

High Inflation and Contemporary Monetary Theory

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I. Introduction

In this paper, I am drawing throughout on joint work with Daniel Heymann¹. Our interest is in economic behavior under conditions of extreme monetary instability, that is, in deep depressions and very high inflations. Only the inflations will be discussed in what follows.

The first part of the paper describes some of the salient features of high inflations. The remainder will discuss some of the issues that high inflation behavior poses for contemporary monetary theory.

II. Very high inflations

By very high inflations, we mean inflations that are higher than 'moderate' but below hyperinflation. We consider an inflation to be in the 'moderate' range as long as the people who have to live through it generally remain content to quote the inflation rate in percent per year. In 'high inflations', people measure inflation in percent per month and consider annual figures meaningless except for historical purposes. When the effective horizon for quoting money prices or agreeing on nominal contracts falls below one month, the economy is considered to be in hyperinflation. The conventional criterion for hyperinflation since Philip Cagan's now classic study of the post-World War I German inflation has

¹ While this is my own summary, and he has no responsibility for errors, much of the material I have learned from Heymann. Our book, **High Inflations**, is to be published by Oxford University Press.

Earlier versions of this paper were given as lectures at the Fourth Summer Workshop of the Siena International School of Economic Research, at Universität Hohenheim (Stuttgart) and at the Bank of Uruguay.

been a rate of price rise of 50% per month.² This appears to be in rough accord with our behavioral definition. Those who would prefer having approximate numerical boundaries for our 'high inflations' might think of them as in the range between, say, 8-10% per month and Cagan's 50%.

High inflations, in contrast to hypes, can be sustained for many years. They are more interesting also in that the distorted remains of a financial structure survive in high inflation, whereas hyperinflation burns it out altogether. The effects of inflation on financial structure will be of particular interest because finance theory has come to loom large in the most modern work in monetary theory.

These inflations are all associated with the monetization of large, persistent fiscal deficits. In standard neoclassical theory, they are modelled as general equilibria with a fiscal distortion due to the inflation tax but, on the whole, not otherwise different from how the economy would function under conditions of monetary stability. The reality is quite different.

High inflations are pathological processes, the products of socio-political persistence in negative sum games. The losses are large. In a period of rapid growth of the world economy, Argentinian real per capita income declined 26% over the 1980-89 decade, for instance.

III. The Finances of the Government

We regard high inflations as processes of "unreliable interaction" between the public and the private sector. Let me take the sectors one at a time, beginning with the government. If we describe high inflations from the private sector's point of view as Random Walk Standards³ of a

²Cf. Philip Cagan, "The Monetary Dynamics of Hyperinflation," in M. Friedman, ed., *Studies in the Quantity Theory of Money*, Chicago: University of Chicago Press, 1956.

³For the concept of "random walk monetary standard", cf. Leijonhufvud, "Inflation and Economic Performance," in B. Siegel, ed., *Money in Crisis*, Cambridge, Mass.: Ballinger Press 1984.

particularly virulent variety, the obvious question becomes why any sane government would behave in such unpredictable fashion, given the economic costs and social consequences of so doing. The general answer is loss of control. That generalization made, it remains to give it some specific content. What follows is intended to be (as that all too useful evasion goes) "stylized facts." I cannot guarantee that they apply to every high inflation country episode.

The main features of government finances in high inflation regimes are the following:

- i) A ramshackle tax-structure and a badly functioning tax collection system.
- ii) No systematic and comprehensive budget process to allocate planned expenditures "rationally" and to control the actual ones. Government departments, nationalized industries, and other organizations operate under "soft budgets".⁴
- iii) A significant portion of government revenues are allocated to extraordinary expenditures (wars, reparations, foreign debt service).
- iv) Government debt cannot be marketed in significant volume.

The high inflations are also highly variable inflations and the variations in the rate are fairly unpredictable to the private sector. One major reason for this is the impossibility of debt management (iv): the government cannot smooth transitory disturbances to its cash-flow deficit, but must monetize them as they come. The immediate result is a high-frequency nominal impulse.

