Endogenous Market Power and Adjustment under Fixed Exchange Rates: Interpreting the Polish Experience 1990-1991

Working Paper # 714
July 1994

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this revision: June 1994

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* I thank an anonymous referee, whose comments on my earlier work motivated this paper, and Ryszard Rapacki for enlightening discussions. I am also grateful to the same anonymous referee and the guest editors, Max Corden and Patrick Asea, for very useful suggestions.

Abstract

This paper describes and models Poland's adjustment in 1990-1991. The model assigns a crucial role to the market power implications of the devaluation-related changes in the distribution of domestic output. Under certain assumptions, a relative reallocation of output of the domestic monopolized sectors away from consumption and towards further use as inputs in the export sector is shown to increase markups, thus reducing employment and the real wage. This makes a devaluation contractionary in the short run. The policy implication calls for a devaluation under capital immobility to be accompanied by an equiproportional injection of nominal money.

JEL Classification Numbers: F30, F32, F41

1. Introduction

This paper describes and models Poland's adjustment in 1990-1991, which followed a January 1, 1990 implementation of a stabilization program whose major components were: a sharp devaluation of the zloty, a unification of the exchange rate, and an introduction of internal convertibility at a fixed exchange rate. Comparing the Polish data with Edwards's (1989) data on 39 devaluation episodes in other countries, reveals that the country's adjustment was exceptionally contractionary in terms of output, and exceptionally expansionary in terms of exports. This is what makes this case interesting. Obviously, Poland was also the first formerly communist country to introduce internal convertibility and fixed exchange rate regime.

Although several explanations have been previously offered to explain Poland's post-1990 recession, none seems completely convincing. The earliest, due to Blanchard et al (1990), sees a source of output collapse in a fall in aggregate demand due to a reduction in real money balances caused, in turn, by price liberalization, devaluation, and an unleashing of monopoly power of the producers of home goods. The principal problem with this explanation is that at the outset of the program, 64% of money balances were held in dollars, and, as opposed to zloties, in January 1990 these took a capital gain, which must have worked towards increasing aggregate demand. Rodrik (1992) blames the recession on the demise of CMEA and the collapse of the Soviet export. However, that did not really happen until 1991. In fact, the data in the National Bank of Poland Annual Report 1990 (1991) show that in 1990, the rouble value of exports to the CMEA countries actually rose by 19%, while the rouble value of imports fell by 33%. Also, as he himself

admits, Rodrik is only able to account for 3.5% of the cumulative 1990-1991 output drop. Calvo and Coricelli (1991) stress a contractionary effect of a "credit crunch", caused by a a price reform and a tight control of nominal credit. However, credit in 1989 was not at all so scarce. Compared to 1989, aggregate nominal debt of state industrial enterprises increased in 1990 by a factor of 16. While aggregate debt to capital ratio indeed fell (from 0.12 in 1989 to 0.1 in 1990), one should remember that the book value of capital was, in part arbitrarily, increased by 2000%. Finally, Atkeson and Kehoe (1993) point out that a rapid technology change associated with a stabilization and liberalization would destroy the previously accumulated information capital, and, thus, temporarily lower efficiency and output. Yet, except for services, which fell only a little, there is no evidence of a substantial adoption of new technologies in Poland in 1990-1991.

The explanation advanced below is different in that, in addition to matching the behavior of key macroeconomic variables, it rationalizes the observed pattern of markups of price over cost, which rose upon a devaluation and then fell. In fact, we assign a crucial role to the market power implications of the devaluation-related changes in the distribution of domestic output between consumption and exports. Under certain assumptions, a relative reallocation of output of the domestic monopolized sectors away from consumption and towards further use as inputs in the export sector is shown to increase markups, thus reducing employment and the real wage. Therefore, a devaluation turns out contractionary in the short run, an outcome well documented for many developing countries (see, e.g., Cooper (1971), and Edwards (1989)).

While the current paper presents a model of a contractionary

devaluation, the precise argument differs from the existing literature. According to the oldest available theory, a devaluation leads to a recession because it raises the price level, thus reducing the real value of domestic money, which, in turn, causes a fall in aggregate demand. This is the "real balance effect". Yet, in most countries, a share of wealth held in domestic nominal assets is just not big enough to rationalize a significant "real balance effect".

The other theory of contractionary devaluation, due to Diaz-Alejandro (1965), claims that a devaluation redistributes income from groups with a low marginal propensity to save to groups with a high marginal propensity to save, which again causes a decline in aggregate demand and output. However, in a thorough study of 39 devaluations, Edwards (1989) failed to find an empirical support for this hypothesis. Finally, in van Wijnbergen's (1986) model, a devaluation raises costs of imported inputs, thus decreasing the supply of nontradeables. But the actual production of nontradeables may actually go down or up. The reason is that a devaluation usually lowers the relative price of nontradeables in terms of tradeables. Provided that the "real balance effect" is small, this leads to an increase in the demand for nontradeables. And even if output of nontradeables indeed falls, the GNP need not.

In employing the concept of monopolistic competition, the current model builds upon the classical contribution by Dixit and Stiglitz (1977). It also draws on a recent work by Gali (1993) who, while preserving the fundamental Dixit and Stiglitz insight, allows for markups to be endogenous and dependent on the composition of demand faced by the monopolists. In fact, the model developed below applies

this idea of endogenous markups to the analysis of devaluation.

The rest of the paper is organized as follows. The empirical evidence is presented in Section 2. The model is laid out in section 3. Equilibrium is studied in section 4. Section 5 discusses the effects of an unanticipated permanent devaluation, and section 6 concludes.

2. Poland's Adjustment under Fixed Exchange Rate: January 1990-April 1991.

On January 1, 1990, the Polish government implemented a comprehensive policy package aimed at stopping inflation and accelerating a transition to a market economy. Most importantly, the zloty was made internally convertible at a unified and devalued by 46% fixed exchange rate. In addition, the program contained restrictions on the government's borrowing at the National Bank of Poland, and the growth of domestic credit as well as wage controls in the form of payroll taxes paid by firms. Finally, it introduced changes in trade, price and capital controls. More precisely, trade was dramatically liberalized, as the average tariff rate was lowered to 8.6%, tariffs on a wide range of goods (mostly raw materials, intermediate goods, and electronics) were suspended for a year and a half, and import quotas and export licenses were basically abolished. At the same time, the scope of price liberalization was relatively small, since by the end of 1989, 86% of consumer prices were already freed. Regarding capital controls, while private transfers abroad of amounts not exceeding $2000 were legalized, the state-owned companies were banned from holding foreign exchange.

