Initiative for Policy Dialogue
Task Force on Macroeconomics

Contractionary Effects of Stabilization and Long-Run Growth

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1. Introduction

Do aggregate demand contractions have long lasting, irreversible effects on output and living standards? Orthodox economic theory seems to give a negative answer to this question. In the traditional view of growth and fluctuations, aggregate demand causes transitory departures from a trend of output determined exclusively by supply factors (capital accumulation and technical progress). In the real business cycles literature departures from trend can be persistent but its source comes from the supply side of the economy (technology shocks). The idea of persistent aggregate demand shocks has not captured the imagination of the mainstream.

Nor has it captured that of policy-oriented orthodox economists. International financial institutions like the IMF and many mainstream economists recommend contractionary aggregate demand policies for economies for dealing with inflation and financial and balance of payments problems. They often recommend sharp contractions to solve such macroeconomic problems quickly, and in broader political economy analyses, to make contractionary policies feasible. Implicit in this recommendation is a "spring theory" of stabilization and growth: following an initial contraction the economy will be able to spring back to a normal full employment path that is independent of the size of the contraction itself. Even more, the economy may well be able to spring back faster, the

greater the magnitude of the contraction. Implicit in this view are two important premises: first, that there are automatic tendencies which take the economy to some "normal" path; and second, that the "normal" path is independent of the contraction and its magnitude.

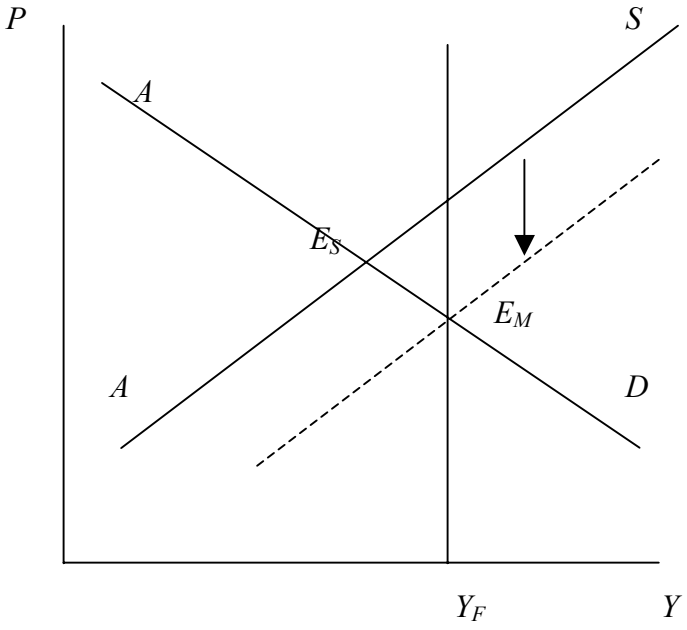
This paper provides a review of theories that cast doubt on both these implicit assumptions using some simple theoretical frameworks of analysis. It also provides some empirical illustrations to argue that these theories raise important real-world issues. The first two sections of the paper look at the first premise: the question of automatic tendencies and the path of the economy when these tendencies are absent or offset. Section 2 starts with the simple textbook aggregate demand-aggregate supply framework to discuss the automatic adjustment mechanism which is sometimes believed to return the economy to a normal path, and then shows how these automatic mechanisms may fail to achieve this end. The reasons include the problems resulting from debt deflation, regressive income distribution, and expectation factors, some of which were highlighted by Keynes, and have all but disappeared from mainstream formulations. Section 3 then reviews models of long-run growth which assume that the economy is not on its so-called 'normal' path, and in which both aggregate demand and aggregate supply issues have a role in determining long-run growth. This review shows that contractionary stabilization policies can have adverse long-run effects on growth, and may in fact exacerbate the problems they were intended to solve.

The rest of the paper turns to the second premise assuming that the automatic tendencies operate unchecked. Section 4 restates the spring back property in the context of an orthodox open economy growth model. Sections 5 to 7 then extend the model in such a way that some departure from orthodox assumptions brings in path dependence: the effects of unemployment and its history on workers' skills, overall productivity and wage bargaining strength (section 5), the existence of multiple equilibria associated to the presence of increasing returns to scale (section 6) and to increasing returns and balance of payments constraints (section 7). Section 8 concludes.

2. Self-adjustment mechanisms and destabilizing effects

It is convenient to start with the simple aggregate demand-aggregate supply (AD-AS) framework which is used to teach macroeconomics at almost all levels, introductory, intermediate and even graduate[1]. The AD curve is a curve showing the relation between the price level, *P*, and the level of real output, *Y*, which ensure equilibrium in goods and financial markets. It is normally drawn to be negatively sloped. The AS curves shows the relation between *P* and *Y* consistent with production, pricing and wage determination in the economy. It is taken to be positively sloped because of some short-run rigidity in the economy. Short-run equilibrium in the economy is determined at the intersection of the AD and AS curves. There is no guarantee that the short run equilibrium, shown in Figure 1 by point E_S, is at full employment, where the demand and supply of labor are equal, shown by Y_F in the figure.

Figure 1



In the medium run the money wage can adjust in response to conditions in the labor market. So if the economy finds itself in a short-run equilibrium at a point like E_S, which implies that the economy produces at less than the natural rate, the money wage will fall.

This will shift the AS curve downwards, and the economy will move down along the downward-sloping AD curve to medium-run equilibrium at E_M. In the long run the economy will be on the Y_F line, which will itself move over time in response to capital accumulation, technological change and labor supply growth. If the production function exhibits diminishing returns to capital, and if labor-augmenting technological change occurs at an exogenously given rate, in long-run steady state the economy will grow in per capita terms at the rate of technological change.

The negative slope of the AD curve and thus the return to full employment in the model is due to the so-called Keynes effect: unemployment leads to a fall in the money wage, which increases employment and output, reduces the price level, increases the real supply of money, reduces the interest rate, increases investment, aggregate demand and output. Other effects can also help this automatic recovery. The fall in the price level and the consequent rise in real money balances can directly increase spending through the real balance or wealth effects. Also, the fall in the price level improves international competitiveness, and provided that the Marshall-Lerner condition is satisfied and this can increase net exports and raise output.

Although textbooks seldom point out the difficulties with the mechanisms which automatically restores the economy to full employment or the natural level of output, the problems with them are well known. Keynes (1936) himself expressed his doubts on what has subsequently been dubbed the Keynes effect and other related effects. These doubts have been echoed by other Keynesian scholars – including the so-called post Keynesians, and additional problems have also been pointed out. Mainstream Keynesians have typically ignored these problems, adhering instead to the notion that wage-price rigidity is the cause of unemployment, and that with flexible wages and prices, the economy converges to full employment. Rare exceptions include Tobin (1975) and Hahn and Solow (1995).

One set of problems relate to income redistribution due to changes in the money wage and the price level. Falling prices imply, for rigid nominal interest rates, a redistribution

of income from debtors to creditors. To the extent that these two groups have different consumption propensities, falling prices can change consumption demand. The real balance effect ignores these effects by focusing only outside money – liabilities of Central Banks – while ignoring the liabilities of private individuals, firms and banks. Falling money wages imply, if there is also a fall in real wages (due to the existence of unemployment), a redistribution of income from wage income to non-wage income. If wage-earners have a higher marginal propensity to consume that recipients of non-wage income, this implies a fall in real consumption out of a given level of income, and therefore a fall in aggregate demand. The AD curve therefore shifts to the left. Differential propensities to consume and save out of wage and non-wage income have played an important role in radical and post-Keynesian macroeconomics, and are typically absent in mainstream macroeconomic theory.

A second set of problems concern the effects of deflation. As noted earlier, if the nominal interest rate is rigid, falling prices imply a redistribution from borrowers to lenders which is reflected in a higher real interest rate. By raising the real cost of borrowing, this results in a fall in aggregate expenditures which are elastic to real borrowing costs. In particular, investment spending by firms can be scaled back. Moreover, to the extent that firms have contractually fixed payments, such as wage and interest payments, falling prices will make it make more difficult for them to meet these obligations, which will further reduce the propensity of firms to add to their debt and therefore induce them to reduce investment. In extreme cases it can cause firms to become incapable of meeting their debt obligations, and go bankrupt, further reducing aggregate demand.

