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Inflation, Output and Perfectly Enforceable Price Controls in Orthodox and Heterodox Stabilization Programmes

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Abstract

The paper deals with the success of price controls in stabilizing high inflation rates and their effects on the real economy under an imperfect competition setting derived by optimal maximization. Our model builds on Helpman's work of price controls and imperfect competition, and incorporates inflation inertia through adaptive expectations. The model predicts that under these circumstances price controls can be an effective method of curving inflation when they accompany an orthodox monetary restriction programme; incomes policies alone cannot curve inflation substantially. Efforts where monetary growth is decreased gradually and price controls are implemented to achieve zero inflation result in the boom-recession cycle observed in many real life programmes. When monetary growth is curved immediately and price controls are implemented to achieve zero inflation, there follows a recession and not a boom. Orthodox money-based stabilization programmes implemented on their own need more time to control inflation and always produce a recession.

Keywords: stabilization programmes, inflation, price controls

JEL classification: E64, E31

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1 Introduction

The study of the heterodox stabilization programmes of the 1980s, which used the exchange rate as a nominal anchor in combination with incomes policies, has yielded several theories to explain the boom-recession cycle observed in almost all of them (Rebelo and Végh 1995). These theories rely *inter alia* on the inertia of inflation (Aspe 1993 and van Wijnbergen 1988), on the perceived temporariness of the stabilization measures (Calvo and Végh 1994), and on supply side or wealth effects of a stabilization programme (Roldós 1995). In his work on the effects of a price freeze on an imperfectly competitive market, Helpman (1988) offers a different explanation of the boom-recession cycle. His insight has been that since these programmes were carried out in countries where the market structure was more likely to be imperfectly competitive, price freezes imposed on this type of economy can produce the boom-recession effects without resorting to credibility issues, inflation inertia or wealth effects. In Helpman's view, when the government artificially freezes a price, it sets that particular controlled price below the optimal price that firms would freely set. In a perfectly competitive market this would immediately increase demand and reduce supply by causing a recession and excess demand. In an imperfectly competitive market, the increase in demand brought about by the relative drop in prices can be satisfied by producers and still earn above normal profits. However, if the controlled price falls much below the optimal free price, firms will behave as in a perfect competitive market and will no longer find it profitable to satisfy demand; in fact they will cut production. Thus, in case the controlled price is at first not too far off the free price, production will increase and, as this gap increases, firms will reduce their production, so that a boom-recession cycle will appear due entirely to the fact that prices are controlled in an imperfectly competitive market.

The model we develop in the present paper deals not only with the effects of a price freeze on output, but also with a mechanism for bringing inflation down as well as its effectiveness as a tool accompanying other more orthodox measures. We build on Helpman's idea that a price freeze in an imperfect competitive setting can bring about an increase in output and then, in case the controls are too severe, a reduction in output. The rest of the paper is organized as follows: in section 2 we present our inter-temporal model and discuss incomes policy within the context of this model, along with the derivation of the price level, labour demand, demand and supply by individual firms, aggregate demand and supply, wages and growth rates. Section 3 deals with the effects of an incomes policy in a stabilization programme by using simulation analysis within the context of the model developed in section 2. Section 4 concludes.

2 The model

In order to represent through time the effects that Helpman (1988) recognized in a static world, an inter-temporal model is developed. However, before presenting the model, we deal with two assumptions which are adopted to capture both the monetarist view of the orthodox stabilization programmes implemented during the late 1970s and early 1980s as suggested by the IMF (Buira 1983) and the inertial aspects of those proponents of heterodox programmes. Firstly, we build on the fact that orthodox programmes usually aim at curving fiscal budget deficits in order to eliminate the primary source of money creation which is taken to be the fuel on which inflation thrives on; consequently, and in order to simplify matters, money is assumed to be exogenous to the model; we further assume that the government can completely control money movements. In this manner we side-step the government seigniorage requirements, therefore, there is no government maximization or minimization of any kind. However, behind this assumption lies the implicit management of fiscal deficits on which orthodox programmes rely in practice.

Second, in order to capture the inertial properties of inflation in a manner as simple as possible, we further assume that agents' expectations are formed in an adaptive way. We do this since the paper is not concerned with the causes of inertia, only its consequences. Furthermore, utilizing adaptive expectations makes sense when modelling an economy where there are no reliable government data, or when the government has little credibility (Bruno and Fischer 1990). In addition, although theoretically attractive, rational expectations do not always reflect real life in high inflationary episodes (Dornbusch *et al.* 1990). Finally, given the focus of the present model on episodes of high inflation in developing countries, where a common feature is the lack of available credible government information, fully adaptive expectations is used for the remainder of this paper. Therefore, the expected value of a variable will just be the most immediate past value it has taken.

The rest of the underlying assumptions in the model are as follows. There are several firms in this monopolistic market place, each producing a slight variation of a common good. Each firm utilizes labour from the same unionized pool, paying the same wage set by the union. In deriving its optimal price and its labour demand schedule, the firm takes as given the demand for its own good, as well as the wage rate that constitutes its costs only. In order to simplify matters further, it is assumed that there is no capital in the production technology. There is only one union in the economy, which has enough bargaining power so as to set wages for the whole of the labour force. This union can be considered as a kind of 'mega-union', which serves as an umbrella organization for individual labour unions that actually carry out the wage negotiations for its members.[1] In choosing wages, the union takes into account the decrease in labour demanded that a rise in wages would have, as well as the union members' euphoria when a rise in wages occurs. Households make spending decisions based on the relative prices of each good and on the amount of real wealth.

2.1 Price level

To determine the price that will maximize firms' profits, it is necessary to describe the environment of the firms. There are i firms that encompass the whole economy, with each firm producing a relative differentiated product and having to deal with the same union. Wages are set by this union which has monopoly power, so that wages are taken as given by firms. Wages are the same for all firms and are set at the end of the period $t-1$ for period t. Therefore, firms know the wage level when they set their prices and decide the amount of labour to employ. Labour is the only variable input in production. The production technology and demand functions are the same across firms. Firms are monopolistic and obtain their desired price from the maximization of profits at the beginning of every period t subject to consumer demand and the technology used in