The exchange rate of 9500 zloties for one U.S. dollar was

maintained for over a year and a half. On May 17, 1991, it was devalued by 16.8% percent, and pegged to a basket of currencies made of the U.S. Dollar (45%), the Deutsche Mark (35%), the British Pound (10%) as well as the French and Swiss Francs (5% each). On October 15, 1991, a regime of a preannounced crawling peg was introduced, with a monthly rate of devaluation set at 1.8%. Since the aim of this paper is to study adjustment under strictly fixed exchange rates, we focus exclusively on the period January 1, 1990 through May 17, 1991.

The stabilization was followed by a recession. GNP fell by 11.6% in 1990, mostly because of a 24.2% decrease in industrial production. In April 1991, production was almost 40% below its December 1989 level. The slump was unevenly distributed across sectors: output fell the most in the light and the wood and paper industries (respectively, by 33.8% and 24.9% in 1990), and the least in the energy sector (9.7%).

Total employment decreased by 11.3% in 1990. The unemployment rate rose from zero to 6.1% and 7.3% at the end of, respectively, 1990, and April 1991. The 1990 decline in industrial employment was 9.2%, and its sectoral distribution broadly mimicked the decline in output, with the largest fall occurring in wood (23.2%) and light (22.1%) industries. In contrast, employment in energy sector actually increased by 1.7%. Since employment fell by less than output, the average labor productivity decreased as well (19% in 1990). Figure 1 plots monthly figures on industrial output and total employment. The source of these data is the Statistical Bulletin of the Central Statistical Office (1991).

The measured real wage in 1990 was 25% lower than in 1989. However, a comparison against the average for the entire 1989 is not quite meaningful because of price controls. December 1989 is a much

better reference point, since, by then, close to 90% of prices were liberalized. Compared to that period, real wages in December 1990 were lower by 10.8%. Figure 2 plots the monthly pattern of an index of nominal wage in industry deflated by CPI (this measure differs from the officially computed "real wage", whose monthly observations are not available). The data were taken from the Statistical Bulletin of the Central Statistical Office (1991).

The following evidence suggests that the stabilization temporarily increased profits. First, according to the data in Statistical Yearbook 1991 (1992), the labor share in real output fell from 22.3% in 1989 to 19.4% in 1990. Second, the data in the Statistical Bulletin of the Central Statistical Office (1991) indicate that average markups, defined as the ratio of sales to total costs, were relatively high in the early 1990, but later fell. The 1990 economy-wide average markup was 1.27, and 1.31 in industry. While a comparison against the entire 1989 is not informative (because of arbitrariness of administrative prices), and monthly data is not available for 1989, one is led to believe that, when properly measured, markups had increased upon the stabilization. This was subsequently reversed: markups were falling throughout 1990, and in December 1990 the economy-wide markup was 1.09.

Consumption in 1990 was 15.8% below its 1989 level, while the fixed investment - by 27.8%. Figure 2 plots a measure of a real per capita consumption, computed by deflating an average monthly consumption expenditure per family member in non-farm and non-pensioner families by CPI. The raw data were taken from the Statistical Bulletin of the Central Statistical Office (1991).

The 1990 value of imports in constant zloty prices was 17.9% lower

than in a previous year, while value of exports in constant zloty prices was 13.7% higher. The share of exports in output reached a record 24% (it was the highest for chemicals: 29.7%), and the country recorded an overall trade surplus of more than 4% of GNP. The performance of hard currency exports, which increased in nominal dollar terms by over 40%, was particularly impressive. Figure 3 plots the data on the hard currency trade from the National Bank of Poland Annual Reports 1990 (1991) and 1991 (1992).

The January 1990 stabilization was not immediately successful in stopping inflation. In April 1991, CPI and the price index for services were, respectively, more than 400% and more than 700% higher than in December 1989, implying a large real appreciation. It seems that the 1990-1991 inflation in the presence of a fixed exchange, low tariffs, and no import quotas must have reflected a delayed nominal adjustment to the January 1990 and earlier devaluations (real depreciations in November and December were of the order of 30% and 50%, respectively) as well as a movement of relative prices of tradeables in terms of nontradeables in response to a trade reform, which eased restrictions on imports and, very importantly, exports.

At the time of a devaluation, there was a sharp drop in the real money balances of zloties. As can be seen in Figure 4, which plots the data from the Statistical Bulletin of the Central Statistical Office (1991), their subsequent recovery occurred despite a continuing inflation. Given the constraints on the growth of domestic assets, a creation of nominal money was mostly due to an accumulation of reserves by the National Bank of Poland. These reserves rose by $2.7bn in 1990, reflecting a large trade surplus. At the end of the 1990, 46% of the

high-powered money and 20% of an entire money stock were backed by the foreign exchange reserves. A year before, these numbers were, respectively, 35% and 13%.

The nominal interest rate followed the usual post-devaluation path of an initial rise and a subsequent fall. The pattern of the ex post real interest rate was less clear. However, as expected, its correlation with output, computed using monthly observations for January 1990 through April 1991, was negative (-0.12).

Table 1 provides a condense characterization of Poland's adjustment, by presenting the coefficients of correlation between industrial production and several real variables. These correlations were computed using monthly observations for January 1990 through April 1991. As can be seen, employment, average productivity, real wage, labor share in output, and consumption were statistically significantly procyclical. These features qualitatively agree with the Kydland and Prescott (1990) and Backus and Kehoe (1992) evidence for other countries.

The average markups were countercyclical, although not statistically significantly so. However, as noted by Bils (1987 p.840), the average markup has a procyclical bias (because of fixed costs). Incidentally, countercyclical markups have been found in Rotemberg and Woodford's (1990) recent study of the U.S. data. Like the average markups, net exports were statistically insignificantly countercyclical. Using international data, Backus and Kehoe (1992), and Backus, Kehoe, and Kydland (1992)) have recently found that a correlation between net exports and output, while generally negative, was often also insignificant.

3. The Model

Consumers

There is a large number of identical, infinitely-lived families, whose total measure is one, and who have perfect foresight. At any point in time, the representative family derives utility from a continuum of varieties of home goods (on a [01] interval), an importable good, and real balances of domestic money as well as disutility from working. It also owns two firms: one producing home/intermediate goods, and the other exportables.

