Capital, Taxes and Growth

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Executive Summary

This report is based on the neoclassical economic theory of capital, adopted by most of the leading capital theory economists of the 20th century. The theory is consistent with the last 37 years of empirical evidence and the observations of economists extending back into the 19th century. Among the report's most important conclusions — supported by both theory and evidence — is that the aftertax rate of return on capital tends to be constant:

- Over the past 37 years, the aftertax return on real capital in the United States has averaged 3.3 percent.
- This rate of return rarely varies by a percentage point above or below its historic average.
- When a significant deviation occurs, say because of a change in taxes on capital, the aftertax rate of return is usually restored to the 3.3 percent average within five years, with 60 percent of the adjustment taking place within two years.
- As a result, the aftertax rate of return on capital is one of the most constant relationships found in all of economics.

The reason this rate tends to be constant is that the world investment community is willing to supply virtually any amount of capital to the United States so long as investors can earn a 3.3 percent rate of return.

- When the rate of return rises above 3.3 percent, increased investment expands the capital stock until the rate of return falls back to its historic average.
- When the rate of return falls below 3.3 percent, reduced investment slows the growth in the capital stock until the rate of return rises to its historical average.

The relationship between investment behavior and the aftertax rate of return to investors has been largely ignored by economists in the Keynesian tradition, who tend to focus exclusively on interest rates. Yet the Keynesian focus is without empirical foundation.

- Over the past 37 years, 75 percent of the variation in investment spending can be explained by changes in the rate of return on capital alone.
- By contrast, there is virtually no relationship between investment spending and interest rates.

The recognition that the rate of return on capital tends to be constant has profound policy implications. Specifically:

- Although taxes on capital affect the *before-tax* rate of return to owners of capital, they have no permanent effect on the *aftertax* rate of return.
- Thus the primary effect of increased taxes on capital is to reduce the size of the capital stock and, therefore, the incomes of wage earners.

In the current policy debates over "tax fairness," proponents of higher taxes on capital income imply that wage earners will somehow gain, or at least be unaffected, by the higher tax rates. In fact, almost every proposal to tax capital is an indirect attempt to tax labor.

- Since 98 percent of the variation in the wage rate over the past 37 years is directly due to changes in the size of the capital stock, any proposal that would reduce the size of the capital stock will also reduce labor income.
- Moreover, for every dollar of extra aftertax income to investors, there are $12 of additional aftertax income for wage earners — a relationship that has been fairly constant over time.
- Thus more than 90 percent of any new taxes on capital will be paid by wage earners rather than recipients of capital income.
- The reverse is also true: more than 90 percent of the benefit of any reduction in taxes on capital will flow to wage earners rather than to investors.

Proponents of high taxes on capital also argue that a reduction in taxes on investment income will cause a larger federal deficit. In fact, almost any cut in capital taxes will produce a substantial profit for the tax collectors. In general,

- Every $1 billion reduction in annual taxes on capital income will ultimately lead to a $25 billion increase in the nation's output of goods and services.
- Government will receive about $12 billion in new tax revenues as a result of the higher output, and wage earners will receive an additional $12 billion in aftertax wages.

Because the United States overtaxes capital relative to labor, we have less capital than we otherwise could have — given the same government revenue. The lower level of capital results in less output and a lower national income. We also have less capital and labor services than we could have — given the same government revenue — because we exempt some capital and labor income from taxation and impose higher than necessary marginal tax rates. These distortions are having a major impact on the U.S. economy.

- Because we overtax capital relative to labor, we are losing $213 billion in output every year.
- Because marginal tax rates are higher than they need to be, we are losing $411 billion of output each year.
- The total loss from tax distortions is $643 billion per year — about $2,650 for every man, woman and child in the country.

Every society is likely to be willing to sacrifice some economic efficiency for other social goals. But the United States could easily adopt measures which would encourage capital formation, with no loss of government revenue, by adopting a few simple reforms. Among these are: (1) indexing tax depreciation schedules, (2) indexing capital gains and/or reducing the capital gains tax rate and (3) allowing people to make aftertax contributions to and tax-free withdrawals from Individual Retirement Accounts (IRAs).