A third set of issues relates to expectations. The so-called Keynes effect assumes that a fall in the rate of interest increases investment demand, overlooking the fact that investment decisions are made in a world of pervasive uncertainty and that investment decisions depend mainly on expected long-term yields on capital assets. Thus, falling prices of goods, as noted earlier, may reduce long-term yields, and fail to spur investment even with a fall in the interest rate. Uncertainty due to changes in the price and the wage

can also push asset holders into demanding more money, which also circumvents the Keynes effect. Changes in the price level can also lead to changes in expectations about inflation. A fall in the price level could lead to a postponement of purchases of goods with the expectation of further falls in the price, as pointed out by Keynes (1936). These effects are observable in the US deflation of the early 1930s and Japan's slump of the 1990s.

A fourth set of issues relates to factors which prevent the rate of interest from falling below a certain level at which the so-called liquidity trap begins to operate. This rate of interest is equal to what can be called the convenience yield of holding money (based on its property of liquidity). At this rate asset holders will willingly hold any amount of money that is supplied to them without requiring a further reduction in the interest rate. When the economy arrives at this liquidity trap, the Keynes effect will be unable to operate. Situations like this have occurred in the real world, as in Japan in the 1990s.

A final set of issues relates to money supply and monetary policy. In the textbook story the fall in the price level results in a rise in real money balances which makes asset holders turn to non-money assets or the purchase of goods. The implicit assumption that is made that when the price levels falls money supply does not change. If it is remembered that money supply is affected by the demand for credit, if there is a fall in the price level and a lower demand for money, there will be a lower demand for credit, and economic agents with excess money balances will simply pay back loans. When they do so, the interest rate charged by banks may not necessarily fall. Moreover, the interest rate is affected by the interest rate policy of the Central Bank. A number of post-Keynesian economists have stressed the horizontalist view of money supply rather than the verticalist view which is prevalent in macroeconomic textbooks (see, for instance, Moore, 1988). According to this view banks charge a markup on the cost of borrowed funds (such as the Federal Funds Rate) and lend to borrowers according to the effective demand for bank loans (credit-worthy borrowers), adjusting the supply of loans to the demand for it. This approach seems to be more acceptable to at least some textbook authors because of changes in the conduct of monetary policy by Central Banks which

use an interest rate target (although it is a real interest rate target) in the US and in other countries (see Romer, 2000). These authors assume that when the rate of inflation increases the monetary authorities target a higher real interest rate and this reduces aggregate demand, but there is no automatic market tendency to make the economy rebound to full employment or to the natural rate of output[2].

All of these considerations imply that when, in the presence of unemployment, the money wage falls and the AS curve shifts down, there may well be no increase in the level of output and employment. The AD curve may be vertical (absent the Keynes and real balance effects, and with endogenous money), or even positively sloped (if, for instance, firms reduce investment when the price level falls), and also shift to the left when the money wage falls. All of this can prevent the convergence to full employment.

The implication of non-convergence is that the economy can be at levels of output less than full employment or the natural rate in the medium and long run. Changes in the wage and price can be held in check, despite this, due to various 'frictions' and 'rigidities' in the economy. The point is that the removal of such frictions will not necessarily take the economy to full employment. In any case, many mainstream economists believe that in the long run the economy will grow with full employment because fiscal and monetary policy will keep the economy at full employment. This overlooks the problems policy-makers face, due to uncertainty and political constraints, in maintaining full employment. Moreover, the spring theory relies on automatic mechanisms after a policy-induced shock.

3. Demand-determined growth

What happens in the medium and long run if the economy fails to return to its full employment growth path through the operation of market forces or government policy? In this section we assume that the economy may not be pushed to its full employment growth path and discuss how in these conditions aggregate demand affects the rate of growth of the economy in the longer run. Growth models in which growth is constrained

by aggregate demand have been extensively studied in the structuralist and post-Keynesian literatures on growth and income distribution (see especially Taylor, 1991). We describe a simple model that captures some of the relevant features of the approaches.

Consider a closed economy producing one good with two factors of production, capital and labor, with a fixed coefficients production function[3]. Firms set their price as a markup on labor costs, maintain excess capital, and adjust output according to the demand for goods. Consumption demand depends on total income and may also depend on the distribution of income if wage earners have a higher propensity to consume than profit recipients (or non-wage income). Investment demand depends on: the profit share and the rate of capacity utilization (to capture expected returns); the rate of interest; and on the rate of technological change (the rate of labor productivity growth).

In the short run the labor share in income and output is given, as is the stock of capital. In the longer run the labor share and the stock of capital change over time. Changes in the labor share are determined by changes in the money wage, by the change in the price level and by the rate of labor productivity growth. The rate of change in the money wage depends on the inflation rate and on conditions in the labor market proxied by the degree of capacity utilization. The rate of inflation depends on the change in wages and the rate of interest, capturing cost-push factors, and possibly on the rate of capacity utilization. The rate of labor productivity growth depends on the investment rate (to capture research and development, learning by doing and embodied technical change). The rate of change of the stock of capital is determined by the investment rate.

In short run equilibrium the rate of capacity utilization adjusts to clear the goods market, which requires the equality of saving and investment. The interest rate is either taken to be exogenously fixed (with the supply of money being endogenously determined by demand), or to be determined by the supply and demand for loans (with money supply exogenously given in the short run). An exogenous fall in the wage share is likely to reduce capacity utilization (given the lower propensity to consume out of non-wage

income) and even to reduce the rate of capital accumulation (because of accelerator effects) and the rate of technological change (due to learning effects). Thus, as discussed in the previous section, if unemployment leads to a fall in the real wage which reduces the share of wages, the economy may experience contraction, rather than being pushed towards full employment growth. Monetary and fiscal contraction reduces the rate of capacity utilization and the rate of capital accumulation in the economy, directly reducing aggregate demand, or by increasing the interest rate in the case of monetary contraction. Monetary contraction may even have a stagflationary effect by raising the interest rate, which increases inflation by increasing costs[4].

In the longer run the labor share and the rate of capital accumulation adjusts according to changes in the money wage, price, labor productivity, and to investment, and in long-run equilibrium the labor share, capacity utilization and the rate of capital accumulation are constant[5]. The economy converges to a steady state in which aggregate demand grows at the same rate as productive capacity. There is no reason, however, why the economy should converge to full employment of labor (if labor supply growth is taken to be exogenously given) or even to full capacity. There is no "normal" path of output independent of aggregate demand. In fact, as already mentioned, by changing capacity utilization in the short run, aggregate demand shocks change the steady state rate of growth itself as capacity utilization affects the rate of capital accumulation. For example, an exogenous monetary or fiscal contraction will have a negative effect on long-run capital accumulation and technological change, as in the short run. In fact the short-run effect can even be exacerbated in the long run with a fall in the labor share in income. Such an outcome can occur because the lower rate of employment growth exerts downward pressure on the real wage, if the fall in capacity utilization reduces investment more through accelerator channels than it increases it by increasing the profit share (see Bhaduri and Marglin, 1990, for these conflicting effects).

Models of demand-determined growth of this type can be criticized for allowing the rate of capacity utilization to be endogenous, and for the rate of unemployment to be changing even at long-run equilibrium or steady state. Regarding the endogeneity of the

rate of capacity utilization, it can be questioned why if the rate falls below some desired level there is not a cumulative decline in the rate of investment which results in a Harrodian knife edge instability problem. Regarding the unemployment rate, unless the rate of growth of labor demand happens to be accidentally equal to the exogenously-fixed rate of growth of labor supply, it will change in equilibrium, arguably negating the concept of equilibrium itself. In general, the models can be defended, however, by clarifying that the equilibria they refer to are not tranquil states for actual economies, but hypothetical constructs which show how the economy behaves in the time span in which capital stock, income distribution, and technological change interact with one another. The models therefore depict economies in which capacity utilization rates can be low and in which unemployment rates change over prolonged periods of time, as in actual economies. On the capacity utilization issue, it can also be argued that economies have no unique desired or normal levels of capacity utilization so that equilibrium can therefore occur within a band. Moreover, the desired rate of capacity utilization – if it exists – is likely to be endogenously determined (see Dutt, 1990, Lavoie, 1995). On the unemployment issue, it can be argued that unemployment rates tends to be stable over the longer run because of government efforts to stabilize the economy which prevent sharp increases in unemployment over time, and because of changes in the effective supply of labor due to endogenous technological change, immigration, and changes in participation rates.

