PRICE CONTROLS, INFLATION, AND WELFARE IN THE STEADY-STATE

by

Kazimierz Stanczak

PRICE CONTROLS, INFLATION, AND WELFARE IN THE STEADY-STATE[*]

Kazimierz Stanczak
Department of Economics
UCLA
(310) 825-5665
E-mail: stanczak@econ.sscnet.ucla.edu

Abstract

I seek an answer to the following question: how different are the steady-state welfare implications of an accelerated money growth in the economies with price controls and black markets? I proceed by embedding Barzel's (1974) classical rationing-by-waiting arguments in two general equilibrium monetary models. In the first, money is introduced through a cash-in-advance constraint on the black market purchases (the CIA model), while in the other, real balances appear as an argument in the utility function (the MIUF model). In each of these two endowment economies, binding price controls lead to queuing and the black market. I show that, in the CIA model, an unanticipated permanent increase in a growth rate of the money supply is welfare-improving because it reduces the steady-state waiting line by inducing a substitution towards the inflation-tax-free leisure. In the MIUF model, however, the steady-state waiting line is independent of inflation. Given that the real money demand is interest-elastic, welfare necessarily falls in the rate of the money growth. The results derived in this paper strongly support the case for a price liberalization ahead of the inflation stabilization.

1

1. Introduction

I seek an answer to the following question: how different are the steady-state welfare implications of an accelerated money growth in the economies with price controls and black markets? This question seems relevant and timely in quite a few formerly-socialist countries, for example Russia, where fast money-printing coincides with price controls on certain goods.

There seems to be a presumption that money-printing is even more undesirable in a presence of price controls, for it leads to more queuing (see e.g., Kolodko and McMahon (1987) who even coin a term "shortageflation"). I shall show below that such conclusion critically depends on how one models money.

It must be noted that the growing literature on queuing and the black markets, while providing several new and valuable insights, has so far ignored the monetary considerations (see e.g., Osband (1992)). Yet, it seems that a complete analysis of these issues requires putting money at the centerstage, for, essentially, all of the black market transactions are settled in cash. This paper may be seen as an attempt to bring the question of money to the forefront.

In order to address the issue at hand, I embed Barzel's (1974) classical rationing-by-waiting arguments in two general equilibrium monetary models. In the first, money is introduced through a cash-in-advance constraint on the black market purchases (the CIA model), while in the other, real balances are put as an argument in the utility function (the MIUF model).

In each of these two endowment economies, binding price controls

lead to queuing and the black market. As well known, pervasive waiting lines and black markets were characteristic of the socialist economies. According to the Soviet sources, quoted in Shleifer and Vishny (1991), waiting in line used to take about 25% of waking time of every adult. There is an accumulated evidence, mostly anecdotal, on the market for waiting services, black market premia, etc. (See e.g., Podkaminer (1988) for some Polish data.)

I show that, in the CIA model, an unanticipated permanent increase in a growth rate of the money supply is actually welfare-improving. This is because it reduces the steady-state waiting line by inducing a substitution towards the inflation-tax-free leisure. In the MIUF model, however, the steady-state waiting line is independent of inflation. Given that the real money demand is interest-elastic, welfare necessarily falls in the rate of the money growth.

The rest of the paper is organized as follows. The two monetary models are developed and discussed in section 2. Section 3 concludes.

2. Money and Queuing

2a. The Cash-in-Advance Model

Consider the following perfect foresight model set up in continuous time. An infinitely-living representative family consists of four members: a store-keeper, a speculator, a worker, and a shopper. The store-keeper sells the family's constant endowment of a perishable good, y, at the state-controlled price, $\bar{p}$.[1] The speculator buys s goods on the

---

[1] The assumption that output is endowed rather than produced does not

3

official market only to resell them on the black market at price p.