The market for government debt is at best very thin and may not exist at all. In the latter case, the government finds itself in effect in the position of an insolvent debtor -- despite its ability to print legal tender. How is this possible? Consider a fiscal deficit, net of interest,

⁴Cf., János Kornai, "The Soft Budget Constraint," *Kyklos* 1986:1 and also the earlier treatment in Kornai's *Economics of Shortage*, 2 vols., Amsterdam: North-Holland, 1980.

which is large enough to be near the maximum point on the inflation-tax Laffer-curve. If the market perceives the government as unable to reduce this primary deficit, the demand for public debt will vanish. The government cannot by offering higher nominal interest rates induce the private sector to finance the postponement of the monetization of deficits any further because increased real interest payments cannot be financed, not even through the inflation tax.

Erosion of the Tax system (i): It is not the case that the Latin-American high inflation governments necessarily spend more. But they tax less. If the general taxes -- VAT and the income tax -- were actually collected across the board at the legislated rates, they would be in good shape. But they are shot through with exemptions and loopholes and are widely evaded. Collection is erratic, inefficient, and sometimes corrupt. As a result they only yield perhaps 3-5% of GNP each. Much government revenue stems from a crazy-quilt of excise taxes and the like that, although they individually yield little, are imposed at very high rates and thus cause significant distortions.

The lag between tax accrual and tax collection causes a large decrease in real tax revenues. High inflations add a powerful incentive to pay late to all the standard incentives to avoid taxes. This Olivera-Tanzi lag-effect is reversible -- even temporary stabilization improves the fiscal picture considerably.

Lack of a Structured Budgeting Process (ii): Budget projections for periods as long as a fiscal year become impossible under conditions of high and erratic inflation. The allocation of expenditures, therefore, cannot be settled for the coming year in one comprehensive political negotiation. Instead, the de facto budget is constantly revised without the benefit of parliamentary legitimation, and various political pressure groups negotiate their demands sequentially (rather than simultaneously).

Governments will find such sequential negotiations difficult to handle for each successive interest group feels itself "the last to be compensated" and does not have to moderate its demands because of countervailing pressures from other groups. So, not only will expenditure allocation be inefficient and inequitable but it will be extremely difficult to control total expenditures.

The whole thing is obviously a negative sum game. Why then the persistence? Escape from high inflation requires the creation of an efficient tax machinery. But if others will come to control it in the future, should I support its creation today? Mutual suspicions of this sort among parties and interest groups keep these countries ungovernable, independently of who is in power. These suspicions feed on the frequent changes and sharp reversals of relative real incomes that are characteristic of these high inflations.

Once in this situation, government policy makers find it just as difficult as people in the private sector to take the long view. Rather than attempting to implement some social optimum or other, they find themselves making the best of a bad situation from one day to the next. The result will be policies that are time-inconsistent in almost every area -- and correspondingly difficult for the private sector to predict.

IV. Living with High Inflation.

Standard inflation theory would have us concentrate attention on the inflation tax and the various distortions that it causes.⁵ These effects

⁵The view that the economic costs and social consequences of inflation are by and large confined to the effects of the inflation tax on cash-balances had become the prevalent one among American and Western European economists already more than 20 years ago. For a critique that may have been too intemperate and hostile in wording -- characterizing the prevalent view as one of "profound and appalling naiveté", etc. -- but from which I would not otherwise detract, cf., Leijonhufvud, "Costs and Consequences of Inflation," in G.C. Harcourt, ed., *The Microeconomic Foundations of Macroeconomics*, London: Macmillan, 1977, reprinted in my *Information and Coordination*, New York: Oxford University Press, 1981.

It should be perhaps be acknowledged that the standard model referred to in the text also predicts the so-called Tobin-effect: that people will hold less money but titles to more real capital in inflationary situations. We see no

may be passed by with but two brief observations:

First, the social costs of the inflation tax do become quite substantial in the range of inflation rates considered here. The amount of time and effort spent economizing on cash balances is really very large.

Second, the incidence of the inflation tax is very uneven. For a variety of reasons it is strongly regressive. The well-to do are generally better able to avoid the inflation tax than are low-income people -- except in so far as the very poor live outside, or fall out of, the market nexus altogether. In Brazil or Argentina, furthermore, not much of the proceeds of the tax go to lower income people. In those cases, at least, inflation does not benefit the poor. It is important to emphasize this because the prejudice is deeply ingrained in the literature that anti-inflationary policies hurt the working class.