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[1] Examples of this situation are Mexico's *Confederación de Trabajadores de México* and Israel's *Histadruth.*

production. The profit function for each firm is denoted by Π_{it}, and is determined by the following equation:

$$(1)\quad \Pi_{it} = P_{it} Y_{it} - W_t N_{it}$$

Where labour demanded by each firm i is represented by N_{it}, W_t is the wage rate that all firms face, and P_{it} is the price of good i at time t. Firms care equally about present and future profits so that there is no discount factor to incorporate. Each firm faces a consumer demand equation assumed to behave according to the following equation:[2]

$$(2)\quad Y_{it}^d = \left(\frac{P_{it}}{P_t}\right)^{-\rho} \frac{M_t}{P_t}$$

Where Y_{it}^d is the demand for product i by all households, P_t represents the aggregate price level, M_t is the nominal money stock at time t and $\rho > 1$ is the constant elasticity of demand. The production function is the same for all firms and it is characterized by diminishing returns, where γ is the share of labour in the production process, and is given by:

$$(3)\quad Y_{it}^s = N_{it}^{\gamma}$$

From the maximization of the profit function subject to the individual demand and the production functions, we can derive the profit-maximizing price in the absence of price controls p_{it}^*:

$$(4)\quad p_{it}^* = \gamma(\mu - z) + \gamma w_t + (1-\gamma) m_t$$

Here lower case letters represent the log of that variable, therefore, $p_{it} = \log P_{it}$. We define μ as the log of the price mark-up that occurs in monopolistic markets and z as the log of the share of labour in the production function. Finally w_t stands for the log of the wage rate for the whole of the economy. Equation (4) represents the optimal price that all firms would choose to set if they were free to do so; this optimal price gives firms a monopolistic profit margin. However, in heterodox programmes, some or all firms have their prices set by the government, so that only a proportion of firms will set their prices in line with (4). The number of firms that are subject to supervision will depend on whether the government determines that a price freeze will affect some sectors, or the entire economy. Let δ be the percentage of firms that are under government control, thus if $\delta = 1$ the government will determine prices for the whole of the economy. If $\delta = 0$ then there will be no incomes policy as no firms are obliged to set their prices according to government guidelines. As long as $1 > \delta > 0$ holds, the price freeze will affect only a fraction of the economy, and so some firms will be able to set prices freely according to equation (4).

2 This equation is similar to the one derived by Blanchard and Kiyotaki (1987).

We build on Helpman (1988) to derive the price charged by firms as determined by the government. The underlying assumption is that when a government implements a price freeze, it does so in order to stop prices from increasing. However, following Helpman's insight, what the government actually does in practice is to set prices below their profit-maximizing level. Thus, a wedge is formed between the price the firms set and the price which is determined by the government. This wedge is captured by the following equation:[3]

$$(5) \quad p_{jt} = p^{*}_{jt} - \beta_t$$

Where p^{*}_{jt} is the log of the average profit-maximizing price freely set by firms, which is the same across this type of firms, and p_{jt} is the log of the average government controlled price which is the same for all these firms. The gap between these prices is measured, in logs, by β_t, which is government determined. Thus the controlled price is the optimal price less a government-determined percentage. By taking the p^{*}_{jt} as a reference point, the government has an inkling of how it distorts relative prices.[4]

To calculate the individual price set by firms in the controlled sector, we take into account that without a price freeze all profit-maximizing prices will be the same, thus we have $p^{*}_{it} = p^{*}_{jt}$. Therefore, by substituting the firms' profit-maximizing price (4) in equation (5), the actual price equation set by firms in that sector is:

$$(6) \quad p_{jt} = p^{*}_{it} - \beta_t = \gamma(\mu - z) + \gamma w_t + (1-\gamma) m_t - \beta_t$$

Eq. (6) states that the actual price set by firms in the controlled sector will depart from their optimal price as the intensity of the price controls increases, i.e. the more β_t grows. The aggregate price level is the weighted average of the two average price indices in the economy: the freely set price index and the index made up by prices determined by the government. This weight is given by δ . So, the price level is: [5]

$$(7) \quad p_t = (1-\delta) p_{it} + \delta\, p_{jt}$$

By substituting the price set by the 'free' (non-supervised) firms (5) and the government set price (6) into the above expression, we obtain the aggregate price level for this economy:

$$(8) \quad p_t = \gamma(\mu - z) + \gamma w_t + (1-\gamma) m_t - \delta\, \beta_t$$

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[3] See Appendix for details.

[4] The negotiations carried out with the private sector in Israel (1985-92) and Mexico (1987-94) provide us with some confidence to this part of the present theory (Reyna-Cerecero, 2001).

[5] Agénor in his (1995) study of credibility of price controls uses a similar idea; in his model δ is the proportion of inflation under government control and it is fixed over time.

It is clear that a price freeze will directly lower the general price level in direct proportion as the fraction of firms that are under supervision increases.

2.2 Labour demand

The derivation of labour demand will be obtained from the profit-maximization problem of the firm, above. As has been seen above, there will be two different individual prices in the economy, one for the 'free' firms and one for the controlled ones. Therefore, there will also be two equations for labour demand. The free market labour demand is given by:

$$(9) \quad n_{it} = (z - \mu) + m_t - w_t - \tfrac{\delta(\rho - 1)}{\gamma} \beta_t$$

where n_{it} represents the quantity of labour demanded by firms in the free sector. Equation (9) shows that each individual labour demand schedule depends on the amount of goods produced by firms, which in turn depends on the firms' demand for their goods. Given that demand depends on the relative prices and since prices in the controlled sector are lower than in the free sector, their demand has increased relatively to the demand of goods in the free sector. Therefore as shown in (9) as β_t grows, the amount of labour demanded by free firms will diminish.

The labour demand expression for the controlled sector is more complicated to derive due to the nature of the model. In line with Helpman (1988), the effects of the incomes policy on the controlled sector will initially increase output, and with it labour demand. However, after a certain point, the price freeze will reduce output and in so doing will diminish the quantity of labour demanded by firms in the controlled sector. Consequently, for those firms whose prices are under government supervision, there will be two labour demand equations: one according to which labour demand increases as the wedge between optimal and set prices increases (when prices are above the intersection of marginal cost and demand) and another one in which labour demand decreases as the gap continues to increase (i.e. when prices are set below the intersection of marginal cost and demand). These expressions are given below by equations (10) and (10a), respectively, where n_{jt} represents the quantity of labour demanded by firms in the controlled sector.

$$(10) \quad n_{jt} = (z - \mu) - w_t + m_t + \tfrac{\rho(1-\delta)+\delta}{\gamma} \beta_t$$

$$(10a) \quad n_{jt} = z + \tfrac{\gamma}{1-\gamma} \mu - w_t + m_t - \tfrac{1}{1-\gamma} \beta_t$$

As can be seen, as long as firms are still earning above normal profits they will accommodate the increase in demand by increasing their supply of goods. This will in turn increase their demand of labour in order for them to have the capacity to increase production. Once the gap is large enough to erode their profits, any increase in the wedge between prices will result in these firms diminishing their production, and with it the quantity of labour demanded. As with the aggregate price level, the aggregate demand schedule is determined as a weighted average of the quantity of labour demanded by the free and the controlled sectors, with the weight again being the proportional size of each sector represented by δ. This is given by:

$$(11)\ n_t = (1-\delta) n_{it} + \delta\, n_{jt}$$

where n_t is the aggregate labour demand. As there are two expressions for the labour demand of the supervised firms, there will be two equations for aggregate labour demand:

$$(12)\ n_t = (z-\mu) - w_t + m_t + \tfrac{\delta}{\gamma}\beta_t$$

$$(12a)\quad n_t = z + \kappa\mu - w_t + m_t - \tfrac{\delta\phi}{\gamma}\beta_t$$

where $\phi = \frac{\gamma + (1-\delta)(\rho-1)(1-\gamma)}{1-\gamma} > 1$ and $\kappa = \frac{\gamma+\delta-1}{1-\gamma}$. Thus, the total amount of labour demanded will increase with the initial implementation of the price freeze and, after a certain point, will diminish as this gap increases further.