Introduction: Why the Federal Government Is Not Responding to the Current Recession

In all previous recessions for the past 30 years, the administration and the Congress felt compelled to adopt policies that stimulated the economy and put us back on the road to a healthy recovery. The political response to the current recession is a glaring exception.

"Under the new budget rules, every pro-growth measure is assumed to have no effect on economic growth."

The federal government is paralyzed — unable to respond to the economic needs of the American people. Since President Bush assumed office, the only major pieces of legislation enacted have been laws that are harmful to economic expansion and growth. Not a single pro-growth measure has been adopted.

The major reason for this paralysis is that the administration and congressional leaders of both parties have agreed to adopt an economic theory that is not consistent with reality. Under the new budget rules, every pro-growth proposal is automatically subjected to forecasting techniques that assume the measure will do nothing to stimulate growth.[1] Specifically:

- Whereas economists have known for 30 years that tax cuts stimulate the economy, the federal government's chief forecasting agencies assume that tax cuts *harm* the economy.
- Whereas economists have known for 30 years that lower taxes on investment income stimulate investment, federal forecasting agencies assume that taxes have no effect on investment.
- Whereas economists have known for 30 years that tax policies can be used to stimulate capital formation, federal forecasters assert that capital formation is unaffected by tax policy.

Congressional Forecasting Errors. The principal sources of these bizarre theories are the economists employed by the Congressional Budget Office (CBO) and the Joint Committee on Taxation (JCT). Despite a decade of overwhelming evidence that supply-side penalties and rewards affect economic behavior,[2] these economists routinely assume that supply-side incentives are irrelevant. Take capital gains taxes, for example:[3]

"The congressional forecasting agencies over-estimated capital gains income by 50 percent."

- Both the CBO and the JCT have repeatedly asserted that the 40 percent increase in the capital gains tax rate in 1986 would have no effect on investment and investment income.

- As a result, both agencies originally predicted that capital gains income would be 50 percent higher than it actually was in 1989 and 1990.

When forced to confront errors and contradictions in their analyses, the CBO and the JCT go to great lengths to deny there is anything wrong with their view of the world. For example:[4]

- The CBO recently admitted that a change in taxes on capital would ultimately lead to an increase in the capital stock, but implied that the full adjustment would take more than 100 years, with annual increases being so small they could be safely ignored.

- The empirical evidence of the past 37 years, however, shows that the adjustment takes only five years and most of it occurs within two years.

Administration Forecasting Errors. Similar faulty views are held by economists at the Office of Management and Budget (OMB) and the U.S. Department of the Treasury — despite the fact that the Bush Administration openly embraced the legacy of the supply-side vision of Ronald Reagan. This explains why the administration's economists completely ignored the negative economic consequences of the increase in the capital gains tax rate and the limitation on IRA contributions passed in 1986 and, more recently, of the Clean Air Act, the Americans with Disabilities Act and 1990 budget summit tax increases.[5]

"The Bush Administration underestimated the five-year federal deficit by almost $1 trillion."

And just as the congressional agencies' forecasts have been wide of the mark, so have those of OMB. For example:[6]

- Between January 1990 and July 1991, the administration increased its forecast of the five-year federal deficit by almost *$1 trillion.*

- This trillion-dollar increase occurred despite a budget summit agreement that was touted as a deficit reduction measure and the fact that no major new spending program was adopted in the interim.

The Current Political Debate. If supply-side penalties and rewards have no effect on the size of the economic pie, it follows that politicians can safely focus on how to divide the pie without worrying about the macroeconomic effects of their actions. In this way, inside-the-Washington Beltway economics has created a climate in which class warfare has substituted for pro-growth strategies in the national political debate. The congressional forecasting agencies have contributed to this shift of emphasis by publishing a steady stream of reports designed to pit class against class — focusing only on how income is divided, not on what makes its production possible.[7]

"Politicians are focusing on class warfare rather than on economic growth."