Binding price controls (i.e., $\bar{p} < p$) imply that the official market clears through queuing. The total line is linear in the quantity bought. Precisely, a unitary purchase requires q hours of waiting, and each family takes q as given. The linearity assumption really means that, at the individual level, queuing is a constant returns to scale activity. It is not too difficult to see that the alternative assumptions of either decreasing or increasing returns to scale would create severe problems in general equilibrium. More precisely, if the unitary queue were to fall in the quantity bought (increasing returns), then a feasible set would not be convex. If q were to increase with the quantity (decreasing returns), then marginal cost in the queuing business would be higher than the average cost implying positive profits.[2]

Quite realistically, waiting is performed by the professional "waiters" hired by the speculator. The "waiters" earn a competitive nominal wage, W. The shopper buys the consumption good, c, on the black market. The black market purchases are subject to the cash-in-advance (CIA) constraint. The worker sells n hours of his labor to the domestic employers. In addition to money, the households hold privately-issued real bonds, b, each yielding an instantaneous real return ρ. In each instant of time the representative household receives from the

seem too outrageous in the context of the socialist economies in which, in general, labor participation and hours were mandated.

---

[2] The importance of the linearity assumption can be clearly seen in Stahl's (1987) proof of the existence of a queue-rationed non-monetary equilibrium.

government a lump sum transfer of nominal money, T. The nominal money stock (M) and the official price are time-continuous and growing at the rates of σ and η, respectively (i.e., $\dot{M}/M = \sigma$ and $\dot{\bar{p}}/\bar{p} = \eta$). I study a realistic case in which the controlled prices do not keep up with the money growth, i.e., $\eta < \sigma$.

The family maximizes a life-time integral of the discounted intraperiod utilities defined over consumption and leisure. The total endowment of time is normalized to unity. The intraperiod utility function, $u(c, 1-n)$, has standard properties. Consumption and leisure are both assumed to be normal goods.[3]

Formally, given M_0 and b_0, each family solves:

$$(1) \quad \max_{c, n, s, m, b} \int_0^\infty u(c, 1-n) \exp(-\delta t) dt$$

subject to:

$$(2) \quad \dot{a} = a\rho - (\rho + \pi)m + y(\bar{p}/p) + (w/p)n - s[(\bar{p}/p) + q(w/p)] + s - c + t$$

$$(3) \quad m = \alpha c$$

$$(4) \quad a = m + b$$

---

[3] Normality requires that $u_{22}u_1 - u_{12}u_2 < 0$ and $u_{11}u_2 - u_{12}u_1 < 0$.

(5) $\lim_{t \to \infty} a \exp(-\int_0^t \rho d\tau) = 0$ (no Ponzi games)

where: $\delta > 0$ is the subjective rate of time preference; $a \equiv$ the stock of real assets; the formulation of CIA constraint in continuous time, (3), was originally derived by Feenstra (1985); $m \equiv M/p \equiv$ the real balances of money; $\alpha > 0$; $t \equiv T/p \equiv$ the real value of money transfers; $w/p \equiv$ the real wage; the time subscripts are suppressed to economize on notation;

It is convenient to substitute (3) into (2). Denote by λ the marginal utility of real wealth (i.e., the multiplier on (2)). The first-order conditions consist of (2)-(5) and

(6) $u_1(c, 1-n) = \lambda[1 + \alpha(\rho+\pi)]$

(7) $u_2(c, 1-n) = \lambda(w/p)$

(8) $1 - (\bar{p}/p) + q(w/p) \le 0$ ($= 0$ if $s > 0$)

(9) $\dot{\lambda}/\lambda = \delta - \rho$

(10) $\lim_{t \to \infty} a\lambda \exp(-\delta t) = 0$

As usual, (6) and (7) implicitly define the demand for consumption and leisure (and, hence, the supply of labor), respectively. The (implicitly) imposed Inada conditions ensure that the choices of c and 1-n are interior. Note that the effective cost of consumption includes

the inflation tax paid on money balances held in advance of the acquisition of goods. The zero profit condition, (8), implicitly defines the demand for labor by the speculators (i.e., sq). It is easily seen that this demand is zero if the official price is at least as high as the current black market price. When $\bar{p} < p$, then, not surprisingly, the demanded quantity of labor varies negatively with the real wage. Also, an increase in $\bar{p}/p$ shifts the labor demand downward. (9) characterizes the optimality in the accumulation of assets, while (10) is the transversality condition.

