STABILIZATION POLICIES IN AN EXPLOSIVE ECONOMY: ANNOUNCEMENTS AND EXPECTATIONS

by

Giorgio Basevi* and Francesco Giavazzi**

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* Università di Bologna, Bologna, Italy

** Università di Venezia, Venezia, Italy

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Giorgio Basevi
University of Bologna

and

Francesco Giavazzi
University of Venice

Abstract

The article studies policy options in an economy which is unstable under bond-financing of a predetermined government deficit. We analyze policies based on pre-announced changes in monetary control or on confiscation of that part of the Government debt which could only be retired through a prolonged period of high inflation.

The dynamics of the economy is characterized by the interplay between policy announcements and private agents' behaviour in reply to them.

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Giorgio Basevi
University of Bologna

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1. Introduction

Real rates of interest which exceed rates of economic growth have been a widespread characteristic of the international economy in recent years.

Among the many and serious problems that this phenomenon entails one that has attracted much attention concerns the credit-worthiness of countries whose ratio between Government debt and gross national product has risen to alarming levels. On the one hand this question has raised, in both official and academic circles, a number of studies aimed at the more appropriate measurement of the relevant macroeconomic variables when inflation and recession affect their magnitudes.[1]

On the other hand, at a more theoretical level, concern about the financial reliability of such countries, has induced analyses of the stability characteristics of economies where the rate of growth falls below the real rate of interest, thus increasing Government deficits just at a time when recession is already pushing the budget in the same direction. In this situation, attempts to fight inflation by reducing money creation add further to the necessary increase in debt financing, and give rise to expectations that the Government will be forced to repudiate its debt either explicitly or through inflation depreciation.[2]

Within this context, our paper raises two questions. First, what are the policy options opened to such countries' authorities when their economies are shocked by destabilizing changes in the foreign-determined real rate of interest. Second, how can they permanently reduce their rate

of inflation under the set of constraints specified above.

Surely these themes are not new in the literature, particularly since Blinder and Solow's (1973) analysis of bond financed deficits, and the correlated debate on the effectiveness of monetary policy recently revived by Sargent and Wallace (1981). However, most of the theoretical contributions in this vein are characterized by models that are made stable either through the endogenous reaction of the private economy (e.g.: Blinder and Solow (1973)) or through specific assumptions about the institutional or policy reactions of the Government (Blanchard (1983), Giovannini (1983)).

Our model differentiates itself from this line by considering the limiting situation of an economy which is stabilized neither through private behaviour nor through built-in policy mechanisms, and is thus explosive. We are interested in analyzing stabilization policies based on preannounced changes of monetary control. In the economy we describe, for a given real budget deficit net of interest payments and a given stock of public debt inherited from the past, monetary policy is endogenous. Thus, to prevent explosion, the rate of money growth must accomodate any exogenous shock, such as an increase in the world real rate of interest. The only choice open to the Government[3] is between instantaneous accomodation and the announcement of future accomodation. Although inflationary expectations are determined by perfect foresight, we show that there are circumstances under which postponing the accomodation yields short-run inflation benefits, and thus more leeway for steering monetary policy.

Our analysis also leads in a natural way to the consideration of alternative means to reduce inflation, based either on wealth taxation or on repudiation of Government debt. The latter option, which will not be analyzed in detail in this paper, becomes relevant when the economy accumulates an excessive amount of debt, so that no preannounced monetary stabilization program is credible any more.

2. The model

In this section we present a model of the dynamics of public debt and inflation tailored to investigate the limiting case of an economy which is explosive when the government budget deficit is financed by issuing money and bonds.

In order to study this particular situation we assume that output and the real budget deficit net of interest payments are fixed, thus eliminating possible stabilizing forces through these channels. The economy does not grow, but the model could be interpreted as describing deviations from a constant growth rate. There are no impediments to capital mobility, foreign bonds are perfect substitutes for domestic government bonds and we rule out deviations from purchasing power parity. The domestic real rate of interest is therefore given by the rest of the world, while the domestic nominal rate equals the foreign nominal rate plus the expected inflation differential. Inflationary expectations are determined by perfect foresight.

When the world real interest rate is positive, this economy -with fixed output and fiscal policy set in real terms- is unstable.[4] For example, a shift from money to debt financing of the exogenous budget deficit will raise interest payments; these will be met by issuing more bonds so that the stock of public debt increases forever.

Only one stabilizing channel is left open: we assume that Government bonds are part of private wealth and that a fraction of this is held in money balances on which the Government collects revenue from seignorage. An increase in the stock of public debt raises wealth and hence money demand, but seignorage is never enough to close the budgetary gap induced by higher interest payments. Thus the economy ramains unstable.

Given our strong assumptions, two equations are sufficient to describe the economy: a money market equilibrium condition and the equation describing the financing of the Government budget deficit.