2.3 Derivation of aggregate demand

Aggregate demand will also be defined as a weighted average of demand for goods of firms in the government-supervised sector and in the free sector:

$$(13)\ y_t^d = (1-\delta) y_{it}^d + \delta\, y_{jt}^d$$

Where y_t^d stands for aggregate demand, y_{it}^d represents demand of firms in the free sector and y_{jt}^d gives demand of firms in the controlled sector. Each individual firm demand schedule is given by the equation above. After substituting equations (4), and (6) and (8), into the demand function, expressed in logs, we have:

$$(14a)\qquad y_{it}^d = \gamma(z-\mu) - \gamma\, w_t + \gamma\, m_t - \delta(\rho-1)\beta_t$$

$$(14b)\qquad y_{jt}^d = \gamma(z-\mu) - \gamma\, w_t + \gamma\, m_t + [\rho(1-\delta)+\delta]\beta_t$$

which are the demand expressions for firms in the free and controlled sectors, respectively. Inspection of these equations shows that while the incomes policy will, in line with Helpman's model, increase the demand schedule for firms under government supervision, it will also decrease demand for those firms in the free sector. Substituting (14a) and (14b) into the aggregate demand expression given above we have:

$$(15)\ y_t^d = \gamma(z-\mu) - \gamma\, w_t + \gamma\, m_t + \delta\,\beta_t$$

Equation (15) states that aggregate demand will increase as the price freeze becomes widespread, both in terms of the number of firms it covers and in the intensity of the freeze.

2.4 Derivation of aggregate supply

Aggregate supply function is defined as a weighted average of the quantity of output produced by firms in the free and supervised sectors:

$$(16)\ y_t^s = (1-\delta)\, y_{it}^s + \delta\, y_{jt}^s$$

where y_t^s is the quantity of aggregate supply, y_{it}^s is output produced by firms in the free sector and y_{jt}^s is the output of the firms in the supervised sector. Because of the switch in profit earning that firms in the controlled sector suffer, there will be two supply schedules for these firms and two equations for aggregate supply. These are:

$$(17)\ y_{jt}^s = \gamma(z-\mu) - \gamma\, w_t + \gamma\, m_t + [\rho(1-\delta)+\delta]\,\beta_t$$

$$(17a)\ y_{jt}^s = \gamma z + \tfrac{\gamma^2}{1-\gamma}\mu - \gamma\, w_t + \gamma\, m_t - \tfrac{\gamma}{1-\gamma}\beta_t$$

where equations (17) and (17a) give the supply schedules for firms under government supervision before and after the switching point. As can be seen from equation (17) supply will accommodate demand as it increases due to the lowering of the relative price. In fact equations (14b) and (17) are equal, meaning that these firms' output grows exactly as their demand increases. However, this situation is reversed once profits become negative as they continue to accommodate demand growth. As equation (17a) shows, after the switching point has been reached, if the price freeze continues to distort relative prices, firms under official supervision will decrease their output. As can be seen from eq. (18) below, the increase in the gap between optimal and controlled prices will decrease the supply of free firms.

$$(18)\ y_{it}^s = \gamma(z-\mu) - \gamma\, w_t + \gamma\, m_t - \delta(\rho-1)\,\beta_t$$

Therefore, non-supervised firms can accommodate changes in demand because they are still earning above normal profits. However, as the price freeze becomes more stringent and their relative price higher, their demand will be falling. Nevertheless, inspection of equations (14a) and (18) verifies that 'free firm' demand and supply schedules are always in equilibrium. In order to obtain aggregate supply when supervised firms are still making above normal profits, we substitute (17) and (18) into the expression for aggregate supply given in the previous sub-section. To calculate aggregate supply, once the switching point has been reached, we substitute (17a) and (18) into the above expression.

$$(19)\ y_t^s = \gamma(z-\mu) - \gamma\, w_t + \gamma\, m_t + \delta\,\beta_t$$

$$(19a)\ y_t^s = \gamma z + \gamma\kappa\mu - \gamma w_t + \gamma m_t - \delta\phi \beta_t$$

Aggregate supply as given by (19) is equal to aggregate demand in equation (15). Aggregate supply will continue to expand as the increasing incomes policy parameter reduces relative prices in the supervised sector. Aggregate supply will then diminish as the gap between optimal and controlled prices gets larger, and firms decrease production in reaction to this increase. Aggregate demand will continue to grow in response to the continuing price freeze, output however will diminish and will thereby create a situation of excess demand.

2.5 Derivation of optimal wages

The union in this economy sets the wage rate for period t in period $t-1$, without knowing what the price and demand for real balances are going to be. Hence, these variables will be derived by the expectations at time $t-1$.[6] In setting the wage rate, the union will take into account the absolute level of employment of its own union members and the real wage level:

$$(20)\ UL_t = \frac{1}{1-\varepsilon}\left(\frac{W_t}{P_t}\right)^{1-\varepsilon} N_t \qquad \varepsilon > 1$$

Where UL_t is the utility function of the union and ε measures the degree of relative risk aversion. This particular specification was chosen since it reflects the popular view that a union utility function should be increasing and concave in its arguments of the wage rate and the employment of union members (Oswald 1982). The underlying assumption is that the union is utilitarian, i.e. it cares about the sum of all of its members' utility. Using a utility function for a labour union that has many members is justified in that it is no different than using a utility function for a family consisting of many individuals or for industries with more than one firm (Dertouzos and Pencavel 1981). Having the real wage appearing in the utility function instead of the nominal wage is not uncommon (Dertouzos and Pencavel 1981 and Jensen 1993). In line with the wage bill hypothesis which states that a union with monopoly power maximizes its utility function subject to the labour demand function derived by firms (Oswald 1982), the union will maximize its utility function with respect to aggregate labour demand given by (12) and (12a). The result of the maximization process for both labour demand schedule gives two wage setting equations, with expectations taken at time $t-1$:

$$(21a)\quad w_t = \tfrac{1}{1+\varepsilon}(\psi + z - \mu) + \tfrac{1}{1+\varepsilon} E_{t-1} m_t + \tfrac{\varepsilon-1}{1+\varepsilon} E_{t-1} p_t + \tfrac{\delta}{\gamma(1+\varepsilon)} E_{t-1}\beta_t$$

$$(21b)\quad w_t = \tfrac{1}{1+\varepsilon}(\psi + z + \kappa\mu) + \tfrac{1}{1+\varepsilon} E_{t-1} m_t + \tfrac{\varepsilon-1}{1+\varepsilon} E_{t-1} p_t - \tfrac{\delta\phi}{\gamma(1+\varepsilon)} E_{t-1}\beta_t$$

