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STAGFLATION, NEW PRODUCTS, AND SPECULATION

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By

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The paper looks at the macroeconomic implications of some recent developments in the theory of industrial organization. In a Kalechian model, firms are assumed to invest heavily early in the product life cycle, thus creating effective demand. Conversely, it is assumed that late in the product life cycle firms hoard, waiting for new products to invest in. Under reasonable conditions, the rates of growth, unemployment, and inflation can be related to the fraction of new products in the economy.

The purpose of this paper is to trace the possible macroeconomic implications of some recent developments in the practice of corporate strategy and the theory of industrial organization.

1. INTRODUCTION

This paper will focus on the theory of corporate strategy put forward by the Boston Consulting Group (BCG). Since its introduction some twenty years ago, this theory has had a growing influence on management practice. (Haspeslagh [1981] reports that more than half of the Fortune 500 use this theory or a spin-off from it.)

That part of the BCG theory which I shall use provides a rough framework for assessing investment opportunities under capital rationing. It is known as the <u>growth-share matrix</u> and is, in my judgment, the major factor behind the spectacular success of the firm during the past two decades.

The reasoning behind the growth-share matrix is simple and intuitively appealing. Assume the following four premises to be true:

1. All costs follow "experience curve" reductions, where experience is a measure of accumulated, firm-specific sales.
2. In order to grow, a firm must, even in a friendly capital market, be able to retain some earnings.
3. Market shares exhibit declining price sensitivity over time.
4. Growth rates for individual products decline over time.[1]

BCG has developed an extensive body of data purporting to back up premise 1, while premises 2, 3, and 4 are easier for most practitioners to evaluate.

Note in passing that the above four premises are in obvious conflict with neoclassical economic theory. Premises 1 and 3 imply the existence of external effects of consumption on both production possibility sets and preferences, while premise 2 indicates an imperfect capital market and premise 4 an inexplicable regularity.

Let us look at BCG's practical conclusions from the above four points:

1. If you have a big market share and have moved far down the experience curve, you will have lower unit costs than your competition.
2. This condition can be reached by an all-out effort in the early stages of the life cycle (see Spence [1979] for a reconstruction).
3. In the late stages, market shares stabilize and total market growth slows down; investments are thus nonrewarding and you should channel funds to younger industries.

Under the assumption that a big current market share corresponds to a history of high market shares, BCG can now group firms into four categories:

1. stars--high growth, high market share
2. cows--low growth, high market share
3. question marks--high growth, low market share
4. dogs--low growth, low market share

BCG also deduces three basic financial implications:

1. The stars have low relative costs and thus generate high profits, they also have high growth and thus high investment needs. They should be approximately self-financing.
2. The cows produce high profits, but low investment needs because of slow growth. These are cash sources.
3. The question marks have high relative costs and thus low profits, whereas the high growth means high cash needs. As market shares are still elastic, however, we might be able to turn them into stars. These can then be cash users.

In terms of price space, the implication is that firms will price low early in the produced life cycle and take profits home later. I will combine this pricing pattern in individual industries with the speculative behavior of diversified/potentially diversified firms. The idea is that firms in old industries will keep funds liquid until new, more attractive industries appear. This is an example of the Keynesian "speculation motive" [Keynes 1969, Ch. 13]. In addition, consumers are assumed to speculate, in the sense that they will buy or sell from their share of a fixed pool of liquid assets if their price grows at a lower or higher rate than the steady-state growth rate of the economy.

2. ANALYSIS

2a. A Kalechian Model.

I will here present a simple n + 3 sector model of economic growth. The model assumes n(t) consumer good industries, which at time t may be at different stages of the product life cycle. As the product matures, several things happen: first, the industry is gradually monopolized; second, the initial growth in demand tapers off; and third, consumers become less and less price-sensitive. All of this, of course, is based on the BCG assertions. In addition to the n(t) consumer goods, there is one capital good which is assumed to be produced in a profitless sector. Furthermore, there is a firm or capitalist consumption good, also produced without profit. In these n(t) + 2 sectors, production is set to meet net demand. The last good is nonproducible, but available in a certain fixed amount. It is storable and liquid, so it can be used for value storage by firms and speculation by consumers. One could consider land or gold as examples.