Families hold exclusively domestic assets, A, which consist of private nominal bonds, B, each earning an interest rate i, and money, M. Money is internally convertible, i.e., the central bank sells foreign exchange only for the purpose of an importation of goods, and repurchases the entire export earnings. The nominal exchange rate, E, is constant.

The representative household chooses consumption, labor supply, and holdings of bonds and money so as to maximize life-time utility

$$\int_0^{\infty} \left[(1/1-\phi)\{[(\int_0^1 c_k^{(\theta-1/\theta)}dk)^{\alpha\theta/(\theta-1)}]z^{1-\alpha}\}^{1-\phi} + v(M/P) - h(n)\right]e^{-\delta t}dt, \quad (1)$$

subject to

$$dA/dt = Ai - iM + \Pi_E + \Pi_{Ik} + wn - \int_0^1 c_k p_k dk - zEq^* \quad , \quad (2)$$

$$A = M + B \quad , \tag{3}$$

$$\lim_{t\to\infty} A\exp(-\int_0^t i d\tau) = 0 \quad \text{(no Ponzi games)} \; . \tag{4}$$

c_k is consumption of the kth variety of home goods, while p_k is its given price. z and q^* denote, respectively, consumption and a given world price of importables (PPP holds). $0 < \alpha < 1$, $\theta > 1$, and $\phi > 0$ (if ϕ is unity, then the subutility defined over $(\int_0^1 c_k^{(\theta-1/\theta)} dk)^{\alpha\theta/(\theta-1)} z^{1-\alpha}$ is logarithmic). P is the exact price index which, after a normalization, is defined as $(\int_0^1 p_k^{1-\theta} dk)^{\alpha/(\theta-1)} (Eq^*)^{1-\alpha}$. The function v is increasing, concave, and satisfies the Inada conditions. Labor supply is denoted by n, while a competitive wage by w. The function h is increasing and convex. Π_E and Π_{Ik} denote profits earned by the firms producing, respectively, the exportables and the kth intermediate good; households take them as given. $\delta > 0$ is the subjective rate of time preference.

Notice that preferences for home goods exhibit the Dixit-Stiglitz (1977) love for variety. θ is an elasticity of substitution between any two varieties, and, given the large number of varieties, it is also the relative price elasticity of demand for any particular variety. Let λ be the the marginal utility of nominal wealth, i.e., the multiplier on (2). The first-order optimality conditions consist of (2)-(4) and:

$$\alpha R^{-\phi_S(\alpha\theta-\theta+1)/(\theta-1)} c_k^{-1/\theta} z^{1-\alpha} = \lambda p_k \quad \text{for each } k \quad , \tag{5}$$

$$(1-\alpha)R^{-\phi}S^{\alpha\theta/(\theta-1)}z^{-\alpha} = \lambda Eq^{*} \quad , \tag{6}$$

$$v'(M/P) = \lambda Pi \quad , \tag{7}$$

$$h'(n) = \lambda w \quad , \tag{8}$$

$$d\lambda/dt = \lambda(\delta-i) \quad , \tag{9}$$

where $R \equiv [(\int_0^1 c^{(\theta-1/\theta)}dk)^{\alpha\theta/(\theta-1)}]z^{1-\alpha}$, and $S \equiv \int_0^1 c^{(\theta-1/\theta)}dk$.

(5)-(8) implicitly define, respectively, the demand for goods, real balances, and the supply of labor. An optimal accumulation of assets is characterized by (9).

Producers of Exportables

The representative firm in the export sector good operates the Dixit-Stiglitz (1977) technology, which transforms a continuum of intermediate inputs into a good which sells exclusively in the world market at a given price p^{*}. PPP holds. The elasticity of substitution in production between any two input brands is $v > 1$, and, given a large range of inputs, it is also equal to the relative price elasticity of demand for any particular brand. Let s_k be the amount of the kth intermediate input, and p_k its competitive price. The representative

firm chooses s_k's so as to maximize profits:

$$\Pi_E = Ep^* \left(\int_0^1 s_k^{(v-1)/v} dk\right)^{v/(1-v)} - \int_0^1 s_k p_k dk \quad . \tag{10}$$

The first-order condition is:

$$Ep^* T^{1/(v-1)} s_k^{-1/v} = p_k \quad \text{for each } k \quad , \tag{11}$$

where: $T \equiv \int_0^1 s^{(v-1)/v} dk.$

Producers of Home/Intermediate Goods

The representative firm in the home/intermediate goods sector produces output which is sold to domestic consumers and producers of exportables. That is, by, assumption, home goods and intermediate inputs are identical. This is certainly true for utilities. Buildings are another example, for they can be used to either house people, or as offices of exporting firms.

There are two factors of production: managerial skills, which are a nontraded factor of production, and hired labor. A unitary set-up employment of managerial skills is needed to produce any amount of any variety. In addition, making one unit of any brand requires one unit of hired labor. Each firm is endowed with exactly one unit of managerial skills, and can freely choose the produced variety. Thus, in equilibrium, it always picks a distinct brand and becomes a monopolist.

The firm producing the kth variety recognizes its market power,

and, while taking as given R, S, z, λ, p^*, E, and T, exploits a negative relationship between the quantities sold and price. Most importantly, the firm charges the same price in both consumption and input markets, since it cannot price-discriminate. The assumed lack of price discrimination can be defended on the following grounds. First, if prices in the two markets were different, then there would be an arbitrage opportunity and, unless arbitrage were costly, only the lower price would be effective. Second, enacting barriers to arbitrage can be costly, and sometimes impossible and/or illegal. For example, without eavesdropping, a telephone company is unable to establish if any given call is private (i.e., consumption) or export-related.

The firm chooses p_k and employment l_k so as to maximize profits,

$$\Pi_{Ik} = (c_k + s_k)p_k - wl_k \quad , \tag{12}$$

subject to

$$l_k = c_k + s_k \tag{13}$$

as well as (5) and (11).

At the optimum, the marginal revenue product of labor, MRPL, is equal to the real wage. MRPL is, in turn, equal to the marginal product of labor, MPL, divided by the optimal markup, μ_k, which is given by $[1-1/\xi_k]^{-1}$, where ξ_k is the elasticity of total demand for the kth brand. Note that in our case, MPL is unity.