Ironically, almost every country in the world has followed the Reagan Administration in substituting pro-growth policies for policies that seek only to redistribute income. Thus the current policy debate in Washington puts the United States in a league with countries such as China and Cuba — where equality of income is considered more important than prosperity and growth.

Rethinking How the World Works. Over the past several years, the National Center for Policy Analysis in conjunction with Fiscal Associates has produced forecasts of most major tax and spending bills before Congress. These forecasts contrast sharply with those of the official forecasting agencies. The most important difference in the two approaches is that we focus on how policy changes affect the nation's capital stock and how the amount of capital affects the wages of workers.

In what follows, we (1) discuss the principles that govern our analysis, (2) show how the assumptions we use are solidly grounded in empirical evidence and (3) contrast the approach we take with the mistaken assumptions routinely used by the federal government's forecasting agencies.[8]

Why Everyone Should Care about Capital

In the past 200 years, the United States has evolved from a less-developed country to a country with the highest standard of living in the world. The reasons for this evolution were that (1) we maintained a relatively free economy and (2) we encouraged the accumulation of capital.

Workers today are not smarter than their ancestors, and there is no reason to think that they work harder. Yet today's workers earn many times more than people did when the average wage was a dollar a day. Today's workers earn more because they produce more, and they are more productive largely because of the existence of capital.

Two hundred years ago, the primary capital in America's dominant agricultural industry consisted of little more than a hoe, a plow and an axe. Today, people combine their labor with highly sophisticated electronic equipment in virtually every industry.

"In this report, 'capital' means physical assets used to produce goods and services."

What Is Capital? The word "capital" means different things to different people. In the financial press, capital often means money or liquid assets. In the context of this report, capital means physical assets such as buildings, machines, equipment, etc. In terms of the economy's ability to produce goods and services, the constraint is not paper money, which we can print in unlimited quantity. The constraint is the number and quality of physical assets that labor can use in the production process.

Who Owns Capital? Aside from the ownership of houses and durable goods, most people do not own capital directly. Instead they own capital indirectly by owning financial assets such as stocks and bonds. A share of stock in a company entitles the stockholder to a share of the company's assets. A bondholder has a claim against the income from a company's assets. Most people are also indirect owners of capital through employer-provided pension plans.

Considering both direct and indirect ownership, the ownership of capital in the American economy is widely dispersed. It is also closely connected with retirement. As Figure I shows, about 40 percent of the nation's capital stock is owned by those 65 years of age and older and another 29 percent is owned through pension plans and IRAs. Thus more than two-thirds of the nation's capital stock is owned by the elderly or held for the purpose of providing people with an income during their retirement years.

Despite the fact that ownership of capital is widely dispersed, the wealthy tend to own more capital than the nonwealthy. On the average:[9]

- People with an annual income of $1 million tend to receive about 75 percent of their income as capital income and only 25 percent in the form of wages.

- By contrast, families with the average income of $29,314 tend to receive only 25 percent of their income from capital and 75 percent from wages.

"Most proposals to 'tax the rich' are really proposals to tax capital."