The phenomena not predicted by standard inflation models are more interesting. In particular:

- i) The staying power of domestic money. It continues in general use even at extremely high rates of inflation taxation.⁶
- ii) The disappearance of markets. High inflation countries end up with an extremely impoverished structure of intertemporal markets.
- iii) The excess variability of relative prices.

Contracts and asset markets in high inflations. High inflations are not steady processes. Typically, the "average" inflation rate and relative prices are both highly variable. Although people spend much time and effort gathering information, they are unable to anticipate price

empirical evidence whatsoever for this implication in the high inflations.

⁶Strictly speaking, of course, modern monetary theory has nothing to say about the conditions under which the use of domestic money might be abandoned, It cannot, since it provides no satisfactory account of why it is used in the first place. We feel nonetheless that the staying power of money deserves to be listed as one of the riddles posed by the evidence on high inflations. That riddle, however, will not be explored in this paper.

movements with any precision. Their uncertainty about the real value of nominal sums blows up very rapidly with distance from the present. Effective planning horizons become very short. They know that their best inflation forecast for the month ahead can very easily be off by several percentage points. The very meaning of "the" inflation rate is blurred for them by the volatility of relative prices. The likely forecast error cumulates to much larger figures as they look further ahead so that nominal contracts made over anything but very short periods appear forbiddingly risky.

Long-lasting physical assets tend to have their markets dollarized. For the most part the alternative wealth-placements considered by owners are also abroad.⁷ The ownership of housing is the most important case here. Note, however, that the stock-markets tend not to survive. There is then no organized market in manufacturing capital.

With regard to contracts, people have three options: (i) they can simply avoid certain transactions, (ii) they can choose to make shorter contracts or (iii) they can attempt to control the added uncertainty by means of contingency clauses. In practice, the latter means indexing. In fact, all of these strategies are to be observed, in different combinations depending upon the concrete situation. But, no matter what strategies they adopt, people are unable to negate the real effects of price instability.

For some kinds of transactions, renegotiation -- or the threat of having to renegotiate -- is particularly costly. In the case of housing rentals, or recurrent customer-supplier relationships and, in particular, labor contracts, the parties will normally want an agreement that covers more than just a few weeks or months.⁸ Since, in a high inflation,

⁷Brazil was however for a long period an exception in this regard.

⁸However, in hyperinflations, wage negotiations, for example, are also very short-term. This is presumably due to the difficulty of finding indexing formulas that share the risk in a mutually agreeable manner. Nonetheless, it remains true that, as inflation increases, some types of contracts shorten much less readily

expected errors in predicting the price level over periods of such length are large, there is practically no alternative to indexing for "long" contracts of these types.

There are several problems with indexing, however. One of them, obviously, is the choice of the basket of goods whose price will be used to adjust the value of payments, when there are several available proxies for "the" price level. The reporting lag is another complication. Indexing is backward-looking, which means that the purchasing power of indexed payments changes when the inflation rate fluctuates. There are, of course, prices (such as the exchange rate) that are almost continuously measured, so that contemporaneous indexing could be obtained by linking to those prices. But "dollarization" of contracts has drawbacks since the real exchange rate is apt to be extremely volatile in high inflations. For most people, maintaining constant purchasing power over a basket of foreign goods is of little or no help if, in so doing, their command over the domestic goods that are the stuff of daily existence is rendered more variable.⁹ Typically, dollarization only becomes a more or less universal practice in the limiting case of true hyperinflation, when the variability of inflation has become extreme, and when the prices of domestic goods also tend to be quoted in terms of foreign currencies.

Shortening the length of contracts is a natural response when information about future conditions is very unreliable. For short horizons, indexation is of little use since (given the lags in obtaining and using the indices) simple extrapolation of the immediately past inflation rate will do as well. Short contracts, then, are written in

than others. For the German case, cf., C. Bresciani-Turroni, **The Economics of Inflation**, London; Allen & Unwin, 1937, and H. Schacht, **The Stabilization of the Mark**, London: Allen & Unwin 1927.

⁹The markets that are first dollarized, in fact, are not the ones in which the continuous availability of an index-measure would be particularly beneficial. Dollarization tends to spread first in the sale or purchase of housing, for instance -- that is in markets where people are making major wealth-placements for some length of time.

nominal terms and incorporate the price expectations of the transactors.