Money demand is assumed to be a function of wealth and of the nominal rate of interest. Wealth is the sum of the real money balances (M/P), plus

the value of public debt (b), plus the present discounted value of output (q/r). Public debt is issued in the form of a real bond of instantaneous maturity.[5]

The budget deficit is the sum of current expenditures, plus interest payments on outstanding debt, minus revenue. It is financed by issuing money and the real bond. With output constant, we assume that the budget deficit net of interest (d) is also constant in real terms. Thus the two equations are:

$$(1) \qquad M/P = \tilde{\sigma}(i) \cdot (M/P + b + q/r); \qquad \tilde{\sigma}' < 0, \quad \tilde{\sigma}'' > 0$$

$$(2) \qquad \dot{M}/P + \dot{b} = rb + d$$

where i is the nominal rate of interest, equal to the real rate of interest r plus the perfectly anticipated inflation rate π. Defining $\vartheta \equiv \dot{M}/M$, the rate of money creation, $m = M/P$ and $\sigma \equiv \tilde{\sigma}/(1-\tilde{\sigma})$, with $\sigma' < 0$, the two equations may be rewritten:

$$(1') \qquad m = \sigma(i) \cdot (b+q/r)$$

$$(2') \qquad \dot{b} = rb + d - \vartheta m$$

The share of the budget deficit which is financed by the issue of money, $\vartheta \cdot m$, represents the revenue from seignorage. Since real money balances are a fraction of total wealth, seignorage has two components, as can be seen substituting (1') in (2'):

$$(3) \qquad \dot{b} = (r - \vartheta\sigma)b + d - \vartheta\sigma\, q/r$$

One is proportional to output, the other effectively taxes the real return on Government bonds, but, as we shall see, does not introduce a sufficient stabilizing element.

3. Public Debt and Inflation in the Steady State

In the steady state the stocks of real public debt and of real money balances are constant: the latter condition requires that the inflation rate be equal to the rate of money creation.

Given r, d and q, the stock of real public debt sustainable in the steady state, $\bar{b} = (\vartheta\sigma\, q/r - d).(r - \vartheta\sigma)^{-1}$, depends on $\vartheta\sigma\, q/r$ which, as shown in (3), constitutes that part of the revenue from seignorage (equal to the inflation tax in steady state) which is proportional to output.

If the Government is a net borrower, the effective return on Government bonds $(r - \vartheta\sigma)$ must be positive for steady state consumption, $c = (q/r + b).(r - \vartheta\sigma)$, to be positive.[6]

A higher rate of money creation reduces real money balances but raises the inflation tax rate $\vartheta\sigma$, with an ambiguous overall effect on the total revenue from the tax. The maximum revenue obtains for a rate of money creation equal to the inverse of the interest rate semielasticity of money demand, $\vartheta^* = -\sigma/\sigma'$. Figure 1a illustrates the stock of public debt sustainable in steady state for a given rate of money creation;[7] Figure 1b, the inflation tax.

Since the inflation tax is bounded, there is also an upper bound b^{MAX}, to the stock of public debt sustainable in steady state, for given r, d and q. Below this upper bound there are always two values of ϑ which yield the same inflation tax revenue; any admissible stock of public debt can therefore be sustained with two different rates of money creation. We shall assume that the Government, on welfare grounds, always choses the lower one.

For any given value of ϑ, an increase in the world real rate of interest reduces the demand for real money balances, hence the revenue from the inflation tax and the sustainable stock of public debt; both schedules in Figure 1 shift down.

4. Announcements and Expectations

When the real rate of interest is positive, the economy we have constructed, with fixed output and fiscal policy set in real terms, is explosive. Consider for example a substitution of debt for money financing -a permanent reduction in ϑ- which moves the economy out of steady state, thus inducing an accumulation of debt. Higher interest payments on the growing debt raise the budget deficit; the growing wealth raises money demand, but insufficiently to offset the fall in the revenue from seignorage induced by the reduction in ϑ. The net effect would be ever increasing budget deficit and public debt.

Differentiating with respect to time the money market equilibrium condition (1'), the dynamics of inflation under perfect foresight is described by

$$(4) \qquad \dot{\pi} = \frac{\sigma}{\sigma'}\left[(\vartheta - \pi) - \frac{\dot{b}}{b+q/r}\right]$$

This, together with (3), characterizes the path of the economy out of steady state. As shown in the Appendix, any steady state with a net outstanding stock of public debt is an unstable equilibrium. Thus, having assumed that the Government cannot borrow indefinitely, the only admissible equilibria are the points along the steady state locus SS in Figure 1.

Therefore, if the path of fiscal policy is predetermined, any shock which would push the economy out of a stationary equilibrium, must be accompained by policies which prevent explosion of the economy. There are two possibilities. One requiring an instantaneous stabilization, the other relying upon the Government announcing a future stabilization and private rational agents acting accordingly.

In the first case, stabilization requires an instantaneous change in ϑ in order to make the stock of debt inherited from the past sustainable under the new situation.

The second possibility is particularly interesting, both because it is less likely that the authorities will respond immediately, and because

of the interplay between announcement and expectations. In this case, as monetary policy does not accomodate, the stock of public debt will start snowballing (assuming that the nature of the shock is such that b starts increasing) but the Government announces a stabilization program. When enacted, this will consist in setting the rate of monetary growth to the level required by the stock of public debt reached in the meantime.