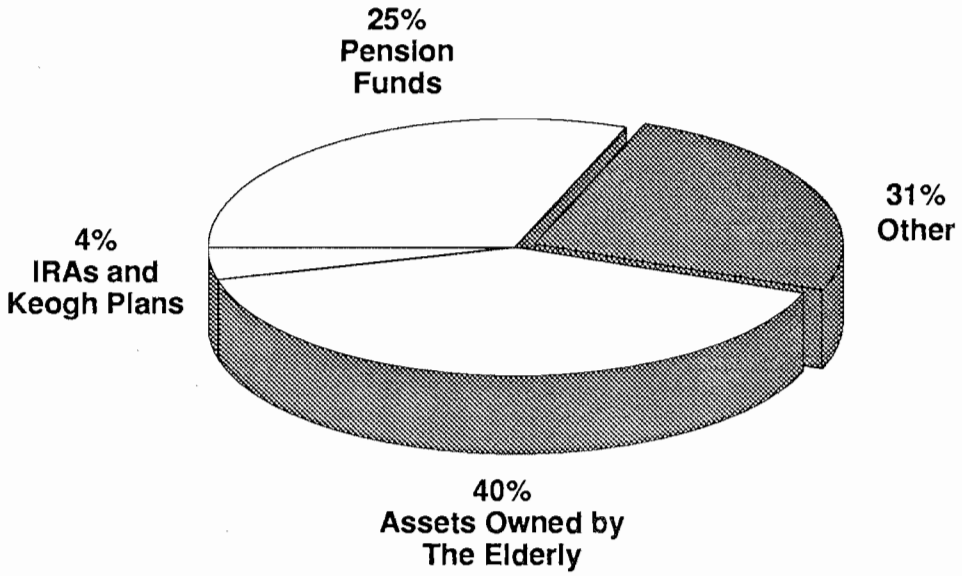
Precisely because wealthy people receive a very large share of their income from capital, most proposals to "tax the rich" are either necessarily or inadvertently proposals to tax capital.

How Is Capital Taxed? In the United States and in other countries, governments tax capital in one of three ways. Taxes are levied on (1) capital assets, (2) the output of capital assets and (3) the income of the owners of capital

"More than two-thirds of the nation's capital stock is either owned by the elderly or held in a retirement plan."

FIGURE I

Ownership of U.S. Capital Assets



Source: John C. Goodman, Aldona Robbins and Gary Robbins, "Elderly Taxpayers and the Capital Gains Tax Debate," National Center for Policy Analysis, NCPA Policy Report No. 153, July 1990.

assets. Examples of taxes on capital assets are property taxes and wealth taxes. Examples of taxes on the output of capital are sales taxes and value-added taxes. Examples of taxes on the income from capital are corporate income taxes and personal income taxes on dividends, interest, rent and profit.

Why Do Taxes on Capital Matter? The primary difference between rich and poor countries is the amount of capital per worker. The amount of capital determines not only a country's standard of living, but also its rate of economic growth. Economists have long known that economic growth is the most effective anti-poverty program there is, and that the key to economic growth is capital formation. For example:

- Many less-developed countries have the potential to grow at 6 percent per year, provided that they adopt policies which attract capital.
- At 6 percent per year, national income doubles every 12 years and quadruples every 24 years.
- If 24 years is considered a generation, a 6 percent growth rate will expand national income 12-fold after three generations — a feat which would do far more to alleviate poverty than all other programs combined.

Ten Principles of the Economics of Capital

Capital theory is one of the most difficult topics in all of economics. This may explain why political leaders who want to "get the country moving again" so often adopt policies that lead to economic stagnation. In what follows, we briefly describe the principles of the economics of capital and their implications for public policy.

Ten Principles

"The 10 principles explain how capital works in our economy."

Principle 1: **Capital is the single most important determinant of real wages.**

Principle 2: **More than 90 percent of the benefits of a larger capital stock go to wage earners rather than owners of capital.**

Principle 3: **The amount of capital is determined by investment.**

Principle 4: **The amount of investment is determined by the real aftertax rate of return on capital.**

Principle 5: **Because of changes in investment spending, the aftertax rate of return on capital tends to be constant.**

Principle 6: **Taxes on capital do not affect the aftertax rate of return on capital but instead affect the amount of capital available.**

Principle 7: **Taxes on capital raise the cost of capital to business and make U.S. industry less competitive in international markets.**

Principle 8: **The structure of U.S. capital taxes encourages investment in short-lived assets and discourages investment in long-lived assets.**

Principle 9: **Because capital taxes lower the nation's output, an increase in capital taxes almost always results in less revenue for government.**

Principle 10: **By moving to a more efficient tax system, the United States could collect the same amount of government revenue with much less harm to the private sector.**

Principle 1: Capital is the single most important determinant of real wages.