In the equations above we define $\psi = \log[-\tfrac{\varepsilon}{1-\varepsilon}] > 0$. As already stated, the expectations that are used in the model are fully adaptive so that the union expects that

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[6] This approach has been used in Naish (1988).

the values these variables take today will be the same values they had yesterday. Deriving the expectations of eqs. (21a) and (21b) we take:

$$\text{(22a)}\quad w_t = \tfrac{1}{1+\varepsilon}\left(\psi + z - \mu\right) + \tfrac{1}{1+\varepsilon} m_{t-1} + \tfrac{\varepsilon-1}{1+\varepsilon} p_{t-1} + \tfrac{\delta}{\gamma(1+\varepsilon)} \beta_{t-1}$$

$$\text{(22b)}\quad w_t = \tfrac{1}{1+\varepsilon}\left(\psi + z + \kappa\mu\right) + \tfrac{1}{1+\varepsilon} m_{t-1} + \tfrac{\varepsilon-1}{1+\varepsilon} p_{t-1} - \tfrac{\delta\phi}{\gamma(1+\varepsilon)} \beta_{t-1}$$

These equations reflect the fact that as the gap in prices increases, there will be a higher labour demand whatever the wage rate. Therefore, the union can raise its wage demands and still be better off than before. Obviously, the opposite is true when the switching point has been reached and firms are now loosing money.

2.6 Deriving the reduced-form equations

To derive the reduced-form equations' growth rates, we substitute (22a) and (22b) into (8), (15), (19) and (19a) and take their first difference. A circumflex (ˆ) represents the growth rate of that variable, and the inflation rate is defined as $\pi_{t-1} = p_{t-1} - p_{t-2}$. Therefore, the dynamic equations are expressed as follows:

when supply is demand determined:

$$\text{(23a)}\quad \hat{w}_t = \tfrac{1}{1+\varepsilon} \hat{m}_{t-1} + \tfrac{\varepsilon-1}{1+\varepsilon} \pi_{t-1} + \tfrac{\delta}{\gamma(1+\varepsilon)} \hat{\beta}_{t-1}$$

$$\text{(23b)}\quad \hat{y}_t^d = \gamma \hat{m}_t - \tfrac{\gamma}{1+\varepsilon} \hat{m}_{t-1} - \tfrac{\gamma(\varepsilon-1)}{1+\varepsilon} \pi_{t-1} - \tfrac{\delta}{1+\varepsilon} \hat{\beta}_{t-1} + \delta \hat{\beta}_t$$

$$\text{(23c)}\quad \hat{y}_t^s = \gamma \hat{m}_t - \tfrac{\gamma}{1+\varepsilon} \hat{m}_{t-1} - \tfrac{\gamma(\varepsilon-1)}{1+\varepsilon} \pi_{t-1} - \tfrac{\delta}{1+\varepsilon} \hat{\beta}_{t-1} + \delta \hat{\beta}_t$$

$$\text{(23d)}\quad \pi_t = \left(1-\gamma\right) \hat{m}_t + \tfrac{\gamma}{1+\varepsilon} \hat{m}_{t-1} + \tfrac{\gamma(\varepsilon-1)}{1+\varepsilon} \pi_{t-1} + \tfrac{\delta}{1+\varepsilon} \hat{\beta}_{t-1} - \delta \hat{\beta}_t$$

when supply is no longer demand determined:

$$\text{(24a)}\quad \hat{w}_t = \tfrac{1}{1+\varepsilon} \hat{m}_{t-1} + \tfrac{\varepsilon-1}{1+\varepsilon} \pi_{t-1} - \tfrac{\delta\phi}{\gamma(1+\varepsilon)} \hat{\beta}_{t-1}$$

$$\text{(24b)}\quad \hat{y}_t^d = \gamma \hat{m}_t - \tfrac{\gamma}{1+\varepsilon} \hat{m}_{t-1} - \tfrac{\gamma(\varepsilon-1)}{1+\varepsilon} \pi_{t-1} + \tfrac{\delta\phi}{1+\varepsilon} \hat{\beta}_{t-1} + \delta \hat{\beta}_t$$

$$\text{(24c)}\quad \hat{y}_t^s = \gamma \hat{m}_t - \tfrac{\gamma}{1+\varepsilon} \hat{m}_{t-1} - \tfrac{\gamma(\varepsilon-1)}{1+\varepsilon} \pi_{t-1} + \tfrac{\delta\phi}{1+\varepsilon} \hat{\beta}_{t-1} - \delta\phi \hat{\beta}_t$$

$$\text{(24d)}\quad \pi_t = \left(1-\gamma\right) \hat{m}_t + \tfrac{\gamma}{1+\varepsilon} \hat{m}_{t-1} + \tfrac{\gamma(\varepsilon-1)}{1+\varepsilon} \pi_{t-1} - \tfrac{\delta\phi}{1+\varepsilon} \hat{\beta}_{t-1} - \delta \hat{\beta}_t$$

Therefore, the system is reduced to four endogenous variables and two exogenous variables. The main difference between (23) and (24) is how the price gap affects the variable in question. In most instances, the sign on the β_t term is reversed and its coefficient has increased once the point satisfying equation (26) below is reached. The other variables in the model are not affected in their sign or size of their relationship by the implementation of the incomes policy. It should be noted that as long as $\varepsilon > 0$, the effect of the current gap β_t outweighs the effects of past gaps β_{t-1}.

To obtain the level of excess demand we equate aggregate demand and supply in levels:

$$\text{(25a) } y_t^d = \tfrac{\gamma}{1+\varepsilon}\left[\varepsilon z - \left(1+\varepsilon+\kappa\right)\mu - \psi\right] + \gamma m_t - \tfrac{\gamma}{1+\varepsilon} m_{t-1} - \tfrac{\gamma(\varepsilon-1)}{1+\varepsilon} p_{t-1} + \tfrac{\delta\phi}{1+\varepsilon}\beta_{t-1} + \delta\beta_t$$

$$\text{(25b) } y_t^s = \tfrac{\gamma}{1+\varepsilon}\left[\varepsilon(z+\kappa\mu) - \psi\right] + \gamma m_t - \tfrac{\gamma}{1+\varepsilon} m_{t-1} - \tfrac{\gamma(\varepsilon-1)}{1+\varepsilon} p_{t-1} + \tfrac{\delta\phi}{1+\varepsilon}\beta_{t-1} - \delta\phi\beta_t$$

Defining excess demand as $ED_t = y_t^d - y_t^s$, and subtracting (25a) from (25b), we obtain:

$$\text{(25c) } ED_t = \delta\left(1+\phi\right)\beta_t - \gamma\left(1+\kappa\right)\mu$$

In view of eq. (25c), the level of excess demand is positively related to the degree of the gap between optimal and controlled prices and negatively to a constant value. In order to determine the point where supervised firms will lower their production, we equate aggregate demand and supply and clear for β_t:

$$\text{(26) } \beta_t = \tfrac{\gamma}{\delta}\mu$$

When the gap in prices is large enough to satisfy equation (26), the price freeze will make it no longer profitable for firms to accommodate increases in demand. Therefore, the economy will start to experience shortages as this rise is met by a decrease in aggregate supply. If the initial value of the gap surpasses the value of (26), it will generate excess demand from the beginning of the stabilization programme.

