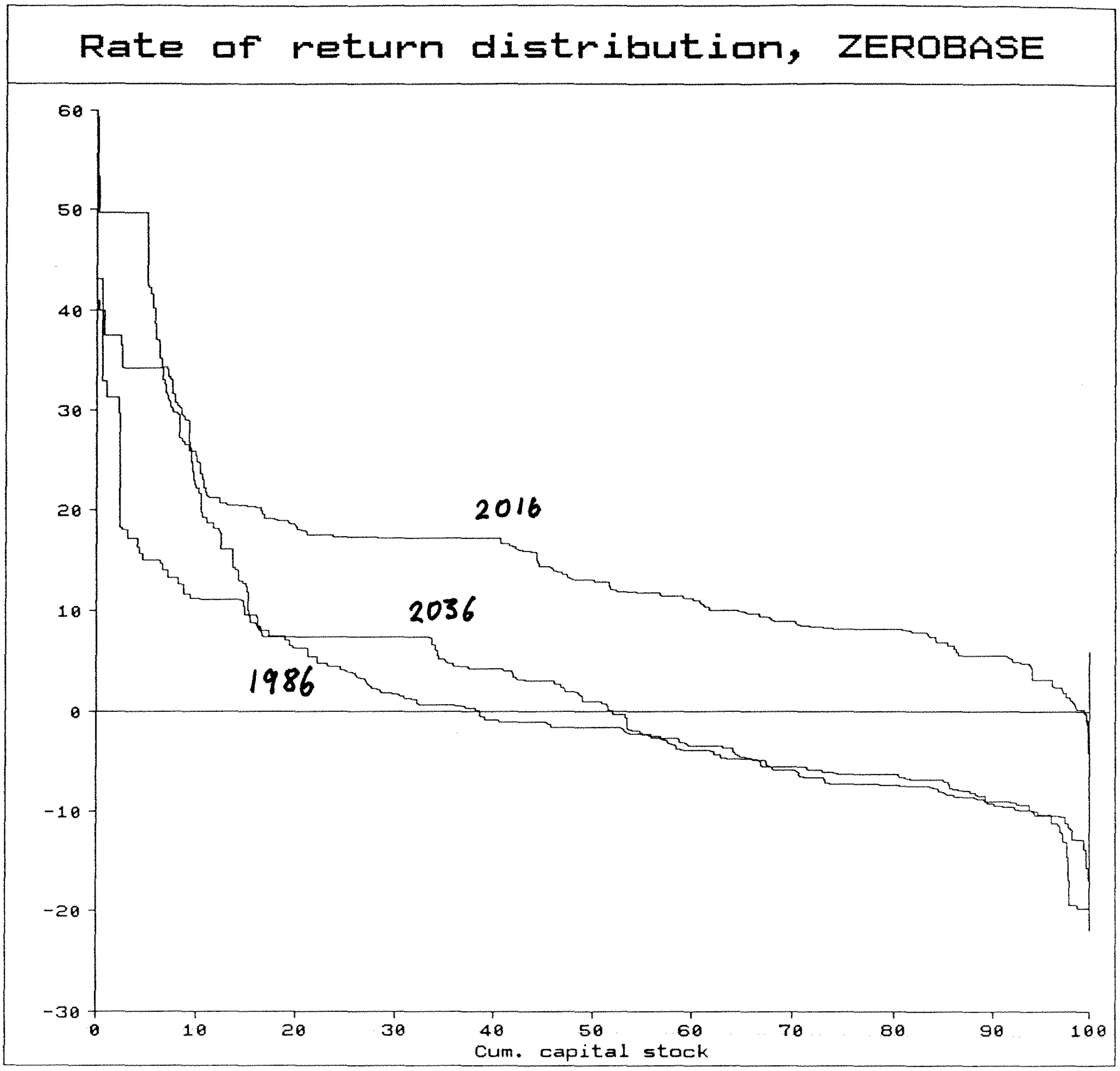

Annual change in manufacturing wages
17
16
15
14
13
12
11
10
9
8
7
6
5
4
1985
1990
1995
2000
2005
2010
2015
2020
BASE0
BASE
SIMP1
RAT2