Numerous extensions of this simple model can be made to highlight additional factors that may be at work. One such modification examines the role of public investment in infrastructure when private investment responds positively to the level of public investment due to what has been called the "crowding in" through complementarities between private and public investment. Fiscal contraction, in this case, by reducing government investment, will have a further contractionary effect on the rate of private investment and hence technological change.

In an open economy, an aggregate demand contraction will reduce output and employment in the short run. This will lead to lower rates of increase in wages and prices

which improve competitiveness. However, slower productivity growth following the slowdown of accumulation will tend to worsen competitiveness. Moreover, monetary contraction will increase the interest rate and lead to appreciation, a profitability squeeze and slower capital accumulation. We will discuss these kinds of effects later.

4. Path independence and long term growth: a benchmark model

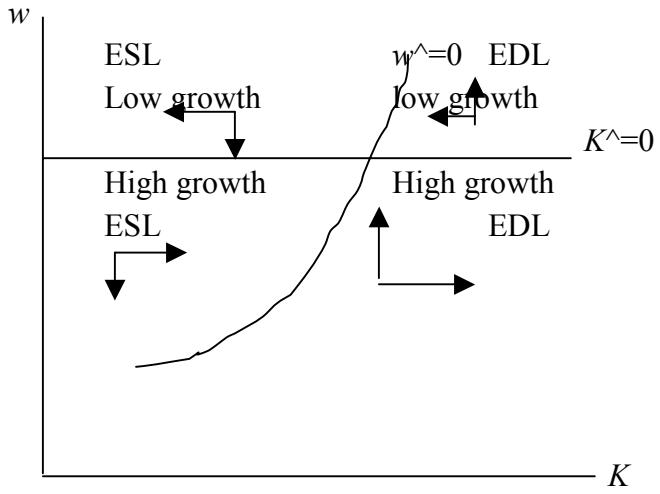
We shall assume now that the economy converges to a normal path determined by supply factors and address, in this context, the second assumption implicit in orthodox views: that the normal path of output is independent from the size of the aggregate demand contraction. To illustrate this independence we use a neoclassical open economy model with two sectors[6]. One of them produces traded goods with capital and labor under constant returns to scale and operates under atomistic competition facing perfectly elastic demand curves at prices determined in the international market. Capital accumulation in this sector depends on the difference between the domestic profit rate and a risk adjusted international profit rate. The other sector is an informal economy producing non-traded goods with labor under diminishing returns. In this sector there is ease of entry, workers earn the average product of labor and the wage is fully flexible. By contrast, in the traded goods sector the wage is predetermined and varies according to the wage differential between the two sectors. For the time being, we assume away open unemployment so that workers that do not find a job in the traded goods sector work in the informal non-traded goods sector.

Figure 2 shows the determination of the steady state values of the capital stock and the product wage in the traded goods sector. The $w^ = 0$ curve of stationary wages is a locus of labor market equilibrium. Along this locus, the wage in the traded goods sector is equal to the average product of labor in the non-traded goods sector so that there are no downward or upward pressures on the wage. The curve is upward sloping: an increase in the capital stock raises the demand for labor in the traded goods sector and the wage in the non traded sector, and a higher product wage is required to restore equilibrium in the labor market. Above the curve, the wage in the traded goods sector is higher than labor

income in the non-traded sector and competition among workers exerts downward pressure on the wage. There is excess supply of labor in the sense that involuntarily underemployed workers in the informal sector are willing to work in the traded goods sector at the prevailing wage and do not find jobs. Below the curve, a relatively low wage generates excess demand for labor in the labor market.

The K^ = 0 line of stationary capital stocks shows the value of the wage for which the associated profitability yields an equilibrium rate of capital accumulation (equal to the depreciation rate or to depreciation plus the rate of growth of the labor force in the case of positive population growth)[7]. This steady state value of the wage is unique under the assumption of constant returns to scale and thus the locus is horizontal. Above the line, with a high wage, profitability is low and the capital stock contracts; below the line profitability is high and the capital stock expands. The two curves thus divide the (wage, capital stock) space into the four disequilibrium regions indicated in the figure.

Figure 2

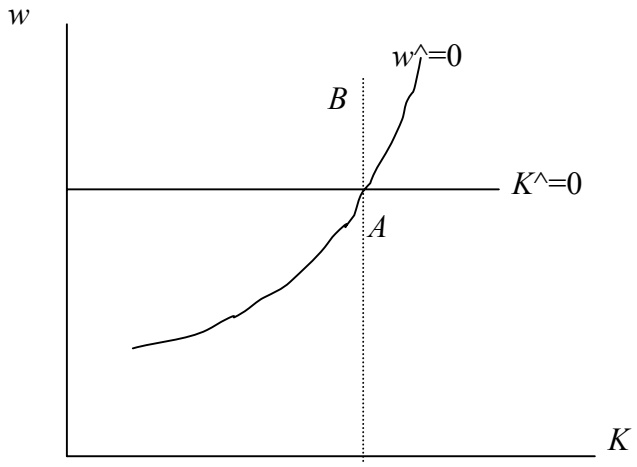


How does the economy converge to the steady state? With instantaneous wage adjustments the economy would always be on the labor market equilibrium curve and converge to the steady state along this locus, either from below when the capital stock is relatively small or from above when the capital stock is larger than its steady state value.

This is the equilibrium full employment path of the standard neoclassical growth model. With sluggish wage adjustments, there will be "disequilibrium paths" that converge to the steady state. Figure 3 shows one such path. Under constant returns to scale, a positive effect of the capital stock on the rate of change of wages and a negative effect of the wage on the rate of capital accumulation are sufficient to guarantee the stability of the steady state equilibrium.

Consider now the effects of a contractionary monetary policy that, starting from the steady state position, causes the domestic currency to appreciate. The (perfectly elastic) demand curve for the traded good shifts down and the sector's product wage increases from A to B in figure 3. The sector's employment falls with a contractionary multiplier effect on the demand for non-traded goods. With flexible wages in this sector, their level falls below the wage in the traded goods sector. The economy is in the region of excess supply of labor and low growth. The increase in the wage differential exerts downward pressure on the wage. As the economy converges to the steady state, the fall in the wage eventually restores the level of employment in the traded goods sector (thus eliminating involuntary underemployment in the informal sector) as well as profitability. The key point in our context is that the levels of the wage, employment and capital stock to which the economy converges are unaffected by the size of the initial contraction. The steady state is independent of the actual path followed by the economy after the contraction.

Figure 3



How fast is the initial level of employment reestablished? Employment in the traded goods sector is subject to two opposite forces during the process of adjustment. First, as the wage falls, employment recovers. To the extent that the wage tends to fall faster the larger the initial disequilibrium, and since (other things being equal) employment grows more rapidly the faster the wage falls, employment recovers at an initially high rate (which is higher the larger the initial contraction) that falls over time as the initial level of employment is reestablished. Other things are not equal, however, because another force is in operation. Since the economy fell in the region of low profitability, the capital stock contracts during the adjustment process and this slows down the recovery of employment. The speed of the recovery will thus depend on the speeds of adjustment of wages and the capital stock. Intuitively, with fast wage adjustments and slow capital stock adjustment the model produces the spring theory result: the larger the size of the initial contraction, the faster the return to the steady state.

In this benchmark model, the reestablishment of labor market equilibrium is achieved through wage deflation in the context of positive competitiveness effects that are guaranteed in our model by perfectly elastic demand curves facing firms in the traded goods sector. In the extensions presented in the following sections these effects operate unchecked but while the economy returns to labor market equilibrium, this equilibrium may be different from the initial one and in particular take place at a lower level of output. It is worth noting, however, that the return to labor market equilibrium (to the normal full employment path) and thus the recovery of employment after the initial contraction may actually be offset by a number of effects discussed in section 1. With less than perfectly elastic demand curves, wage deflation will lead to price deflation and in such conditions the economy may not converge to a full employment path in the long run. In the absence of such convergence, the path of the economy in the longer run is determined in part by aggregate demand, and it does not spring back to its normal full employment path.