If no action is taken, nor a stabilization program announced, the course of the economy is undetermined, unless further assumptions are made about agents' expectations. A benchmark assumption is that agents expect that the Government will stabilize just before it is "too late", namely that monetary policy will be adjusted when the stock of public debt will reach b^{MAX}. In fact, going beyond this point would imply that the Government "stabilization" comes too late to be effective without repudiation of part of the public debt: an action which we assume to be excluded from the expectations of agents trusting their Government financial worthiness.[8]

5. Responding to an Increase in the World Real Rate of Interest

Consider Figure 2. The economy was in a stationary equilibrium at E_0 with a rate of money creation θ_0 sufficient to keep the stock of public debt b_0 constant. The increase in r comes unexpected and shifts the SS locus down: a higher rate of money creation is now needed to sustain the existing stock of public debt, because real interest payments have increased.

Instantaneous stabilization requires increasing the rate of money creation and hence the rate of inflation to θ_1; the economy would set at E_1 with an unchanged stock of public debt. Any delay will imply a higher steady state rate of inflation because in the meantime new debt will have been issued.

Choosing not to accomodate instantaneously would therefore seem irrational on the part of a foreward-looking Government. Investigation of the dynamic path of the economy suggests however that postponing the

monetary accomodation may keep the rate of inflation temporarily below ϑ_1 hence making this policy option attractive in the short run.

In fact, assume that agents anticipate that the Government will stabilize at E_2 when the stock of debt reaches b_{MAX}, raising the rate of money creation to ϑ^*. At the time the policy is implemented, b suddenly stabilizes, but nothing else happens: the inflation rate does not jump. If it did, this would imply anticipated infinite rates of capital gain or loss on real money balances: with perfect foresight these are discounted back to the time when the policy is anticipated.[9]

Therefore, it is at the time when the exogenous increase in the real interest rate occurs and the future stabilization plan is anticipated, that the inflation rate jumps and sets the economy on the unique path which will bring it to the stationary equilibrium E_2 exactly at the time when the plan is implemented. The situation is described in Figure 3.

Although monetary policy is temporarily unchanged, the current rate of inflation jumps because in this model inflation is a foreward-looking variable determined by the present discounted value of the anticipated future rate of money creation. The current rate is unchanged at ϑ_0 in the short run and is known to jump later to ϑ^*. The direction of the initial jump is a function of the interest rate semielasticity of money demand, σ'/σ. A relatively high interest rate semielasticity means small discount rates: the jump in inflation will be positive. A low interest rate semielasticity implies instead a negative instantaneous jump in inflation.

The condition under which postponing the monetary accomodation results in an initial jump in inflation to a value smaller than ϑ_1, hence yielding a short run benefit, is derived in the Appendix, where we also show that this (the left hand path in Figure 3) is the more plausible case.[10]

6. Reducing Inflation Without the Help of Fiscal Policy.

When the real budget deficit net of interest payments is predetermined, the steady state rate of inflation is also predetermined. The higher the

stock of debt inherited from the past, the higher the revenue from the inflation tax necessary to service it, if the world real rate of interest is positive. In this economy, unless debt is reduced, inflation cannot be reduced.

An unanticipated confiscatory reduction in b -a wealth tax- accompanied by reduction in the rate of money creation could instantaneously put the economy on a path where inflation is permanently lower, thus for example allowing to jump from E_0 to E_2 in Figure 4 through confiscation of (b_o-b_1).

The alternative to a once and for all wealth tax is a temporary higher revenue from seignorage -a temporary increase in the rate of money creation from ϑ_o to ϑ_1- accompanied by the announcement the the Government will "stabilize" when the stock of public debt has been reduced to the level b_1 consistent with the inflation target, ϑ_2. But in the empirically relevant case[11] characterized by the right-hand path in Figure 4, a permanent reduction in the rate of inflation requires temporarily higher inflation rates starting from π_1.

This analysis invites a reconsideration of a strong proposition recently proved by Sargent and Wallace (1981).

In their model, which is similar to ours but does not include wealth in the money demand function, it is shown that, when fiscal policy is predetermined, tighter money now implies more inflation in the future and possibly more inflation now. While their long run result is confirmed in our model, Figure 5 shows that, in the empirically relevant case, tightening of monetary policy does reduce inflation in the short run.[12] This feature suggests a possible explanation for an antinflationary policy based on monetary restriction, when the political decision makers are myopic.

A P P E N D I X

The dynamic properties of the economy around a stationary equilibrium $(\bar{b}, \bar{\vartheta})$ are characterized by the trace and the determinant of the transition matrix obtained linearizing (3) and (4):

$$\text{trace} = (r - \vartheta\sigma) - \sigma/\sigma'(1 - \vartheta\sigma')$$

$$\det = -\sigma/\sigma'(r - \vartheta\sigma)$$

the determinant is always positive; $(r - \vartheta\sigma) > 0$ is a sufficient condition for the trace to be positive, and is always satisfied in the neighborhood of any $\bar{b} > 0$ (see footnote 6). Both eigenvalues are then positive and, as can be verified, real: if the economy is anywhere out of the SS locus of Figure 1, it will diverge along a path originating in $(\bar{b}, \bar{\vartheta})$. The slope and the curvature of these trajectories anywhere in the (b, π) space can be studied taking the ratio of the two differential equations (3) and (4), hence eliminating time. The following result is used in the text: when the interest rate semi-elasticity of the demand for money is sufficiently small, a trajectory which intersects the SS locus to the North-East of the singular point lies to the left of the SS locus up to the point of intersection; if instead the intersection occurs to the South-West of the singular point, the same condition guarantees that the trajectory will lie to the right of the SS locus.
This result can be proved as follows.

