

Hofman, Bert; Koop, Michael J.

Working Paper — Digitized Version

Monetary overhang and the dynamics of prices, exchange rates, and income in the transition to a market economy

Kiel Working Paper, No. 418

Provided in Cooperation with:

Kiel Institute for the World Economy – Leibniz Center for Research on Global Economic Challenges

Suggested Citation: Hofman, Bert; Koop, Michael J. (1990) : Monetary overhang and the dynamics of prices, exchange rates, and income in the transition to a market economy, Kiel Working Paper, No. 418, Kiel Institute of World Economics (IfW), Kiel

This Version is available at:

<https://hdl.handle.net/10419/46820>

Standard-Nutzungsbedingungen:

Die Dokumente auf EconStor dürfen zu eigenen wissenschaftlichen Zwecken und zum Privatgebrauch gespeichert und kopiert werden.

Sie dürfen die Dokumente nicht für öffentliche oder kommerzielle Zwecke vervielfältigen, öffentlich ausstellen, öffentlich zugänglich machen, vertreiben oder anderweitig nutzen.

Sofern die Verfasser die Dokumente unter Open-Content-Lizenzen (insbesondere CC-Lizenzen) zur Verfügung gestellt haben sollten, gelten abweichend von diesen Nutzungsbedingungen die in der dort genannten Lizenz gewährten Nutzungsrechte.

Terms of use:

Documents in EconStor may be saved and copied for your personal and scholarly purposes.

You are not to copy documents for public or commercial purposes, to exhibit the documents publicly, to make them publicly available on the internet, or to distribute or otherwise use the documents in public.

If the documents have been made available under an Open Content Licence (especially Creative Commons Licences), you may exercise further usage rights as specified in the indicated licence.

Kieler Arbeitspapiere Kiel Working Papers

Working Paper No. 418

**Monetary Overhang and the Dynamics of Prices,
Exchange Rates, and Income
in the Transition to a Market Economy**

by

Bert Hofman & Michael J. Koop

Institut für Weltwirtschaft an der Universität Kiel
The Kiel Institute of World Economics

ISSN 0342 - 0787

Kiel Institute of World Economics
Duesternbrooker Weg 120, D-2300 Kiel 1
Federal Republic of Germany

Working Paper No. 418
**Monetary Overhang and the Dynamics of Prices,
Exchange Rates, and Income
in the Transition to a Market Economy**

by
Bert Hofman & Michael J. Koop

AG 1825 / 90
Weltwirtschaft
Kiel

May 1990

The authors, not the Kiel Institute of World Economics, is solely responsible for the contents and distribution of each Kiel Working Paper. Since the series involves manuscripts in a preliminary form, interested readers are requested to direct criticisms and suggestions directly to the author and to clear any quotations with him.

1. Introduction

The long road from capitalism to capitalism the Eastern European economies have made has been paved with many economic problems, but the transition from a command economy into a market economy is likely to become a bumpy ride as well. Apart from the major real economic reforms that have to take place, combined with virtual turnaround of the political structure, several countries aiming to reform face a monetary problem as well. Due to persistent state budget deficits, financed by the printing press, a so called monetary overhang threatens the reform process. Monetary overhang is here defined as the excess of money supply over demand at the current price level and at world market interest rates. The consequences of the monetary overhang under a planning system are obvious: the fixity of prices prevents the real money supply from falling to its equilibrium level, and the situation of repressed inflation translates into long queues in front of shops, forced savings, and, if not checked, into a flourishing black market and corruption. The official exchange rate is overvalued, but import demand is checked by rationing of foreign exchange.