As stressed in Gali's (1993) recent paper on growth, if a price-not-discriminating monopolist faces several markets with different

price elasticities, then the elasticity of total demand is endogenous and given by a share-weighted average of elasticities in the individual markets, with weights equal to the fractions of these markets in total sales. In the current model, ξ_k is then equal to $\theta c_k/l_k + v[1-(c_k/l_k)]$, or $(\theta-v)c_k/l_k + v$. Therefore, profit maximization requires:

$$[(\theta-1)c_k + (v-1)s_k]/(\theta c_k + vs_k) = 1/\mu_k = \tag{14}$$

$$[(v-1)l_k + c_k(\theta-v)]/[vl_k + c_k(\theta-v)] = w/p_k \quad .$$

It is convenient to rewrite (14) so as to get an explicit expression for the kth firm's demand for labor:

$$l_k = (\theta-v)c(w/p_k - 1)/[v(1-w/p_k) -1]. \tag{14'}$$

(14') leads to Proposition 1.

Proposition 1.

Suppose that the elasticity of substitution between any two varieties of home consumption goods is higher (lower) than the elasticity of substitution between any two intermediate inputs used in the production of exportables, i.e., $\theta > v$ ($\theta < v$). Then:

(i) for a given w/p_k, the elasticity of l_k with respect to c_k is one;

(ii) for a given c_k, l_k is decreasing (increasing) in w/p_k.

The intuition behind Proposition 1 is relatively straightforward. Assume that $\theta > v$. If w/p_k is constant, so must be μ_k and ξ_k.

Therefore, an increase in c_k must be matched by an equiproportional increase in l_k. Further, in response to a higher real wage, the kth firm lowers markup or, equivalently, chooses to produce and sell at a point which is characterized by a higher elasticity of demand. When c_k is fixed and $\theta > v$, this requires a decrease in output and, hence, employment.

The Government

We assume that gross earnings on the central bank's stock of foreign exchange are used to pay for the government's wasteful consumption. This eliminates permanent wealth effects of temporary trade imbalances.

4. Equilibrium

In a symmetric Nash equilibrium, all firms in the home/intermediate goods sector charge the same price (p), employ the same amount of labor (l), and choose the same - but, in general, unequal - c and s. In addition,

$$n = l \quad , \tag{15}$$

$$n = c + s \quad , \tag{16}$$

$$B = 0 \quad , \tag{17}$$

$$dM/dt = E(sp^{*} - zq^{*}) \quad , \tag{18}$$

since the labor and goods markets clear, nominal bonds are in zero net supply (as every household is alike), and, given internal convertibility, a change in the stock of money is given by net exports.

It follows from symmetry and constant returns in the competitive export sector, that p equals Ep^*, P equals $Ep^{*\alpha}q^{*1-\alpha}$, and $\Pi_E = 0$. At the same time, $\Pi_I > 0$, since this is actually a reward earned by the nontraded managerial skills. Dividing (5) by (6), substituting the equilibrium conditions, and rearranging yields the following positive relationship between z and c:

$$z = c\alpha p^*/(1-\alpha)q^* . \tag{19}$$

Substituting the equilibrium conditions into (8) and (14) leads to

$$[(v-1)n + c(\theta-v)]/[vn + c(\theta-v)] = 1/\mu = w/Ep^* = \tag{20}$$

$$= h'(n)/(1-\alpha)c^{-\phi}\, U^{-\phi(1-\alpha)-\alpha} ,$$

where μ is the economy-wide equilibrium markup, and $U \equiv (1-\alpha)p^*/\alpha q^*$.

(20) implicitly defines the general equilibrium relationship between employment and consumption of home goods. The left-most expression is the economy-wide labor demand, while the right-most expression is the economy-wide labor supply. We can now state Proposition 2.

Proposition 2.

Suppose that the elasticity of substitution between any two varieties of

home consumption goods is higher than the elasticity of substitution between any two intermediate inputs used in the production of exportables, i.e., $\theta > v$, and the general equilibrium elasticity of labor supply with respect to consumption of home goods is larger than -1. Then the general equilibrium elasticity of employment with respect to consumption of home goods is positive and less than one.

The intuition behind Proposition 2 is as follows. As already explained, when $\theta > v$, an increase in c increases labor demand. But such an increase in c also decreases labor supply. The elasticity of labor demand with respect c is unity. Thus, when the general equilibrium elasticity of labor supply with respect to c is larger than -1, then the fall in labor supply is in absolute terms smaller than the rise in labor demand, implying a positive but less than proportional relationship between n and c.

It can be shown that the condition that the general equilibrium elasticity of labor supply with respect to c be larger than -1 is equivalent to a condition that the negative of the general equilibrium elasticity of marginal utility of c with respect to c be less than the elasticity of the marginal disutility of labor with respect to labor. Further, in our case, the negative of the general equilibrium elasticity of marginal utility of c with respect to c is equal to ϕ, and is different from the negative of the partial equilibrium elasticity of marginal utility of c_k with respect to c_k, which is $1/\theta$.

Under the conditions of Proposition 2, c/n is increasing in c, so the real wage and markup are, respectively, increasing and decreasing in c. Proposition 2 and (16) do not imply any particular

relationship between s and c. However, it is not difficult to establish that s is a decreasing function of c, provided c/n is not too small, a condition which will always be met in equilibrium.

Solving for λ in terms of c, differentiating and substituting the resulting expression, along with (7) and the equilibrium P, into (9) gives the equilibrium law of motion for the consumption of home goods:

$$dc/dt = -c/[\phi(\delta - i)] = \tag{21}$$

$$= -c/\phi\left[\delta - [v'(M/Ep^{*\alpha}q^{*1-\alpha})/c^{-\phi(1-\alpha)}U^{-\phi(1-\alpha)-\alpha}]\right] \quad .$$

Substituting (16) and (19) into (18) yields the law of motion for nominal balances:

$$dM/dt = E(sp^{*} - zq^{*}) = E[p^{*}(n(c) - c) - q^{*}p^{*}(1-\alpha)c/\alpha q^{*}] = \tag{22}$$

$$= Ep^{*}[n(c)\alpha - c]/\alpha \quad .$$

The dynamic general equilibrium is described by (21), (22) and (4). The steady-state consumption, c_{ss}, and nominal money balances, M_{ss}, are implicitly determined by:

$$\alpha n(c_{ss}) = c_{ss} \quad , \tag{23}$$

$$\delta = v'(M_{ss}/Ep^{*\alpha}q^{*1-\alpha})/c_{ss}^{-\phi(1-\alpha)}U^{-\phi(1-\alpha)-\alpha} \quad . \tag{24}$$

Note that the steady-state real balances, $m_{ss} \equiv M_{ss}/Ep^{*\alpha}q^{*1-\alpha}$, are independent of the price level, so there is no "money illusion" in the long run. Analyzing the system derived by linearizing (21) and (22) around the steady-state leads to Proposition 3.

