COWLES FOUNDATION FOR RESEARCH IN ECONOMICS

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COWLES FOUNDATION DISCUSSION PAPER NO. 555

"POLICY RESPONSES TO THE PRODUCTIVITY SLOWDOWN"

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June 12, 1980

POLICY RESPONSES TO THE PRODUCTIVITY SLOWDOWN

Much has been written by economists about the sources of the productivity slowdown; and self-serving policy recommendations by interest groups abound. Strangely, the two are seldom connected. It is as if, upon seeing a neighbor jog his rounds more slowly than usual, we give him our expert advice without finding out why.

But surely, our advice to our neighbor must depend on the source of his lagging pace. Perhaps his shoes are old and pinch his feet, in which case we would recommend a program of modernizing his jogging equipment. Or, instead, has he grown somewhat fat, in which case a period of dietary austerity is in order? On the other hand, if his strength is depleted, it might be suicidal for him to go faster.

My theme here is similar. There are numerous possible reasons for the U. S. productivity slowdown. How we should respond depends on what has happened. A less fanciful example of the dilemma can be seen in the area of drilling for oil. Figure 1 shows the finding rate for oil over the last 15 years. As can be seen, there was a sharp break in the trend in 1973: whereas finding rates had been falling at about 1% per year up to 1974, from 1974 to 1978 they fell at 12% per year.

Prepared for Productivity Conference, Federal Reserve Bank of Boston, Martha's Vineyard, Massachusetts, June 12, 13, 1980.

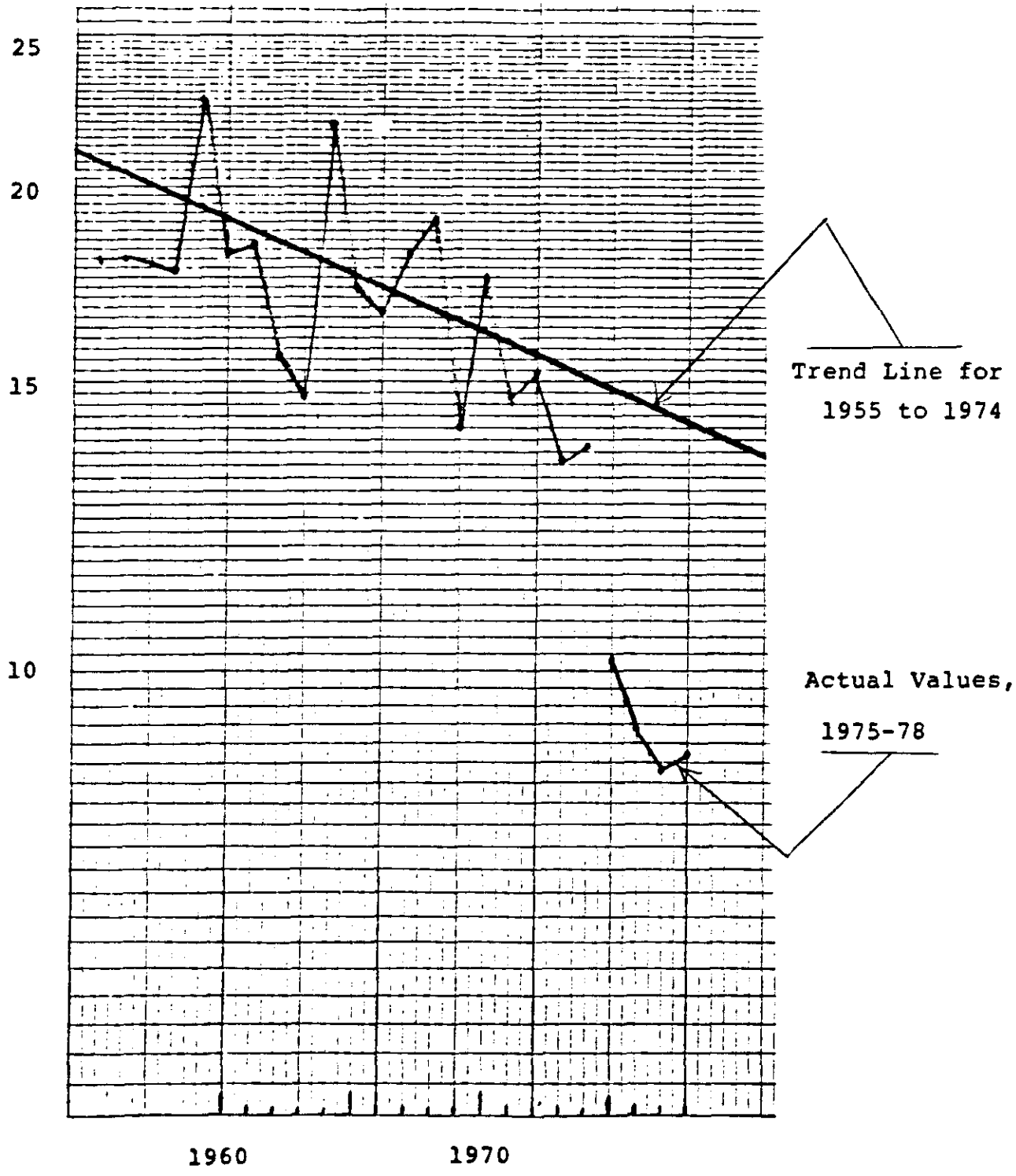
What was the source of the productivity break in oil drilling in 1974? There are two classes of reasons--manmade obstacles and natural depletion. In the former category we would place the results of the regulatory apparatus set up in 1973 to control oil prices. In the depletion category we would place the observation that the dramatic upturn in drilling rates since 1973 are the result of severe short-run diminishing returns.

Although the oil drilling story is fascinating in itself, I tell it here only to illustrate the more general point. How we should respond to the productivity drop in oil drilling depends crucially on which of the two explanations in the last paragraph we believe. If we think manmade impediments (price controls, high or distorted taxes, confusing regulations) are to blame, then we should work overtime to rationalize or dismantle these obstacles. If, on the other hand, we feel that we have simply been dealt a poor hand by Nature (depletion of resources or new ideas, low marginal productivity of capital), then the appropriate response is much less clear. Upon seeing that the yield per well drops sharply, do we want special tax incentives for investment or saving to induce us to drill more wells? Or should we drill less and use the freed resources to develop synthetic fuels or to enjoy solar intensive beach activities? There is no clear answer. Some old joggers try harder while others fade away.

With these introductory notions, I now turn to a discussion

PRODUCTIVITY IN OIL DRILLING, 1955-78

[Crude oil reserves added per successful oil foot drilled]



Source: U. S. Department of Energy, Histcrical Review of Domestic Oil and Gas Exploratory Activity, October 1979, DOE/EIA-1096.

of the productivity puzzle and policy reactions. The next section provides my personal synthesis of existing studies. The second sections then review policy responses.

A. Sources of the Productivity Slowdown

The purpose of the present section is to review the recent discussion of the productivity slowdown. I will use the inaccurate "productivity slowdown" as shorthand for "a slowdown in the growth rate of labor productivity". Has there really been a productivity slowdown? Is it unprecedented in recent economic history? What are the generally accepted reasons given for its occurrence? And how do the reasons given fit into the depletion v. obstacle theory given above?

1. Has there really been a productivity slowdown?

It is by now generally accepted that the productivity growth rate in the United States has significantly slowed down over the course of the 1970s. There is no consensus about the exact timing of the slowdown; there has clearly been a slowing down in productivity growth since the early 1960s, but whether the decisive year was 1969 or 1973 is subject to dispute. In what follows we will use the year 1973 as the break year. The reason for using 1973 is that a distinct break shows in the data, and that many of the prominent reasons for the slowdown (energy prices being the outstanding example) appeared in 1973.

Using 1973 as a break point, Table 1 gives several measures of aggregate productivity performance in the earlier and later period. The decline in the growth of labor productivity is clear for all the concepts used. As a rough rule of thumb, the growth in the private business economy has fallen from around

Table 1. Measures of productivity performance, before and after 1973

[Annual average growth rate, percent]

	1948-73	1973-79
Output per hour of all persons:		
Total economy	2.3	0.2
Private business	2.9	0.6
Nonfarm private business	2.4	0.5

Source: Economic Report of the President, 1980. Figure for total economy is real GNP divided by total employment.

three percent per annum to about one-half percent per annum after 1973.