Figure 7a



Rate of return distribution, ZEROBASE
60
50
40
30
20
10
0
-10
-20
-30
0
10
20
30
40
50
60
70
80
90
100
Cum. capital stock
2016
2036
1986

Figure 7b

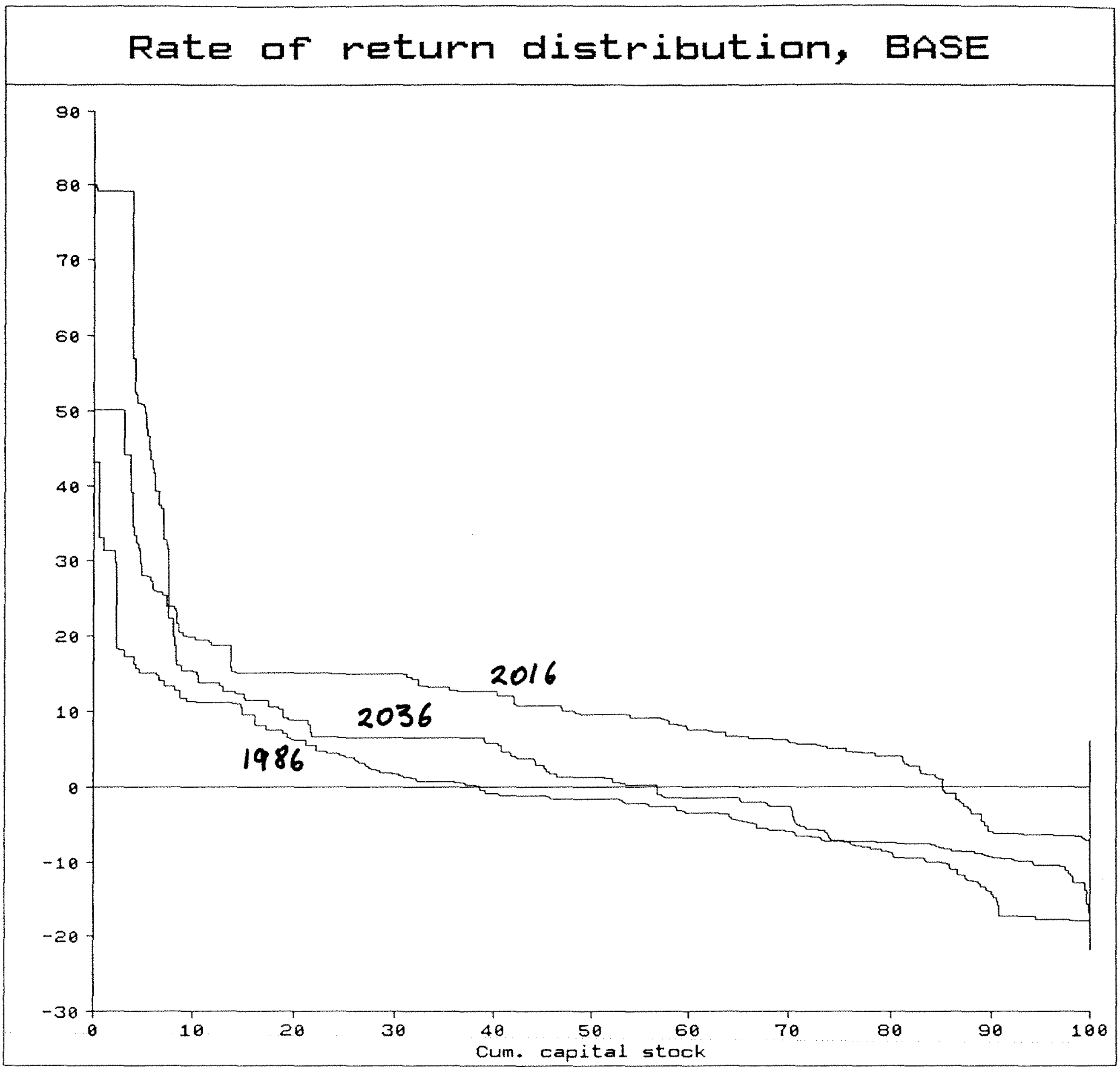
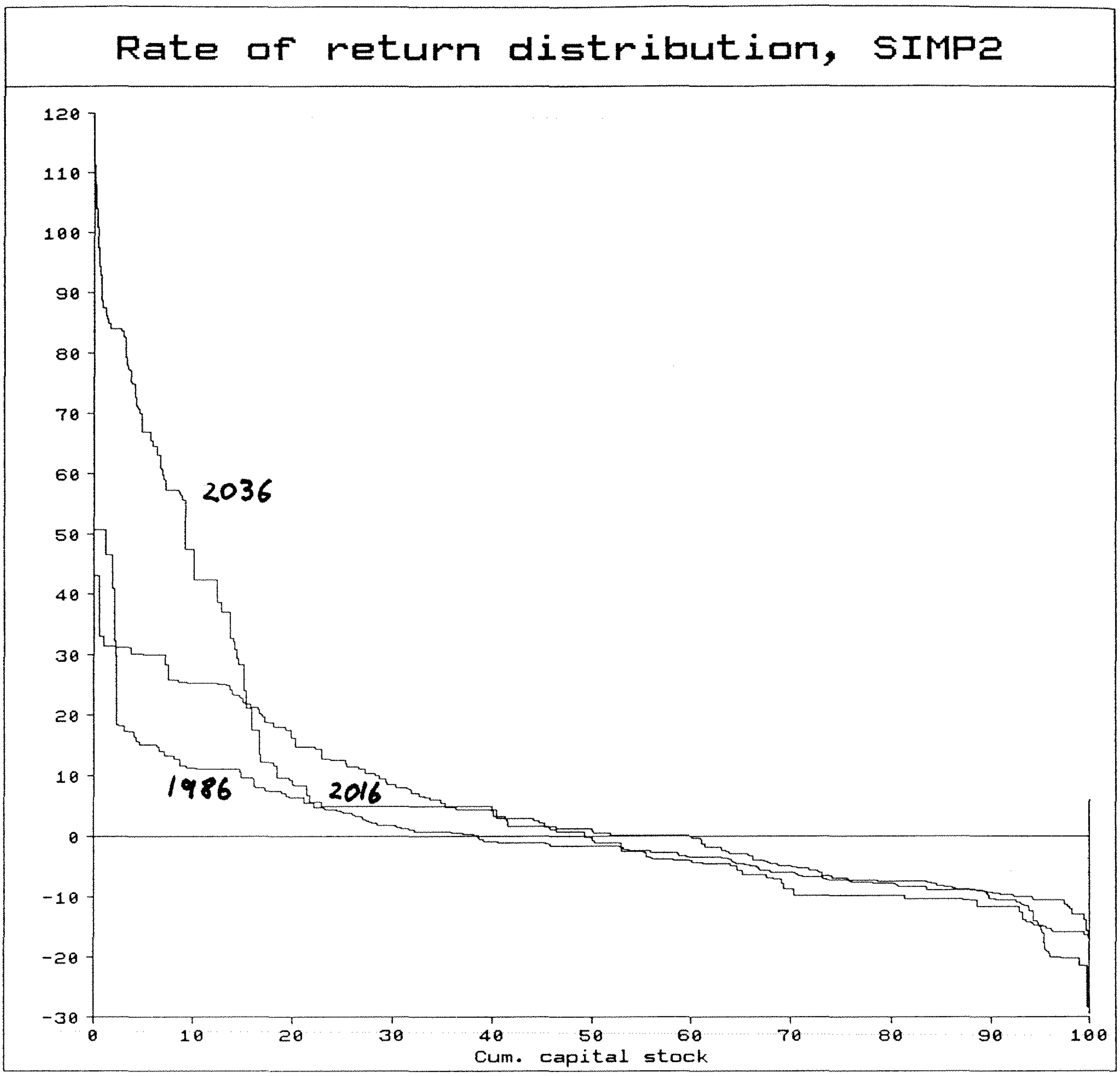

Rate of return distribution, BASE
90
80
70
60
50
40
30
20
10
0
-10
-20
-30
0
10
20
30
40
50
60
70
80
90
100
Cum. capital stock
2016
2036
1986

Figure 7c



Rate of return distribution, SIMP2
120
110
100
90
80
70
60
50
40
30
20
10
0
-10
-20
-30
0
10
20
30
40
50
60
70
80
90
100
Cum. capital stock
2036
1986
2016