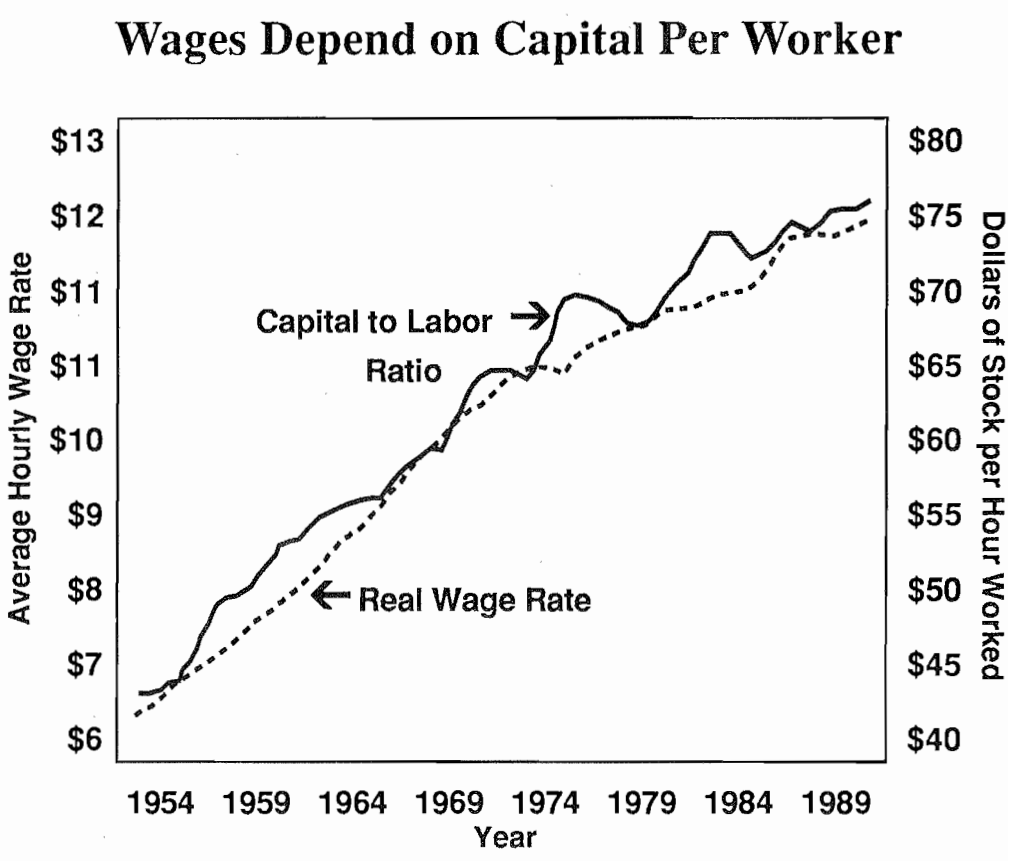
In a very real sense, the amount of capital in our economy determines how much wage income we earn, even if we do not personally own any capital. Workers' wages and the capital stock are inescapably linked. The only way that the real wages, and thus the well-being, of workers can rise is if there is more capital per worker. In general:

- About 98 percent of the variation in real wages over the past 37 years can be explained by the capital-to-labor ratio alone, without reference to any other economic factor.
- For every 10 percent increase in the average amount of capital per worker, the real wage rate increases by 11.9 percent.[10] [See Figure II.]

"About 98 percent of the change in real wages is explained by the change in the amount of capital per worker."

In recent years, there has been considerable discussion about which policies will raise the average income of the average worker. The answer is those policies which encourage more capital formation.