It should be noted that the productivity decline is also extremely widespread. Of the 12 major industries groups, only communications and fire (finance real estate and insurance) have not suffered a slowdown in the post-1973 period. The productivity slowdown has also been felt in all major industrial countries. Although it is not clear why this fact should make us more convinced that the U. S. slowdown is real, the fact that the slowdown is universal should point us toward explanations that are widely felt.

At a somewhat deeper level, we might ask whether the productivity slowdown is an illusion. After three days of continuous rain we do not generally dust off plans for building an arc--although after thirty we might. To what extent is the half dozen years of dismal productivity growth sufficient to convince us that, to return to our climatic analogy, we have encountered a technological climate change rather than a run of storms.

To my knowledge, no one has looked hard at the question of whether the recent productivity slowdown has a precedent. For this reason, I patched together a long time series on labor productivity in the nonfarm business sector of the U. S. running over the period 1909 to 1979. Using standard techniques I removed the cyclical influence on productivity.[1]

[1]The cyclical influence was removed as follows: A regression of productivity change on output growth and lagged output growth was run; the coefficients being .316(± .044) and -.077(± .044) respectively. A cyclically corrected productivity growth was then constructed by subtracting from measured growth the deviations of output growth from its mean times the estimated coefficients. Note that the sum of the coefficients is about 0.25, indicating that faster growth leads to faster productivity growth in the long run. While this extent of economies of scale is high, it is not entirely out of line with estimates of Denison or Kaldor.

I then asked a number of questions about the past behavior of the cyclically corrected series.

First, we can simply inspect the time series on productivity growth. The most revealing series, shown in Figure 2, is the long time series on smoothed, cyclically corrected productivity growth. For this series, I chose a six year lagging average (corresponding to the six lean years since 1973). The last observation (for 1979) thus corresponds to the average productivity growth over the period 1973-79. The results are quite striking. If we ignore the wiggles, there was more or less constant rate of productivity growth from World War I to the middle 1960s. Starting about 1966, however, there has been a slow but steady downward creep from an average of 2 to 2 1/2 percent annually to a level of slightly under one percent in 1979. Moreover, the smoothed rate of productivity growth in 1979 was lower than any year since 1933, and one would have to go back before 1920 to find a markedly worse year. The only year remotely as poor in the postwar period was 1951. Thus casual evidence indicates that one would have to go very far back--to a period which surely stretches credibility about the data--to find comparable poor experience.

A second way of examining the data is to perform a formal statistical test on the hypothesis that there was a change in structure after 1973. To do this, we simply take our regression described in the footnote 1 above and add a dummy variable to the post-1973 period. This technique gives results that are consistent with the visual impression in Figure 1. When the test is confined to the postwar period (1949 to 1979) there is

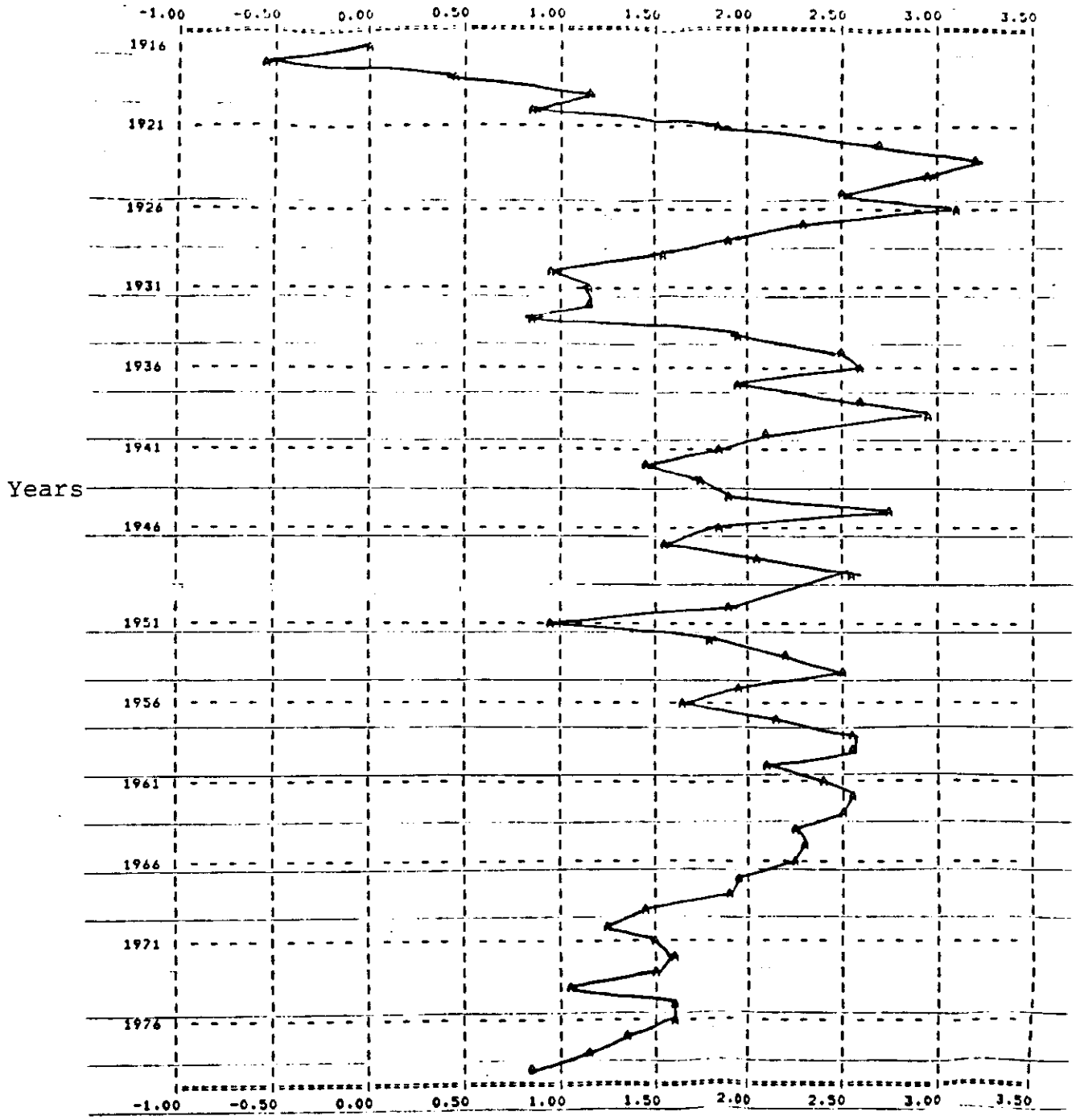


Figure 2. Estimated long-term growth of underlying productivity growth. Series is output per worker-hour in the private non-farm business economy. Cyclical influence has been removed as described in footnote. For each year the rate is the average of the cyclically corrected growth over the last six years. The last observation, therefore, is the average cyclically corrected productivity growth rate over the period 1973-79.

a statistically significant decline in productivity (the dummy shows slower productivity growth by 1.3 percent with a standard error of .63 percent). However, if the entire period is weighed (1912 to 1979), the slowdown is smaller (.98 percent) and has a larger standard error (1.0 percent). Thus, while the slowdown may look quite unprecedented for those with short memories, in the longer view, the slowdown is one which we would expect to occur from time to time. Indeed, such slowdowns have occurred twice before in the last 60 years. Judging on the basis of the postwar period, we would expect to draw a hand as bad as that of the last 6 years once every 4 decades. Over the entire sample period, we would expect as bad a hand about once a decade.

2. Why has productivity slowed?

I will from now assume that productivity has slowed; we now turn to the reasons. There are by now a gaggle of studies available on the sources of the slowdown, but I will restrict my attention to those that deal with broad aggregates rather than with individual industries. With the assistance of Robert Lurie of Yale University, I have compiled in Table 2 the key results of several of the recent studies.

In the various studies, seven important factors have been identified as possible sources of the productivity slowdown. For the most part, the tecnique that is used to estimate the effect of the specific factor on productivity growth is the technique known as "growth accounting". This technique assumes

that there is a well-behaved aggregate production function; and that for most factors the contribution of inputs (the marginal product of a factor) is measured by its market return.