The monetary overhang is not only a menace in a centrally planned economy, however. Once markets take over, prices are free to fluctuate, and the initiated inflation may threaten the success of the reform process, since the efficiency of the price mechanism is impeded by inflation. This may seriously hamper reforms due to an initial fall in output. Moreover, the economy might enter an explosive path with ever increasing inflation, and ever decreasing output. Of course the monetary overhang could be dealt with in a monetary reform ,as in the Federal Republic of Germany in 1948. However, the distributional consequences involved in such a drastic step are enormous. Alternatively, the monetary overhang could be absorbed by issuing less liquid government assets, such as bonds. The budgetary consequences of this alternative, however, might endanger the sound monetary policy necessary for success of the reforms. Finally, state assets could be sold in a privatization program, but the Eastern European countries lack a developed stock market, which is a prerequisite for such a program. These considerations have led the Polish government to choose the inflationary solution for the monetary overhang. Since november 1989 the lifting of price controls has led to an inflation of over 500% on an annual basis, a sharp depreciation of the Zloty, and a sharp fall in industrial output.

This paper aims to evaluate the consequences of a monetary overhang for the movement of prices, exchange rates and output of an economy in transition to a market economy. The structural policies necessary to avoid explosive behavior are discussed, as well as those required for inflation reduction. It is shown that these structural policies may not always coincide. The paper continues as follows: in section 2 the basic model is sketched and the adjustment of prices, exchange rates, and output after markets are liberalized is discussed. Section 3 is devoted to considerations of the stability of the adjustment process and the possibility of hyperinflation. Necessary institutional reforms to avoid this are elaborated. Section 4 extends the model to include growth in the structural output level, and section 5 gives a summary and conclusions.

2. The Model

In this paper we will take a fairly abstract view of the economy under consideration and the liberalization process undertaken. At the start of the reform process, the economy inherits certain values for a set of variables from the previous system: price level, money supply, exchange rate, and output. It is assumed that there is monetary overhang: the money supply is, given output and price level, too large to clear at world market interest rates. However, before markets are liberated, arbitrage possibilities are effectively blocked by the inconvertibility of the currency¹. Concerning the reforms we will assume that all markets are instantaneously liberated, i.e. prices are moved by market forces, leaving aside the interesting problem of sequencing (see e.g. Edwards, 1989). This, however, does not mean that all markets clear immediately: the assumption is that asset markets are fully flexible, and thus clear at equilibrium prices, whereas the prices on goods markets move only gradually, starting from the fixed price level of the old planning system. To simplify, we assume that the government budget is balanced throughout the reforms, thereby excluding the classical route to hyperinflation (see e.g. Dornbusch and Fischer, 1986; Bernholz, 1988). For the moment we will assume that the structural - non inflationary - level of output is not increased by the reforms. This is of course a gross oversimplification, since the very purpose of the reforms is to improve upon the material conditions of the old regime. However, it is not unreasonable to assume that the positive effects of the reforms

¹ This abstracts from the possibility of black markets.

will take time to substantiate, and therefore to treat structural output as a constant in the short run. This assumption will be relaxed in section 4.

Actual output, in turn, is negatively affected by inflation. Following the arguments of Hayek (1935), inflation causes dispersion of relative prices, which reduces the informational capacity of the market system, thereby misallocating resources. The increased dispersion of relative prices was empirically established by Hercowitz (1981, 1982), but the modelling of these effects is not straightforward. Moreover, in a perfectly rational world, it might be argued that all the elasticities of demand across all markets are known, and that thus no errors are made. However, the costs of gathering such information can be considerable, thus validating Hayek's argument. Additionally it can be argued that in times of high inflation goods are hoarded by producers, since the alternative of selling them for rapidly devaluing money is unattractive. The latter mechanism seems to have been at work in Germany before the monetary reforms in 1948 (see e.g. Wallich, 1955). Note that this negative relation between inflation and output contrasts with Philips curve-arguments of a positive relation between surprise inflation and output, due to the increased profitability of hiring labor, which is locked into nominal wage contracts.²

The model looks as follows (variables are expressed in logarithms, unless otherwise stated; a ' indicates the derivative to time; time subscripts are omitted for notational simplicity, provided it is not essential for the argument): Output is determined by the structural - non inflationary - rate of output y_e , corrected for inflation effects, which we will assume to take a rather simple loglinear form:

$$(1) \quad y = y_e - \alpha p'$$

with $p' = d\ln(p)/dt$ ³.