All production functions are assumed to be linear and limitational with respect to capital and labor, although the capital good and the firm consumption good are produced from labor only. Capital has an infinite lifetime and unused capital is sold at full price.

In each consumer good industry, there is a unique debt/equity ratio, such that all firms have to finance some fraction of their capital costs internally, whereas all labor costs require internal funding. The loan market is not explicit in the model, but is assumed to channel exactly the demanded amount of loans from surplus industries to deficit industries at a given exogenous interest rate r. This interest rate is assumed to be identical to the steady-state growth rate of the economy (which will be discussed later). It is assumed that all loans go from firms to firms. Consumers participate only in the markets for consumption goods and occasionally in the market for the nonproducible good.

On this basis, we can construct the model below, where

X_i = production and sales level of consumer good i, $i \varepsilon N(t)$;

$N(t) = \{1, 2, ..., n(t)\}$ = set of consumer goods;

X_o = production and sales level of capital good;

X_s = production and sales level of firm consumption good;

X_h = net flow of nonproducible good into firm sector;

L = labor employed, assumed feasible;

P_i, P_o, P_s, P_h = prices of X_i, X_o, X_s, X_h;

w = wage, used as numeraire, written for clarity;

a_i = labor coefficient of good i, $i \varepsilon N(t)$;

b_i = capital coefficient of good i, $i \varepsilon N(t)$;

a_o, a_s = labor coefficients of capital and firm consumption goods;

$\frac{E}{D+E}_i$ = share of internal capital financing needed in industry i, $i \varepsilon N(t)$;

$m_i(t)$ = variable going from close to 0 (but above) towards 1 as industry $i \varepsilon N(t)$ is monopolized;

$F_i(P_1, P_2, ..., P_{n(t)}, t)$ = demand for good $i \varepsilon N(t)$ in units per worker (see Henderson [1979]); and

$1-c$ = firm consumption as share of profits, $0 < c \leq 1$.

All variables, save $P_h X_h$, are positive. $F(\cdot)$ and $m(\cdot)$ are differentiable.

The endogenous variables are $X_i, X_o, X_s, L, P_i, P_h, X_h$ as functions of time. The exogenous or constant variables are $N(t)$, $P_o(= a_o w), r, a_i, b_i, a_o, a_s$, $\frac{E}{D+E_i}$, $c, m_i(t)$.

2b. Firms

The model of firm behavior is based on the following equation:

$$(1) \quad P_i = wa_i + rP_o b_i - m_i(t) \frac{F_i}{\partial F_i/\partial P_i}, \ i\varepsilon N(t).$$

This is intended to mimic the pricing pattern suggested by BCG, such that $m_i(t)$ reflects the monopolization, the price being at cost for $m_i(t) = 0$ and and at the monopoly level for $m_i(t) = 1$.[2]

Note that the partial demand curve is used as a basis for the monopoly price. Except in very special cases, no firm will speculate in terms of dF_i/dP_i, nor have an idea of its value.

A solution to (1) is a fixed point for the continuous vector function $\phi(P) : R^{n+} \to R^{n+}$, where $\phi_i(P) \equiv wa_i + rP_o b_i - m_i(t) \frac{F_i}{\partial F_i/\partial P_i}$, $i\varepsilon N(t)$. Existence of such a point could be guaranteed by Brouwer's familiar fixed-point theorem, if we could use reasonable maximum prices to restrict the domain of ϕ to some box C R^{n+}, such that the image of C, call D, is contained in C. For any value of P_j, $i \neq j\varepsilon N(t)$, it is clear that ϕ remains positive for $P_i \to 0$, provided

(F1) $F_i > 0, \ i\varepsilon N(t)$,

(F2) $\frac{\partial F_i}{\partial P_i} < 0, \ i\varepsilon N(t)$.