We will not attempt to summarize the studies in any detail at this point, but make general comments about the overall findings. In addition, for the private business economy, we make in Table 3 a "best guess" as to the magnitude and the source of the productivity slowdown.

It is generally agreed that the slower rate of growth of the capital stock has contributed significantly to the productivity slowdown. The severe recession after 1973, as well as policies which were less pro-investment than in the earlier periods, led to a significantly slower growth in the utilized capital stock. In addition, a point omitted in most studies, the profit rate on capital (and presumably the marginal productivity of capital) has declined in recent years. This would imply that at a given rate of growth of capital the contribution to output would be smaller. There is a serious problem in most of the estimates in Table 1 of the contribution of the capital stock (see Berndt's paper in this volume). They compound changes in stock with changes in utilization. The latter appears responsible for most of the contribution of capital to lower growth. Assuming the two factors have the same output elasticity is clearly a misspecification. The best guess as to the contribution of the slower growth of the capital stock to the slowdown is 0.3 percent per annum; the utilization effect should hardly be attributed to cost of capital or similar variables.

As the productivity concept we are using here is output per hour worked, the contribution of labor is likely to be small. There have, however, been some demographic shifts over the postwar period; consequently, the best guess is that labor quality subtracted approximately 0.1 percent annually from productivity growth.

The contribution of energy to the productivity slowdown is extremely controversial, and is discussed elsewhere in this conference. The estimates generally converge on numbers in the range of 0.1 to 0.2 percent per annum, except for models which have a rapid adjustment of the capital stock to change relative prices. Given the implausibility of the latter assumption, we will use 0.2 percent per annum as the best guess as the contribution of changed energy prices to the productivity slowdown.

The influence of regulation is perhaps the most difficult effect to measure. The direct effects--inputs diverted to tasks that do not show up as measured output--are easily measured, and the estimates given in Table 4 reflect these direct effects. The indirect effects--chilling effects of regulation or innovation, entrepreneurship, or choice of techniques--do not appear in the estimates. As I suspect the latter is quite significant, I use the high end of the range in estimating the effects of regulation on productivity.

Two other items which have been explicitly identified and measured with some care are the effects of the lower intensity of research and development, and the role of sectoral shifts. It is estimated that these contribute modestly to the productivity slowdown. One of the important features of Griliches' study is that it suggests that the social rate of return on R & D had declined markedly in the most recent period.

Table I: Changes in the Rate of Growth of Labor Productivity: Pre 1965 to Post 1972

	J. Kendrick	Norsworthy, Harper, Kunze	Norsworthy, Harper Kunze	E. Denison	Z. Griliches	P. Clark	P. Clark	L.Thurow	Miscellaneous
Sector	Private Business	Private Business	Private Non-Farm Business		Manu-facturing	Private Non-Farm Business	Private Non-Farm, Non-residential Bus.	Private Non-Farm Business	Private Business
Output Measure	Gross Dom. Inc.	Gross Dom. Inc.	Gross Dom. Inc.	Net Nat'l. Inc.	Gross Output	Gross Dom. Inc.	Gross Dom. Inc.	Gross Dom. Inc.	Gross Nat'l. Product
Periods Studied	1948-66 & 1972-78	1948-65 & 1973-78	1948-65 & 1973-78	1953-64 & 1972-76	1959-68 & 1969-77	1948-65 & 1973-76	1948-65 & 1973-78	1948-72 & 1972-78	
Total Decline	-2.40	-2.12	-1.68	-2.64			-1.83		
Cyclical	-0.30			-0.05				-0.40	
Trend						-1.67			
Capital	-0.40†	-0.74 ††	-0.57††	-0.17†		-0.4 to -0.97††	-0.54 ††		
Labor	+0.10	-0.28	-0.18	-0.14		+0.04			
Energy		-0.18 (manufacturing)	-0.18 (manu-facturing)	-0.10					-0.6(Jorgenson-Hudson) -1.3(Rasche-Tatom) -0.2(G. Perry)
Regulation	-0.30	-0.09	-0.08	-0.27				-0.20*	
Research	-0.60			-0.10	-0.10 to -0.40				
Sectoral Shifts	-0.50			-0.27				-0.60**	-0.10 (CEA)
Other Factors	-0.30	-0.83	-0.67	-1.54		-0.67 to -1.28	-1.29		

† stock effect only
†† stock and utilization effect

* Mining only
** Output composition changes.

A final factor in the productivity slowdown is the effect of slower economic growth since 1973 upon productivity growth. This factor is sometimes ignored, even though there is considerable evidence of short-run (even long-run) increasing returns to scale. Most studies that directly examine this question find some modest effect of cyclical conditions--ranging up to 0.3 percent for the period 1973 to 1978. In a statistical test performed for this paper (and described in footnote 1 above) I found that the slower economic growth for the private business sector contributed about 0.3 percent to the slowdown after 1973. I will use 0.3 percent as a reasonable best guess.

Table 4 collects my best guess as to the sources of the productivity slowdown in the private business sector. In this collection, I have used the period up to 1965 and after 1973, because it is so difficult to identify exactly where the break point came historically. For these periods, the productivity slowdown was 2.5 percent. Taking all the identified factors, we can reasonably explain about 1.5 percent of the decline, but the remaining 1.0 percent must at this point be labeled as mystery.

Table 4. "Best Guess" Sources of Productivity Decline*

Total Decline	2.5 percentage points
Cyclical	0.3
Trend	2.2
Sources:	
Capital stock	0.3
Labor	0.1
Energy	0.2
Regulation	0.2
Research & Development	0.1
Sectoral Shifts	0.3
Unexplained	1.0

*The "slowdown" is the difference in the growth rate of productivity per hour worked from the period 1948-65 to the period 1973-79. Output is gross product originating in the private business sector. Note that a positive number indicates a slowdown.

B. POLICY RESPONSES: GENERAL PRINCIPLES

Having reviewed briefly current knowledge about the sources of the productivity slowdown, I turn to the question of how we should respond. I first discuss general principles and then turn to specific suggestions.

To begin with, can the literature on economic growth say anything about how policy should respond to the productivity slowdown? Let us start by assuming that economic growth policies had been well-designed in the period before 1973. Figure 2 illustrates the growth equilibrium that might have been experienced in the 1960s. Given the consumption possibility curve-- $F(c_1, c_2)$ --and the utility function-- $U(c_1, c_2)$ --the best outcome is with consumption $(\hat{c}_1, \hat{c}_2)$. Savings in the first period is $(\bar{c} - \hat{c}_1)$ and the economy grows at rate g on ray from the origin OC.*

*The discussion of diagrams in the taxt is based on the standard optimal growth analysis. A thumbnail description of the derivation of the informal presentation is given in the appendix.