5. Hysteresis effects in labor markets

In this section we discuss a number of reasons relating to the labor market why the economy may not converge to the unchanged long-run equilibrium in the manner discussed in the previous section. The reason for this is that departures from long-run equilibrium unleash forces that change the position of the long-run equilibrium itself. These reasons have been – somewhat inaccurately – called hysteresis effects in the literature, and we use that terminology here.[8]

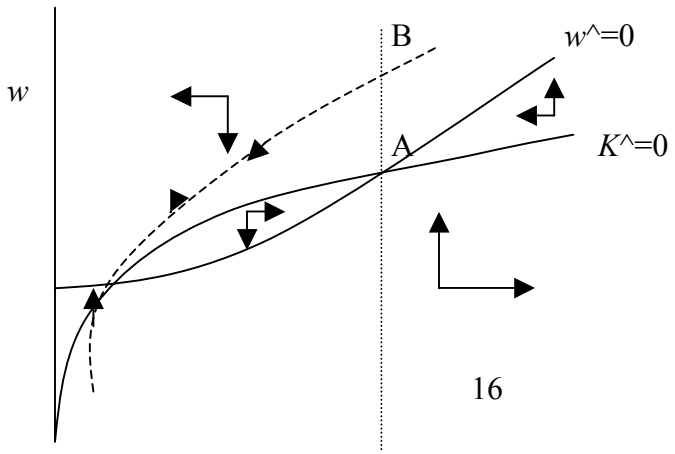
One mechanism of hysteresis that has received some attention in the literature draws on the idea that unemployment leads to a loss in worker quality. Explanations of such effects include the depreciation of human capital due to not using skills, and erosion of the work ethic due to not going to work (see, for instance, Tobin, 1972 and Hargreaves-Heap 1980). Price (1988) models this effect by assuming that effort or worker efficiency depends on the unemployment rate. We can incorporate this mechanism into our model without introducing open unemployment, by assuming that the efficiency of workers depends on the proportion of workers who are employed in the traded goods sector.[9] The high incidence of disguised unemployment in the form of informal sector employment and the fact that such employment often requires rudimentary or no skills and flexible working conditions makes this interpretation particularly suited to less-developed countries. Our assumption that worker efficiency depends on the proportion of workers employed in the formal traded goods sector can be justified with the simple story that all workers are identical and that they spend a proportion of their time in the informal non-traded goods sector. Each period a given fraction of all employed workers randomly lose their jobs (due to exogenous firm closings), and the workers employed in the informal sector are randomly chosen when job vacancies arise.

We modify the implicit assumption of our model in the previous section that workers have a given efficiency by the assumption that efficiency depends on the ratio of workers employed in the traded goods sector. Although when making hiring decisions firms in the traded goods sector take the efficiency of workers to be parametrically given, when they actually hire more workers, the efficiency of workers increases. As shown in the

appendix, this modification does not fundamentally alter the w^=0 locus: it is still positively sloped for the same reason that it is in the previous section, although it now takes into account the efficiency-employment link. The K^=0 locus now becomes positively sloped. Given the real product wage in the traded goods sector, an increase in the capital stock in the traded goods sector increases employment in that sector, and this, by increasing worker efficiency increases the rate of profit in the sector. The rise in the rate of profit leads to a rise in the rate of growth of the stock of capital, which has to be curtailed and brought back to zero by increasing the product wage. Under the assumption that the productivity-increasing effect of the higher employment rate diminishes with increases in employment, the curve will be concave from below: at higher levels of capital stock a smaller increase in the product wage will be required to offset the effect of increases in capital stock.

Various configurations of the two curves are now possible. One of them is shown in Figure 4, where the K^=0 curve intersects the w^=0 curve twice. With multiple equilibria, the key difference with the benchmark model is that the high level steady state is no longer a globally stable equilibrium. As illustrated in figure 4, along with a high-wage locally stable equilibrium with a large capital stock (point A), there is a locally stable equilibrium with a low wage equilibrium and no capital stock (point D). The interior equilibrium at the intersection with a low capital stock (point C) is a saddle point. The corresponding saddle path limits a corridor of stability outside which shocks to the high wage economy can generate, as we shall see, a process of cumulative decline in the capital stock.

Figure 4



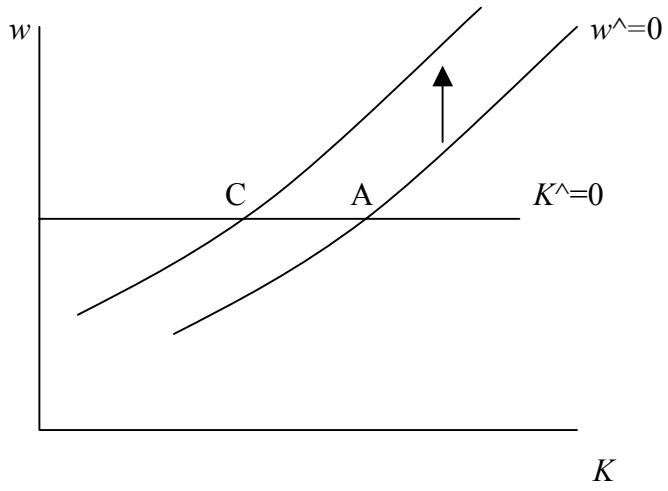
Suppose that multiple equilibria exist. In this case, if we start at the long-run equilibrium position at *A*, contractionary monetary policy reduces the exchange rate and increases the product wage. If the economy is pushed to a point like *B*, it will find itself in a path on which a return to the long-run equilibrium at A will no longer be possible. Instead, it will be on a path on which the product wage and the stock of capital will fall steadily. The traded good sector will contract over time, and the non-traded good sector becomes home to a larger and larger proportion of workers. The reason for this denouement is that the increase in the product wage and the fall in the rate of profit reduces the level of capital in the traded good sector, which reduces traded sector employment and skills in the economy. This reduction in skills reduces the rate of profit further, bringing about a cumulative decline. Actual economies do not, of course, have to behave in this knife-edge fashion, where an increase in the real wage beyond a certain level will bring about an irreversible contraction: a number of factors not taken into account in our simple model could arrest the decline. However, our sharp caricature does, in our opinion, capture and important aspect of real economies.

A second mechanism that produces hysteresis can also be depicted using our framework. This mechanism, which focuses on role of insiders (for instance, union members) in the labor market in determining wages, has also been widely discussed in the literature following the pioneering work of Blanchard and Summers (1987). Insider power can be captured in our model by introducing wage bargaining in the traded goods sector in our model, which can be captured as a parameter in the wage adjustment equation. The presence of wage bargaining implies that the wage in the traded goods sector need not be equal to that in the non-traded goods sector for there to be no change in the former. Instead, a stationary traded goods sector wage can be consistent with a wage premium in the traded goods sector. This wage premium, in turn, can respond to conditions in the labor market. When the level of employment in the traded goods sector is low for some

time insiders who are employed will try to obtain a higher wage premium to increase their wages at the expense of greater unemployment. This causes hysteresis.

This effect is shown in Figure 5. We abstract from the efficiency effects discussed earlier in this section, so that we return to the case of a horizontal $K\hat{}=0$ curve. Stabilization policy which increases the product wage in the traded goods sector and causes a reduction in traded-sector employment if wage adjustment is slow, result in an increase in the wage premium as insiders bargaining for wages which represent the interests of the insiders. This increase in the wage premium shifts the $w\hat{}=0$ locus upwards, so that the long-run equilibrium position from A to C. At the new long-run equilibrium the capital stock and traded sector employment will be lower to make the non-traded sector employment higher and the wage lower to make it consistent with the higher wage premium.