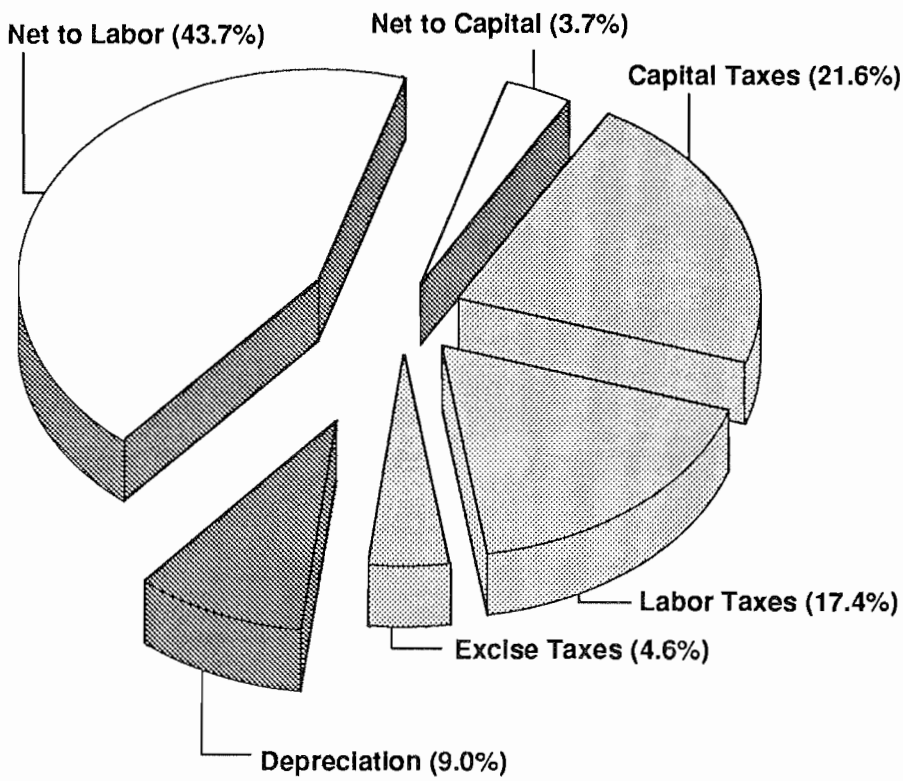
FIGURE II



"For every $1 of aftertax income received by investors, wage earners receive $12."

FIGURE III

Distribution of a Dollar of Sales



Principle 2: More than 90 percent of the benefits of a larger capital stock go to wage earners rather than owners of capital.

Many people believe that owners of capital get most of the benefits which capital creates. That turns out not to be the case. One of the most surprising findings of the economics of capital is that the overwhelming bulk of the extra income generated by capital accumulation flows to people in their role as wage earners, rather than to the owners of capital. As Figure III shows:

- For every additional dollar of income produced by a larger capital stock, two-thirds goes to labor and only one-third to capital.
- After taxes and depreciation, the discrepancy is even greater; labor receives 43.7 cents of each additional dollar of sales, while owners of capital receive only 3.7 cents.
- In other words, workers get to keep $12 in aftertax wages for every $1 of additional aftertax income to investors.

These facts have dramatic public policy implications. In general, public policies that promote capital accumulation primarily benefit wage earners, while policies that discourage capital accumulation primarily penalize wage earners.

In today's political debate, it is common for politicians to assert or imply that taxes on income from capital only affect the well-being of the rich. For example, those who argue for a higher tax rate on capital gains income frequently imply that average-income families will be better off, since the rich will bear a larger share of the burden of government. They conveniently ignore the fact that less capital means lower wages for everyone, including those who own no capital.

Principle 3: The amount of capital is determined by investment.

"Policies that promote capital formation primarily benefit workers, not investors."

The nation's capital stock is the sum total of all of its capital goods. Because these goods lose value over time, some level of investment is necessary to maintain the capital stock at its current size. Beyond that level, additional investment will cause the capital stock to grow, whereas less investment will cause it to shrink. Where do new investment funds come from? One source is increased savings by U.S. citizens. A second is investment by foreigners. A third is the repatriation of funds invested in other countries by U.S. citizens. Just as foreign investors have part of their portfolios in U.S. assets, so many U.S. citizens have investments overseas. When investment opportunities in the United States become more attractive relative to options in the rest of the world, U.S. investors will allocate more of their funds to the United States and less to other countries.

Principle 4: The amount of investment is determined by the real aftertax rate of return on capital.