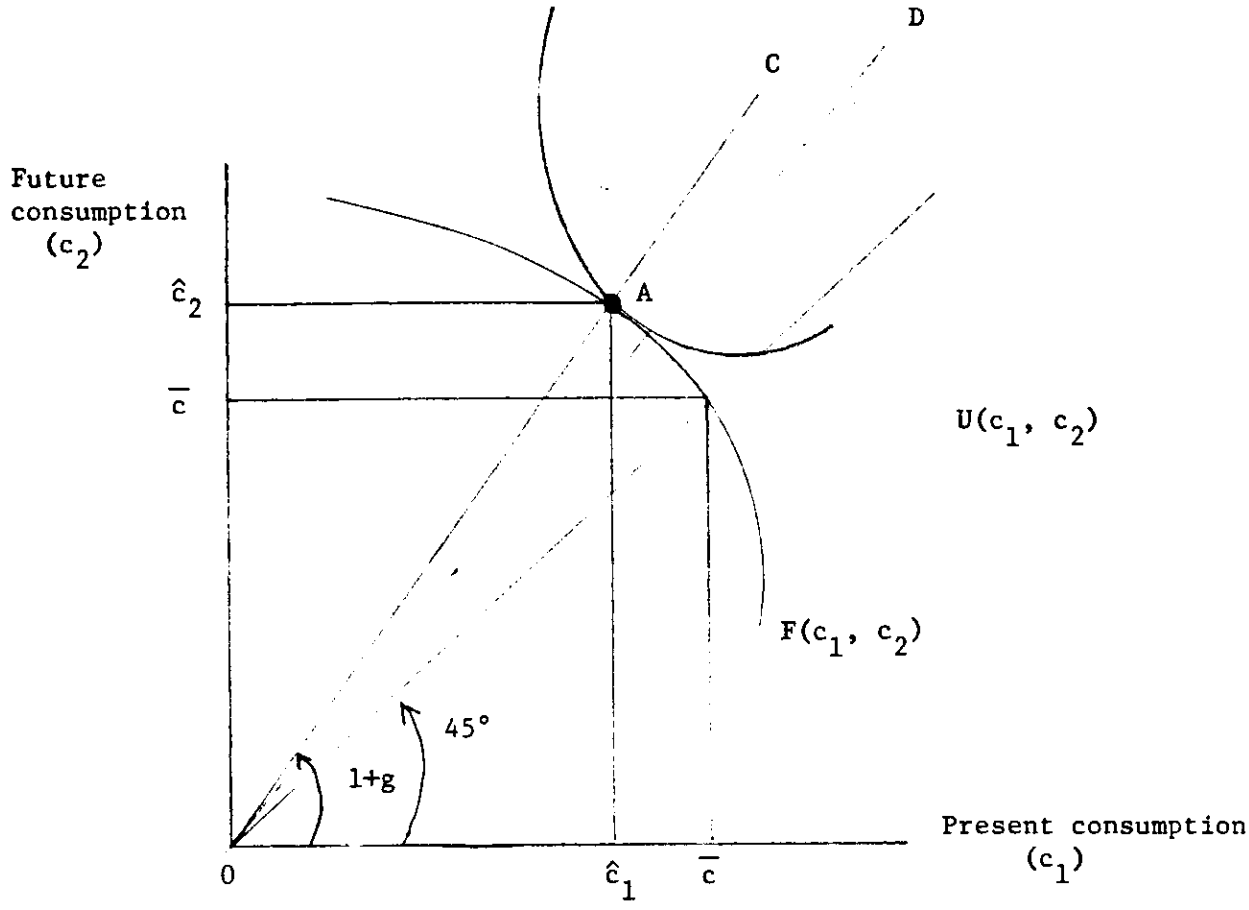
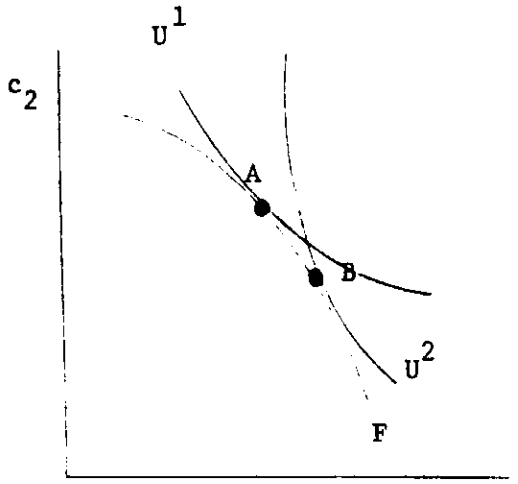


Figure 2. Illustration of outcome of choice of optimal growth path before productivity slowdown.

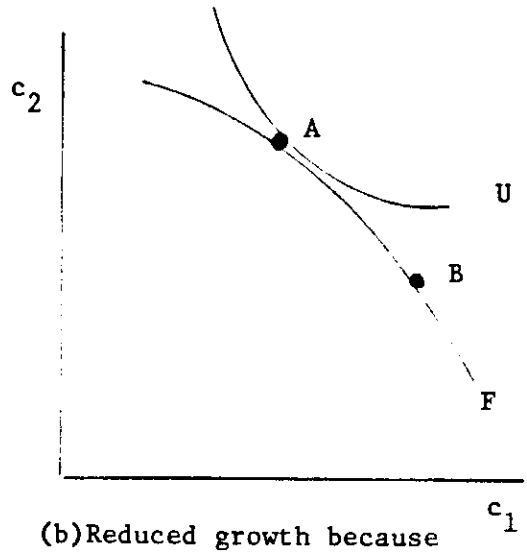
If we return to examine our economy a few years later--after the productivity slowdown--what do we see? Unfortunately, we don't see the F or U functions in Figure 2. Rather, we simply observe that the economy is growing at reduced rate along line OD rather than the earlier ray OC .

What are the causes of the reduced growth? In the various panels of Figure 3 we show the important possibilities. We will first attempt to fit the different causes of part A into the analytical mold, then we will discuss the appropriate policy response. Table 3 divides the "best guess" sources into

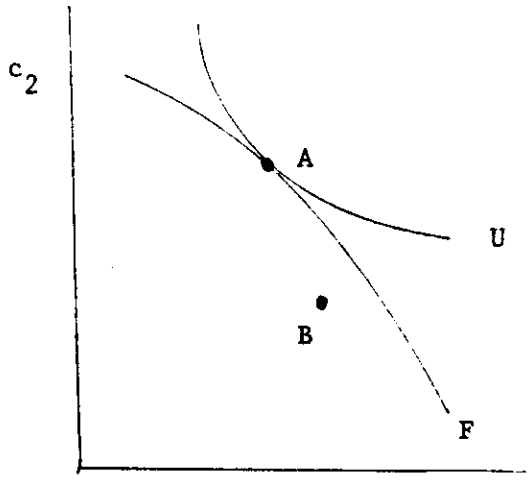
Figure 3. Illustration of four possible reasons for the productivity slowdown. In each panel, point A represents the consumption bundle before, and point B after, the productivity slowdown.



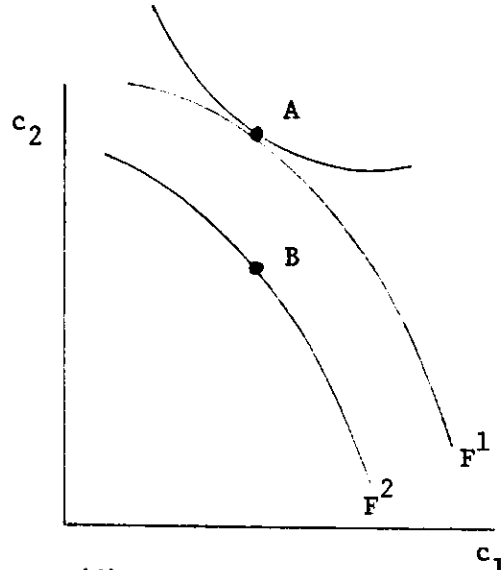
(a) Reduced growth because of change in tastes.



(b)Reduced growth because of undersaving



(c) Reduced growth because of self-inflicted wounds.



(d) Reduced growth because of depletion of resources and ideas.

the four categories, and notes the appropriate policy response. Needless to say, the way we might categorize the sources of the slowdown is controversial, but the exact numbers are less important than the general outline.

a. Two kinds of phenomena may represent a shift in tastes: I interpret the lack of further pro-growth policies during the 1970s and the attempt to internalize externalities as changes in tastes. In both cases, decisions were taken which were tilted toward consumption or away from conventionally measured output. A rough guess would be that one-tenth of the slowdown arises from this source.

b. The second category is market failure. As noted above, there are few documented examples outside of the role of inflation in the tax system, and this is ambiguous. I would guess 5 percent as a total.

c. The third category is self-inflicted wounds. One clear case is poor cyclical management. Excessively expansionary policies before 1973, and poor choice of tools for fighting inflation since 1973, led to a distinctly slower growth rate and thereby slower productivity growth. A second example of poor management is excessively stringent or inefficient regulation. A rough guess is that 20 percent of the slowdown fits here.

d. The balance of the slowdown, totalling 65 percent, can be attributed to depletion. The evidence on the depletion hypothesis is quantitative and circumstantial but, in my view, persuasive. The review of sources of productivity growth above

Table 3. Illustrative division of sources of productivity slowdown and appropriate policy responses

Category	Quantitative Significances (percent of slowdown)		Policy response
1. Shift in tastes	Capital (due to incentives). Internalize externalities	10%	no response
2. Market failure	Capital (due to tax system).	5%	correct market failure
3. Self-inflicted wounds	Regulation and cycle (due to poor policies).	20%	Improve regulatory and anti-inflation policies
4. Depletion	Energy. R&D. Investment (lower productivity of capital). Sectoral shifts. Cycle (due to slowdown). Residual.	65%	Ambiguous. Probably save smaller fraction of output.

seems unable to find a substantial number of causes of type (a), (b), and (c), so we are probably left with depletion as a residual. The decline in productivity in extractive industries is of course a literal example of depletion. The decline in the return on capital and R&D (without a surge of either) seems to indicate depletion of investment opportunities. There is evidence that economies of scale in electrical generation and many process industries have been exhausted. We have also largely exhausted the productivity bonus due to sectoral shifts from agriculature to industry. It would also be appropriate to attribute to depletion the cyclical (or economies of scale) effects that are due to these items. Finally, and vaguest of all, I have the impression that the great inventions that we have witnessed in the past century (telephone, automobile, rayon, airplane, computer, ball point pen) are appearing less and less frequently.