3 Effects of an incomes policy in a stabilization programme

In this section we examine how effective different variations of orthodox and heterodox stabilization programmes are in controlling inflation, as well as their respective costs. This involves understanding the dynamics that the model predicts for each type of programme. To do this, values for the parameters in the model must be specified. Table 1 gives the values that were used in the analysis which follows:

Table 1
Values of the parameters used in the model

ρ	γ	ε	δ
2.33	0.6	6	0.80

3.1 Orthodox money-based stabilization

First we consider the case where the government brings down inflation without incomes policies, but by relying entirely on orthodox policies to control inflation. In this type of plan, usually recommended by the IMF in the 1980s (but also implemented in many developing as well as middle-income countries with inflationary pressures in the 1990s), the government implements cuts in its expenditures to reduce its fiscal deficit. This in turn reduces monetary growth, and thereby, inflationary pressures. The government can choose between the several forms that this type of programme can take. The government can assume an extreme position of achieving an immediate zero growth of the monetary base, known as a shock programme, or it can set the money supply to grow at a diminishing rate, and then to keep it at a lower plateau. These different policy scenarios will be analysed.

Case 1: Orthodox stabilization: immediate zero money growth

A shock treatment has rarely been applied in a real life programme.[7] As we show below, this might be related to its inherent costs. The programme involves an immediate cessation of all government activities that generate a positive growth rate of the money supply, effectively bringing it down to zero in an abrupt manner.[8] In the context of our model, setting $\hat{m}_t = 0$ will reflect this policy. Since in an orthodox programme, by definition, there is no price freeze, the set of equations we focus on are (23a) to (23d), with $\hat{\beta}_t = \hat{\beta}_{t-1} = 0$. Thus in the first period of the programme, inflation is:

$$(27)\ \pi_t = \tfrac{\gamma}{1+\varepsilon}\left[\hat{m}_{t-1} + (\varepsilon - 1)\pi_{t-1}\right]$$

In line with equation (27), because of the inertial factors in the economy, even a total reduction in monetary growth will not bring about an immediate elimination of inflation, though it will reduce it substantially. In subsequent periods of the programme, with money growth still at a zero per cent level, inflation will converge to the growth rate of money. However, because of the positive remaining inflation rate, it will do so only slowly, as long as $\frac{\gamma(\varepsilon-1)}{1+\varepsilon} < 1$.[9] As can be seen from equation (27a):

$$(27a)\ \pi_t = \tfrac{\gamma(\varepsilon-1)}{1+\varepsilon}\pi_{t-1}$$

The effects of this programme on the real economy can be seen by examining equation (23c), with $\hat{m}_t = 0$ and $\hat{\beta}_t = \hat{\beta}_{t-1} = 0$, for the first two periods after the plan has been put into practice:

$$(28)\ \hat{y}_t^S = -\tfrac{\gamma}{1+\varepsilon}\left[\hat{m}_{t-1} + (\varepsilon - 1)\pi_{t-1}\right] \text{ first period of the programme}$$

7 Agénor and Montiel (1996).

8 Which can be taken to represent a total elimination of the budget deficit.

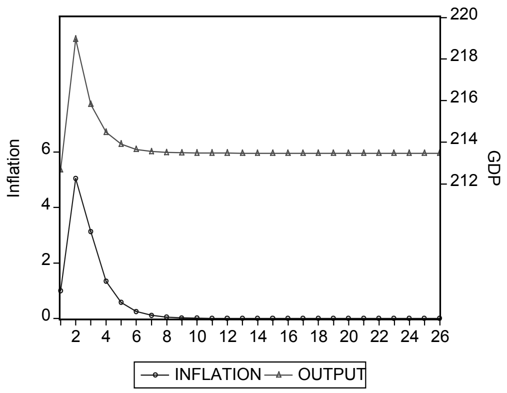
9 Which will be the case as long as $\gamma < 1$, which is by definition true.

(28a) $\hat{y}_t^s = -\frac{\gamma(\varepsilon-1)}{1+\varepsilon}\pi_{t-1}$ second period of the programme.

Since past money growth and inflation are positive, a recession will come about from a zero money growth target, the magnitude of which will diminish as inflation decreases and the policy is maintained. As can be seen in equation (28a), after the first period of the programme, the depth of the recession will diminish but will continue as long as there is a positive inflation rate. The same can be said for aggregate demand. Figure 1 shows that after the programme, inflation and output decrease immediately.

In Figure 1 money growth is set to zero in the third period after growing at 10 per cent and 12 per cent the previous periods. Output decreases by 1.43 per cent in the first period and suffers a recession in the following 8 periods, eventually diminishing 2.5 per cent overall. During this time, inflation drops from 5.04 per cent to 0.25 per cent within four periods, and continues to decline until it reaches 0 per cent within eight periods to stay there thereafter.

Figure 1
Shock orthodox programme



Case 2: Orthodox stabilization—decreasing money growth to a zero rate

A much more realistic approach to an orthodox stabilization effort is one where the government decides to slow down the rate of money growth to a lower level. This gradual approach seeks to diminish the inflation rate without incurring too much output loss. However, taking the derivative of (23c) and (23d) with respect to money growth, we see that money growth has a bigger impact on output than on inflation:

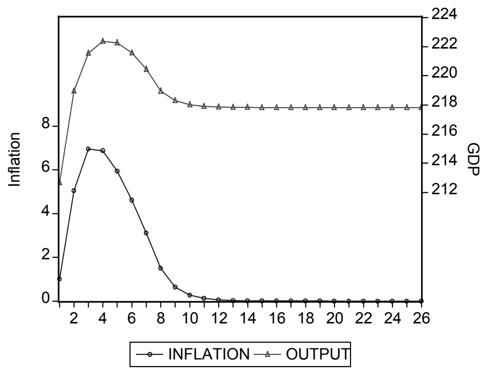
$$(29)\ \frac{\partial \hat{y}_t^s}{\partial \hat{m}_t} = \gamma > \frac{\partial \pi_t}{\partial \hat{m}_t} = 1-\gamma \ \text{ for } \gamma > 0.5$$

Therefore, even though this policy will not create such a large recession, it will affect output more than inflation. This effect can be seen to represent some degree of price stickiness, so that as money growth is slowed down, output will decrease faster than inflation. Starting from a 12 per cent rate of money growth, and assuming a 2 per cent decline every period so that it reaches a zero rate in six periods, we have the effects shown in Figure 2.