Figure 5



Besides the classic and amply discussed experience of Western Europe after the growth slowdown of the 1970s (see Blanchard and Summers,1987), hysteresis effects appear to have been present as well in the recent Latin American experience. In the early 1980s, the highly indebted economies in Latin America were subject to large negative aggregate demand shocks and for the rest of decade remained severely constrained by low levels of demand associated to credit rationing in international capital markets. This “lost decade”

led to increased unemployment and underemployment and a reduction in living standards. Although other factors have also been at work, the demand shocks of this period appear to have had ratchet effects on poverty and unemployment. Poverty rates increased during the 1980s from 40.5% to 48.3% on average and fell with the recovery of growth (to 43.5% in 1997). However, the poverty rate associated to a given level of GDP per capita was in the mid 1990s almost 6 percentage points higher than in 1980 before the debt crisis (Ocampo, 2002). Among the many factors responsible for these ratchet effects on poverty, a significant and perhaps dominant one has been higher unemployment and its negative effects on the skills of the labor force. The average unemployment rate in Latin America in the late 1990s, at the end of the decade of growth recovery, was still higher than in the late 1980s (see table 1).

Table 1. Urban unemployment and wage differential

	1990	c.2000	Change	c.1990	c.1999	Change
Panama	20.0	15.2	-4.8	2.93	3.14	1.07
El Salvador	10.0	6.5	-3.5	3.79	3.60	0.95
Guatemala	6.3	3.8	-2.5	3.79	4.45	1.17
Honduras	7.8	5.3	-2.5	5.13	3.34	0.65
Mexico	2.7	2.2	-0.5	2.19	3.32	1.52
Costa Rica	5.4	5.3	-0.1	2.46	2.53	1.03
Bolivia	7.3	7.6	0.3	3.46	2.90	0.84
Latin Am 1/	9.8	10.3	0.5			
Venezuela	10.4	11.3	0.9	2.12	3.32	1.57
Chile	7.8	9.2	1.4	4.05	4.87	1.20
Nicaragua	7.6	9.8	2.2	2.53	2.76	1.09
Brazil	4.3	7.1	2.8	6.58	5.46	0.83
Paraguay	6.6	10.7	4.1	2.75	3.62	1.32
Uruguay	8.5	13.6	5.1	2.45	3.14	1.28
Argentina	7.4	15.1	7.7	2.14	2.47	1.15
Ecuador	6.1	14.1	8.0	2.85	3.72	1.31
Colombia	10.5	20.2	9.7	2.59	3.82	1.47

Associated to this phenomenon is an increase in wage inequality. As shown in table 1, with only one exception all Latin American countries with significant increases in unemployment (more than 0.5 percentage points) recorded an increase in the wage differential between skilled and unskilled labor and in most of them the increase is of the order of 20 percent or more. By contrast, in all countries with significant reductions in unemployment or stagnant unemployment rates, the wage differential falls or, with one exception, increases by 17 percent or less[10]. The increase in the wage premium along with a path dependent increase of unemployment and underemployment are exactly the predictions of the second extension of our model presented above.

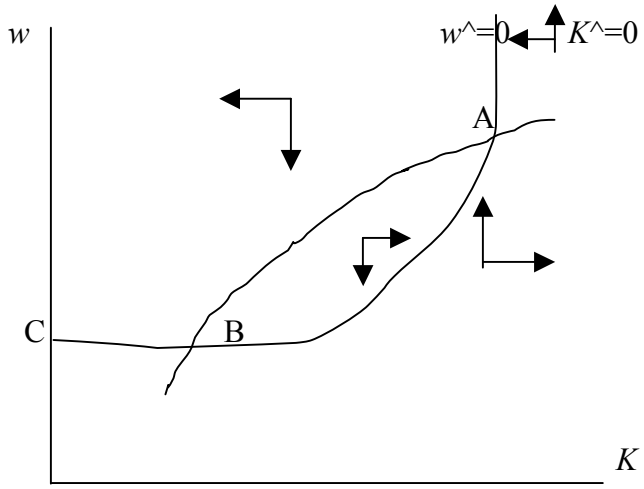
5. Increasing returns and multiple equilibria

We now assume the existence of increasing returns to scale in the technology of the traded goods sector[11]. Increasing returns are due to technological externalities associated to the size of the capital stock. Cumulative investment enhances learning by doing and this increases the productivity of the sector as a whole. The presence of increasing returns generates an upward sloping K^ = 0 locus: an increase in the capital stock raises the profit rate at each level of the wage (due to the external productivity effects of the capital stock); an increase in the product wage is thus required to restore profitability to the level consistent with a stationary capital stock. As before, above the locus, with a high wage, profitability is low and the capital stock contracts; below the locus profitability is high and the capital stock expands. Note that although the shape of the $K\hat{}=0$ locus is the same as in the model with endogenous efficiency discussed in the previous section, the reason why it is upward-rising here is quite different. In the previous section the positive slope was due to the loss of skills caused by loss of employment in the traded goods sector. In the model of this section it is due to the nature of the production process within the traded goods sector.

Depending on the precise shape of the two loci there is again the possibility of multiple equilibria. Consider in this case the effects of a contractionary monetary policy. In the

absence of instantaneous wage adjustments, the effect is to produce a real overvaluation of the domestic currency, a profitability squeeze and a contraction of employment in the traded goods sector. The economy falls in the region of slow growth and excess supply of labor. Now as the capital stock contracts, productivity falls and the increase in profits resulting from the downward adjustment of wages may now be offset by the reduction in profits resulting from the fall in productivity. The economy then remains in the region of slow growth and excess supply of labor even after the wage falls below the high-level equilibrium value and the real exchange rate has returned to its initial level. The economy may then converge to the low level steady state with lower wages[12].

Figure 6



Such an outcome may happen as a result of a combination of slow wage adjustments and rapid capital stock adjustments or a large aggregate demand contraction. In any case the presence of increasing returns is critical to the outcome: it is the presence of increasing returns that explains why the pre-contraction levels of profitability and capital accumulation fail to be restored despite the fall of the product wage below values prevailing before the contraction. With constant returns the locus of stationary capital stocks is horizontal and the whole region below the (unique) equilibrium wage is one of high profitability. Thus, if product wages fall below the equilibrium level, profitability will be sufficiently high to trigger a recovery of capital accumulation. Unlike what

happens in the benchmark model, the size of the initial shock now matters: when the shock is sufficiently large it puts the economy outside the corridor of stability and it no longer springs back to the high level steady state.

The mechanisms at work in the cumulative contraction of the tradable goods sector are illustrated by a number of experiences of trade liberalization cum real exchange rate appreciation causing a negative demand shock on the import-competing sectors of the economy (see Damill, Frenkel and Maurizio, 2002, for Argentina in the 1990s; Ros and Skott., 1998, for Chile in the 1970s and Mexico in the 1990s; Ffrench-Davis and Agosin, 1993, for Chile and other Latin American countries; Ros,1995 and 2001, for Mexico in the 1990s). In all these cases, exchange rate policy was assigned to price stabilization objectives while, at the same time, the authorities undertook a radical trade reform. The model in this section captures the key stylized facts in these experiences. First, the relative price of imported goods falls causing a contraction of output demand and employment in the traded goods sector. This happens despite a significant improvement in export performance. Given nominal wages in the tradable goods sector, the adjustment involves an expansion of employment in the non-tradable goods sector which reduces productivity and wages in that sector. Illustrate with Mexico 1988-94 and Argentina in the 1990s. Second, even if the initial relative prices are reestablished in the long run, through competition in the labor market and cost reductions, the displacement of local production by imports may have cumulative effects which lead to long lasting consequences on employment and real wages in the import-competing and non tradable goods sectors. Illustrate with Argentina's fall in real wages in the 1990s. These hysteresis effects are also typically reflected in a sharp and permanent increase of the ratio of imports to domestically produced import-competing goods. Finally, the intensified competition in the domestic market leads to a fall in profit margins in the import competing sectors. The profitability squeeze tends to reduce investment in this sector — typically investment remains far below its historical levels — with negative long run effects on employment as sluggish output growth (less than one percent in Chile 1974-1981 and Mexico 1990-94) produces increasing rates of underemployment and open

unemployment. Manufacturing employment and overall unemployment in Argentina in the 1990s.