We next turn to a detailed discussion of the appropriate policy reactions to each of the different sources of the productivity slowdown.

a. In Figure 3a we consider the possibility that a change in tastes has led to a reduction in the desired growth rate. Such a change would reflect a transition to a lower steady state growth path as the saving rate is reduced. In our formal model of the appendix, such an outcome might arise because of greater impatience (higher ρ) or a lower tolerance for inequality across generations (higher b). The revulsion against the abuses of an industrial society, the rise of

"no growth" philosophies, and social regulation are less easily formalized but obviously important forces, and the impact of regulation attests to their importance; we guessed that 10 percent of the slowdown can be attributed to this source. If it did occur through a legitimate channel, presumably we would accept the outcome and not wish to undo it. That is, if we wish to grow slower because people are persuaded that a no or slow-growth society is better, then it would hardly seem sensible to reverse policies because these policies have succeeded.

b. A case which has the same observable outcome as case (a) is that, through mistaken policies or market failures, the economy has been undersaving (and under investing). We guessed that 5 percent of the slowdown arises here. One mechanism by which a market failure could occur is inflation. As a result of the acceleration of inflation, the fraction of tax to replacement cost depreciation has fallen from 100 percent in 1965 to 90 percent in 1979. Similarly, in inflationary periods the taxation of nominal interest payments as ordinary income raises considerably the tax rate on property income. Both of these could lead the economy to save and invest less. If we are convinced that we have fallen into the undersaving trap, the policy response is clear: we must correct the market failures (the tax code or our inflationary ways), tighten our belts, and save and invest more.

Some will find it highly surprising that undersaving and underinvesting through (a) or (b) are given such little weight here. It is useful to note that there is a fatal flaw in both

theories (a) and (b) as explanations of recent behavior. They both have an unambiguous prediction that the marginal product of capital, and presumably the rate of return on investment, should have risen since the days of high productivity growth. The clear evidence is that the rate of profit has fallen. Thus for 1955-69 the pretax rate of profit on corporate capital was 12.9 percent, while for the 1970s it fell to 9.4 percent. Similar data are given in the McCracken report for other industrial countries, where the evidence is even more compelling. More generally, I regard it as one of the major puzzles of economic psychology how those who argue that the U.S. is under-saving ignore the fact that the profit rate does not corroborate their theories.

c. The third view of the productivity crisis, illustrated in Figure 3c, is that the U.S. has with increasing frequency taken to shooting itself in the foot. Increasingly stringent social regulation is the most prominent example of policies which inhibit growth, although there appears to be, as well, increasing sensitivity to the counterproductive facets of policies such as payroll taxes, minimum wages, self-imposed embargoes, and trade restrictions. Empirically, we found some evidence that self-inflicted wounds, or obstacles, have led to a minor portion of the productivity slowdown--perhaps 20 percent of the slowdown arises here.

The policy response to self-inflicted wounds is obvious--

ban economic handguns--but it may not be politically popular. While more effective regulation is agreed upon, few can admit that we need to deregulate dumping wastes into Love Canal or vent gases from Three Mile Island, and we have yet to hear from a politician brave enough to kill the sacred cows of micro-economic policy (Davis-Bacon, minimum wages, etc.).

d. The final category into which we might put the productivity slowdown, shown in Figure 3d, is that of depletion. Is it not possible that we are riding down the backside of a long-term decline in productivity growth, a Kontradieff cycle? In this case the consumption possibility curve in Figure 3d has shifted inward; for a given level of first period consumption, second period consumption (and growth) is reduced. We guessed that 65 percent of the slowdown was attributable to depletion.

Of all the possible sources of the productivity slowdown, depletion is the one for which a policy response is most difficult to prescribe. Should we jog less or more as we get older? If oil is expensive to find, should we drill fewer or more holes? In Figure 3d, we see more generally, that the new optimal consumption choice may have a higher or lower growth rate depending on the shape of the utility function and on the way that the consumption possibility curve shifts.

In some special cases we can make limited statements as to the optimal policy. Take as example the case formally analyzed in the appendix--the standard optimal growth model. The productivity slowdown is here best seen as a decline in the rate

of labor-augmenting technological progress. In such a circumstance an optimal response is to reduce the equilibrium rate of return on investment (the reduction is proportional to the extent to which higher consumption is less valuable, b). But for a Cobb-Douglas (or substitution inelastic) technology the eventual savings rate will be below that which held before the productivity slowdown. It would take us too far afield to go into the logic of this result from optimal growth theory. Suffice it to say that if the slowdown is a result of depletion, we can make a strong argument for investing less rather than more.

C. Specific Policy Responses

Having spent most of my time circling the issue, it is time to attack the question of specific policy responses to the productivity slowdown. It is useful to group our approaches into "demand side" and "supply side" approaches. the first two policy tasks (inflation and demand management) refer to the demand side, while the next three (investment, regulation, and energy policy) concern the supply side.

1. Anti-inflation policy

The first issue on the demand side concerns the role of anti-inflation policies in productivity policies. We must here separate out inflation per se, which we discussed here, from the indirect effects of inflation on demand management or supply side, which we turn to later. Little serious research can be drawn on to indicate the extent to which inflation is the proximate or ultimate cause of our problem. One clear mechanism, discussed in the Kopcke paper, is that inflation may raise the burden of taxation on capital because depreciation allowances do not rise as fast as economic depreciation. He argues that much of the decline in investment (and therefore of productivity) "can be attributed to rising inflation since the late 1960s."

I find the Kopcke argument unconvincing on two grounds. First, he nowhere actually shows what, in his model, inflation has done to the cost of capital and to productivity. Much more important, however, is that he omits from his argument the fact that inflation is a double-edged sword. It not only cuts the

fraction of true depreciation that is deductible, but it also raises interest deductions because of the effect of inflation on nominal interest rates.* Examine the ratio of the sum of positive incentive due to interest deductibility and negative incentive due to illiberal depreciation allowance to true profits. This ratio has risen from 0 in 1955 to 12 percent in 1965 to 21 percent in 1979. Hardly a major disincentive. In fact, the recent outpouring of complaints of unfair depreciation rules shows a scandalous lack of attention to the fine print. A perusal of company reports indicates most companies are gaining more from deductibility of interest than they are losing from illiberal depreciation.

A second area in which inflation can lead to slower productivity growth is through resource misallocation. Thus, in regulated utilities the fact that accounting and control systems are designed for non-inflationary periods means that, recently, marginal costs are well above average historical costs. Similar misallocation arises because of tax distortions, such as the fact that high debt-equity industries (electric utilities) have lower effective tax rates. There are other, but vaguer, misallocations concerning inflation's effects on risk and uncertainty. And, of course, there is the classical cost of inflation--shoe leather.

I am unaware of any studies which would impute large annual costs to these misallocations due to inflation. Indeed, the

*A more rigorous treatment shows that inflation actually raises tax deductions for high debt equity ratios, long lifetimes, and high inflation rates. For example, with inflation of 10 percent a constant pretax real interest rate of 5 percent, a lifetime of 10 years, and a 1:2 debt equity ratio, an increase in inflation decreases the cost of capital (increases the post-tax return on investment.)

theorem of little triangles suggests that inflation losses--like monopoly or tariff losses--are unlikely to be more than a few tenths of a percent of output.