Combining (6) and (7) as well as substituting an expression for w/p from (8) leads to the following chain of equalities:

$$(11) \quad u_1/u_2 = [1 + \alpha(\rho+\pi)]/(w/p) =$$

$$= q[1 + \alpha(\rho+\pi)]/[1-(\bar{p}/p)]$$

(11) says that, at the optimum, the marginal rate of substitution between consumption and leisure is equal to the respective relative price. Clearly, the higher the opportunity cost of money, $\rho+\pi$, the higher the wedge between the relative price of consumption (leisure) and the inverse of the real wage (the real wage).

In equilibrium the following must be true:

$$(12) \quad y = s = c$$

$$(13) \quad n = sq = yq$$

(14) $m(\sigma-\pi) = \dot{m}$

(15) $b = 0$

(12), (13) and (14) say that the (official and black) goods, labor and money markets clear. Because all the families are alike, the privately-issued bonds are necessarily in zero net supply. Hence (15). Since y is constant, (3) and (12) jointly imply that:

(16) $\dot{m} = 0$

and thus

(17) $\pi = \sigma$

Now consider the steady-state. Since $\eta < \sigma$, it is ultimately the case that $\bar{p}/p$ is zero.[4] Also, the real interest rate equals the subjective rate of time preference. These two facts together with (12)-(13) and (17) allow me to rewrite (11) as:

(18) $u_1(y, 1-yq^*)/u_2(y, 1-yq^*) = q^*[1 + \alpha(\delta+\sigma)]$

---

[4]   As a side point, notice that the time-continuity of M well as constancy of y (=c) and CIA constraint ((3)) jointly imply that, in equilibrium, the black market price is a predetermined (i.e., non-jumping) variable. Given the assumed time-continuity of p, so is $\bar{p}/p$.

where a star, " * ", signifies the steady-state value.

(18) implicitly defines the steady-state queue. Under the assumed normality of consumption and leisure, the total differentiation of (18) yields:

(19) $dq^*/d\sigma < 0$

Thus, the unitary queue falls in the rate of the money growth. Given constant endowment, the same is true for the total amount of time wasted in lines. Therefore, inflation is welfare-improving.

The underlying intuition is simple. While the steady-state labor demand does not depend on the rate of the money growth (because, terminally, $\bar{p}/p$ becomes a constant, i.e., zero), the steady-state labor supply declines in the rate of the money growth reflecting the inflation-induced substitution towards the inflation-tax-free leisure. The latter effect was originally uncovered by Wilson (1979) (see also Aschauer and Greenwood (1983)). It is the fall in the labor supply that lowers the waiting in lines. Notice that, by continuity, an infinite money growth (and inflation) would eliminate queuing altogether!

3. The Money-in-the-Utility-Function Model

Suppose now that money is held not because of CIA constraint, but because its real balances (defined as the nominal money divided by the black market price level) yield utility. Except for this feature, I shall retain the assumptions and notation introduced in section 2.

In addition to standard properties, I assume that both the utility function, $u(c, 1-n, m)$, displays a block-separability between consumption and leisure on one hand, and real balances of money on the other, and that consumption and real balances are gross complements.[5] As these assumptions are critical for the subsequent results, a few words in their defense are in place. First, it is well-known that, in the MIUF model, the condition $u_{13} \geq 0$ is sufficient to ensure a downward sloping money demand, that is someting which seems justified by numerous empirical studies (see, e.g., a recent survey in Goldfeld and Sichel (1990)). Second, the block-separability means that the marginal rate of substitution between consumption and leisure is independent of real balances. Thus, the substitution effects triggered by, say, a tax on money result in the perfectly symmetric shifts in the demands for consumption and leisure. If inflation does not affect the labor demand, which is a reasonable assumption, in general (but see Fuerst (1992)), and true below in the _steady-state_, then the real wage becomes independent of the inflation rate.