By its continuity, ϕ is furthermore bounded in any closed interval. All we need to find D C is that $\phi_i < P_i$ for $P_i \to \infty$, regardless of P_j, $i \neq j \varepsilon N(t)$. This is the case if for all P_j, $j \neq i$:

(F3) $$-\frac{F_i/P_i}{\partial F_i/\partial P_i} < \frac{1}{m_i(t)} \text{ for } P_i \to \infty,\ i \varepsilon N(t).$$

For $m_i(t) = 1$, we thus get the ordinary condition that the elasticity should be greater than 1.

It is interesting to look at the conditions under which (1) has the property that prices increase if no new products arrive. To find a set of sufficient conditions for this we differentiate (1) w.r.t. time and get:

(2) $$[I-M(F_{pd}^{-2}F_d F_{pp} - F_{pd}^{-1}F_p)]\dot{P} = -\dot{M}F_{pd}^{-1}F + M(F_{pd}^{-2}FF_{pt} - F_{pd}^{-1}F_t),$$

where F_{pp} and F_p are n x n matrices with typical elements $\frac{\delta^2 F_i}{\delta P_i \delta P_j}$ and $\frac{\delta F_i}{\delta P_j}$, respectively, while I, M, F_{pd}, F_d are diagonal n x n matrices with typical elements 1, $m_i(t)$, $\frac{\delta F_i}{\delta P_i}$, and F_i. Finally $\dot{P}$, F, F_{pt}, F_t, and P will denote n vectors with typical elements $\dot{P}_i$, F_i, $\frac{\delta^2 F_i}{\delta P_i \delta t}$, $\frac{\delta F_i}{\delta t}$, and P_i. Let us now look at the r.h.s. of (2) and assume that, as $t \to \infty$ and no new goods arrive, $M \to 0$ and:

(F4) $$\frac{\delta F_i}{\delta t} \to 0 \text{ for } i \varepsilon N,$$

(F5) $$\frac{\delta^2 F_i}{\delta P_i \delta t} \geq 0 \text{ for } i \varepsilon N.$$

In this case, the r.h.s. of (2) goes positive for $t \to \infty$.

As for the l.h.s., I will apply a theorem by which $(I-E)^{-1}$ is nonnegative, if E is a nonnegative n x n matrix and there exists a positive n vector, call e, such that $e > Ee$.[3] Now $M(F_{pd}^{-2}F_dF_{pp}-F_{pd}^{-1}F_p)$ is nonnegative if

(F6) $F_i \frac{\delta^2 F_i}{\delta P_i \delta P_j} \geq \frac{\delta F_i \delta F_i}{\delta P_i \delta P_j}$ for $i, j \epsilon N(t)$.

Using P as the e vector, we find the condition $P > EP$ as:

$P > M(F_{pd}^{-2}F_dF_{pp}-F_{pd}^{-1}F_p)P$.

Assume now

(F7) $\sum_{i=1}^{n(t)} F_iP_i = 1$

such that $F_pP = -F$.

Since by (1):

$$-MF_{pd}^{-1}F < P,$$

the condition above at least holds if:

(F8) $-2\frac{\delta F_i}{\delta P_i} > \sum_{j=1}^{n(t)} \frac{\delta^2 F_i}{\delta P_i \delta P_j} P_j$ for $i\epsilon N(t)$.

Under (F1) - (F8), $[I-M(F_{pd}^{-2}F_dF_{pp}-F_{pd}^{-1}F_p)]^{-1}$ is therefore nonnegative, and as $t \to \infty$, we will eventually get $\dot{P} \geq 0$, since the r.h.s. of (2) goes positive. So, unless new products enter the economy, real prices (or profit rates) eventually rise.

Proceeding further, we can find employment by

(3) $L = \sum_{i=1}^{n(t)} a_iX_i + a_o \sum_{i=1}^{n(t)} b_i\dot{X}_i + a_sX_s$, as defined,

whereas firm consumption is given by

(4) $P_sX_s = (1-c) \sum_{i=1}^{n(t)} (P_i-wa_i)X_i$, as defined,

and where X_s must be thought of as slack, R & D, artificial product differen tiation, and the like.

From the budget restriction of firms, we get

$$(4) \quad P_h X_h + P_o \sum_{i=1}^{n(t)} {}_T \, b_i \dot{X}_i = c \sum_{i=1}^{n(t)} (P_i - wa_i) X_i$$

for the sector as a whole.