High inflation economies differ from one another with regard to the way in which contracts are typically made. What contracting strategies will predominate depend on the magnitude of the inflation, on the institutional structure of the country in question and on its previous experience with monetary instability. For example, in Brazil and Israel, indexation was formally introduced in a wide variety of financial contracts¹⁰. In Argentina, although indexing was often used, it was much less widespread. Instead, financial assets were held mostly in the form of very short-run nominal instruments or foreign currencies. Also, while in Brazil (with an inflation rate on the order of 15% per month at the beginning of 1986) non-synchronous wage-adjustments based on an explicit indexing formula were made every six months, the practice in Argentina by early 1985 (when the inflation rate oscillated between 20 and 30% per month) was of monthly increases, often without any explicit linkage to the CPI.

In sum, high inflation economies tend to end up operating on a multiple standard. The Argentinian economy of the 1980's, for example, had a triple standard roughly as follows:

- i) spot markets for long-lasting assets are dollarized;
- ii) housing rentals and wages are indexed or partially indexed;
- iii) wholesale and retail markets for consumer goods and services and intermediate products, etc. continue to use domestic money.

Such multiple standards are shot through with problems and inconsistencies of various kinds. The real estate market is in dollars, but there is no mortgage market in any currency. When the exchange rate moves it changes the relative price of dollarized houses and indexed rentals, causing huge

¹⁰Cf. esp. Mario Simonsen, "Indexation: Current Theory and the Brazilian Experience," in R. Dornbusch and M. Simonsen, eds., *Inflation, Debt and Indexation*, Cambridge, Mass.: MIT Press, 1983, and Stanley Fischer, "Israeli Inflation and Indexation," in J. Williamson, ed., *Inflation and Indexation: Argentina, Brazil, and Israel*, Washington, D.C.: Institute for International Economics, 1985, reprinted in S. Fischer, *Indexing, Inflation, and Economic Policy*, Cambridge, Mass.: MIT Press, 1986.

excess demands in one market while the other dries up completely.

The general picture to have in mind is one of the intertemporal structure of markets shrinking, starting in the long end. In moderate inflations, it may be only the markets for 30-year bonds and fixed-rate mortgages that disappear. In an economy mired in high inflation, the bank loans and trade credit of a few weeks maturity may be the longest term instruments surviving in the private sector. The limit of this process is revealed in the signs seen in many stores during Argentinian bouts with hyperinflation: "*Closed for the lack of prices*". In the limit all transactions become speculative. Retailers do not know at what prices they will be able to restock tomorrow. A wrong move and your working capital is wiped out! -- and you cannot borrow to start up again.

At this point, the socio-political consequences of high inflation are dramatized. When the *Closed for the lack of prices* sign goes up, the riots start and the police powers of the State have to be mobilized to halt the slide into generalized anarchy. But this is also the point where the survival of the State hangs by a hair -- for what the government can offer the police or the military is just newly printed paper money. And if the police complains: "But this isn't worth anything!", the government is reduced to its final promise: "Ok, ok, we'll double that."

Relative Price Variability. Here I am relying on the work of Angel Palerm¹¹ whose detailed study is based on monthly data for the least aggregative subcomponents available of the Mexican WPI (1940-84) and CPI (1969-84).

There has been some recent discussion of the statistical fact that the positive relation between the inflation rate and relative price variability gets very weak at high rates of inflation. The impression that beyond some point additional inflation "doesn't matter" is almost

¹¹Angel Viquiera Palerm, *Price Formation and Relative Price Variability in an Inflationary Environment: Mexico 1940-1984*, UCLA Doctoral Dissertation, 1990.

certainly completely false, however. Palerm finds that the variance of the price change distribution decreases dramatically as frequency of observation is decreased. Also the ratio of the variance based on monthly observations to that based on longer intervals increases with the inflation rate. Thus we infer that the "flat portion" of the relationship hides a dramatic rise in intramonth price variability. This is in accord with abundant anecdotal evidence.

Numerous papers modelling excess relative price variability have been published. Most of them are built on the "Keynesian" presumption that the phenomenon is due to the "stickiness" of a subset of prices. They tend to take for granted that flex-prices closely follow "the" inflation rate (that they determine what it is, really) and that the infrequent, discrete step-adjustment of fix-prices "is to blame". The picture that we get from Palerm's study is more complicated.