A sufficient condition for a trajectory which intersects the SS locus to the North-East of the singular point to be, (i) positively sloped, (ii) convex $\left(\frac{d^2b}{d\pi^2} < 0\right)$ at the point of intersection, and (iii) to cut the SS locus from above, is:

$$(A1) \qquad (1 + \sigma) - \sigma_1(r + \pi_o) > 0$$

where $\sigma = \sigma(\pi_o)$, π_o is the inflation rate at the point of intersection

and we have assumed $\sigma(i) = \sigma_0 \exp(-\sigma_1 i)$.

(i) is always true since in the (b, π) space the slope of a trajectory based on the current rate of money creation ϑ when it intersects the steady state locus in a point (b_o, π_o) is

$$(A2) \qquad \left.\frac{db}{d\pi}\right|_{SS} = m(b_o, \pi_o) \frac{\sigma_1}{1 + \sigma(\pi_o)}$$

always positive.

At the same point, (ii) is verified if and only if

$$(A3) \qquad (1 + \sigma(\pi_o)) - \sigma_1 \left[(r + \vartheta) + \sigma^2(\pi_o - \vartheta)\right] > 0$$

and (iii) requires

$$(A1) \qquad (1 + \sigma(\pi_o)) - \sigma_1(r + \pi_o) > 0$$

If $\sigma \in [0,1]$, which is true if real money balances are less than 1/2 of total wealth –an empirically plausible assumption– (A3) is always verified if (A1) is verified; thus (A1) is a sufficient condition for both (ii) and (iii).

The condition will be verified if σ_1 –the interest rate semielasticity of money demand– is sufficiently small.

In the region to the North-East of the singular point and above the SS locus the slope of the trajectories is always positive. For σ_1 sufficiently small the trajectories remain convex: in fact vertically above the singular point ($\pi = \vartheta$, $\dot{b} > 0$), the convexity condition becomes:

$$(A4) \qquad 1 - \sigma_1 \frac{rb + d - \vartheta m}{b + q/r} > 0$$

When intersection occurs to the South-West of the singular point, i.e. at a $\pi_o < \vartheta$, (A1) becomes a sufficient condition for concavity ($\frac{d^2 b}{d\pi^2} > 0$) at the point of intersection.

F O O T N O T E S

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1. See, among the many, Miller (1982) and OECD (1983).
2. This alternative is mentioned but not analyzed by Blanchard (1983).
3. This rules out the possibility that Government debt may grow forever at a rate higher than the rate of the growth of the economy.
4. Note that the instability here arises because bonds are issued to finance current Government expenditure. Bond financed capital expenditures -in so far as the return on Government investment is not below the real rate of interest at which Government bonds can be sold- is not a source of instability.
5. With perfect foresight there is no difference between an instantaneous bond yielding a real rate of return and a nominal bond.
6. In the steady state of a non-growing economy consumption plus purchases of nominal money balances, required to keep real money balances constant, equal disposable income:

$$c + \vartheta \bar{m} = q + r \bar{b}$$

or

$$c = (q/r + \bar{b})\ (r - \vartheta\sigma)$$

7. A theoretical and empirical analysis of Figure 1 is contained in Bailey (1956). Results from a cross-country study presented in Fisher (1982) show that orders of magnitude of seignorage of 75% to 1% of GNP are common.
8. These are obviously very special assumptions: a full treatment of the case when there is no policy announcement would require the explicit consideration of agents' probabilistic assesment of the time at which stabilization will come.
9. A mathematical treatment of this process is contained in Wilson (1979), while the diagrammatic solution used here is discussed in Begg (1982).
10. If for example in the money demand function $\sigma(i) = \sigma_0 \exp(-\sigma_1 i)$ and hence agents expect the economy to be stabilized at a rate of money creation $\vartheta^* = 1/\sigma_1$ the condition is $(\sigma - r\sigma_1) > 0$, which is empirically plausible since both r and σ_1 are of the order 10^{-2} while $\sigma = m/(b+q/r)$.

11. As shown in the Appendix, the location of the paths corresponding to the two different magnitudes of $|\sigma'/\alpha|$ changes side with the sign of $\dot{b}$.

12. The reduction in the rate of money creation reduces the revenue from seignorage, ϑm, hence widens the Government budget deficit and induces the stock of public debt to grow. If the rate of inflation on impact increases, the revenue from seignorage unambiguously falls because both ϑ and money demand decrease. But if inflation temporarily falls, the two effects -as noted by Buiter (1982)- work in opposite direction because ϑ falls while m rises. The fall in the revenue from seignorage however is unambiguous if, as we have assumed, between the two rates of money growth which yield the same revenue, the Government chooses the smaller one.