2c. Consumers

After correction for speculative actions, consumers are assumed to allocate their income over the n(t) goods as:

$$(6) \quad X_i = (wL + P_h X_h) F_i(P_1, P_2, \ldots, P_{n(t)}, t), \; i \varepsilon N(t).$$

Note that reallocations in the holdings of the nonproducible good inside the consumer sector are assumed to be immaterial to the sector consumption pattern. In analogy to the fund circulation among firms, one could perhaps expect a pattern of retired workers as sellers and young workers as buyers. Since the steady-state growth rate of the economy, at which workers do not increase their holdings of the nonproducible good, is identical to the interest rate, the assumption that consumers do not enter the loan market can be justified by stipulating a need that to do so requires large chunks of capital.

2d. The Market for Liquid Assets

In order to understand the microbasis for this, we must look at the investment opportunites for an individual firm.

Such a firm can place its capital in three ways: If it has enough liquidity and is fast at the right moment, it can sometimes invest in equity and earn an average rate of return of $r + \Pi(\frac{E}{D+E_i})^{-1}$ on limited amounts of capital, $P_o b_i X_i \frac{E}{D+E_i}$, where $\Pi \equiv [\sum_{i=1}^{n(t)} - m_i(t) \frac{F_i}{\partial F_i/\partial P_i} X_i](P_o \sum_{i=1}^{n(t)} b_i X_i)^{-1}$

is the average rate of surplus profit.

There is also a demand of $P_o \sum_{i=1}^{n(t)} b_i X_i \frac{D}{D+E_i}$ for corporate loans paying r, our firm may lend or borrow a greater or smaller share of these loans. I will assume these loans to be relatively illiquid, but essentially risk-free. Finally, the firm can place its funds in the nonproducible good, which (as we shall see and as consumers expect) increases its price at the rate r, if the economy is in steady-state growth. I will assume the nonproducible good to be more liquid, but also more risky, than the loans, since its price may fluctuate quite a lot, leading to huge positive or negative rates of return, depending on prices at the dates of purchase and sale.

Of these three types of investments, equity is clearly the most favorable. What keeps it favorable, however, is the barriers to its use, which incumbent firms erect over the life cycle. In order to gain access to sustainable equity investment, a firm must be able to invest a big chunk of capital as early in the life cycle of a new product as possible. It makes no sense to make a bet with a small amount of capital; only if the investor has a big enough chunk does he stand a chance of gaining a sustainable, high-return-paying, equity position in the new industry. Thus, a firm with limited amounts of capital will not credit the nonproducible good with a liquidity premium, since it will not diversify for a long time; instead, it will prefer the lower risk of the loan market. Conversely, a richer firm will value the liquidity highly, since it will be looking for young industries into which it can channel its resources. So, if we look at a single business firm, it will have equity investments only early in the product life cycle, whereas later the accumulating surplus will give it more surplus funds than its "proportionate" loan, $P_o b_i X_i \frac{D}{D+E_i}$. Sometime during this process, the firm will try to diversify in order to be able to invest a new chunk of capital at the high rate. In this situation, the liquidity of its holdings of X_h plays a crucial role in the firm's ability to react fast.

As an industry ages, then, it should expect its participants to put more and more funds into the nonproducible good, in order to prepare for diversification. On the other hand, firms which actually diversify will sell off chunks of this good and thus supply volume for all those who are trying to build their own chunks in anticipation of diversifying. The point in time when these firms actually diversify will depend on the availability of young industries and the firms' assessment of the strengths of other potential diversifiers and, thus, the "price" of gaining dominance in a given young industry.

With respect to consumers, they are assumed to consume all their income, but to speculate occasionally in the market for the nonproducible good. Consumers expect the price of this good to grow at the steady-state growth rate of the economy (to be discussed later). If the actual growth rate of P_h falls much below the expected growth rate for an extended period of time, consumers will buy some of the nonproducible good, thus making X_h negative. Conversely, if P grows at a rate much higher than expected for an extended period of time, consumers will sell, and thus make X_h positive.