Proposition 3.

Suppose that the elasticity of substitution between any two varieties of home consumption goods is higher than the elasticity of substitution between any two intermediate inputs used in the production of exportables, i.e., $\theta > v$, and the general equilibrium elasticity of labor supply with respect to consumption of home goods is larger than -1. Then the dynamic equilibrium is saddle-point stable, and on the saddle path, consumption of home goods and the nominal balances money move in the same direction.

Figure 5 presents the phase diagram, with an upward-sloping KK curve being the saddle path.

5. The Effects of An Unanticipated Permanent Devaluation

Suppose that the model economy is in the steady-state equilibrium for a given value of the nominal exchange rate, say, E_0. As is drawn in Figure 1, an unanticipated permanent devaluation from E_0 to, say, E_1, rotates the dc/dt = 0 curve clockwise, shifting the saddle-path to K'K'. Given the previously derived results, one can state the following proposition.

Proposition 4.

Under the conditions of Proposition 2, an unanticipated permanent devaluation instantaneously lowers consumptions of home goods and importables, employment, output, the real wage, and real money balances, but increases markup, gross and net exports as well as nominal and real interest rates. These impact effects are gradually reversed on a transition, which, in addition, features an accumulation of nominal money balances.

Proposition 4 is clear, except for the behavior of real balances and interest rates. To understand these, note, first, that since the domestic price level adjusts instantaneously (because PPP holds), real balances drop on impact. M, P, and c are time-continuous on a transition, so (7) implies that i is time-continuous as well. But since c is increasing following an initial drop, it follows from (21) that i is above the steady-state level of δ. That means that it jumps on impact and then gradually falls. The behavior of real interest rate is the same, since there is no inflation.

The following intuition is behind Proposition 4. In view of the lack of long-run "money illusion", a post-devaluation adjustment must involve an equiproportional increase in the nominal stock of money. Given the absence of capital mobility, the latter is possible only if there is a temporary trade surplus, which arises due to both a fall in imports and a rise in exports. Since producers of exportables are relatively inelastic demanders of the differentiated varieties of home inputs, and price-discrimination is impossible, the elasticity of total demand for the domestically-produced intermediate goods falls, which

leads to a higher markup, and a lower labor demand. If the latter effect dominates a simultaneous increase in labor supply, which is due to a fall in consumption, then employment, output, and the real wage fall. Thus, the real wage and consumptions of home goods and importables are procyclical, while net and gross exports as well as markups are countercyclical. This broadly agrees with the Polish data, as discussed in section 2.

6. Conclusions

This paper has first documented, and then modeled the recent Polish experience under a fixed exchange rate. The model explains how a devaluation can simultaneously produce a recession and an export boom. The exact theoretical argument for a contractionary devaluation is new, and stresses the market power implications of the devaluation-related changes in the allocation of domestic output between consumption and exports. In the model, a devaluation is bound to generate a temporary trade surplus, since there is no long-run "money illusion" nor capital mobility. This, in turn, necessitates a relative reallocation of output of the domestic monopolized sectors away from consumption and towards further use as inputs in the exportables-producing sector. If monopolies have more market power in the input market than in the consumption market (because of a relatively lower elasticity of substitution), then such a reallocation increases markups, thus reducing employment and the real wage.

The key role in the analysis is played by the assumptions that the elasticity of substitution between any two varieties of home consumption goods is higher than the elasticity of substitution between

any two intermediate inputs used in the production of exportables, and that monopolies cannot price discriminate. In defense of these assumptions, it has to be said that it is indeed true for the Polish monthly data from January 1990 through April 1991, that the correlation coefficient between the average markup and consumption per capita is negative (-0.26), while the correlation coefficient between the average markup and net exports is positive (0.67).

The principal policy implication derived from this paper calls for a devaluation under capital immobility to be accompanied by an equiproportional injection of nominal money. In such a case, real balances would be unaffected by the resulting price change, so agents would have no incentive to rebuild them via trade surplus. Thus, there would be no change in the elasticity of demand facing the domestic monopolies, and the post-devaluation recession would be avoided.

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Table 1

Coefficients of Cross-Correlations with Industrial Production*

employment	0.48*
average productivity in industry	0.8*
real wage	0.8*
labor share in output	-0.56*
consumption per capita	0.68*
average markup	-0.02
net exports	-0.05

Note: except for net exports the data was taken directly from, or computed using, raw numbers in the Statistical Bulletin of the Central Statistical Office (1991); employment refers to the entire economy; average productivity was computed by dividing an index of industrial production by industrial employment; the real wage was computed by deflating an index of nominal wages in industry by CPI; labor share in output was computed by dividing the ratio of a nominal wage bill to CPI by an index of real output; consumption per capita was computed by deflating an average monthly consumption expenditure per family member in non-farm and non-pensioner families by CPI; average markup was computed as a ratio of nominal sales in industry to total costs; net exports refer to hard currency trade and were taken from the National Bank of Poland Annual Report 1990 (1991) and 1991 (1992); a star, "*", indicates a statistical significance at 95% level (two-tailed test).