Money market equilibrium requires:

² The Financial Times of March 16, 1989 reported for Poland a drop in real wages of 37% since January 1st 1990, but a drop in industrial output 29% lower than February 1989.

³ Of course deflation may equally affect output negatively, along the line of the arguments given. If we would take account of this, a more complicated functional form of (1) would be required. Since we only discuss the situation of inflation caused by a monetary overhang, simplicity is preferred over elegance.

$$(2) \quad M - p = \emptyset y - \mu r$$

with M the money supply, p the price level, y actual output, and r domestic interest rates.

If capital is allowed to move freely across borders, and domestic and foreign bonds are perfect substitutes, interest rate parity must hold. Assuming rational expectations, the expected exchange rate movement equals the actual one, e' in this deterministic context:

$$(3) \quad r = r^* + e'$$

with r^* being the foreign interest rate and e' the expected and actual exchange rate expressed as domestic currency per foreign currency.

Finally, the movement in the price level over time is determined by the extent of excess demand:

$$(4) \quad p' = \pi(\delta(e - p) - \theta y - \sigma r)$$

where θ is $1 - c(T)$, with c the marginal propensity to spend, and T the rate of income tax, $c_T < 0$.

From equations (1), (2) and (4) an expression for the inflation rate can be derived:

$$(4') \quad p' = \pi\delta(e - p) - \pi\theta(y_e - \alpha p') - \pi\sigma\{\emptyset(y_e - \alpha p') + p - M\}/\mu$$

Rearranging, taking deviations from the long run equilibrium levels p_e , and e_e , and noting that in equilibrium $p' = e' = 0$ gives:

$$(5) \quad p' = \{-A(p - p_e) + \pi\delta(e - e_e)\}/N$$

$$\text{where } A = \pi\delta + \pi\sigma/\mu \quad A > 0$$

$$N = (1 - \alpha(\pi\theta + \emptyset\pi\sigma/\mu))$$

Given that asset markets clear immediately, equations (2) and (3) yield an expression for the rate of exchange rate change, again taken in divergence of long run equilibrium:

$$(6) \quad e' = \{(p - p_e) - \theta \alpha p'\} / \mu$$

Inserting (5) yields:

$$(6') \quad e' = \{(N + \alpha \theta A)(p - p_e) - \pi \delta \theta \alpha (e - e_e)\} / \mu N$$

Equation (5) and (6') form a system of two differential equations, which, under rational expectations (see Obstfeld and Stockman, 1985), yields a saddle path solution, provided it exists. Individuals in the economy "choose" an exchange rate which excludes explosive behavior, which brings them on the saddle path. The saddle path exists if $N > 0$ (stability conditions are derived in Appendix I). This condition is intuitively clear from equation (1), (2), and (4): if the negative effects of inflation on output are large, then once the goods markets are in a situation of excess demand, and thereby causing inflation, the fall in output will only worsen the excess demand. Directly through the supply on the goods market, and indirectly through an interest rate reduction on the money market initiated by lower transaction demand for money. The countervailing effect of higher price level on the money market - reducing the real supply of money - would then be overruled, creating an instable situation. For the moment, we will assume that the saddle path conditions are satisfied, but we will return to the issue in section 3, which discusses structural reforms.