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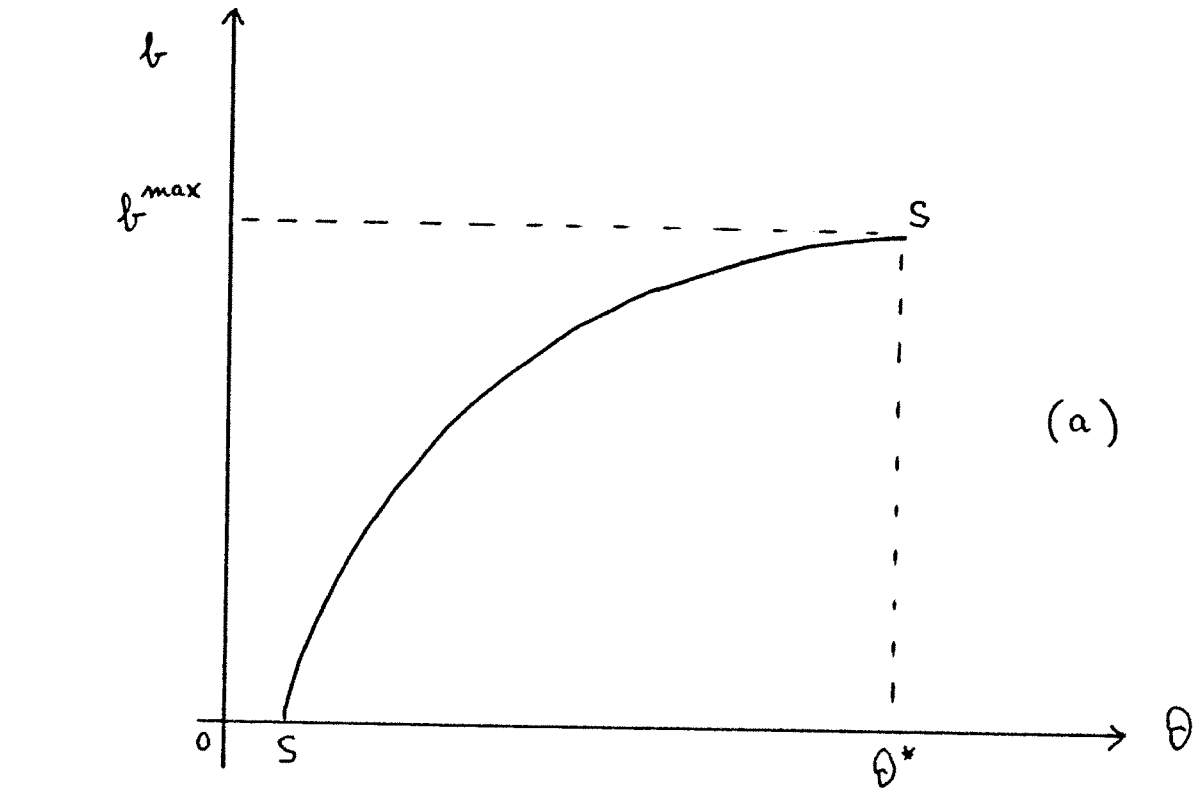