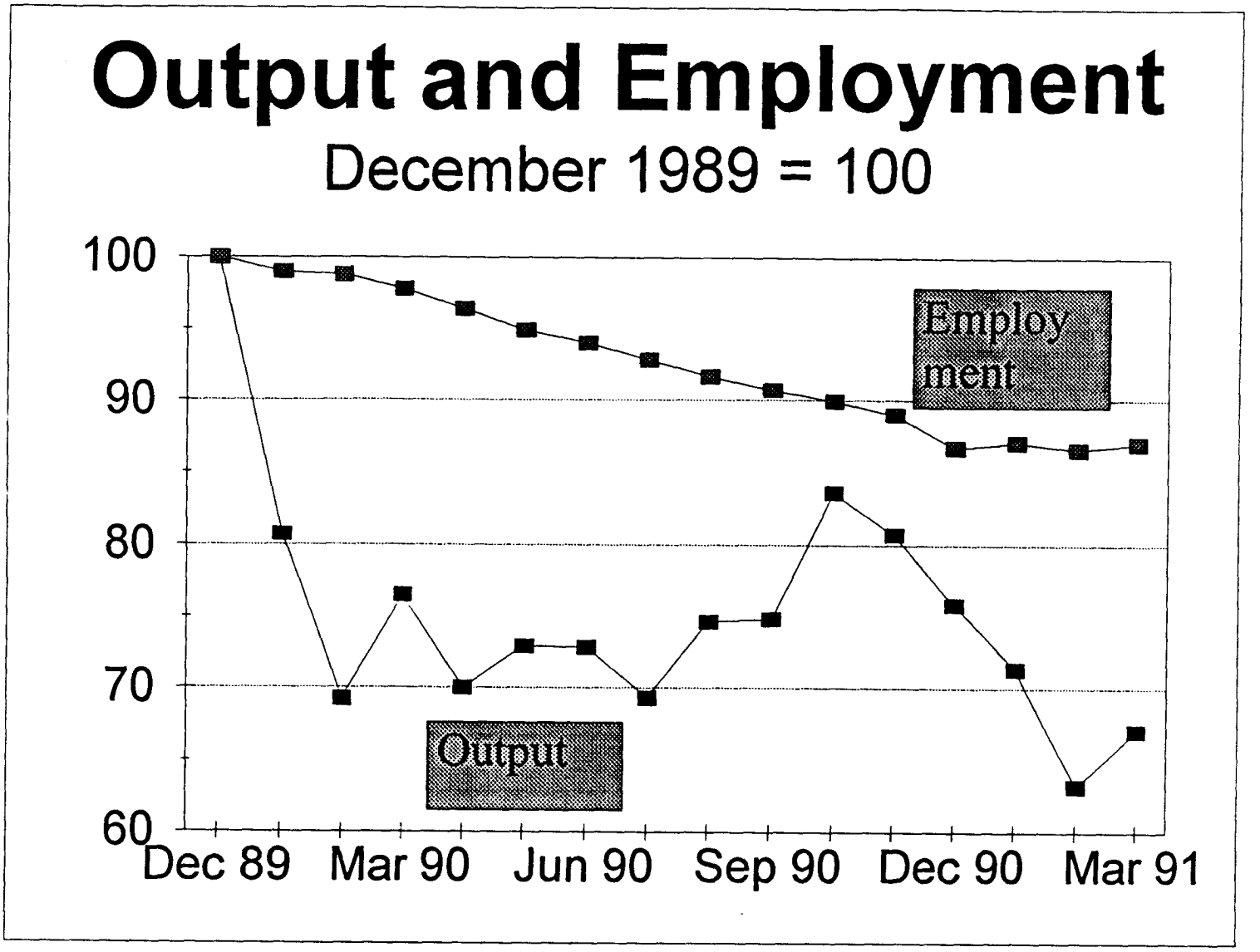
Output and Employment
December 1989 = 100
100
90
80
70
60
Employ ment
Output
Dec 89
Mar 90
Jun 90
Sep 90
Dec 90
Mar 91

FIGURE 1

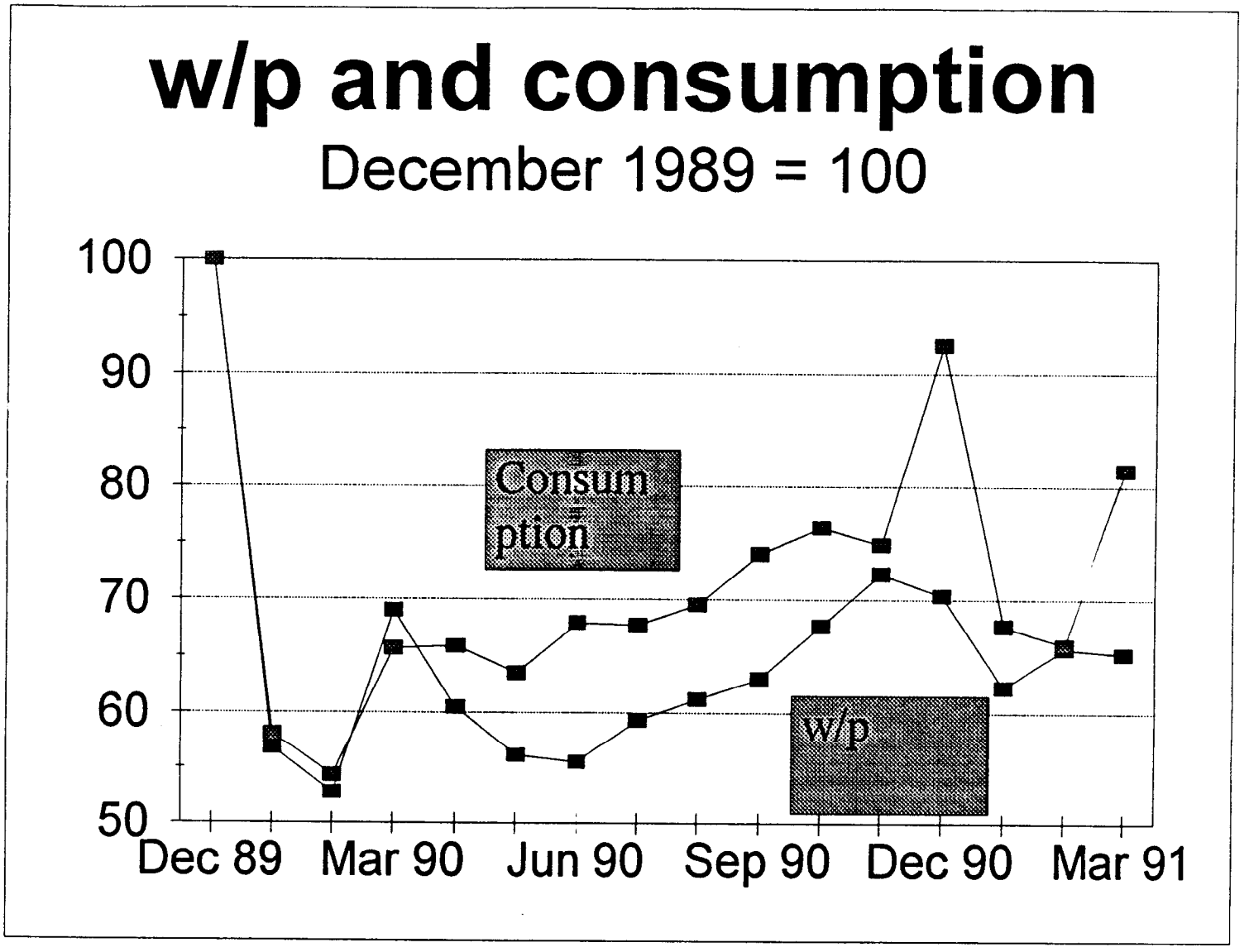
w/p and consumption
December 1989 = 100
100
90
80
70
60
50
Consum
ption
w/p
Dec 89
Mar 90
Jun 90
Sep 90
Dec 90
Mar 91