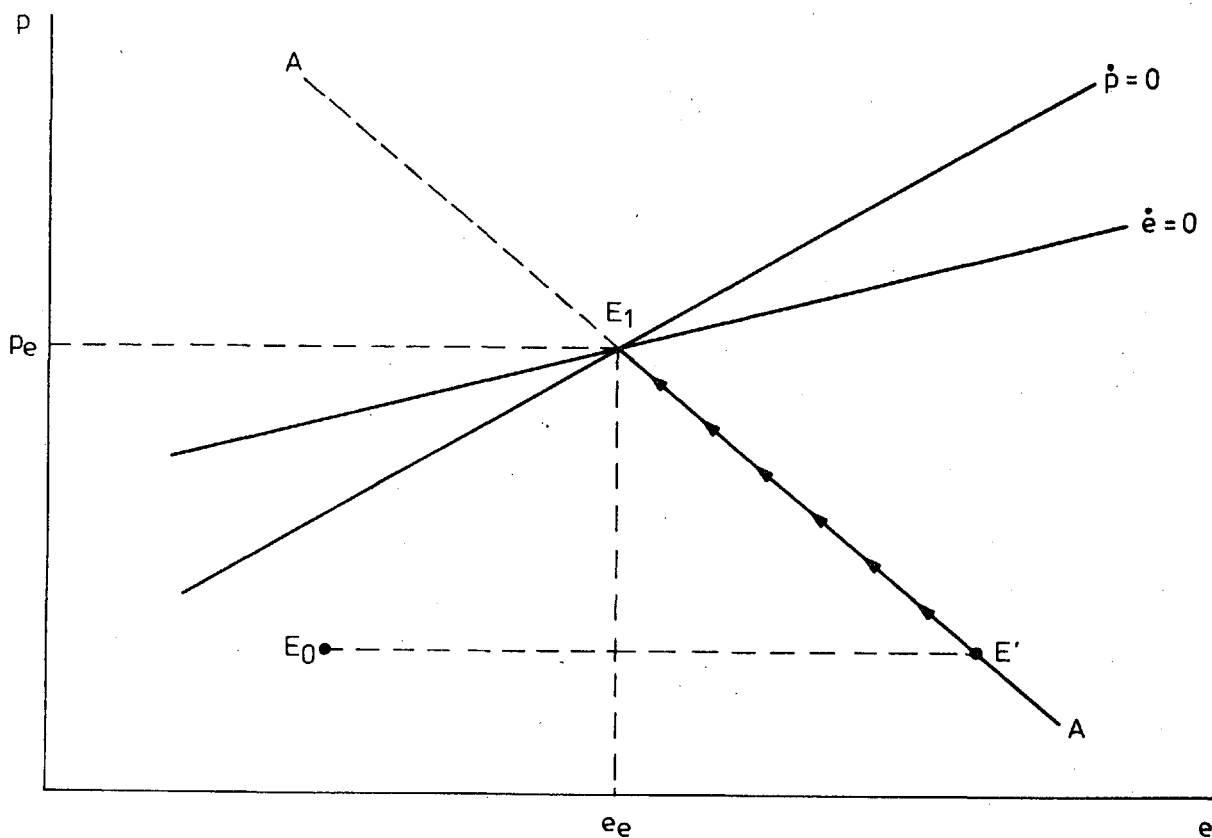
The movement of prices and exchange rates is sketched in Fig. 1⁴. Given that the asset markets always clear, the asset market line must coincide with the saddle path solution AA.

If the price level is low relative to its equilibrium level, real money supply is high, and in order to clear the money market, the interest rate is low. Therefore, domestic assets will only be held if people expect an appreciation of the currency, which must therefore be higher than its equilibrium level. Low price level, a low level of interest rates and a high level of the exchange rate cause excess demand, and therefore inflation. This reduces output, but at the same time reduces the real money supply, and given that the latter effect