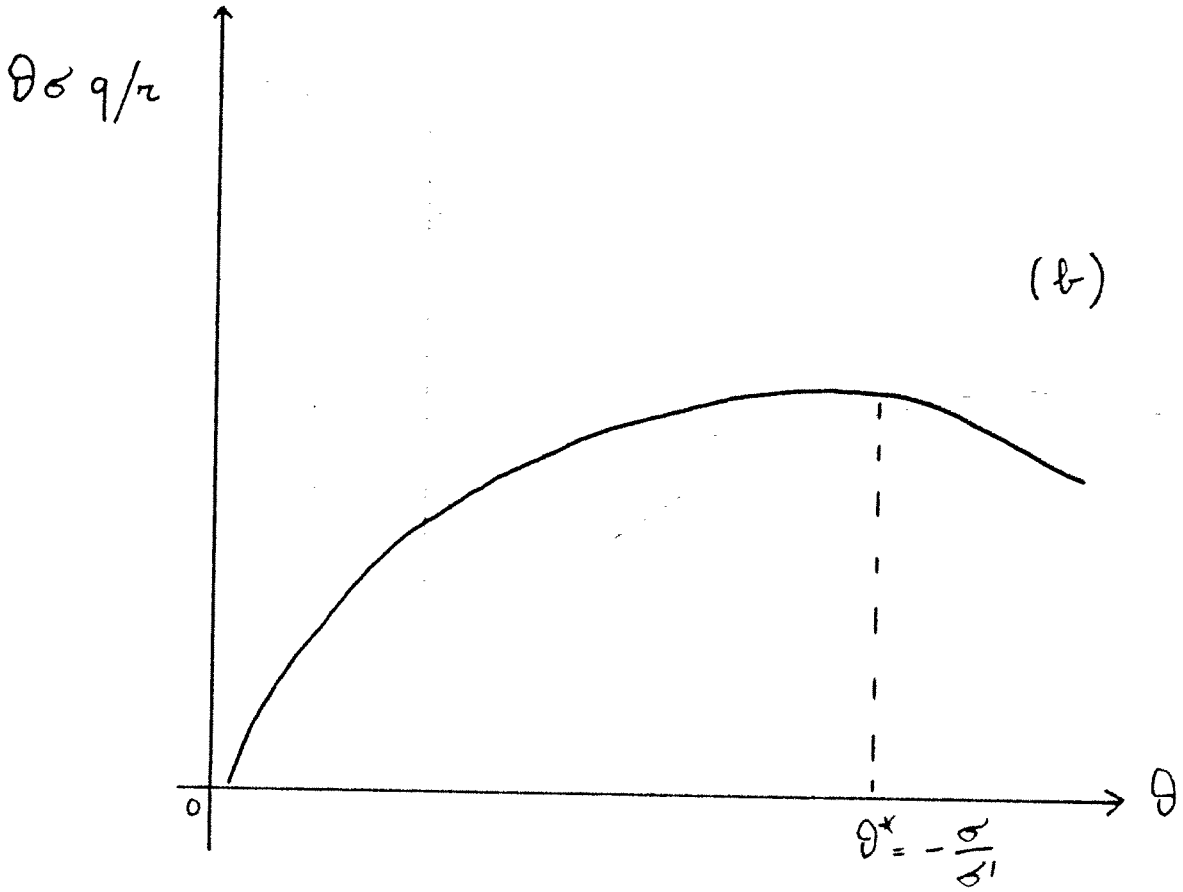

Figure 1

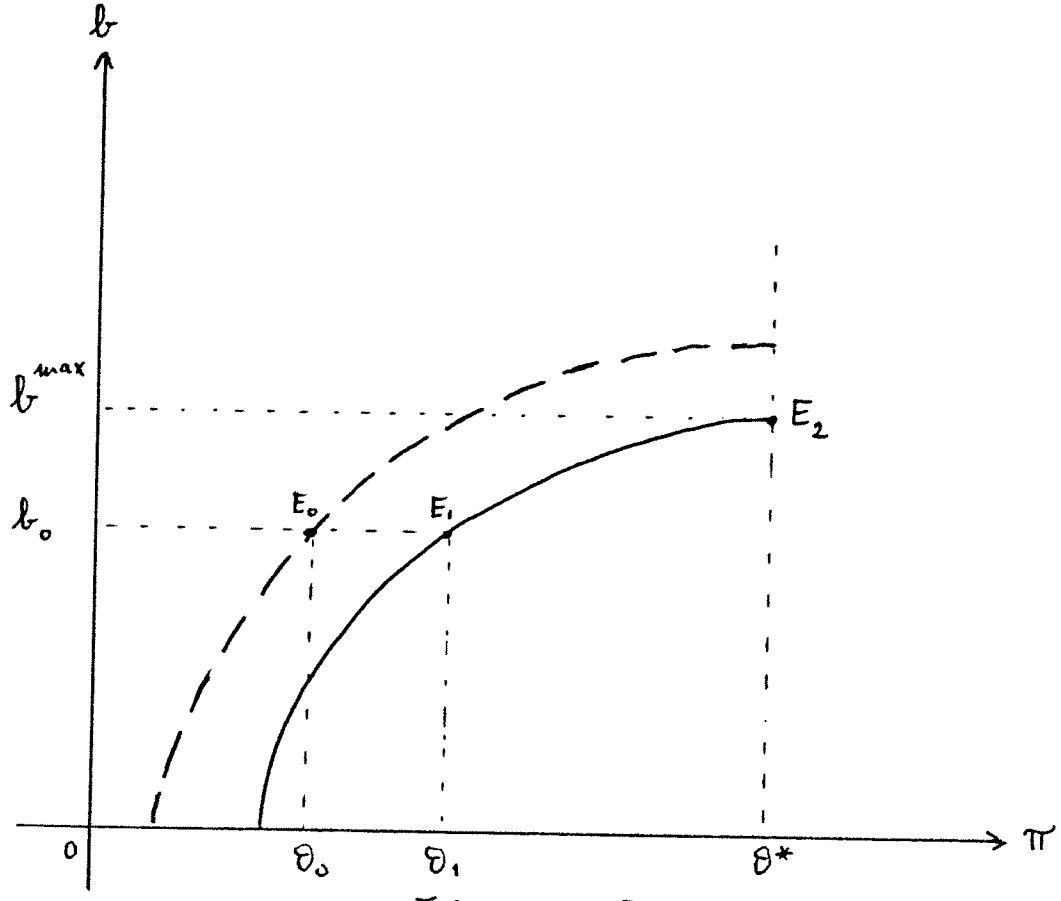