In all three cases the experience culminated in a major balance of payments and financial crisis that forced the authorities to massively devalue the currency (Chile, 1982; Mexico, 1994; Argentina, 2001). In the case of Chile and Mexico this massive devaluation launched the economy into a phase in which the rate of capital accumulation accelerated, unemployment and underemployment fell and real wages eventually recovered.

7. Competitiveness and balance of payments constraints

Our third extension brings in balance of payments constraints into the model considered in the previous section. The trade deficit (normalized by the capital stock) can be expressed as:

$TD/K = I/K + d - sr$

Where: I/K = rate of (net) capital accumulation (equal to $K\hat{}$)

d = depreciation rate

s = propensity to save out of profits

r = profit rate

and we assume that workers do not save.

For a given $TD/K = (TD/K)\sim$, we have: $I/K = K\hat{} = sr - d + (TD/K)\sim$, where r as before is a negative function of the product wage in the traded goods sector and a positive function of the capital stock (due to the presence of increasing returns). Thus:

$$K\hat{} = sr\,(w, K) - d + (TD/K)\sim$$

The locus $K\hat{} = 0$ is now a locus of (w, K) combinations along which the economy's output is constrained by the given trade deficit and domestic savings are those

required to generate the equilibrium rate of accumulation [equal to d = sr +(TD/K)~] given the balance of payments constraint. As before, the locus slopes upwards. In the presence of increasing returns, an increase in the capital stock raises the profit rate and thus the overall savings rate at each level of the wage; an increase in the product wage is thus required to reduce savings to the level consistent with a stationary capital stock. Above the locus, low profits generate insufficient savings and therefore a contraction of the capital stock; below the locus, high domestic savings allow for an expansion of the capital stock. The position of the locus is affected by the given trade deficit and the rate of depreciation of the capital stock. A relaxation of the balance of payments constraint shifts the locus upwards and leads the economy to a new steady state with a larger capital stock and higher wages. A higher depreciation rate has opposite effects as the locus shifts downwards and the given balance of payments constraint reduces the steady state level of the capital stock.

As before, we have the possibility of multiple equilibria. The effects of a contractionary monetary policy are to produce a real overvaluation of the domestic currency, a reduction of the domestic savings rate and a contraction of employment in the traded goods sector. The economy falls in the region of low savings and excess supply of labor. As the capital stock contracts, productivity falls and the increase in profits and savings resulting from the downward adjustment of wages may now be offset by the reduction in profits and savings resulting from the fall in productivity. As long as economy is stuck in the region of low savings and excess supply of labor, there is a deterioration of the growth-balance of payments trade off: with the same trade deficit the economy's rate of accumulation falls below the equilibrium rate as a result of the contraction of domestic savings. The process involves a negative competitiveness effect because the loss of productive capacity implies that the economy requires a larger level of net imports to sustain a given level of production. Eventually, the economy may converge to a lower level steady state with a smaller capital stock, lower output level and wages and the same trade deficit. The same trade deficit is now generated at a lower output level.

In related models, other, perhaps more important, mechanisms operating during the process of adjustment can generate path dependent outcomes (see Palley, 2003 for a review of the issues and related literature). As a result of overvaluation, output in the exportable and importable goods sectors is lost. Exporting and import-competing firms are driven out of domestic and foreign markets and start-up investments as well as organizational capital are irreversibly lost. Consumers become addicted to newly imported goods and the propensity to import rises. As a result of these effects, to generate the same trade balance the real exchange rate has to be higher than before the shock. Thus, even if the economy returns to a steady state with the same product wage and capital stock as before the shock, the real consumption wage will be lower as a result of the higher real exchange rate and with it the standard of living will also be lower. In the final equilibrium, the level of real income (adjusted for the terms of trade) is lower at the same level of the trade deficit.

The contraction of savings, the reduction in competitiveness and the resulting deterioration of the growth-trade balance trade off is illustrated by the performance of the Mexican economy and more generally of Latin America as a whole in the years following the end of the debt crisis (see Ros, 1995, and for Latin America, Ocampo, 2002). By the early 1990s, the Mexican economy was generating trade deficits that were larger than those of the early 1980s, despite a higher real exchange rate and lower growth rates and levels of capacity utilization. Part of this structural deterioration was the consequence of the fall in oil revenues following the collapse in oil prices in 1986 but another part, of the same order of magnitude, was attributable to the structural decline in the non-oil trade balance. This in turn was closely associated to a sharp decline in private savings (from 18.1% of GDP in 1988 to 11.3% in 1991). As in the model of this section, a major factor behind the fall in private savings appears to have been the profitability squeeze that the traded goods suffered in the context of a trade liberalization cum real exchange rate appreciation experience. Ocampo (2002) has shown that a similar deterioration of the growth-trade balance trade off occurred in Latin America as a whole from the 1980s to the 1990s. In the pre-debt crisis period 1971-80 Latin America's GDP grew at an average rate of 6% per year generating a trade deficit of the order of 1% of GDP. In 1991-97, with

a similar trade deficit the economy was growing at a rate slightly above 3%. Even worse, during the "lost half decade" from 1997 to 2002, the trade deficit was again of the order of 1% of GDP but the economy was able to grow only at the slow pace of 1% per year.

8. Conclusions

(to be written)

This paper has provided a critique of the assumptions underlying the "spring theory" of stabilization and growth and illustrated with a number of experiences the irreversible effects on output that large contractions of aggregate demand can have.

Appendix

A.1 Demand-determined growth model

One good is produced with two factors – labor and capital – using a fixed coefficients technology. Firms set their price as a markup on labor costs maintaining excess capital, adjusting output to demand. The price level is given by

$$p = (1+z)wa, \qquad (1)$$

where p is the price level, w the money wage, z the markup rate and a the labor-output ratio. The level of capacity utilization, given by $u = Y/K$, where Y denotes output and K the stock of capital, is assumed to be always lower than the technologically feasible amount: we therefore have persistent excess capacity.

The demand for goods consists of consumption, investment and government demand, assuming a closed economy. Assuming, for simplicity, that all wage income is consumed, and a constant fraction, s, of profit or non-wage income is saved, real consumption is given by

$$C = \mathrm{T}\ Y + (1-s)\ (1-\mathrm{T})\ Y = [1-s(1-\mathrm{T})]Y, \qquad (2)$$

where $\mathrm{T} = (w/p)a$ is the labor share in income, and 1-T the profit share. Real investment demand as a fraction of capital stock is given by

$$I/K = g = b_0 + b_1\ (1-\mathrm{T}) + b_2\ u - b_3\ (i-p\hat{}) + b_4\ 9 \qquad (3)$$

Government expenditure is taken to be a fixed as a ratio of capital, or

$G/K = ..$

The Central Bank is assumed to fix the interest rate and to supply money to meet the demand for it. The loan market clears the variations in the quantity of money, which is assumed to have no other effects on spending. Inflation is assumed to depend on the gap between the wage share firms desire and the actual wage share, so that

$$p\hat{} = 7\ (T - T_f), \tag{4}$$

where, T_f is the share of wages desired by firms which is assumed to depend inversely on the interest rate (since firms desire to increase their share of income to meet higher interest payments).