FIGURE 2

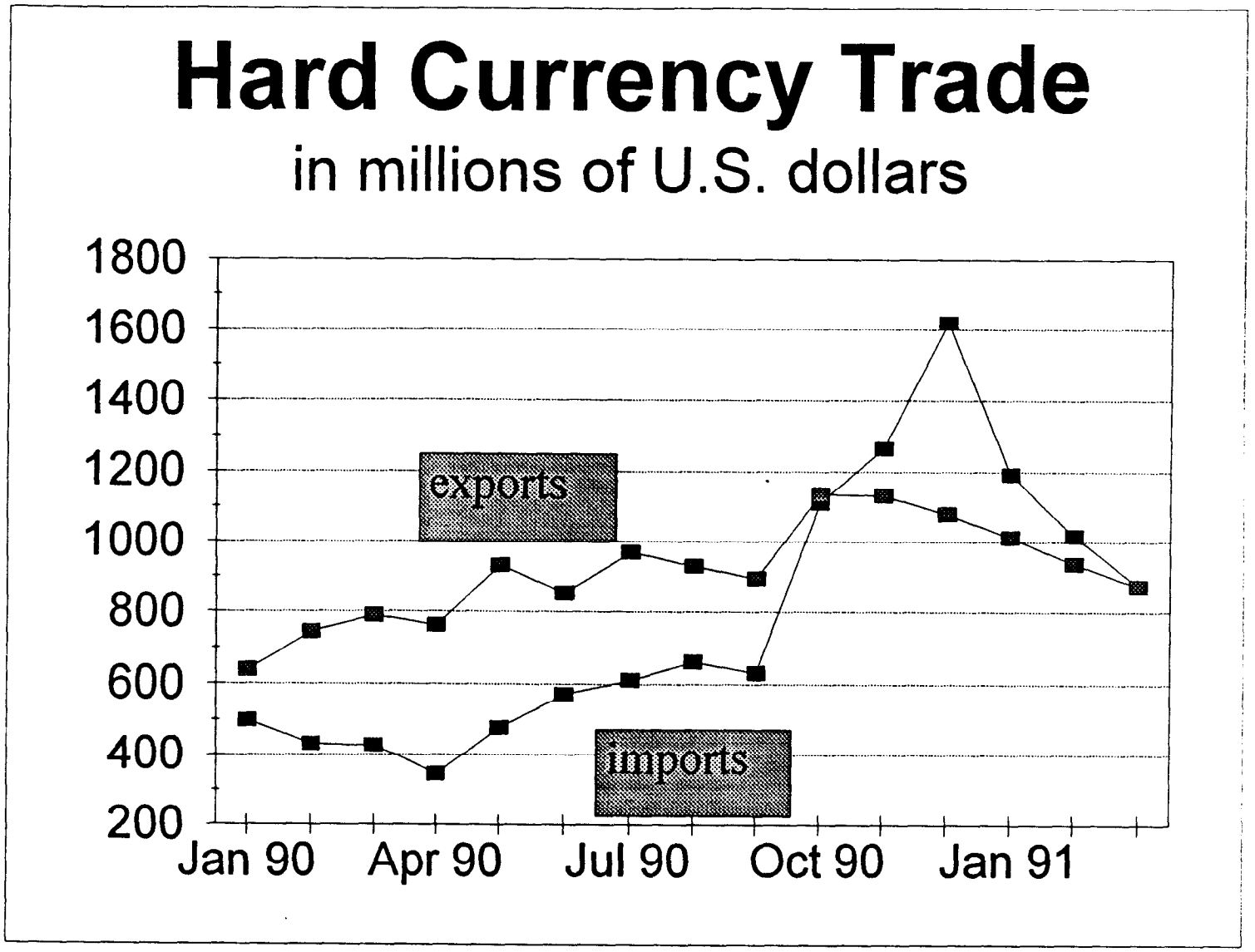
Hard Currency Trade
in millions of U.S. dollars
1800
1600
1400
1200
1000
800
600
400
200
exports
imports
Jan 90
Apr 90
Jul 90
Oct 90
Jan 91