From the above, the development of n(t) will play a crucial rule in the determination of $P_h X_h$. Assume first that "very few" new industries appear (see later discussion). In this case, potential diversifiers keep on hoarding funds into the nonproducible good in order to be able to compete for dominance once the young industries start to reappear. This will drive P_h up and consumers will enter as sellers, so that X_h goes positive. If, conversely, "too many" new industries appear, (see later discussion) the "price" of gaining dominance will decline, and still more firms will enter with still smaller chunks of capital. In this case, a lot of firms want to sell the nonproducible good, leading to a decrease in P_h and purchases from consumers, such that X_h goes negative. The equilibrium situation is clearly one in which X_h is 0, such that the fund circulation in the firm section is self-contained. This case clearly corresponds to a balanced portfolio in the BCG sense of that term (see Henderson [1979]).

2e. Steady-State Growth

I will now look at the steady-state growth or equilibrium situation, in which $X_h = 0$.

Assume that the new goods, whose arrival is marked by increases in n(t), come from the same (a, b, m, $\frac{E}{D+E}$, F) distribution as the existing goods. Write (5) as

$$\text{(5a)} \quad \frac{P_o(\sum_+ b_i\dot{X}_i + \sum_- b_i\dot{X}_i}{c\sum_{i=1}^{n(t)}(P_i - wa_i)X_i} = 1,$$

$$\text{where } \sum_+ b_i\dot{X}_i \equiv \sum_{i=1}^{n(t)} b_i\dot{y}_i,\ \dot{y}_i = \text{MAX }\{0,\dot{X}_i\}$$

$$\text{and } \sum_- b_i\dot{X}_i \equiv \sum_{i=1}^{n(t)} b_i\dot{z}_i\ ,\ \dot{z}_i = \text{MIN }\{0,\dot{X}_i\}.$$

Goods with growing sales will be called "young" and goods with declining sales "old." With many goods, which "on the average" are "alike," (5a) shows that there must be a constant fraction of young goods in the economy. Accordingly, if no goods "die," the arrival rate of young goods must grow exponentially with time, such that the number of goods also grows exponentially with time. Note that this means that the number of new markets (in which initial competition for dominance has to be financed by sales of the nonproducible good) will grow at a constant exponential rate. This rate will be identical to the steady-state growth rate of the economy and, by assumption, to the interest rate r. The expectation on the part of consumers that P_h should normally grow at the rate r is thus rational, in the sense that it will grow at this rate for stable competitive relationships in steady-state growth. The assumption that r should equal the steady-state growth rate is made plausible by the fact that firms, if they wanted to, could put all or no funds into loans, if these paid much more or less than the returns expected from the nonproducible good.

Note that in the steady state, n(t) and P_h both grow at r.

2f. Disequilibrium

I would now like to discuss briefly the general effects of greater or lower values of P_hX_h. Differentiating (6) w.r.t. time, we get

(7) $\dot{X}_i = (\dot{wL} + (\dot{P_hX_h}))F_i + (wL + P_hX_h)\,\dot{F}_i,$

which inserted into (6) gives

(8) $$\frac{\dot{L}}{L} = \frac{c(r+\Pi)\sum_{i=1}^{n(t)} b_i\dot{X}_i}{wL\sum_{i=1}^{n(t)} b_iF_i} - \frac{P_hX_h}{wLP_o\sum_{i=1}^{n(t)} b_iF_i} - \left(1 + \frac{P_hX_h}{wL}\right)\frac{\sum_{i=1}^{n(t)} b_i\dot{F}_i}{\sum_{i=1}^{n(t)} b_iF_i} - \frac{(\dot{P_hX_h})}{wL}$$

(in the above, $(\dot{P_hX_h}) \equiv \frac{d(P_hX_h)}{dt}$).

Note how (8) is a "dynamic Philips curve," since for $\frac{P_h X_h}{wL} > -1$, rising prices, resulting in negative $\sum_{i=1}^{n(t)} b_i \dot{F}_i$, allow greater expansion rates of employment such that unemployment may fall, depending on the growth of the total labor force. The reason for this, of course, is that total surplus, $\sum_{i=1}^{n(t)} (P_i - wa_i)X_i$, will go up for growing P_i. Note also, however, that the growth rate in employment will be smaller if growing amounts of surplus are used for nonproduced goods, such that $(\dot{P_h X_h}) > 0$. As could be expected, higher c, r, and Π allow higher growth through higher investment.