Figure 2

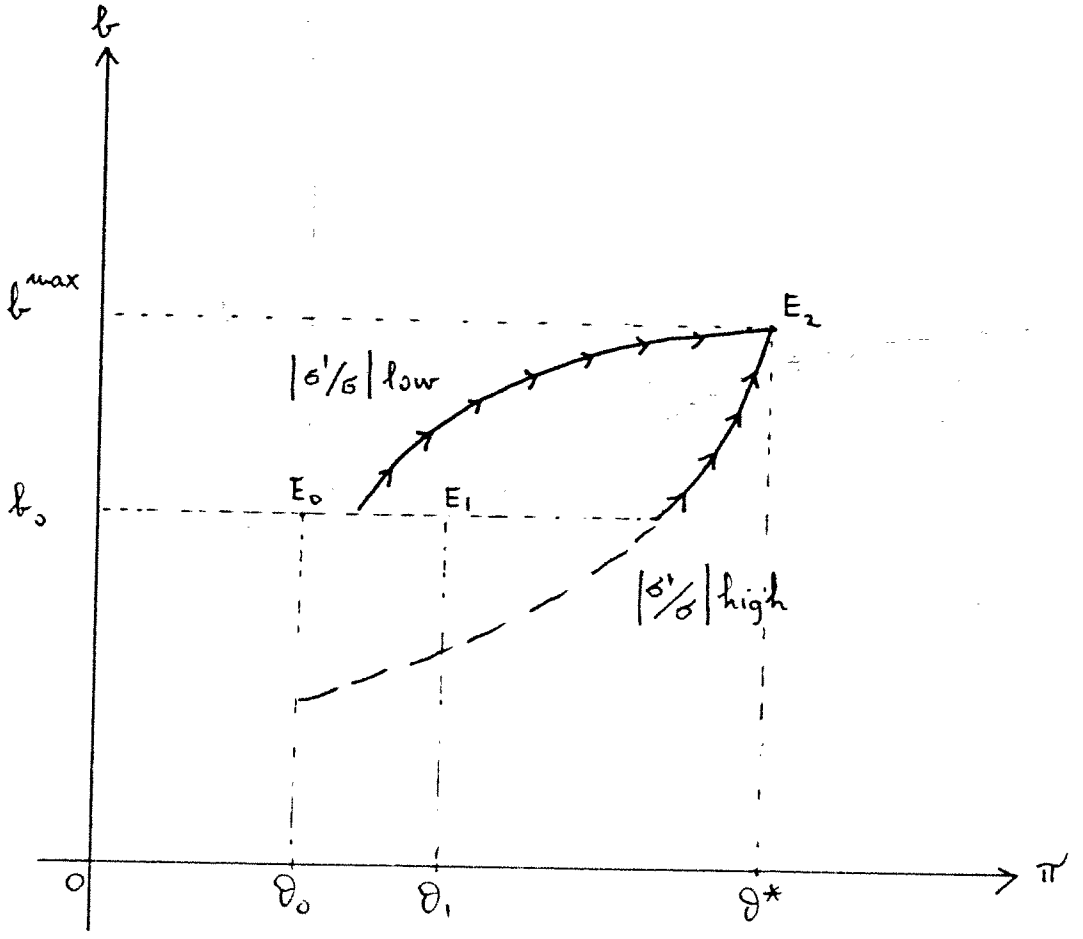

Figure 3