On the whole, then, it is hard to see a convincing link from the recent inflation to productivity. Given this, this victory over inflation by itself will contribute little to improving our productivity performance.*

2. Demand management policies

A second area on the demand side which might have a significant effect on productivity is demand management. Here there are a number of facets of demand management that might affect productivity. Four that come to mind are the growth, level, and variance of the pressure of demand, as well as composition and possible bias in demand management policies.

a. The overall growth of aggregate demand clearly has a significant impact on productivity growth. Growth in the 1973-79 period was 1.1 percent slower than in 1948-65, and we guessed this might be responsible for 0.3 percentage points of the slowdown. Most of the slowdown in recent years is, however, lower potential output due to lower productivity, so that the remedy for slower productivity growth appears here to be more rapid productivity growth--hardly a useful insight.

Some of the slowdown in output growth, perhaps a third, is due to the anti-inflationary policies after 1973. And more

*This statement does not mean that the productivity slowdown has had no effect on inflation.

of the same is in sight. To the extent that we can adopt the more efficient anti-inflationary policies, such as tax-based incomes policies, we can temporarily grow faster and reap slightly more productivity growth. This bonus seems to me yet another in a powerful list of arguments for more innovative policies to fight inflation.

b. There is a more subtle question as to whether a generally higher level of demand, a perpetual state of tight markets such as exists in Eastern Europe, will lead to more or less rapid total factor productivity growth. People have worked hard to find such an effect, but no convincing evidence has turned up. If a larger market is a spur to invention, so are hard times. Failing such evidence, I don't think we can turn to productivity growth as a reason to run a perpetually overheated economy.

3. One of the most familiar litanies is that productivity has been hurt by stop-go economic policies. Nowhere is there greater confusion than on what "stop-go" means. We must separate out the variance of policies (hitting the brake or accelerator) from the variance of outcomes (changes in the speed of the car). The reason we engage in stop-go policies is to <u>reduce</u> the variance of outcomes. Every sensible person would certainly desist from stop-go policies if that would stabilize output and inflation. But many of us feel that a constitutionally imposed balanced budget or a fixed money growth would lead to a more unstable economy.

It would seem obvious, then, that a successful stop-go policy would create greater predictability and certainty, would lead to lower risk premia on investment, and would improve productivity; an unsuccessful policy would do the reverse. Thus the goals of stabilization policy are coincident with those of productivity policy.

A different question is whether economic policy since the New Economics has been stabilizing or destabilizing of output variables. It's intent has surely been to stabilize output, and reviews on its success are mixed. But the greater variance of output since 1973 has surely been largely due to non-policy shocks rather than policy mistakes. And, in any case, the increased variance in output since 1973 cannot explain the deterioration in productivity growth, for the variance is smaller than the interwar or early postwar period.

d. A final set of issues in demand management concerns the composition and possible bias in policies. These are closely related to supply-side issues, but it will be useful to raise them briefly at this point. The major issue in the composition of policies concerns the division of labor between monetary and fiscal policy. It has been a common (and accurate) complaint that monetary policy fights inflation while fiscal policy fights recession. The result has been that "Q" has fallen from 1 in the late 1960s to .65 in 1979, and that the real cost of equity capital (the corrected earnings-price ratio) has risen from 7 percent in 1970 to 12 percent in 1979. At the same time Federal govern-

ment outlays as a share of GNP has risen almost 1 percent. The institutional characteristics which lead to anti-investment and anti-productivity cyclical responses are well-known (the spineless Congress responding to political pressures and cycles being bailed out by the courageous Federal Reserve System).

There are hopes that the bias in demand policies might improve. The survival of the fragile Congressional budget process is clearly extremely important to some kind of fiscal discipline. A constitutional limitation of Presidential term to six years would help insulate the other branch from election-year economics.

The movement to floating exhange rates has helped free monetary policy from being hostage to exchange markets, but further reliance on exchange market intervention rather than interest rates could allow further pro-growth monetary policy.

Taken together, improved demand management policy appears to be one modest element in improving our productivity performance. Many of the suggestions raised here are worthwhile on their own, and the effect on productivity adds some weight to the argument. But I doubt that more than a few tenths of a percent additional growth can be squeezed out of the feasible set of reforms of demand-side policies.

3. Investment

The central policy response to a productivity slowdown is to set in motion policies that change the savings and investment patterns of the nation. Obviously, this is an extremely complex issue and we can only touch on the major issues.

The first issue, discussed at length above, is whether the U. S. should save more as a result of the productivity slowdown. (We must be very careful, however, to distinguish the reaction to the productivity slowdown from reaction to our present economic morass of stagflation and high energy prices. What is plausible for one may not be for the other.) My tentative conclusion is that if investment and growth policies were well designed before the slowdown, it is quite likely that we will want to save less today than earlier. This conclusion is reinforced by the observation that the rate of return on investment has declined in the last decade or so.

Given the conclusion in the last paragraph, we must look elsewhere to argue that the policy response should be to increase investment incentives. The first place to look is in market failures. That is, we might feel that our economy has been undersaving all along because of inherent biases in our mixed economy. This is a defensible view, but it has nothing to do with the productivity slowdown. Presumably the urgency of the undersaving problem is less today than a decade ago because the optimal savings rate is probably reduced by the slowdown.

A second potential market failure lies in the fact that slow productivity might per se worsen the market failure; thus if low productivity led to higher inflation, this might raise tax rates on genuine capital income. Aside from the questionable issue of inflation (which has nothing intrinsically to do with productivity growth) we have found no mechanism that would lead from slower productivity growth to a greater discrepancy between optimal and actual investment.

We might, however, want to proceed in a lawyerlike fashion--asking what would make sense in terms of investment policy if we decided that we did want to save and invest more as a result of the productivity slowdown. We would probably first start by asking where it makes most sense to channel investment, then ask how to raise the additional savings. If I had to list investments in the order of social return, it would be the following: oil production and conservation, R & D, foreign direct investment, corporate fixed investment, human capital, consumer durables, public investment, housing, land, art, gold, mandated regulatory investments. Any pro-growth strategy would prbably be well off if it consisted of incentives to augment flows into the first five of the above, and to withdraw flows from the bottom five or six.

Once we confront the problems of rechanneling national output in such a way, it becomes clear that many familiar solutions are not really an answer. Take generalized pro-savings programs such as mandatory pension plans, lower social security

benefits, replacing income with consumption taxes, lower taxes on property income or capital gains, or more generally a shift in the mix from tight money-loose fiscal to loose money-tight fiscal. These policies will increase savings and investment in general, but their effects will be generally spread from oil conservation to higher gold prices. Because the fraction of the capital stock that resides in the high yield investments is relatively low, the average yield on changes in the composition of output from consumption to investment may be small. Thus generalized anti-consumption policies should be pursued only if we are convinced that the freed resources will end up in energy conservation, R&D, or corporate capital rather than in low-yield investments such as gasohol, South African gold mines, the M-X missile, or solar-heated swimming pools.

Because I am skeptical about generalized pro-savings policies as a way of improving our productivity performance, I would instead attempt to retarget flows to investment by selective fiscal policies. The most attractive, in my mind are:

1. An energy policy that has a very high reward on incremental production or conservation of oil (more on this later).
2. A program of channeling resources into research and development. The most productive way to do this would be to legislate a general tax credit for R&D, perhaps

providing special incentives in those sectors (energy, pollution control, corporate capital) that appear to have the highest yield on research.

3. A program of encouraging foreign direct investment, both through selective changes in regulations, a revamped DISC, and pursuit of a multinational code for investment and services.

4. The largest program would be a program of investment incentives for corporate investment. The most important reform would consist of correcting structural defects in the current investment incentives system, such as removing the bias of the investment tax credit toward short-lived investments and its extension to structures, and making it refundable. The appropriate way to correct inflation' distortions on depreciation would be to move toward allowing depreciation allowances to take a replacement cost basis. Many of the current proposals (the "10-5-3" proposal) are extremely poorly designed to correct the distortions in today's tax code and will further subsidize investments in the real estate and commercial building market--hardly a way to improve productivity.

A more radical approach would be to restructure the corporate income tax system, for capital is surely more heavily taxed there than is efficient. Perhaps we should consider a program of full integration of corporate and personal taxes.