Money growth is increasing at a decreasing rate after the third period. Starting from 10 per cent growth in the third period, after growing at 12 per cent in the previous one, it falls to zero in the sixth period of the programme. Output increases in the first two periods after the implementation of the programme, then suffers a recession for the following 10 periods, after which it stays at the same level. Inflation grows in the first period of the programme, and falls for the next 11 periods, until it becomes zero and stabilizes thereafter.

In both monetary stabilization programmes, inflation comes down to the constant rate of money growth, the time it takes to achieve a constant inflation rate is associated with the speed money growth is reduced. But even when money growth is reduced immediately to zero, inflation takes some time to come down, and this reduction in inflation comes with the price of lost output growth. In the first case, as we have seen, the economy enters into a deep recession and never recovers. In the second, less extreme case, the recession is not as profound.

Figure 2
Gradual orthodox programme



3.2 Heterodox stabilization: shock price freeze and monetary policy

When a government implements an incomes policy it does so with the intention to eliminate or reduce the inflation rate in as a brief time as possible, with the least cost in output as feasible. To accomplish this, a comprehensive heterodox programme is combined with orthodox monetary policies to eliminate the source of inflation, and a price freeze to eradicate the inertial forces in the inflation process. In this sub-section the different variations this programme can take will be examined.

As in the case of orthodox programmes, the government can choose whether to achieve a zero inflation rate quickly, or reduce the inflation rate gradually towards zero or some other positive rate. For the moment, it will be assumed that the government's main objective is to bring inflation down to a zero rate immediately after the stabilization programme has been put into place. If the authorities pursue this policy, the gap between optimal and control prices will need to be adjusted every period. This is done in order to counter the effects of the inertial components of the present inflation rate, as well as the current, if any, expansion of the monetary base. Setting $\pi_t = 0$ in equation

(23d) and clearing for $\hat{\beta}_t$, we can derive the optimal adjustment of the gap that achieves an immediate zero rate inflation:

$$(30)\ \hat{\beta}_t = \tfrac{1-\gamma}{\delta}\hat{m}_t + \tfrac{\gamma}{\delta(1+\varepsilon)}\hat{m}_{t-1} + \tfrac{\gamma(\varepsilon-1)}{\delta(1+\varepsilon)}\pi_{t-1} + \tfrac{1}{1+\varepsilon}\hat{\beta}_{t-1}$$

This behaviour is dependent on the assumption that the initial gap is less than the quantity given by equation (26). If the gap is not less than the value of (26), then the behaviour of the gap is determined by setting $\pi_t = 0$ in equation (24d) and clearing for $\hat{\beta}_t$:

$$(31)\ \hat{\beta}_t = \tfrac{1-\gamma}{\delta}\hat{m}_t + \tfrac{\gamma}{\delta(1+\varepsilon)}\hat{m}_{t-1} + \tfrac{\gamma(\varepsilon-1)}{\delta(1+\varepsilon)}\pi_{t-1} - \tfrac{\phi}{1+\varepsilon}\hat{\beta}_{t-1}$$

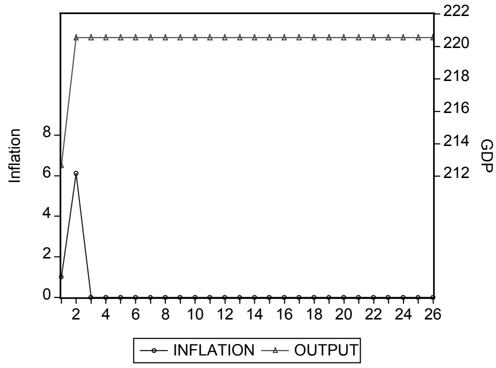
One of the key factors in determining whether $\hat{\beta}_t$ depends on (30) or (31), is the size of money growth. If $\hat{\beta}_t$ has to offset a huge current increase in money supply, then its value will be bigger than that given by equation (26). If on the other hand, $\hat{\beta}_t$ has to offset only the inertial components of inflation, then it is likely that $\hat{\beta}_t$ will not cause an excess demand situation. To show the effects that different monetary policies have when accompanied by a price freeze, we first assume that the government decides to implement a zero growth rate of the monetary base.[10]

Case 3: Heterodox stabilization—money growth is decreasing from 12 per cent to 0 per cent in the first period of the programme with β_t made to keep inflation zero

In this policy scenario, the government decides to accompany the price freeze with a shock treatment of the monetary policy, by implementing a zero per cent money growth in the first period of the programme. This type of policy can be adopted in order to gain instant credibility with economic agents, and to send a signal to the general public that the authorities are committed to combatting inflation. Figure 3 shows what happens in the model when money growth is stopped as the price freeze is put into effect. Output is not affected under the present assumption, and, as the price freeze cancels out any inertia that might fuel inflation, inflation drops to zero level immediately. The price gap starts at 4.66 per cent and stabilizes at 5.41 per cent after four periods, to remain the same thereafter. In this policy mix there is no recession, but there is also no output growth whatsoever. Obviously, zero growth is preferable to negative growth, but it is far from being what the general public and the government authorities might consider as an optimal result.

[10] In what follows both the monetary policy and the price freeze are implemented in the third time period, which can be regarded as period t.

Figure 3
Simultaneous shock/heterodox programme



Managing the price freeze so as to keep inflation at a zero level, is very effective in achieving its goal, but it does come at the price of maintaining a wedge between optimal and controlled prices. As can be seen from equations (30) and (31), this optimal wedge depends on the amount of past and present money growth, and on the amount of inflation it has to offset. The gap will continue to grow at a diminishing rate, as the inertial components of inflation become smaller as the incomes policy offsets them—this can be seen in equation (32). In the first period of implementation of a policy of immediate zero money growth, the price freeze only has to compensate for the inertial components of the inflation, since there is no previous incomes policy parameter to refer to. Therefore, equation (30) is reduced to:

$$(32)\ \hat{\beta}_t = \frac{\gamma}{\delta(1+\varepsilon)}\hat{m}_{t-1} + \frac{\gamma(\varepsilon-1)}{\delta(1+\varepsilon)}\pi_{t-1}$$

In the second period of the programme, money growth has been at zero rate for two periods, and since the previous inflation rate was zero, the main inertial components have been eliminated. However, because of the increase in demand, which translates into an additional demand for labour (and, which, in turn increases wages) there is an additional effect in the form of the previous gap in prices. Thus, the incomes policy is reduced to offsetting previous gaps:

$$(33)\ \hat{\beta}_t = \frac{1}{1+\varepsilon}\hat{\beta}_{t-1}$$

Therefore, after money growth has ceased and inflation has been effectively eliminated, $\hat{\beta}_t$ only has to account for its past values. In the case where $\hat{\beta}_t$ exceeds the value given in eq. (26), its growth rate has to be negative. In subsequent periods, after this stage has been reached, $\hat{\beta}_t$ will alternate signs:

$$(34)\ \hat{\beta}_t = -\frac{\phi}{1+\varepsilon}\hat{\beta}_{t-1}$$

This implies that the sign of the growth rate of the incomes policy parameter will fluctuate, but not the actual degree of the price freeze, which is always positive.