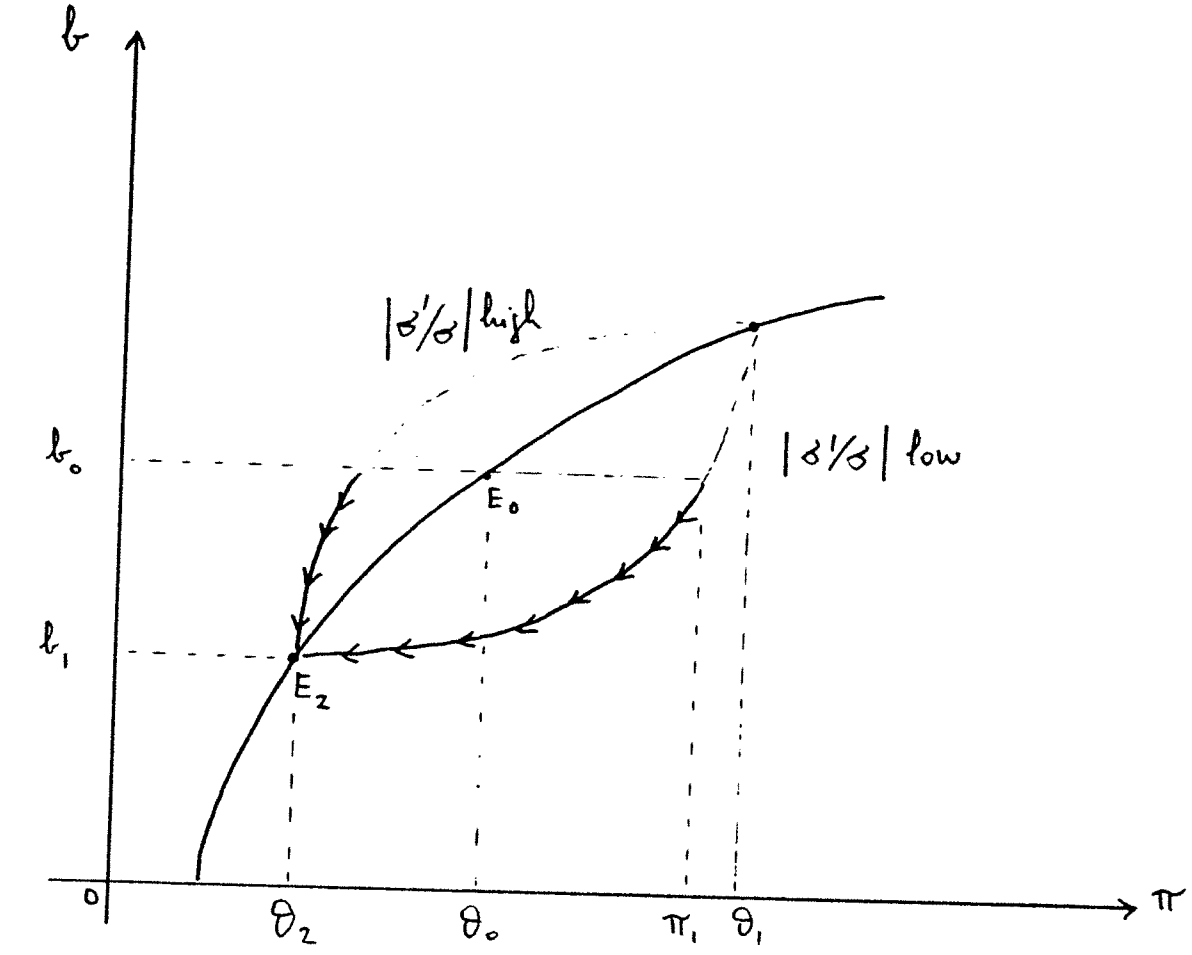

Figure 4

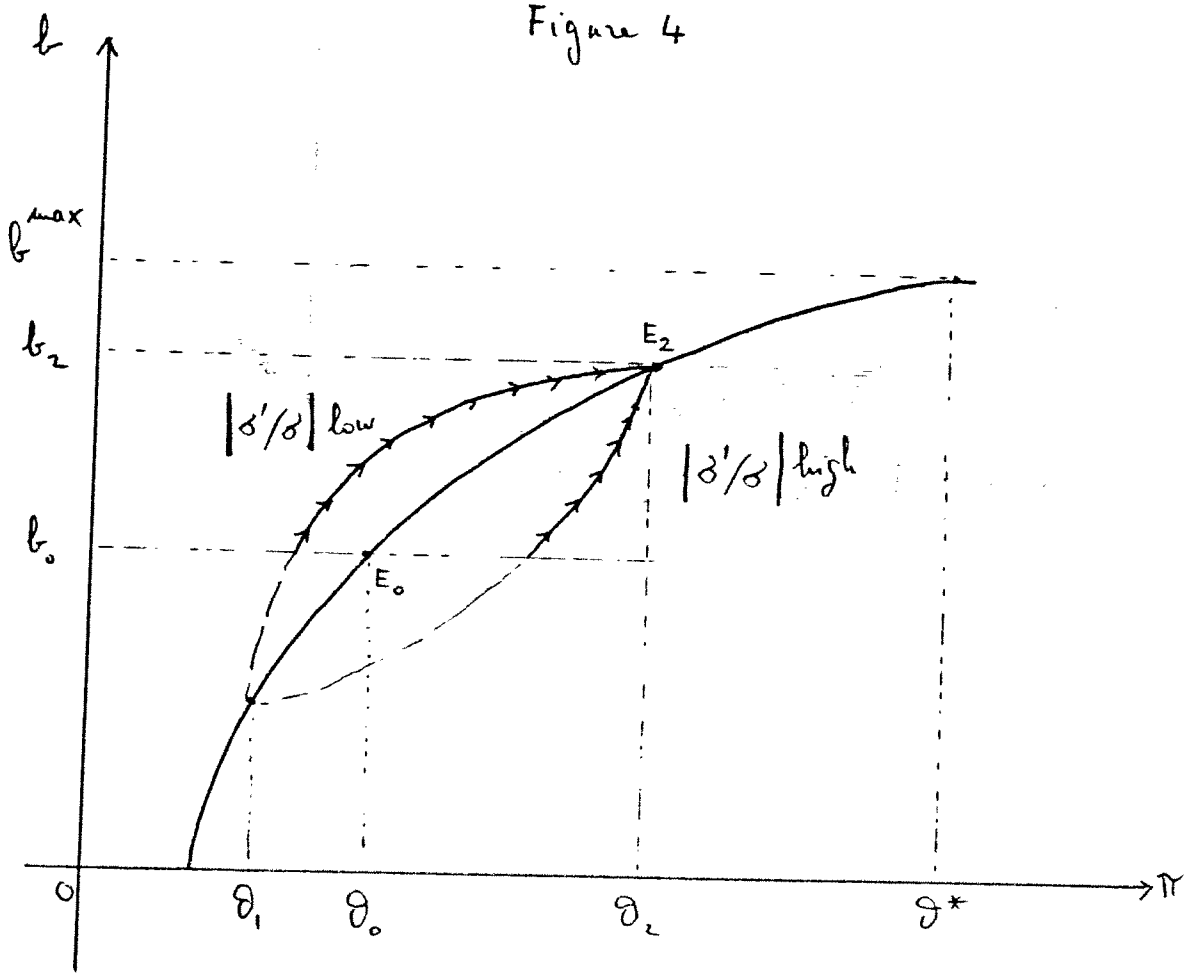

Figure 5