5. Finally, I am impressed by the extent to which the nation is depreciating its stock of intellectual resources. The crumbling of the ivory towers due to deferred maintenance, and the declining relative incomes of those in the academy, can hardly be a healthy sign for basic science and technology over the coming decades. Increased support of basic research, and the institutions that nourish research and produce researchers, must surely be central to an increased investment program.

At the same time, we should attempt to correct some of the major problems that arise in the current system that gives a preference to low yield investments.

1. The most important defect is the enormous tax preference to owner occupied dwellings, where interest and taxes are deductible but imputed income is not taxed. The recent move toward allowing borrowing for mortgages at the state and local interest rate is, as well, an extremely dangerous trend. A major plank in the platform of those who want to make a more efficient use of our investment resources should be to reduce the incentives for very low yield investments here. As a first step, we should disallow use of the state and local interest rate as a vehicle for subsidizing housing. A more serious reform would be to exclude from deductions any taxes or interest payments on non-income-producing investments.

2. Movement toward an indexed tax system, in which taxes at full rates are levied on real returns, would remove some of the distortion that allows sterile investments in gold, art, and land to become so attractive.

3. Regulatory reform, discussed below, is a major possible source of productive investment. It appears that we are channeling an excessive amount of new investment into some sectors or technologies. Complementarity of mandated with new investment, together with the grandfathering of old capital, is currently a major impediment to productive use of investment resources.

Having discussed the role of investment and made some suggestions for restructuring investment policy, it must be reiterated that these policies have little to do with productivity. We should improve our investment policies whether productivity is growing rapidly or slowly. There is, however, no clear reason why we should invest more because of the productivity slowdown.

4. Energy

The energy sector is one in which structural change over the last ten years has been so rapid that it has affected overall economic performance. With respect to the productivity problem, there are three facets that must be recognized. First, the energy industries have experienced an extremely shart decline in productivity growth. Mining experienced a productivity deceleration of 10 percent and utilities of 7 percent over the postwar period. Second, the sharp run-up of energy prices since 1973 led to some substitution of other factors of production for energy, lowering the productivity of these other factors. Finally, the inflationary impact, terms of trade, and real income losses due to the energy crisis contributed to the slower demand growth and concomitant slower productivity growth since 1973.

The major controversy concerning the energy's impact on productivity has been generated by the capital-energy complementarity issue. The issue can be quite succinctly put by considering two polar cases and realistic data for 1973-77. Start with the normal case, where energy, capital, and labor are combined in a Cobb-Douglas production function with shares of 0.10, 0.20, and 0.7 where labor supply and real interest rates are exogenous. In this world a 25 percent rise in real energy prices will lead to a long run decline in labor productivity of about 3.2 percent. At the other extreme, let energy and capital be used in fixed proportions and combined with labor in a Cobb-Douglas production function. In such a case, doubling of energy prices leads to a decrease in labor productivity of 3.4 percent. Over

a 4 year period, with full adaptation of the capital stock, we should find a decline in productivity of 0.80 to 0.87 percent. (In a more complete model, Hudson and Jorguson estimate that the four year effect was 0.6 percent annually.) It is hard to see how this discrepancy could generate much controversy.

In fact, this capital-complementarity controversy has been a smokescreen which effectively camouflaged the real issue--the embodied nature of energy use. The error in both models above was to assume that the capital stock and energy use adapted instantaneously to changed relative prices, the so called putty-putty model. In the first model, energy consumption should have fallen 6 percent annually relative to trend, while in the second it should have fallen 2 percent annually. In fact, in the long run most energy conservation takes place through substituting more energy efficient refrigerators, houses, and cars--a process whose half-life is probably 20 years. From a statistical point of view, the reason time-series putty-putty models keep telling us that energy and capital are substitutes is that, by creating a complementary factor of capital and energy, the speed of reaction of energy demand is effectively slowed down from 6 percent a year to 2 percent a year--to a speed closer to the putty-clay model.

The significance of the putty-clay view is that the effect of energy prices on productivity is spread over many years. In a no-growth economy where capital lives 20 years, the Cobb-Dougles putty-clay model would predict that as a result of the

1973 price shock productivity would show an energy drag of about 0.2 percent until 1993. During this entire period, we will be progressively replacing high cost oil with high cost capital and labor. The slower the adjustment, the longer is the period over which the productivity drop is spread.

Turning to the policy aspects, the adjustment speed presents an interesting paradox about efficient energy policies. It is generally agreed that one of the central goals of energy policy is to accelerate the replacement of the energy-inefficient capital stock with fuel-efficient capital. We have for this reason taken extensive steps to subsidize replacement of old oil and gas equipment and regulate the energy performance of autos, houses and appliances. Paradoxically, these policies are anti-productivity measures for they accelerate use of energy-efficient but labor-inefficient technologies. In today's tight world oil markets, the best energy policy is one that will, on the margin, lower potential output. For by driving the marginal product of energy beyond the world price, industrial countries can reduce oil prices and improve their terms of trade. This while national output may be reduced, national income is increased.

As we look forward to the 1980s, what are the needs for energy policy and how do they relate to productivity policy? My view is that there are three features of energy policy that are necessary to improve energy's drag on our real incomes.

1. The first and key policy is to assure that energy price signals that face consumers and producers reflect social costs. In my view, social costs of oil consumption are 2 to 5

times the world price because of the effects of increased consumption on world oil prices, terms of trade, inflation, and macroeconomic policy. All industrial countries should seek a harmonization of oil import or product taxes (not just on gasoline) at a level of $50 per barrel. Indeed, such a policy should be the first item on the agenda of every major international policy conclave.

As mentioned above, this policy will hurt rather than help productivity. In extractive industries, marginal products will fall even further than in Figure 1, and in the rest of the economy the scramble to scrap old oil-inefficient capital may send productivity temporarily into a downspin. Yet over the long run, the major danger to our economies is that our output increases will be drained away as tribute money; since 1973 one third of our output increase has been lost to increased value of oil imports.

2. An aggressive energy policy like that proposed above will involve enormous transfers from consumers to oil producers and the government. Careful thought should be given to the recycling of the revenues. Experience in the United States is that at least a fraction of the revenues will be devoted to marginal uses (gasohol being perhaps the most inefficient--indeed, counterproductive--use on record). If the tax revenues are completely wasted, then to a first approximation there is no gain from the tax-based energy policy. Put differently, the main gain from high energy taxes is that the oil expenditures

become domestic income rather than foreign income. If the domestic income is not turned to useful purposes, then the potential gain is not realized.

One way in which oil taxes can be efficiently recycled is in ways that lower prices, e.g. through subsidies, tax credits, or lower value-added or social insurance taxes. In these cases some of the inflationary costs of high energy taxes would be removed.

A second route would relate quite directly to productivity. Today, many analysts feel that there will be large "supply side" effects of lower taxes on capital and labor--lower overall taxes would stimulate the supplies of capital and labor and would reduce welfare losses from differential taxation. Thus, one of the possible advantages of heavy energy taxes, together with lower taxes on capital and labor, would be that this fiscal reorganization could actually enhance the efficiency of our tax system overall. More generally, one of the key productivity-raising measures we should keep in mind is to improve our fiscal system--to raise a larger fraction of the necessary government revenues by taxing goods we wanted to discourage (oil consumption or pollution) and a smaller fraction on those activities that we wanted to encourage (supply of labor and capital as well as production of useful goods and services).

3. Finally, there are other points in our productivity discussion that complement energy policy. The most important is regulatory reform. A recent study by the Department of Energy concludes that the sum total of our key energy policies

(e.g., tax preferences for drilling, Jones Act, natural gas decontrol, incremental pricing, windfall profits tax) are a wash with respect to oil prices and oil imports; yet they clearly cost an enormous amount of effort and expenditure. One of our first tasks should be to dismantle many of these conflicting regulations. A second area is in social regulation. Nowhere do the inefficiences of our current regulatory structure appear heavier than in energy. We have excellent case studies--such as in new source performance standard (NSPS) for steam electric plants--where it is clear that we have "gold-plated" our regulations. The original NSPS proposed a standard that actually yielded higher population-weighted sulfur emissions than a less costly standard. In addition, oil imports were projected to be 300,000 barrels a day higher in the original case. It seems clear that by moving toward sulfur taxes, more modest goals, and putting these in a regulatory budget framework, we could save considerable money and make more productive use of our resources.