4 It can be easily shown that the $p' = 0$ schedule is steeper than the $e = 0$ schedule, provided that $N > 0$.

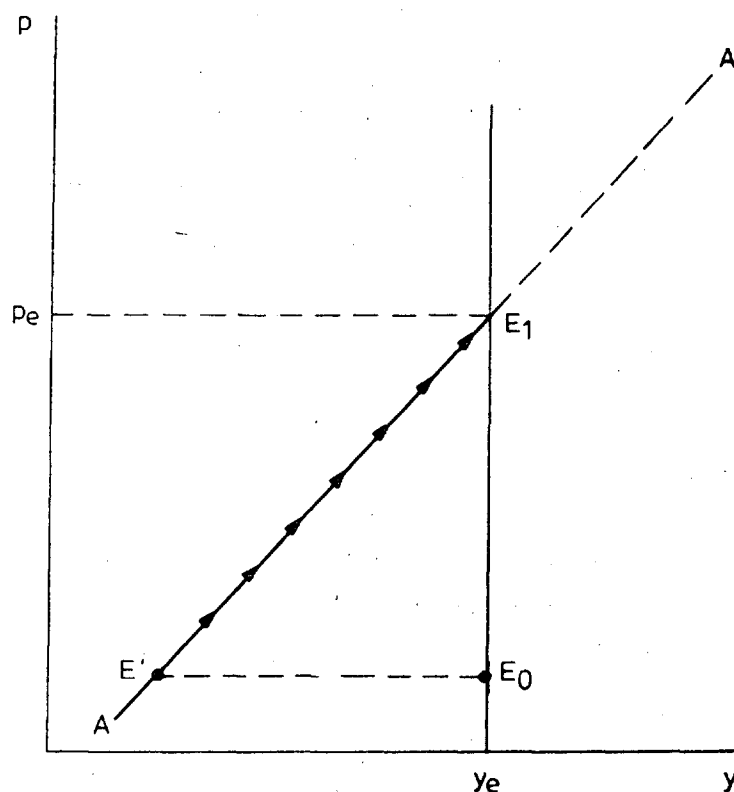
dominates in the money markets, causes r to rise. This reduces appreciation expectations, and thus e falls. The AA schedule is therefore downward sloping.

Figure 1



In the price output space, the asset market line can equally be drawn (see Fig. 2). When the price level is below its equilibrium level, following the foregoing analysis, excess demand on the goods market exists, and prices rise. This will cause output to fall under its structural level y_e , but the price level increase causes the real money supply to fall faster than the demand for money, and therefore interest rates rise, and the currency appreciates. This reduces excess demand, the inflation rate falls, and output rises. The AA schedule is therefore upward sloping and converges to y_e , provided p and e converge to their long run equilibrium levels.

Figure 2



When the markets are liberalized the course of the adjustment process depends on the initial position of the economy, i.e. the inheritance from the command economy. Taking the initial position as described in the introduction, with a price level below its equilibrium level, overvalued exchange rates, and given y_e , the initial position can be described with E_0 in Figure 1. As soon as the markets are liberalized, the economy "jumps" towards AA, since with fully liberated markets, the asset markets clear immediately. With goods prices being sticky, the exchange rate "overshoots" its equilibrium level e_e , since a future appreciation is expected. This is sketched by E' in Figure 2, and is equivalent to Dornbusch's classical result (Dornbusch, 1976). After the initial jump, the economy moves along AA - with falling inflation rates, a rising price level, and an appreciating currency, until equilibrium E_1 is reached.

From the price output space (Figure 2) it is clear that the initially high inflation drives output below its equilibrium level, to E' on the AA schedule. Subsequently, the movements in prices and exchange rates reduce excess demand, and thereby inflation, raising output until E_1 is reached.

3. Stability, the Size of Inflation, and Structural Reforms

As was noted in the previous paragraph, the adjustment process may become instable if the condition $N > 0$ is not fulfilled. In terms of the model parameters, this would mean:

$$(7) \quad \alpha > \mu/(\mu\pi\theta + \pi\sigma\emptyset)$$

In other words, if the negative effects of inflation on output are too large, the economy will enter an explosive path. Starting from a situation of excess demand, and thus inflation, output will fall. This will reduce the demand for money, which may not be compensated for by a reduction in real money supply due to the increased price level. The interest rate may therefore fall, and combined with the fall in supply, excess demand is increased, causing higher inflation, lower output and so on. This path leads to a situation of hyperinflation by ever decreasing output and ever decreasing money demand. This is to be contrasted with the "usual" path towards hyperinflation, which is caused by the Tanzi mechanism of inflation causing a drop in real tax income, government deficits, and thus an increase in money supply and more inflation (see e.g. Dornbusch and Fischer, 1986). Note that in such a situation monetary policy, according to the underlying model, is useless unless the equilibrium price level can be hit at once. Everywhere outside equilibrium, the system explodes.

Explosive behavior is normally considered as undesirable. Indeed, it hardly makes sense to liberalize markets in order to get into hyperinflation. Fortunately, a government of a country willing to liberalize may alter the parameters of the model, or, in other words change the nature of the economy by structural reforms, before the liberalization of markets is initiated. It is clear that the right hand side of (7) is increased by an increase in μ , and a reduction of π, θ, σ , and \emptyset .