The representative household's maximization problem becomes:

$$(20) \quad \max_{c, n, s, m, b} \int_0^\infty u(c, 1-n, m) \exp(-\delta t) dt$$

subject to (2), (4) and (5)

The first order conditions consist of (2), (4), (5), (7)-(10) and:

---

[5] Mathematically, these assumptions can be written as $d(u_1/u_2)/dm = 0$ and $u_{13} \geq 0$.

(21) $u_1(c, 1-n, m) = \lambda$

(22) $u_3(c, 1-n, m) = \lambda(\rho+\pi)$

(21) and (22) define, in a standard way, the demand for consumption and real balances, respectively. Upon combining (21) and (22) it is revealed that, not surprisingly, the optimality requires that the marginal rate of substitution between m and c be equal to the relative price of money, i.e., the nominal interest rate $(\rho+\pi)$.

Notice that the equilibrium conditions (12)-(15) continue to hold. In the <u>steady-state</u>, (16)-(17) are true as well. Further, since $\eta < \sigma$, the terminal $\bar{p}/p$ is again zero. Therefore, (7)-(8) and (21) imply that the steady-state queue is implicitly defined by:

(23) $u_1(y, 1-yq^*, m^*)/u_2(y, 1-yq^*, m^*) = q^*$

Given the block-separability of the utility function, q^* depends <u>only</u> on y. Therefore, the equilibrium consumption and leisure are independent of the monetary factors.

In the steady-state, both the real interest rate is equal to δ and (17) holds. Thus,

(24) $u_3(y, 1-yq^*, m^*) = u_1(y, 1-yq^*, m^*)(\delta+\sigma)$

Under the assumed gross-complementarity between c and m one gets:

(25) $dm^{*}/d\sigma < 0$

that is, real balances fall in the rate of the money creation. Given the established independence of c and 1-n, it follows that inflation unambiguously lowers welfare.

3. Conclusions

I have studied the steady-state welfare implications of a money growth in the endowment economies in which binding price controls lead to queuing and the black market. In the economy in which the black market purchases are subject to a cash-in-advance constraint, an acceleration of the money growth increases welfare because it reduces the amount of time wasted in lines by encouraging a substitution towards inflation-tax-free leisure. However, inflation is shown to reduce welfare in the money-in-the-utility-function economy.

The results derived in this paper have relevance for the current public-policy choices facing the formerly socialist countries, such as Russia. In particular, they may be taken as a warning that a monetary disinflation could be detrimental to welfare if it is not accompanied by a complete elimination of price controls.

References

Aschauer, D., and J. Greenwood, 1983, A Further Exploration in the
        Theory of Exchange-Rate Systems, Journal of Political Economy 91,
        875-878.

Barzel, Y., 1974, A Theory of Rationing by Waiting, The Journal of Law
        and Economics XVII, 73-95.

Feenstra, R., 1985, Anticipated Devaluations, Currency Flight, and
        Direct Trade Controls in a Monetary Economy, American Economic
        Review 75, 386-401.

Fuerst, T., 1989, Liquidity, Loanable Funds, and Real Activity, mimeo,
        University of Chicago.

Goldfeld S.M., and D.E. Sichel, 1990, "The Demand for Money", Chapter 8
        in B.M. Friedman and F.H. Hahn eds., Handbook of Monetary
        Economics, North-Holland, Amsterdam.

Kolodko G., and W. McMahon, 1987, Stagflation and Shortageflation: A
        Comparative Approach, Kyklos 40, 176-197.

Osband, K., 1992, Economic Crisis in a Shortage Economy, Journal of
        Political Economy 100, 673-690.

Podkaminer, L., 1988, Disequilibrium in Poland's Consumer Markets:
        Further Evidence on Intermarket Spillovers, Journal of Comparative
        Economics 12, 43-60.

Shleifer A., and R.W. Vishny, 1991, The Waste of Time and Talent under
        Socialism, mimeo, Harvard University.

Stahl, D.O., 1987, Queue-Rationing and Price Dynamics, Scandinavian
        Journal of Economics 89 (4), 469-485.

Wilson , C., 1979, An Infinite Horizon Model with Money, in: J. Green
        and J. Scheinkman eds., General Equilibrium, Growth, and Trade:
        Essays in Honor of Lionel McKenzie (New York: Academic Press).