Palerm studies subsets of prices with high and with low adjustment frequencies, respectively. Call them "flex-" and "fix-prices". He finds (i) that fix-prices "conform" better to the time-path of the respective indices than do flex-prices, (ii) that in devaluation episodes, fix-prices respond more promptly and strongly than flex-prices, (iii) that accelerations of inflation are associated with larger than average number of fix-prices being moved (the positive skew of the distribution of price changes also increases when inflation accelerates), and (iv) that, similarly, deviations of current inflation from trend do not reflect the faster response of flex-prices but rather the bunched adjustment of fix-prices.

V. High Inflation and Contemporary Monetary Theory

The simple fiscal-monetary model of inflation depicts an economy in a Solow growth equilibrium somewhat distorted by the "tax" on money. Except for the distortions caused by the tax (one is to infer), everything is as it would be under monetary stability: the set of markets operating

is the same, relative prices are roughly the same, and the activities are coordinated to precisely the same extent.¹²

A more up-to-date theory takes an Arrow-Debreu complete markets theory as its starting point. As in all neoclassical theory, money hangs in there less by hook than by crook. The modern insistence on staying as close as possible (or closer) to complete markets puts a sharper edge on the old paradoxes of having money in general equilibrium. This monetary theory is merging with finance theory. Modern finance theory is formally carried out entirely in real terms -- conversion to money asset prices is entirely ad hoc (this is the appropriate term of opprobrium, isn't it?) From finance, we import Modigliani-Miller in generalized form: financial structure does not matter (by and large). Among its lemmas: (i) Ricardian equivalence, and (ii) irrelevance of open market operations.

How should High Inflation be handled within a contemporary monetary theory of this sort? The natural approach to take is to assume that the Arrow-Debreu dated goods/natural contingencies space expands to encompass also the various probable "states of the State" for each date/state of nature. But it can be shown that in trying to calculate the optimal allocation in Arrow-Debreu space the representative agent has posed a problem for himself that is not computable.¹³ Expanding the space further to take in conditional fiscal strategies of the government will not make this theoretical line any more plausible. But, apart from such methodological doubt, this brand of theory would multiply markets -- and that is exactly the wrong implication.

In relation to this literature, then, what do we do with the high inflation problem of disappearing markets? I see three strands in the literature on "missing markets":

¹²Besides, any other tax by which public expenditures could be financed would cause distortions too. So, whether the inflation is a "a bad thing" is an open question -- from the standpoint of this literature.

¹³Unpublished manuscript by K. Velupillai.

i) The idea that the rational expectation of the future price will substitute for the market clearing price in each of the missing markets, and that drawing up their plans on the basis of these expected prices agents will end up acting exactly as they would with complete markets. This tack obviously is of no help since it gives us a theory in which it does not matter how large the set of actually operating markets is.

ii) Another strand starts from the recognition that the substitution of rationally expected prices for market determined prices as in (i) easily results in the multiplication of equilibria. But all of them are supposedly perfectly coordinated (although exactly how agents achieve this when they do not know which one will be realized is unclear) and are thus of no more relevance to the High Inflation inquiry than the previous strand.

iii) A third presupposes that agents are Arrow-Debreu planners and asks whether they will be able to fully insure themselves or achieve Pareto-optimality if deprived of some markets, etc. In cases where the answer is negative, we may get some clues to the consequences of disappearing markets. But the reasons given (if any) for why the markets are missing (e.g., information asymmetries) are often such as to make their relevance doubtful to the High Inflation case where first they do exist and then they don't.

I am not an expert in these areas but my impression is thus that at present we have no help to hope for from any of these strands of the recent literature.

The economic performance of high inflation economies is far worse than in economies with monetary stability. The line between order and disorder in the system is shifting as an economy moves into high inflation and the shrinkage of the set of actually operating markets is a symptom of this. Theories of perfect and/or unchanging coordination offer little help. The

economy will not be able to grope its way behind the fluttering "Veil of Money" to find that all but unaffected "real" equilibrium which, defined by technology and tastes alone, is merely somewhat distorted by the inflation tax. Instead, laboring under extreme monetary instability, it moves into far less well coordinated states.