2g. No New Goods

Let us now look at a situation in which the flow of new products falls short of the need and perhaps even stops. As is well known for ordinary Keynesian growth models, this causes no problems as long as capitalists keep investing. The issue here, however, is that investment has to be shifted to old sectors whose growth has tapered off. Assume an equilibrium situation; here, firms in old industries use their surplus on loans and the nonproducible good. If they do not find a new product into which they can channel their funds, they continue to accumulate in the manner described above. Eventually this happens in more and more industries, and the aging is further speeded up by the fact that surplus now exceeds investment. Eventually all products stop growing and all investment stops, so all loan demand stops and the entire surplus is hoarded.

The point in this process is that total X_h is outside the control of any individual firm, and firms have no way of agreeing to change it. As long as no new products turn up, no firm has an incentive to lower X_h.

A further complicating factor will be the rise in P_h following increased demand. For longer or shorter periods, $\frac{\dot{P}_h}{P_h}$ may exceed $r + \Pi \frac{D+E}{E}$, jeopardizing even new product investment. The assumption that a sudden stop in the supply of new products will lead to a total halt in investment is therefore defensible. Furthermore, as we saw in the discussion of (1), this situation is inflationary.

In order to further investigate this situation, differentiate (5) w.r.t. time under the assumption that all surplus is hoarded, so $\underline{\sum_{i=1}^{n(t)} b_i \dot{X}_i = 0}$.

$$(9) \quad (P_h \dot{X}_h) = c \sum_{i=1}^{n(t)} (P_i - wa_i)\dot{X}_i + c \sum_{i=1}^{n(t)} \dot{P}_i X_i \approx c \sum_{i=1}^{n(t)} \dot{P}_i X_i.$$

(If all products are "similar," the first part on the r.h.s. will be approximately 0.)

If we now use (6) and (F7), we get

$$\sum_{i=1}^{n(t)} P_i X_i = wL + P_h X_h,$$

which differentiated w.r.t. time and inserted in (9) gives

$$w\dot{L} \approx (1-c) \sum_{i=1}^{n(t)} \dot{P}_i X_i > 0.$$

Thus, employment still grows as long as $c < 1$. In most cases, however, unemployment will grow, since the growth of the labor force is likely to be higher than $\dot{L}$ above. This is especially the case if the labor force grows fast enough to allow the much faster growth in L found in the equilibrium situation. Although the argument will not be presented formally, it should be intuitively clear that a recovery will be helped by negative X_h, in the same way the slump is deepened by positive X_h (use (7) and (8)).

2h. Technical Progress

Employment can decrease if we introduce capital-using, labor-saving technical progress. An extension of the above model, which could incorporate this, would have time-varying labor and capital coefficients $a_i(t)$, $b_i(t)$. These time-varying production coefficients would give the following dynamic Philips curve:

$$(8a)\quad \frac{\dot{L}}{L} = \frac{c(r+\Pi)\sum_{i=1}^{n(t)} b_i X_i}{wL\sum_{i=1}^{n(t)} b_i F_i} - \frac{P_h X_h}{wLP_o \sum_{i=1}^{n(t)} b_i F_i}$$

$$- \left(1 + \frac{P_h X_h}{wL}\right) \frac{\sum_{i=1}^{n(t)} (\dot{b}_i F_i + b_i \dot{F}_i)}{\sum_{i=1}^{n(t)} b_i F_i} - \frac{\dot{(P_h X_h)}}{wL},$$

where $\dot{b}_i$ is new. So technical progress of the capital-using type may lower $\dot{L}$. If we assume $a_i w + b_i rP_o \to 0$ for $t \to \infty$, the inflation proof is left unchanged. In the unemployment proof, if all surplus is hoarded and all products are "alike," such that all weighted sums of the $\dot{X}_i$'s are close to 0, then $\dot{wL} \simeq (1-c)\sum_{i=1}^{n(t)} p_i X_i + cw\sum_{i=1}^{n(t)} a_i X_i + \sum_{i=1}^{n(t)} b_i X_i$, which may be negative for labor-saving technical progress. So capital-using, labor-saving technical progress can lead to genuine stagflation, or even "depreflation," if no new goods appear.