However, changing these parameters induces a twofold adjustment process. On the one hand, the stability of the adjustment path is either increased or lowered. On the other hand, the rate of inflation is changed and thereby the amplitude of the adjustment process. The following effects can be derived from the model:

Table 1*

Effect on Increase of	Inflation	Stability	Policy Measure
μ	lower	higher	increase μ
ϕ	indetermined	lower	--
θ	indetermined	lower	--
δ	higher	n. a.	lower δ
σ	indetermined	lower	--
π	higher	lower	lower π
α	lower	lower	lower α

* Note: The effect on inflation is calculated by the first derivative of (5) with respect to the parameter considered. Effects on stability is found by the first derivative of N with respect to the parameter considered, where a positive derivative indicates a stabilising effect, since the condition for stability is $N > 0$.

Leaving indetermined effects aside four parameters are open for structural reform, namely μ , δ , π , and α . How can these parameters be changed by institutional reforms, what are the dominating effects, what are the policy options?

First, it could be attempted to increase μ , the interest elasticity of money demand. A higher μ would indicate the emergence of additional investment opportunities, increased risk hedging facilities or simply lower costs for rearranging private portfolios. Having increased the interest rate elasticity of money demand, domestic interest rates would in case of reforms have to go down by a smaller amount than with unchanged μ . As a consequence, the initial depreciation would be less sharp, excess demand from abroad would be lower as would consequently be inflation. The stability increasing and inflation lowering effects of higher μ could be brought about by the establishment of an efficient financial system, in particular a network of private banks, domestic and foreign. At the same time, efficient use of money would reduce the money demand for transaction purposes and would therefore lower ϕ . This adds to the stability of the reform process but may worsen inflation.

The parameter π measures the effects of excess demand on inflation, i.e. the inflation elasticity of excess demand. A decrease in π would be favorable in terms of inflation as well as higher stability. It can be expected that excess demand will be less detrimental to

price level stability the more competitive the goods market are. Splitting the old monopolistic, government owned firms and supporting the establishment of new competitors would tend to weaken the drive of demand pull inflation^{5,6}.

Though the inflation effects of taxation ($\theta = 1 - c(T)$) are indetermined it is quite clear that a steep progression of income tax rates would only lead to a very modest decline in private consumption. If output and gross personal income decrease by 20 per cent but private disposable income due to a progressive income tax only by 10 per cent domestically originating excess demand would soar⁷. In this context, a progressive income tax would be a built-in-destabilizer.

Finally, the relationship between inflation and actual output, expressed by the parameter α , could be altered. Inflation would generate the least harmful consequences for actual output the lower the variation of prices is. If a monetary overhang is to be cut off by an inflationary process the change of individual prices is lowest if all prices rise. Are some prices, e.g. rents, kept fixed the inflationary burden for the other goods is increased, leading to more uncertainty about absolute and relative price changes and hence to a larger misallocation of resources. Therefore, it is advisable to liberalize all prices at once or at least as many as possible.

4. Adjustment and Growth

Until now we have assumed that the structural level of output remained unchanged by the introduction of a market economy. Although this is not an unreasonable assumption to make for a short term analysis of the transitional period, the absence of growth cannot be maintained in the long run. After all it hardly makes sense to switch to a market system only to experience a period of high inflation. But also concerning non-inflationary output

5 Besides weakening the excess demand-inflation relationship more competition would, of course, increase structural output in the long run.

6 The inflation elasticity of excess demand (δ) from abroad could be temporarily blocked off by tariffs, quota etc. These measures are, however, dubious due to negative effects not explicitly considered in this model, and are therefore not recommended.