3.3 Heterodox stabilization: shock price freeze and gradual monetary policy

As was seen above, any shock stabilization will involve a recession, one that might not be endurable by the general population, and thus neither by the government. Consequently, the government might be tempted to continue to add fuel to the economy to achieve a positive growth of output. In what follows we explore this scenario.

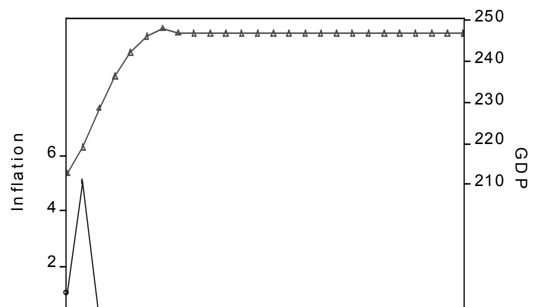
Case 4: Heterodox stabilization—decreasing money growth from 12 per cent to 0 per cent in six periods, β_t made to keep inflation zero

Another form the incomes policy can take is a slow reduction in the growth of the supply of money, with the beginning of this policy coinciding with the price freeze. In the simulation, money grows 12 per cent from period $t-1$ to period t, and it will continue to grow but at a diminishing rate. Therefore in six periods, it will reach and maintain a zero growth rate (Figure 4).

The combination of a complete price freeze and a diminishing growth of money supply result in output growth in the first five periods of the programme, although at a decreasing rate (from 4.35 per cent to 0.81 per cent). Following this initial expansion, output follows three periods of slight recessions (0.42 per cent to 0.01 per cent), to settle down to a new level thereafter. As a consequence of money supply continuing to grow and exerting upward pressures on inflation, the gap required to eliminate inflation is high, surging from 8.32 per cent to 22.184 per cent, remaining at that level thereafter. Even though β_t is large, this scenario does not produce excess demand, which, as we show in the next section, depends largely on γ and on ρ.

This much more realistic type of policy produces the boom-recession stabilization business cycle observed in many heterodox programmes during the 1970s and 1980s. The effect of money supply continuing to grow on the economy, even though at a decreasing rate, will be to produce a boom in the first stages of the programme. As money reaches zero per cent growth, it will result in a recession. However, because of the increase in demand, brought about by the price controls, the recession is slight and short-lived in comparison to the recession which is related to a gradual orthodox programme. This is a distinct advantage over orthodox programmes. There are,

Figure 4
Gradual-money/shock-heterodox programme



however, risks in this approach. One is that authorities might be tempted not to reduce money enough, if at all, in a bid to sustain the boom. The consequences of such an action will be seen below. Another risk is that product shortages might be created, even though in this example none were produced.

Case 5: Heterodox stabilization—constant money growth at 12 per cent; β_t made to keep inflation zero

This case shows the other risk of trying to achieve a zero inflation growth rate, while at the same time pursuing expansionary monetary policies. Here, the authorities do not complement the incomes policies with any measures that diminish the growth rate of money, which is kept at the same rate it was expanding before the programme was put into practice. This case is representative of what was implemented in Argentina and Brazil during the 1980s.

As can be seen from Figure 5, during the first four periods the plan achieves its dual goal of having low inflation and a fast growing real economy. The price gap grows to account not only for inflation inertia, but also for the current inflation pressures arising from the expanding money supply. The gap starts at 9.14 per cent to reach 94.09 per cent on the completion of the programme. As the current controlled price is constantly moving further away from its optimal level, relative prices become more and more distorted, and firms' profits fall. Eventually, firms will diminish production as the gap reaches the threshold of equation (26). Once this happens, the economy will enter a recession that lasts for the remainder of the programme. The recession grows from 1.53 per cent to 2.82 per cent from the fourth period till the last period under examination – Figure 5a.

Once output starts to decrease, excess demand caused by the incomes policies begins to emerge in the fourth period of the programme. It starts at 3.66 per cent and reaches an amazing 358.85 per cent of output at the end of the period. The rather unrealistic levels that the wedge and excess demand reach, make it clear that this case is just a theoretical exercise. However, the example does give us an idea of what can happen when governments try to increase output via an expansionary monetary policy, and keep inflation artificially low by implementing a price freeze. The results presented in this sub-section give support to the conclusion that these policies must be coordinated to achieve the same reasonable goal and not contradictory ones.

Figure 5
Heterodox programme without fundamentals

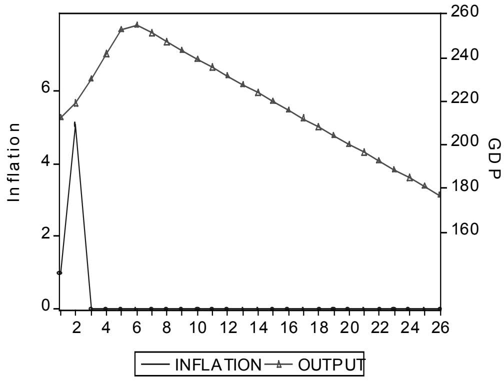
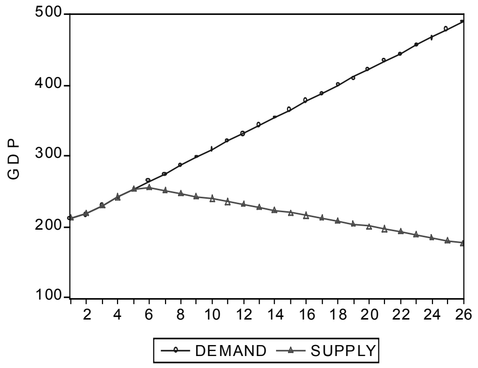


Figure 5a
Aggregate excess demand of case 5



3.4 Heterodox stabilization: gradual price freeze and monetary policy

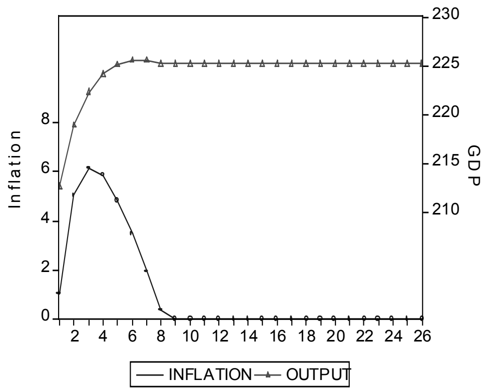
In this section we analyse the effects related to the gradual implementation of the price freeze. This gradual approach was adopted in Mexico for the stabilization programme known as the *Pact*, during the period 1987 to 1994, and it did not try to attain zero per cent inflation right from the beginning of its programme.