3. CONCLUSION

The aim of this paper was to find a macroeconomic analogy to BCG's concept of a balanced portfolio of businesses and to extend the analysis to disequilibrium situations. The mechanics of the model are extremely simple. Young products boost investment and thus effective demand (in the Keynesian sense), whereas old products supply savings, but also exert inflationary pressures. The model is constructed to exhibit these mechanics in the simplest possible way; no attempt is made at any degree of generality.

If one compares the crisis-and-growth explanation in the preceding model to that in other models, the emphasis is laid, in a traditional manner, on effective demand. The analysis is different in two ways, however; first, it explains investment as a function of the share of new products in the economy; and second, the monopolistic pricing models can characterize the crisis by either inflation or unemployment. The increased depth and width are obtained through the product life cycle concept and its derivative characteristics, rather than from, e.g., a monetary sector.

It is interesting to see how the economic policies employed today are evaluated by the model above. Countries of the industrialized capitalist world define their current economic problems as having to do with the balance-of-payments deficit, unemployment, and/or inflation. The means used to handle these problems are either Keynesian demand stimulation or classical regulation of relative prices through changes in interest rates, wages, and/or exchange rates.

A balance-of-payment deficit is handled today by attempts to make exports cheaper. Following the model above, such a crisis is due to the country's failure to hold its share of new products on the world market, so exports are mainly old products, with low price elasticity. Thus, exactly when you need the policy, it works less efficiently than otherwise. Furthermore, the often-seen companion policy of cutting domestic consumption will place domestic firms in young industries at a disadvantage on the world market, and thus prevent solution of the original problem.

If an unemployment crisis is perceived in Keynesian terms, the traditional policy is demand stimulation. Following my model, the economy has too many old goods. Reasoning informally from a somewhat more general model than that in section 2, it becomes clear that increased income in a society with unemployment benefits is not likely to increase sales of old products as much as sales of young products, because of the differences in price elasticities. Thus, the multiplier will be small, since most of the government spending will go to imports. And again, exactly when the policy is most needed, it works least well.

Finally, the model in section 2 indicates that some inflationary situations could be reversed through the introduction of more new products--a remedy directly counteracted by the current practices of monetary restraint.

All in all, the model shows the limitations of the currently used short- and medium-term policies and points to a specific long-term alternative, at least for some types of crises.

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FOOTNOTES

1. Points 1, 2, and 4 can be found in a slightly less precise form on p. 164 in Henderson [1979], whereas point 3 appears on p. 163. (Henderson is the founder and CEO of BCG.)

2. For simplicity I assume that difficulties regarding required self-financing of growth, which arise if $\frac{E}{D+E_i} P_o b_i \frac{\dot{X}_i}{X_i} > -m_i(t) \frac{F_i}{\partial F_i/\partial P_i}$, are solved by short-term declines in $\frac{E}{D+E_i}$.

3. The theorem follows immediately from the Corollary on p. 58 in McKenzie [1960] and Theorem 4 and Remark 2 in Appendix A of Arrow and Hahn [1971].

REFERENCES

[1] Arrow, K. H., and F. H. Hahn. General Competitive Analysis. Amsterdam: North-Holland, 1971.

[2] Haspeslagh, P. D. "Portfolio Planning: Use and Usefulness." INSEAD Working Paper 81/19, 1981.

[3] Henderson, B. D. Henderson on Corporate Strategy. Cambridge, Mass.: Abt Books, 1979.

[4] Keynes, J. M. The General Theory. New York: Harcourt, Brace and World, 1969.

[5] McKenzie, L. "Matrices with Dominant Diagonals and Economic Theory." In K. J. Arrow, S. Karlin, and P. Suppes (eds.), Mathematical Methods in the Social Sciences. Stanford, Cal.: Stanford University Press, 1960.

[6] Spence, A. M. "Investment Strategy in a New Market." Bell Journal of Economics 10 (1979), pp. 1-19.