Models that collapse to a social planner's optimal program, whenever not prevented from so doing by utter artifice, hold no promise -- it seems to me -- of throwing light on these high inflation problems.

VI. A Different Approach

There is an ongoing controversy in the field of Artificial Intelligence between those who advocate the traditional "top down" and those who favor a "bottom up" approach. The "top down" approach relies on the sheer crunching power of a centralized processor eventually to replicate whatever human intelligence can do.¹⁴ The "bottom up" approach relies on interacting networks of relatively simple processors and attempts to make "neural nets" evolve that will handle tasks far beyond the capacities of the components.

Neoclassical monetary theory is quintessentially "top down". More perhaps than other branches of economics, it suffers from the curse of the methodological commandment to cast all behavior description in terms of optimization. Having once assumed the typical agent to be an optimizer, neoclassical theory is hard put to find an acceptable way of stopping short of the perfectly coordinated "rational" system. It is of course possible, within that theory, to change the assumed environment so that the equilibrium will be worse than it otherwise would be. This can be done in innumerable ways. But the equilibrium will always be "as good as you allow it to be."

I do not see how we are ever going to get a handle on ill-coordinated processes such as High Inflations (or, for that matter,

¹⁴Uncomputable problems pose a threat to this line.

Keynesian depressions) in this way. To that end, two conjectures:

(1) For that purpose, one has to conceive of the economy as a network of interacting processors, each one with less capability to process information than would be required of a central processor set to solve the overall allocation problem for the entire system. In other words: bounded rationality.

(2) We should move on, eventually, from forcing money into theoretical systems that will function perfectly well without it to consider the possibility that money is used in the economy because people lack the kind of rationality presupposed in complete markets models¹⁵. Monetary calculation, nominal contracting, and monetary payments practices, I conjecture, are essential to the integration of the computations of the boundedly rational processors of local information.¹⁶ Money, therefore, is not a veil in any meaningful sense. Disturb its functioning sufficiently, and the economy will not achieve as "rational" and finely coordinated an equilibrium as it otherwise would.

VII. Back to High Inflations

Why do Markets disappear? There are a couple of lines that might be pursued, including some recent work on "Knightian Uncertainty" by Truman Bewley, in trying to explain why transactions cease in some part of the space. Here I follow that of Ron Heiner.¹⁷ Heiner notes that as we ascend

¹⁵A subsidiary conjecture for good measure: that, in general equilibrium theory of that sort, we will never achieve a model of money that captures all four of the traditional functions of money at once.

¹⁶Also, that markets are essential as compilers of information in this process. How can we conceive of aggregate demand functions as having any operational significance without corresponding markets actually in operation?

¹⁷Ronald A. Heiner, "Uncertainty, Signal-Detection Experiments, and Modelling behavior," in Richard N. Langlois, ed., **Economics as Process: Essays in the New Institutional Economics**, Cambridge: Cambridge Univ. Press 1986. Also his "The Origin of Predictable Behavior," **American Economic Review**, Sept. 1983. Cf., also Truman Bewley, "Market Innovation and Entrepreneurship: A Knightian View," Cowles Foundation Discussion Paper No. 905.

the hierarchy of the more or less standard decision problems posed in economics, the competence of the assumed decision maker is always increased so as to be fully adequate to the added complexity. This leaves out the question of what happens when the complexity of the environment increases relative to the competence of the agent.

Heiner maintains that the implication of standard theory is false that added complexity always results in commensurably more sophisticated decision strategies. His "Theory of Reliable Interactions" shows agents simplifying their strategies instead. In settings too complex for reliable control of outcomes, they "don't try to be too smart" but adopt rules of thumb that entail ignoring information that would actually be useful to someone trying to calculate the optimal decision.

In High Inflations, I believe, people withdraw from various intertemporal markets and contract forms where they cannot reliably control the real outcomes of their actions.

Why should it matter?