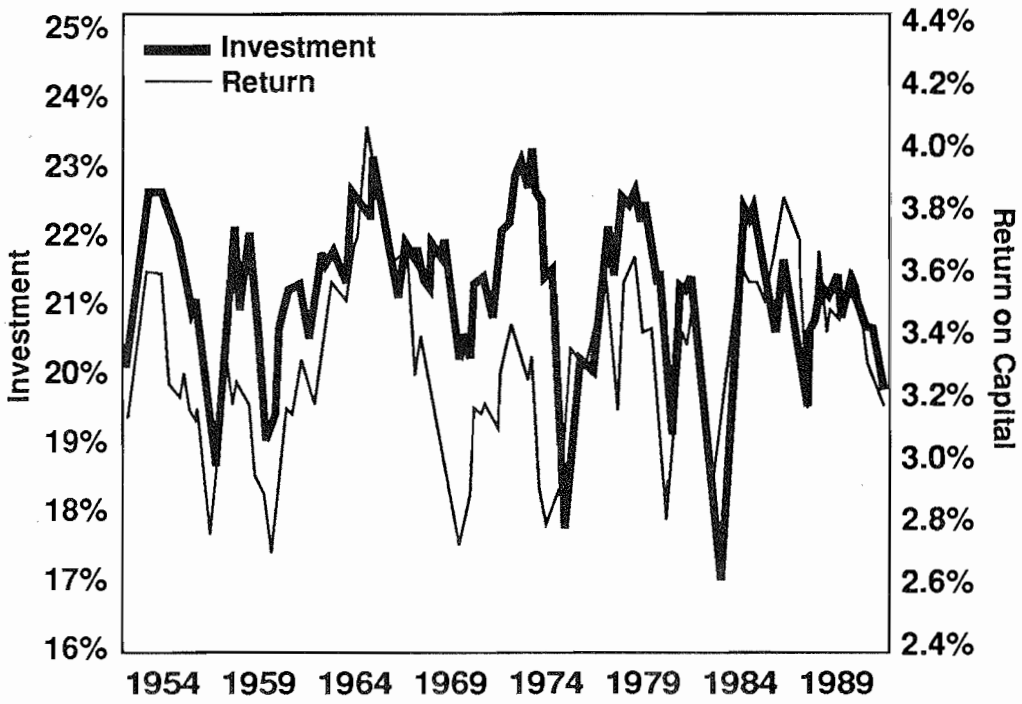
The amount of physical capital available in our economy depends on the willingness of people to invest in productive capital goods. In making these decisions, investors are guided by the return they will receive. The income to the investor must be adjusted for inflation, depreciation, taxes and the riskiness of the investment. After these adjustments are made, the investor can assess the aftertax real rate of return on the investment.

For as long as economists have worried about macroeconomic fluctuations, they have attempted to explain the behavior of investment spending. For John M. Keynes, investment decisions were largely irrational acts. For economists in the Keynesian tradition, investment decisions are primarily determined by market rates of interest. Both these views are inconsistent with the facts. The evidence shows that investment decisions are based on the rate of return investors expect to earn.[11]

"About 75 percent of the change in investment spending can be explained by changes in the aftertax rate of return."

FIGURE IV

Investment as a Percent of Private GDP and the Real Aftertax Rate of Return on Capital



- As Figure IV shows, changes in investment spending are very closely related to the rate of return on capital.

- In fact, a simple correlation can explain about 75 percent of the changes in investment spending in terms of changes in the return on capital alone.