FIGURE 3

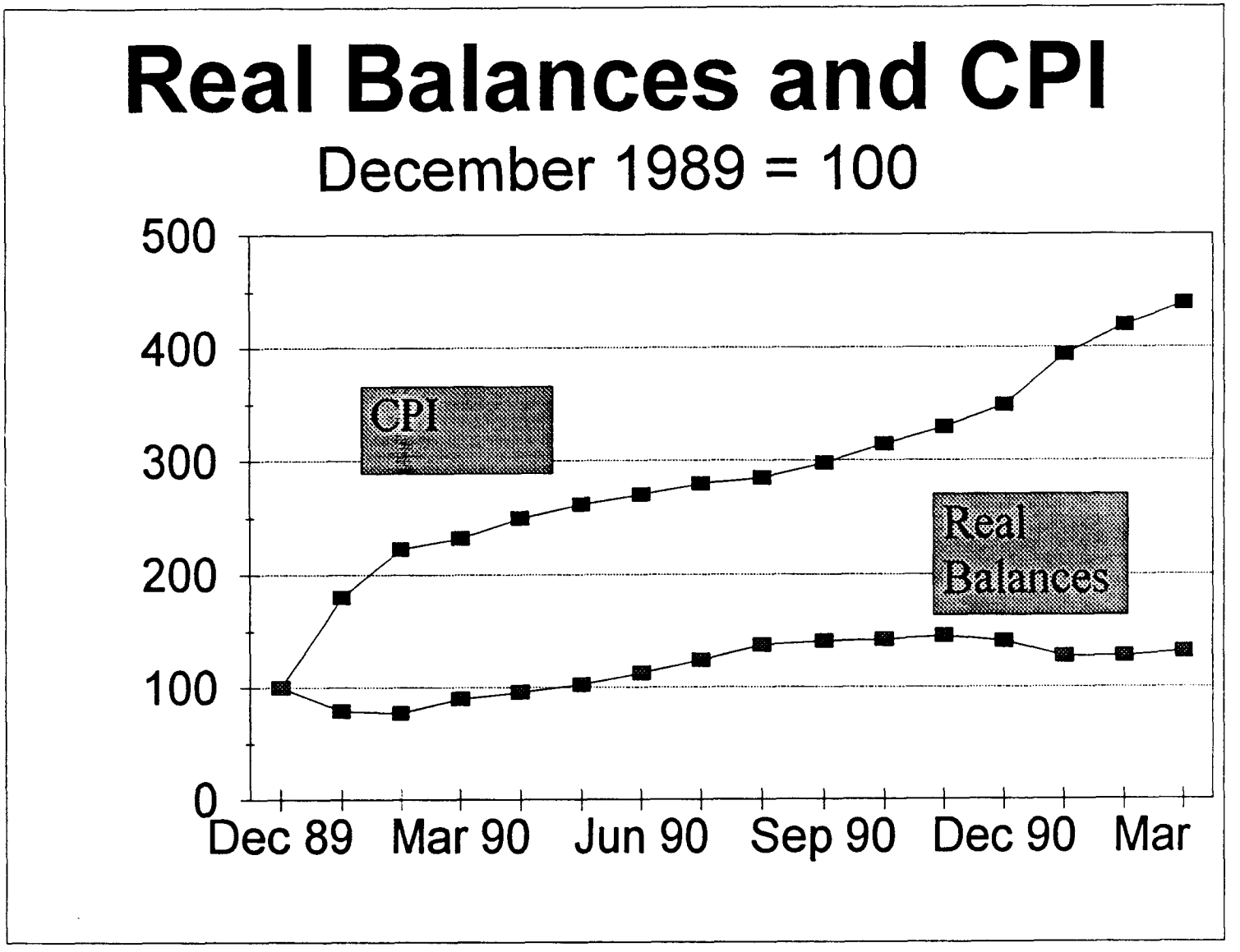
Real Balances and CPI
December 1989 = 100
500
400
300
200
100
0
CPI
Real Balances
Dec 89
Mar 90
Jun 90
Sep 90
Dec 90
Mar

FIGURE 4

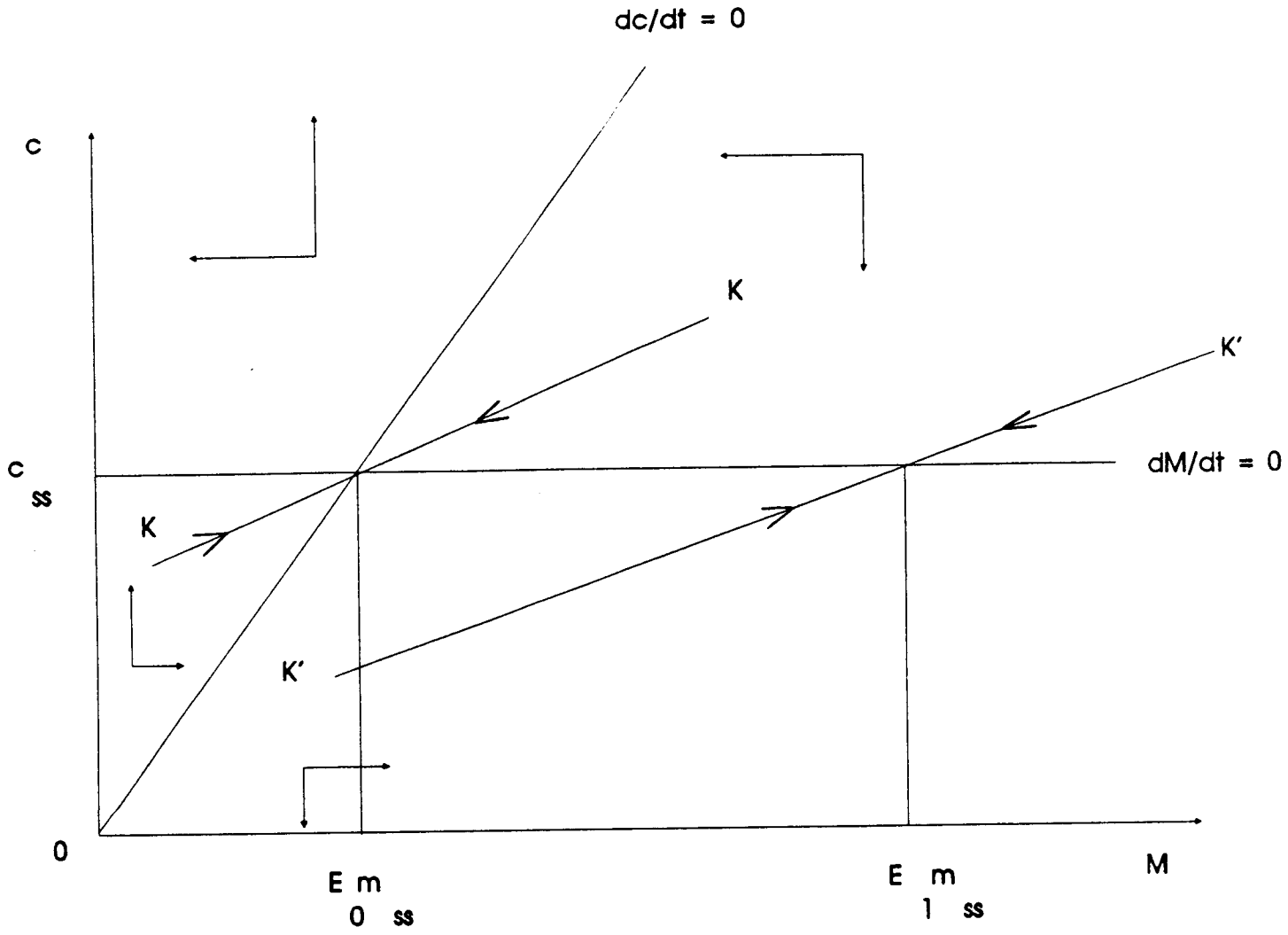

FIGURE 5
The Dynamics of c and M