Calculation. Consumers require knowledge of intertemporal equilibrium prices in order to evaluate their wealth correctly just as firms do to calculate the value of investment opportunities. Consider how the errors and inconsistencies that they are likely to commit increase as we deprive agents of information in stages: (i) Take away the Arrow-Debreu future markets prices. This we are used to in all "realistic" macro. (ii) But we usually assume that people are guided by a market determined real interest rate. That requires knowing the nominal interest rate and having identical inflation expectations. Inflation expectations become incoherent even in moderate inflations, so that the relevant "Law of One Price" ceases to hold in the main intertemporal markets. (iii) In the high inflation economies, nominal market determined interest rates beyond the next month or two also disappear. **Not much is left of a rational basis for decentralized economic calculation.**

Commitment. The production theory that totally dominates in macroeconomics still has the Ricardian farm as the representative production unit: constant returns when both land and labor can be varied, smoothly diminishing returns when labor is varied with land constant. Suppose, instead, an economy made up of Smithian factories.¹⁸ Here, "the division of labor depends upon the extent of the market". Increased division of labor is productive so that the average product of inputs increases with the rate of output. A highly articulated division of labor, moreover, tends to be associated with a high degree of complementarity between inputs. Picture the extreme case of an economy that is an interlocking input-output structure of assembly lines where a whole line comes to a halt if one machine breaks down, if one worker leaves his work station, or if one intermediate goods supplier fails to deliver. Markets for many of these inputs will be thin, moreover.

A structure of this kind requires the support of innumerable credible precommitments to reduce the risks faced by individual producers to manageable proportions. When Heiner-type agents decide that high inflation makes intertemporal contracts into independent sources of risk so dangerous as to outweigh their prospective benefits, they will also retreat into a less specialized, more nearly linear, less productive structure -- and everyone will be poorer as a consequence.

The Excess Variability of Relative Prices.

When considering departures from perfect coordination, the Keynesian habit is to look for sticky prices and violations of market clearing conditions. When the object of study is inflation, the more appropriate focus is on inefficiencies associated with violations of the Law of One Price.

Excess relative price variability reflects fragmentation of

¹⁸ Cf., Leijonhufvud, "Capitalism and the Factory System," in Langlois, *op.cit.*

individual markets and transitory but ever renewed inconsistencies of relative prices. It stems from increased variability in the rate of inflation of individual prices and lack of synchronization between these prices. This means, of course, that the "market forces" normally keeping them in line must have weakened in some sense. Relative prices are not being arbitrated.

The weakening of arbitrage starts with the disappearance of intertemporal markets. In their absence, intertemporal smoothing does not occur to the normal extent. What we normally would think of as "riskless arbitrage" becomes highly speculative whenever the chain of transactions cannot be closed instantly. The *Closed for the Lack of Prices* sign is a case in point. While the increased variance of prices for individual commodities initially encourages increased consumer comparison shopping, the information produced by such search depreciates so rapidly in high inflations that the incentive is much weakened. Spatial as well as temporal violations of arbitrage pricing occur everywhere.

VIII. Tentative Conclusions

The modern economy is complicated, as Hayek would put it, "beyond human comprehension", too complicated by far for individual agents to confront "directly" in their planning. The typical (albeit not representative) agent could not begin to cope with all the opportunities and options that the economy offers, let alone with a goods-dates-contingency decision space of the dimensionality of the Arrow-Debreu model.

The system has evolved to this degree of complexity not because it is populated by agents typically endowed with commensurate cognitive skills but, on the contrary, because ways to simplify individual decisions and to simplify the coordination of individual activities have gradually evolved. The modern economy has not evolved so as belatedly to exploit in full the cleverness that its inhabitants possessed all along. Rather it

has evolved to a complexity beyond human understanding, because people with limited cognitive capabilities have devised ways of getting along without dealing with the full complexity of the system.

These simplifying strategies are a combination of collective institutional arrangements and individual cognitive short-cuts, adapted to one another. We view both money and organized markets as belonging to these institutional arrangements.

It is odd that economists routinely recognize this when discussing the division of labor, i.e., specialization in production. In that context the representative agent is not supposed to know and master everything. In the theory of exchange (and finance), cognitive limitations have traditionally been more or less ignored. And monetary theory, from Patinkin onwards, has been discussed in the framework of exchange theory, with production (and specialization of knowledge) eliminated as an inessential complication.

High inflations destroy social institutions and arrangements that would not have existed in the first place if economic agents were not subject to cognitive limitations. By relying on a monetary theory that assumes such "unbounded rationality" of agents, we fail to understand the social and economic consequences of inflation and the benefits of monetary stability. So, such theory is dangerous.