7 It is assumed, however, that the government keeps expenditure unchanged even if tax revenues decrease. Additional excess demand would, therefore, be created by a budget deficit.

the blessings of the market may be mixed. Of course, the market system will supposedly bring better allocation of scarce resources than under the planning system, and therefore a higher level of non-inflationary output can be ultimately expected. On the other hand, the argument can be made that it will take time for people to get used to the market system, and that old uncompetitive industries will not immediately be replaced by new ones, and that thus structural output will drop at first. The rate of growth in structural output will depend on factors such as the rate of savings, the possible access to foreign borrowing etc.. We will not discuss these factors in detail here, but instead assume a simple time-dependent change in y_e , which levels off in the end, when all efficiency gains from the switch to a market economy are reaped. In the model of section two, this implies replacing (1) with:

$$(1') \quad y = y_e + a(t) - \alpha p'$$

with $\lim_{t \rightarrow \infty} a(t) = c$

Solving the model for p' and e' along the lines of the method in section 2 yields the following system of differential equations:

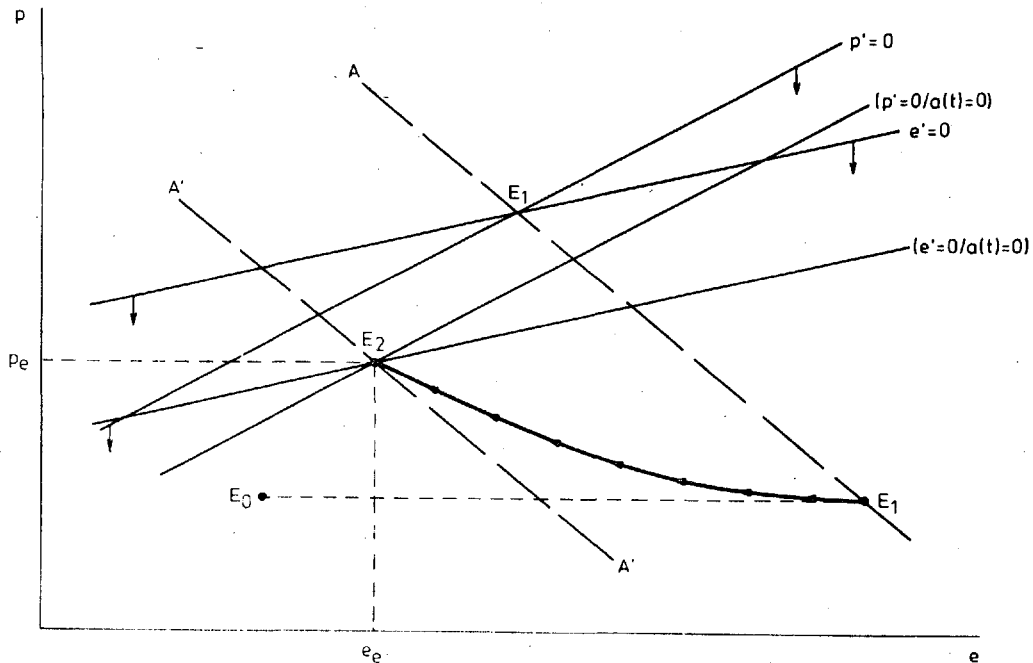
$$(8) \quad p' = \{-Ap + \pi\delta e - B(y_e + a(t)) + \pi\sigma M/\mu\}/N$$

$$(9) \quad e' = \{(N + \alpha\emptyset)p - \pi\delta\alpha\emptyset e + \emptyset(N + \alpha B)(y_e + a(t)) - (N + \pi\sigma)M\}/N$$

with $B = \pi(\theta + \sigma\emptyset)$

The homogeneous part of this system is identical to that of (5) and (6') and therefore the same stability conditions apply. We assume that $N > 0$. The movement of prices and exchange rates can now be sketched, as in Figure 3. Since $a(t)$ is by assumption constant in the long run, prices and exchange rates will move towards a new long run equilibrium E_3 , which can be determined by setting p' and e' to zero. The long run price level and exchange rates are obviously lower than in a situation without growth in structural output, due to the extra money demand. The time path of prices and exchange rates now depends on the precise form of $a(t)$, which, in a sense, moves the $p'=0$ and $e'=0$ lines over time, and therefore the asset market equilibrium line AA moves towards $A'A'$. A possible initial drop in non-inflationary output (not drawn) may enhance the depreciation and inflation due to the monetary overhang, but the subsequent increase reinforces appreciation, and may even lead to a drop in the price level at later stages of the transition period.