Case 6: Heterodox stabilization—decreasing money growth from 12 per cent to 0 per cent in six periods; β_t *slowly increasing and then made to keep inflation zero*

A good example of the coordination between the orthodox and heterodox parts of a stabilization programme can be seen in this example of how a price freeze can be put into practice, namely by having the price controls increased gradually to reduce inflation to a zero rate. This price freeze can be accompanied by either having an immediate zero growth rate of money supply, or reducing its expansion rate gradually until it reaches zero level. In Figure 6 we see what the policy achieves when money is also decreased gradually.

In this scenario output continues to grow, although at a decreasing rate (from 1.54 per cent to 0.01 per cent), for five periods; then it suffers one period with a slight recession (0.16 per cent) before it settles down to its new level. The price gap starts at 0.99 per cent and stabilizes at 6.022 per cent after ten periods, to remain the same throughout. Inflation reaches zero level in the seventh period of the programme, from below 1 per cent in the previous (sixth) period. This policy mix shows that by having money grow at a diminishing rate, the economy also experiences a boom-recession cycle. The expansion in output coming early in the programme is induced by the growing demand, which is stimulated by the reduction in the relative price of the controlled goods. The recession predicted by the model is very slight and very short-lived; this captures well actual experience in Mexico with this type of programme (Reyna-Cerecero 2001). In this example, inflation is diminishing slowly, as the incomes policy takes effect, and gradually increases the gap in prices; once inflation reaches zero, the price wedge is managed so as to keep it at that level.

Figure 6
Gradual heterodox programme



Even though output does experience a small recession once money growth is zero while inflation is still positive, this policy does not cause excess demand because the gap in prices does not reach the levels required to achieve it. The size of the gap in prices of 6.022 per cent, though not insignificant, is much less than under the shock programme of achieving zero inflation right from the beginning of the programme (22.18 per cent). This difference in the size of the price wedge reflects what has already been stated: the price gap depends on the magnitude of the diminished inertial component and present determinants of inflation. Gradually increasing the gap offsets the inertial aspect of inflation and the slow reduction of money growth reduces present inflation, thus making a huge gap unnecessary. This combination also increases output indirectly by stimulating demand via changing relative prices, and directly by continuing to have positive money growth for some time.

4 Concluding remarks

In this paper we developed a model which deals with the potential success of price controls in stabilizing high inflation rates and their effects on the real economy under an imperfect competition setting derived by optimal maximization. Our model builds on Helpman's (1988) work on price controls and imperfect competition and incorporates inflation inertia through adaptive expectations.

A central conclusion that seems to emerge from the previous analysis is that heterodox programmes which only concentrate on the 'hetero' part of the effort, without attention to the fundamental determinants of inflation, will be finally associated with a deteriorating performance on the output and inflation stabilization fronts. Enacting policies that pursue two different and conflicting goals, will fail to achieve either of them. The model presented here enables experiments to be carried out to analyse which policy mix is more effective in bringing inflation down and what their respective costs will be in terms of output loss. Our model shows another path for the stabilization business cycle to take, without having to resort to exchange rate or credibility factors. The only factor needed is the effect of the price control upon the decisions of firms to accommodate demand or not. Since all equations but one in the model are derived from rational microeconomic behaviour, these decisions are always profit maximizing, and in line with the conventional wisdom on how firms operate.

A heterodox programme can be implemented following several and distinct policy mixes, all with different outcomes. The policy of achieving zero inflation right away, with an accompanying shock treatment of monetary policy will eliminate inflation, but at the cost of a recession. The same policy with a gradual decline of money growth will achieve a boom followed by a slight recession. The major disadvantage of this programme comes in the form of shortages in the economy, which will upset consumers and businessmen, and thus put extra pressure on the government to eliminate the controls. This is related to the greatest possible danger inherent in this type of policy, namely policymakers not actually lowering the rate of money growth. In case policymakers adopt the view 'one more period of growth and then we can act' on the assumption that this will not harm the economy, they are seriously mistaken. This behaviour will distort relative prices beyond the limits tolerated by the private sector, which in turn will lower output; the final result will be that the more the government adds fuel to the economy, the deeper the recession becomes.

Any government instituting a stabilization programme will be burdened from the start with credibility problems regarding policy management skills of the relevant government authorities, the duration of the programme and, most importantly, their actual intentions and goals. Bearing this in mind, even the most favourable heterodox policy mix examined here, the gradual lowering of money growth and the phased increase in the intensity of the price freeze, can cause problems in achieving the goals. However, the shock treatment of money and the complete price freeze will successfully achieve low inflation, but at the price of zero growth. Nevertheless, this result is preferable to recession with inflation caused by an orthodox stabilization programme. Therefore, it is highly recommended for the government to gain credibility before the heterodox programme is implemented. Our simulation results are confirmed by the sensitivity analysis we conducted,[11] although econometric analysis should be undertaken in future work, by using real data series on individual country basis, so that more robust results can be derived and policy lessons are learnt.

[11] Sensitivity analysis results are available from the authors upon request.

Appendix

Helpman (1988) basically states that what a price control does is to set the control price below what the optimal free price would be. This means that the controlled price can be expressed as the optimal price divided by a variable that is greater than one:

$$(A.1) \qquad P_{jt} = \frac{P^*_{jt}}{B_t} \qquad\qquad B_t \geq 1$$

where P_{jt} is the government controlled price, P^*_{jt} represents the optimal profit-maximizing price, and B_t stands for the wedge between the government controlled and optimal prices. In logs:

$$(A.2) \qquad p_{jt} = p^*_{jt} - \beta_t$$

where $\beta_t = \log B_t$. This is equation (5) in the text. The advantage of representing a price control in this manner is that this equation is able to model the behaviour of the incomes policy through time. Table 2 below shows the three possible paths β_t can take:

Table 2
Possible paths of price gap

Case 1	t-1	t	t+1
Optimal price	5	8	10
Controlled price	-	5	5
Gap	-	37.50%	50%
Case 2	**t-1**	**t**	**t+1**
Optimal price	5	8	10
Controlled price	-	5	6.25
Gap	-	37.50%	37.50%
Case 3	**t-1**	**t**	**t+1**
Optimal price	5	8	10
Controlled price	-	5	8
Gap	-	37.50%	20%

Notes: Case 1: Constant controlled price and an increasing gap
Case 2: Increasing controlled price and a constant gap
Case 3: Increasing controlled price and a decreasing gap

In all cases periods $t-1$ and t are the same; at time $t-1$ there was no price freeze and the optimal firm determined price is 5, at time t the government institutes a price freeze, setting prices for period t equal to prices at time $t-1$. However, due to inertia or some other factors the optimal price is now 8; thus, there the wedge is formed. Case 1 illustrates the case where the government continues to set the same price at period $t+1$ as it did in period t, the optimal price has increased and so has the wedge. In case 2 the government allows some adjustment of the controlled price to keep the wedge constant.

Finally, in case 3 the government has adjusted the controlled price to diminish the wedge; this could be the case where the government is slowly lifting the controls. Incorporating this pathway into the price freeze will give the model a possibility to model heterodox programmes in a dynamic manner which reflects the changes in the programme as circumstances change and new policy goals evolve.

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