In the short run capacity utilization adjusts to meet the demand for goods, with the wage share, T, and the stock of capital, *K*, taken to be given. In short-run equilibrium, in which the goods market clear, we therefore obtain

$$u = [b_0+b_1(1-T)-b_3(i-p\hat{})+b_4\vartheta+.]/[s(1-T)-b_2], \tag{5}$$

where $p\hat{}$ is obtained from equation (4). For short-run stability, we assume that $s(1-T)>b_2$ which is the standard condition that saving is more responsive to changes in capacity utilization than is investment. The short-run equilibrium rate of capital accumulation, abstracting from depreciation, is obtained by substituting equation (5) into equation (3). A rise in the interest rate reduces investment and capacity utilization, (provided that it does not raise inflation sufficiently to depress the real interest rate, which we assume does not occur), and increases the inflation rate. A rise in government expenditure, shown by ., increases capacity utilization and the rate of accumulation. A rise in the wage share increases the inflation rate (see equation (4)), and has a positive effect on capacity utilization by redistributing income to wage earners who have a higher propensity to consume than profit recipients, and by reducing the real interest rate. It has an ambiguous effect on investment, because of the profit-squeeze effect on investment through the term with b_1 may be stronger than the accelerator effect through the term with b_2. A higher rate of technological change, shown by an increase in ϑ will increase the rates of investment and capacity utilization

In the longer run the wage share changes according to the equation:

$T\hat{} = w\hat{} - \vartheta - p\hat{}$,
(6)

since ϑ is the rate of growth of labor productivity. The rate of change in the money wage is given by

$$w\hat{} = N_1 (T_T - T) + N_2 p\hat{} + N_3 \vartheta, \qquad (7)$$

where N_i are positive, which shows that the rate of change in wages increases with the gap between the targeted wage share of workers, T_T, and the actual share, and with the inflation rate (although with a coefficient of less than one to take account of lags in wage adjustment) and the rate of productivity growth. The targeted wage share, in turn, is assumed to be positively related to conditions in the labor market which are proxied by the rate of capacity utilization: T_T rises with *u*. The rate of technological change is positively related to the investment rate, so that

$$\vartheta = \vartheta_0 + \vartheta_1 g. \qquad (8)$$

Substituting from equations (4), (7) and (8) into (6), we get

$$T\hat{} = N_1 T_T + (1-N_2)8 T_f - (1-N_3) (\vartheta_0 + \vartheta_1 g) - [N_1+(1-N_2)8]T. \qquad (9)$$

It should be remembered that here T_T depends positively on *u*, T_f positively on the interest rate, and *g* on a variety of short-run parameters, including T. We assume that M_3 is close to unity (so that the money wage increases close to the rate of productivity growth). The long-run equilibrium value of T occurs when

$$T\hat{}=0 \qquad (10)$$

is satisfied in equation (9). We assume that the equilibrium is a stable one, the main requirement for which is that a rise in T does not increase T_T sufficiently to cause an explosive increase in the wage share.

The long-run impact of changes in the parameters of the model are found by examining the effects of changes in them on the long-run equilibrium value of T in equations (9) and (10), and then examining the effects of this on the equilibrium values of capacity utilization, inflation and investment from equations (5), (4) and (3), taking into account these changes in T. Stabilization policy that reduces the value of . will reduce capacity utilization and the rate of accumulation in the short run. In the long run it will reduce the wage share by reducing the wage targeted by workers. This fall in the wage share will reduce capacity utilization further in the long run. If the change in capacity utilization has a negative effect on investment (through strong accelerator effects), this will also slow down capital accumulation and technological change. Lower inflation is achieved by reducing the wage share, as shown in equation (4), but at the cost of possibly lower growth and rising inequality. Growth may increase if the profitability effect (through the profit share) on investment is strong enough. Stabilization policy that

increases the interest rate will also reduce the long-run equilibrium real wage by reducing capacity utilization and the targeted wage of workers, and through its effect on the targeted wage share of firms noted earlier. The fall in the wage share will exacerbate the contractionary effect of stabilization on capacity utilization in the long run. If the accelerator effects are stronger than the profit share effect on investment, there will be a slowdown in growth in the long run. Inflation may be curtailed because of the fall in the wage share, but even this cannot be guaranteed if the fall in T_f due to the rise in i is strong enough.

A.2 The benchmark model

The economy has two sectors, a formal sector producing traded goods (T) with capital and labor and a non-traded (N) goods informal sector where workers earn the average product of labor and produce without any capital. Technology in the traded goods sector is described, for simplicity, by a standard Cobb-Douglas production function:

$$T = A\, K^{\alpha}\, L_T^{1-\alpha} \tag{11}$$

where T is the production of traded goods and K and L_i refer respectively to the capital stock in the traded goods sector and employment in sector i.

Given the stock of capital, employment in the traded goods sector (L_T) is determined by profit maximization under competitive conditions and price-taking behavior:

$$L_T = [(1-\alpha)\, A\, (p_T/w_T)]^{1/\alpha}\, K \tag{12}$$

where p and w denote prices and wages. We shall assume that p_T is determined by the world market price of the traded good (p^*) and the nominal exchange rate (e): $p_T = ep^*$

Non-traded goods production (N) is generated by the informal sector under conditions of diminishing returns to labor and, to simplify, we assume away the use of capital in this sector so that labor (L_N) is the only input:

$$N = L_N^{1-\delta} \qquad 0 < \delta < 1 \tag{13}$$

Workers who do not find a job in the formal sector work in the informal sector earning an income equal to the value of the average product of labor. Thus,

$$L_T + L_N = L \tag{14}$$

$$w_N = p_N L_N^{-\delta} \tag{15}$$

where L is the total labor force.

The money wage in the traded goods sector is predetermined at any point in time, but the competitive pressures in the labor market influence the growth of the wage in the traded sector. The lower the relative wage in the non-traded goods sector, the stronger the downward pressure on wages in the traded goods sector:

$$w_T\hat{} = f(w_N/w_T) \qquad f' > 0, f(1) = 0 \tag{16}$$

On the demand side, the following conditions are satisfied. Workers do not save and the propensity to save out of profits (s) is constant. Thus,

$$P_N C_N + p_T C_T = w_N L_N + w_T L_T + (1\text{-}s)\, P \tag{17}$$

where C_i denotes consumption of good i and P is total profits. Our Cobb-Douglas formulation implies that profit is given by:

$$P = \alpha p_T T = \alpha/(1\text{-}\alpha) w_T L_T \tag{18}$$

The non-traded good is used for consumption only. Equilibrium requires then:

$$N = C_N \tag{19}$$

The utility function has a constant elasticity of substitution (σ) between T and N goods so that:

$$C_T/C_N = \mathrm{B}\,(p_N/p_T)^{\sigma} \tag{20}$$

Net investment in the traded goods sector is a function of the difference between the current profit rate (r) and a risk-adjusted international profit rate (r^*) assumed to be exogenous. Thus:

$$K\hat{} = g(r - r^*) \qquad g' > 0 \text{ and } g(0)=0. \tag{21}$$

where the following expression for r is obtained from (11) and (12):

$$r = A^{1/\alpha}\,\alpha\,(1-\alpha)^{(1-\alpha)/\alpha}\,(p_T/w_T)^{1-\alpha)/\alpha} \qquad (22)$$

We now turn to the behavior of the wage in the traded goods sector as a function of the two state variables, $w = w_T/p_T$ and K. We first derive expressions for the demand and supply for labor in the non-traded goods sector. For given values of p_T, w_T and K, equation (12) determines L_T. Using (13), (15), (17), (18) and (19), the value of C_T can be found as a function of w_T/p_T and K:

$$C_T = [(1-\alpha)A]^{1/\alpha}\,(1-s\alpha)/(1-\alpha)\,(w_T/p_T)^{-(1-\alpha)/\alpha}\,K \qquad (23)$$

Combining this expression for C_T with equations (13), (19) and (20) yields an expression for the demand for labor in the informal sector as a function of K, w_T/p_T and w_N/w_T:

$$L_N = L_N^D\,(K, w_T/p_T, w_N/w_T) \qquad L_N^D{}_1 > 0,\ L_N^D{}_2,\ L_N^D{}_3 < 0 \qquad (24)$$

An increase in the capital stock, which raises L_T and C_N, generates a higher demand for labor in the informal sector. A higher product wage in the traded goods sector has the opposite effect by decreasing employment in the traded goods sector (and thus C_N). A narrowing of the wage differential (higher w_N/w_T) reduces the demand for L_N by increasing the relative price of the non traded good.

Equation (24) is derived from the demand conditions for the non-traded good. From the supply side, equation (14) yields an expression for the supply of labor to the non-traded goods sector:

$$L_N = L - L_T$$

Substituting from (12), we get:

$$L_N = L_N^S\,(K, L, w_T/p_T) \quad L_N^S{}_1 < 0,\ L_N^S{}_2,\ L_N^S{}_3 > 0 \qquad (25)$$

A higher capital stock and lower product wage in the traded goods sector reduce the supply of labor to the informal sector by increasing employment in the formal sector. A larger labor force has the opposite effect, i.e., other things being equal it increases the supply of labor to the informal sector.