A second area where other policy reforms could assist energy policy is in R & D. The history of energy R & D from the breeder reactor to the Concorde is that government has been calling the plays from the bench, and calling them badly. We would be well served by a policy which shifts more of the energy R & D funding to the public, and more of the detailed decisions on loops v. vats or underground v. above ground retorting to entrepreneurs. A blanket 70 percent subsidyon energy research, and 30 subsidy on development, could speed the transition to a more sustainable energy system.

5. Regulation

Attempts to change the regulatory environment in the United States are high on the list of many who wish to improve productivity performance. To some extent, particularly for the business community, this emphasis arises because much of the regulatory system is an anathema to begin with, and the productivity slowdown is a fine excuse to reverse or abolish programs which were never palatable. Even though the business attack on the regulatory procress may be as much ideology as economics, there are, in my view, sound reasons for trying to improve the regulatory process as a part of an attempt to improve the productivity performance in the United States. In what follows I will outline three major areas of reform that might contribute to reviving our lagging productivity.

In discussing the regulatory process, we must distinguish between the older economic regulation (which prescribes pricing or conditions of entry) from the newer social regulation (which is broader and regulates the externalities of pollution, health, or worker safety). We have made considerable progress in the last few years in dismantling the economic regulatory apparatus--witness major legislation on the books for airlines, security markets, railroads, financial markets, and natural gas, as well as prospective loosening of regulatory constraints in trucking, oil, and communications. The first set of policies would be to press further and faster in removing or revising the regulatory

constraints in economic regulation. Aside from those in the mill, we should press for further reforms in the area of agriculture (dairy and milk as well as set asides), energy, and local utility rate reform.

The other side of the regulatory story is, unfortunately, much less encouraging. The last ten years has witnessed an explosion of social regulation. By most measures, we will probably see extremely large mandated costs over the next decade as the regulations recently promulgated begin to bite. Estimates of the ten-year cost of major regulations promulgated in the last four years run in the $300-600 billion range.

The high cost of implementing the new social regulation is not per se a reason to stop or slow these programs. There is disturbing evidence, however, that the social regulatory process is quite inefficient.[1] Robert Crandall's paper touches on some

[1]This section draws on many of the ideas in a book under preparation with Robert Litan, Toward Sensible Regulation.

of the important inefficiencies in the process, particularly the bias against new investment. A broad overview of the inefficiencies in the regulatory process suggests that there are two major areas in need of reform: inefficient regulatory techniques and the lack of a budget constraint on regulators.

The inefficient regulatory techniques are discussed in the Crandall paper and have been widely criticized by economists. The most significant problem is the use of quantity regulation and engineering standards rather than price regulation or

performance standards. In the example of the controls of sulfur emissions, for example, it would be much more efficient to use emissions taxes rather than emission limitations a way of reducing emissions. OSHA generally specifies equipment to be used rather than health effects to be reduced. Examples where inefficient regulatory techniques are used are legion in the area of social regulation, yet the movement away from inefficient quantity regulation toward more efficient price-type regulation has been extremely slow. One of the major regulatory reforms that might significantly lower the costs of attaining our regulatory goals would be to improve the techniques. Some examples are:

--In air and water pollution, substitute emissions charges for emissions limitations.

--In automobile emissions, allow trade-off between emissions as a first step and then institute an emissions tax on new and old vehicles.

--In the area of worker safety, substitute injury taxes and mandatory insurance policies for specified work practices and engineering requirements.

--Substitute a wellhead tax for price controls on natural gas.

--Substituting performance for specification standards wherever possible.

None of these ideas are new--in fact they are so old they are practically forgotten. Again, to the extent that we would like to use the productivity slowdown as an occasion to retune our economic engine, these old ideas should be part of the agenda.

In addition to the inefficiency of the regulatory tools in social regulation, there is considerable evidence that the political process which sets the goals or stringency of regulation is defective. The implementation of virtually all regulation in the United States economy is determined by more or less independent regulatory agencies. While in earlier days this independence might have been necessary to protect the integrity of the political process, the pendulum has swung too far. Regulators are acting in the place of the legislative and executive branch in allocating tens of billions of dollars a year--indeed, the figures given above suggest even more--without serious political accountability that we expect in the tax and expenditure system. Put differently, regulators function without an effective budget constraint in making their major decisions. Recent history shows many examples (sulfur scrubbing, aid for the handicapped, ozone standards, oil pricing and entitlements allocation) where regulators were allocating many billions of national output without the other two branches of government sufficiently involved in setting the goals, the standards, and the dollars to be allocated.

There are several policy proposals today for restructuring the regulatory process. (A fuller discussion is contained in the Litan-Nordhaus book.) These proposals can be broken into two parts--assuming greater political accountability and imposing

a budget constraint. Imposing greater political accountability means that the President and the Congress should have greater say in the detailed decisions, particularly the costs, of major regulatory actions. We have witnessed a very modest increase in Presidential oversight in the last four years, but regulators remain largely autonomous. One proposal to impose greater political control is the idea of a "legislative regulatory agenda". Under this proposal, all major regulations must be approved by being part of an annual agenda that is enacted. By requiring inclusion on the agenda, regulators would be prodded to assure that their actions were reasonable in their overall economic impact, that they had weighed appropriate costs and benefits, and that major political actors were generally in accord with these actions.

A more radical proposal is the "regulatory budget". Under this proposal, the legislative agenda would be supplemented by a quantitative cost control system. Each regulatory agency would be given an annual budget for new regulations, and it would be required to stay within this budget in its total actions during a given year. Thus the Environmental Protection Agency might be forced to limit the costs of its new regulations to a total of $30 billion in a year; the budget constraint would force the agency to design cost-effective regulations and to exercise restraint in setting its regulatory goals.

These three proposals are among many that are before the Congress today. Clearly many details must be worked out, par-

ticularly in the area of social regulation. I am convinced that by pushing forward on each of the three routes of regulatory reform discussed here, many of the chilling effects of regulation on productivity could be alleviated or reversed.

* * *

Having reviewed specific policy responses to the productivity slowdown, one further point remains to be made. Few of the recommendations that are made arise directly from the productivity slowdown. They represent sound economic management. We should do them in 1980, but then we should also have done them in the mid-1960s before the productivity slowdown began. The reasons change, but the policies endure.

*In fact, a great deal of implicit theory lies behind the deceptively simple diagram in Figure 1. What I have in mind in order to make this discussion rigorous is something like the following.

Let $c(t)$ be consumption per worker at time t and $L(t)$ the size of the work force. We assume that the labor force is a fixed proportion of the population; therefore, $c(t)$ can also be regarded as an index of per capita consumption. The labor force L is growing exponentially at rate n. Labor-augmenting technical progress is occurring at rate h; so $L(t)e^{ht}$ is the effective labor force, which is growing at rate $g = n + h$. Gross output per worker is $e^{ht}f(k)$, where k is the ratio of capital stock to effective labor force K/Le^{ht}. Capital depreciates at the exponential rate δ. Finally, let $r(t) = f'[k(t)] - \delta$ be the net instantaneous return on capital and $R(t) = \exp[\int_0^t r(v)dv]$ be the t - period rate of return. Then a unit reduction of per capita consumption at time 0 will yield $R(t) \exp(-nt)$ units of per capita consumption at time t. Define "income" as that level of consumption that is indefinitely sustainable, so $\bar{c} - c(0)$ is per capita "savings" at time 0.

The other half of the story relates to the social valuation of increments of future consumption yielded by current saving. Suppose that society's intertemporal preferences can be described by an additive social welfare function $\int u[c(t)] \exp(-\rho t)\, dt$ where $u(c)$ is the one-period utility of consumption, ρ is the constant pure rate of time preference at which utility is discounted, and the elasticity of marginal utility with respect to consumption is $u''c/u' = -b$.

An optimal consumption path equates the marginal cost and marginal value of saving. In general, this requires that $r(t) = g + \rho - h + b\frac{c'(t)}{c(t)}$. In steady state, this reduces to $r = n + \rho + bh$.