Figure 3



5. Summary and Conclusion

Transforming a centrally planned economy to a market economy is a multidimensional problem. In this paper we dealt with the question of a monetary overhang in the transition period. One way of coping with a monetary overhang is to let inflation do the necessary job of cutting the real money supply. Assuming sticky goods prices we showed that the inflation solution includes a temporary overshooting of the exchange rate and an initial fall in output. We proved that institutional reforms such as the establishment of an efficient financial sector, privatization of government owned firms and a comprehensive liberalization of all markets can be used as a remedy for hyperinflation. The growth process intended and started by the reforms helps to diminish the risk of inflation.

Appendix I

The nature of the adjustment depends on the constellation of the characteristic roots of the system of differential equations (5) and (6'), which are given by (see e.g. Kamien and Schwartz, 1981):

$$\begin{aligned}
 \text{(A1)} \quad r_{1,2} &= -1/2(D/\mu N) \pm \sqrt{\{(D/\mu N)^2 - \\
 &4(\emptyset\alpha\pi\delta A)/\mu N^2 + 4(\pi\delta N + \emptyset\alpha\pi\delta A)/\mu N^2 \\
 &= -(1/(2N))[(D/\mu) \pm \sqrt{\{(D/\mu)^2 + 4\pi\delta N/\mu\}}]
 \end{aligned}$$

$$\text{where } D = \mu A + \emptyset\alpha\pi\delta$$

From this expression it is clear that if $N > 0$, the system has two distinct roots, with $r_1 < 0 < r_2$ which is sufficient for saddle point stability under rational expectations, provided no speculative bulbs arise (see e.g. Begg, 1982).

If $N < 0$, it is clear that

$$\text{(A2)} \quad (-1/2N)(D/\mu) > 0$$

the nature of the system depends on the expression under the root sign. Two possibilities exist:

$$i \quad (D/\mu)^2 + 4\pi\delta N/\mu < 0$$

which will give the general solution $r_{1,2} = a \pm bi$, with $a > 0$. This yields an unstable focus.

$$ii \quad (D/\mu)^2 + 4\pi\delta N/\mu > 0$$

which yields $r_{1,2} > 0$, implying that the system is an unstable node.

References

- Begg, David K. (1982), *The Rational Expectations Revolution in Macroeconomics. Theory and Evidence*, Oxford.
- Bernholz, Peter (1988), *Hyperinflation and Currency Reform in Bolivia: Studied from a General Perspective*, *Journal of Institutional and Theoretical Economics*, vol. 144, pp. 747-771.
- Dornbusch, Rudiger (1976), *Expectations and Exchange Rate Dynamics*, *Journal of Political Economy*, vol.84, pp. 1161-1176.
- Dornbusch, Rudiger and Stanley Fischer (1986), *Stopping Hyperinflation, Past and Present*, *Weltwirtschaftliches Archiv*, vol. 122, pp. 1-47.
- Edwards, Sebastian (1989), *On the Sequencing of Structural Reforms*, NBER Working Paper No 3138, Cambridge Mass..
- Hayek, Friedrich A. von (1935), *Prices and Production*, 2nd edition, London.
- Hercowitz, Zvi (1981), *Money and the Dispersion of Relative Prices*, *Journal of Political Economy*, vol. 89 No 2, pp. 328-356
- (1982), *Money and Price Dispersion in the United States*, *Journal of Monetary Economics*, vol. 10, No 1, pp. 25-38.
- Kamien, Morton L. and Nancy L. Schwartz (1981) *Dynamic Optimization. The Calculus of Variations and Optimal Control in Economics and Management*, New York.

Obstfeld, Maurice and Alan C. Stockman (1985), Exchange Rate Dynamics, Chapter 18 in:
Ronald W. Jones and Peter B. Kenen, Handbook of International Economics, vol 2,
Amsterdam.

Wallich, Henry C. (1955), The Mainspring of the German Revival, London.