From (24) and (25), assuming equilibrium in the non traded good market, we can solve for w_N/w_T as a function of K, and w_T/p_T:

$$w_N/w_T = \Phi\,(w_T/p_T, K) \qquad \Phi_1 < 0,\ \Phi_2 > 0 \qquad (26)$$

Uisng (16) and (26), we get:

$$w\hat{} = (w_T/p_T)\hat{} = F\,(w_T/p_T, K) \qquad F_1 < 0,\ F_2 > 0 \qquad (27)$$

The movement of the capital stock is derived using the expression for the profit rate (22) and equation (21) for net investment:

$$K\hat{} = G\,(w_T/p_T) \qquad G_1 < 0 \qquad (28)$$

A.3 Models with hysteresis effects in labor markets

For the first model we assume that the technology available to the traded goods sector is given by

$$T = A\,K^{\alpha}\,(EL_T)^{1-\alpha} \qquad (11')$$

where E, which denotes the efficiency of traded-goods sector workers is given by

$$E = (\underline{L}_T/L)^{\gamma} \qquad \text{with } 0 < \gamma < 1,$$

and where $\underline{L}_T$ is the sector-wide, average level of employment. The inequality restriction implies diminishing returns to efficiency increases due to a higher employment rate.

The equation for the profit rate becomes:

$$r = A^{(1+\gamma)/[\alpha-\gamma(1-\alpha)]}\ \alpha(1-\alpha)^{(1+\gamma)(1-\alpha)/[\alpha-\gamma(1-\alpha)]}\,(K/L)^{((1-\alpha)/[\alpha-\gamma(1-\alpha)]}\,(p_T/w_T)^{(1+\gamma)(1-\alpha)/[\alpha-\gamma(1-\alpha)]} \qquad (22')$$

We assume that $\gamma < \alpha/(1-\alpha)$, imposing an upper limit to the efficiency effect. This implies, given the product wage a higher capital stock increases the rate of profit because it implies a higher level of trade-sector employment, which increases worker efficiency in the sector.

Combining (22') with (21) yields the differential equation describing the movement of the capital stock:

$$K\hat{} = G\,(w_T/p_T, K) \qquad G_1 < 0,\ G_2 > 0 \qquad (28')$$

which yields an upward sloping $K^{\wedge} = 0$ locus. In long-run equilibrium we have $r = r^*$, so that, using equation (22') we can write

$$(w_T/p_T) = \xi^{[\alpha-\gamma(1-\alpha)]/(1+\gamma)(1-\alpha)} K^{\gamma/(1+\gamma)}/r^*,$$

where

$$\xi = A^{(1+\gamma)/[\alpha-\gamma(1-\alpha)]} \alpha(1-\alpha)^{(1+\gamma)(1-\alpha)/[\alpha-\gamma(1-\alpha)]} L^{-\gamma(1-\alpha)/[\alpha-\gamma(1-\alpha)]}$$

This equation implies that the $K^{\wedge}=0$ locus is concave from below.

The $w^{\wedge}=0$ locus will have the same qualitative properties as the locus of in the benchmark case, although its precise form will be different, since it will also depend on the value of γ.

For the second model, we modify the wage change equation as follows:

$$w_T^{\wedge} = f(\theta w_N/w_T) \qquad f' > 0, f(1) = 0, \theta>1. \tag{26'}$$

We assume that then L_T falls (because w_T/p_T rises and K falls – see equation (22)) and stays at a lower level (than the initial long-run equilibrium level) for a while, θ rises, pushing up the $w^{\wedge}=0$ curve upwards. The new long-run equilibrium occurs at the same level of w as at the initial long-run equilibrium, but at a lower level of K and hence L_T, which is consistent with the higher level of θ. We do not explicitly examine the dynamics of θ, but assume that it moves at a speed much slower than changes in w and K. Thus, the fall in L_T is assumed to increase it, and then the long-run equilibrium is assumed to be reached without further changes in it.

A.4 The model with increasing returns and multiple equilibria

We assume that the source of increasing returns to scale are technological externalities associated to the size of the capital stock. The technology available to firms in the traded goods sector is now described by:

$$T = A (\underline{K})^{\mu} K^{\alpha} L_T^{1-\alpha} \qquad \alpha + \mu < 1 \tag{21"}$$

where $\underline{K}^{\mu}$ represents the external effect of the sector-wide, average capital stock. The inequality restriction implies the presence of diminishing returns to capital.

The equation for the profit rate now becomes:

$$r = A^{1/\alpha}\ \alpha\ (1-\alpha)^{(1-\alpha)/\alpha}\ K^{\mu/\alpha}\ (p_T/w_T)^{1-\alpha)/\alpha} \qquad (22'')$$

Given the product wage, the profit rate increases with the capital stock since a higher capital stock raises the sector-wide level of productivity in the presence of increasing returns.

Combining (22") with (21) yields the differential equation describing the movement of the capital stock:

$$K\hat{} = G\ (w_T/p_T, K) \qquad G_1 < 0,\ G_2 > 0 \qquad (28')$$

which yields an upward sloping $K\hat{} = 0$ locus. As in the previous case the $w\hat{}=0$ locus will have the same qualitative properties as in the benchmark model, although its precise form will depend on the value of μ.

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NOTES

[1] Introductory texts almost all use the framework but normally do not develop the AD and AS curves in detail. Intermediate texts develop them in detail, normally starting from IS-LM models for the AD curve, and from assumptions about wage rigidity and diminishing returns under perfect competition, or from the Philips curve relation for the AS curve. An example of a graduate text which uses the model is Romer (1996).

[2] A fall in the price level may not raise aggregate demand by bringing about a real depreciation of the currency. The Marshall-Lerner condition may not be satisfied in the short run in which the price elasticity of exports and imports may be low. Improvements in the trade balance – if they occur – may be offset by an appreciation in the nominal exchange rate in a flexible-exchange rate economy, thereby negating the real depreciation. Contractionary monetary policy, by raising the interest rate, may in any case cause capital inflows and nominal appreciation. Finally, domestic firms which face cash flow problems and possible bankruptcy, may be unable to take advantage of possibly higher export demand and increase exports.

[3] Many of the assumptions, including that of fixed coefficients, can be modified without changing the main conclusions.

[4] Fiscal contraction, by increasing the indirect tax rate can also have a similar consequence.

[5] In the case in which the supply of money is fixed in the short run, the change in high-powered money over time can be determined by the government budget deficit, and in long-run equilibrium the stock of capital to the stock of high powered money becomes constant. See Taylor (1991) for the details.

[6] The model, presented in Appendix, follows Ros and Skott (1998) under the special case in which the technology of the traded goods sector features constant returns to scale. Kouri (1979) presents a model along similar lines.

[7] With a growing population, the appropriate state variable would be the overall capital-labor ratio rather than the capital stock. For simplicity, we shall assume from now on that the steady state is a stationary state.

[8] In mathematics and physics the term is used to denote a particular type of effect on a system (output) when there is a change in some exogenous variable (input). The system is said to exhibit hysteresis or remanence when there is a permanent effect on the output after the value of the input is first changed and then brought back to its initial position (see Cross, 1993, Amable et. al., 1995). In economics the term is used to describe a variety of models which exhibit zero roots (in continuous time dynamic systems), unit roots (in discrete time dynamic systems), and endogeneity of the natural rate of unemployment (in macroeconomic models).

[9] Open unemployment, and the loss of efficiency due to both open and disguised unemployment, could be incorporated into the model along Harris-Todaro lines as discussed in Ros and Skott (1998).

[10] While the increase in the wage premium for skilled labor is generally interpreted as a result of a rapid increase in the demand for skilled labor in the 1990s, Ros (2001) shows that in the case of Mexico the demand induced contraction in the employment of unskilled labor in the face of a rapid increase in its supply was a major source of the increasing wage gap.

[11] This extension follows Ros and Skott (1998). For a related model with two traded goods, see Ros (2000, ch. 9).

[12] Similar conclusions can be derived from a model with a continuum of goods, a Ricardian technology and a Cobb-Douglas consumption pattern (see Krugman, 1987).