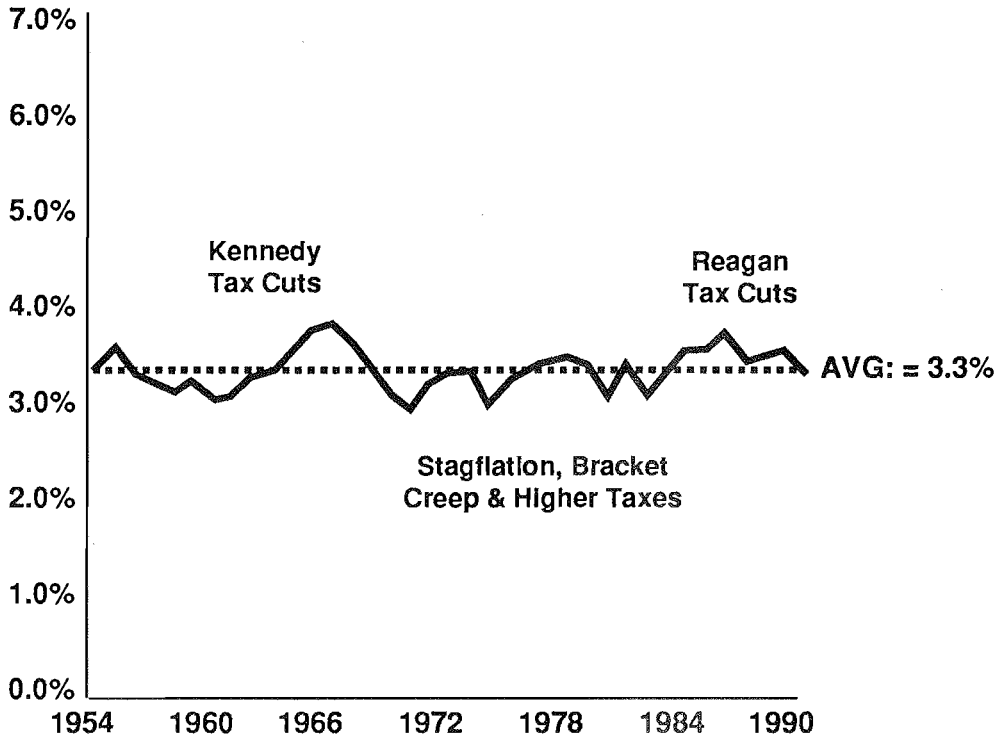
Principle 5: Because of changes in investment spending, the aftertax rate of return on capital tends to be constant.

Suppose something happens to cause the rate of return on capital to rise above its historic average. There will be an increase in investment, adding to the current stock of capital. As the capital stock expands, the rate of return on capital will fall. Conversely, when the rate of return on capital is below its historical level, there will be a decrease in investment. As the capital stock shrinks, the rate of return on capital will rise.[12] In this way, changes in investment spending tend to keep the rate of return on capital constant over time. As Figure V shows:

- Over the past 37 years, the rate of return on capital in the U.S. economy has tended to be remarkably stable — averaging about 3.3 percent per year.

FIGURE V

The Real Aftertax Rate of Return on Capital in the United States



"The real aftertax rate of return on capital is remarkably stable—rarely varying a percentage point away from its historic average."

- This stability has persisted despite radical changes in the structure of the economy, significant changes in technology and substantial changes in the taxation of income from capital.

- Events which change the rate of return on capital (such as a change in the tax law) rarely cause variations of more than 1 percentage point above or below the long-term average.

- A return to the rate of 3.3 percent usually occurs within five years following a significant deflection, and 60 percent of the adjustment occurs within two years.

Measuring the Rate of Return on Capital. In our complex economy, measuring the economy-wide rate of return on capital is difficult. The U.S. Department of Commerce has carefully recorded 37 different types of physical capital in the United States since 1929. We have used this information to construct estimates of investment in each of 73 industries. Because a particular type of capital may have a different productivity and a different useful life depending on the industry in which it is used, there are in principle 2,701 discrete types of capital on which data are maintained. Each type is also affected by significant differences in the tax treatment of capital income in corporations and unincorporated businesses.[13]

"Over the past 37 years, the real aftertax rate of return on capital in the United States has averaged 3.3 percent."

TABLE I

Real Aftertax Rate of Return on Capital In the United States

(1954 to 1990)

Date	Return	Date	Return
1954	3.33%	1973	3.33%
1955	3.68	1974	2.80
1956	3.25	1975	3.13
1957	3.12	1976	3.32
1958	3.00	1977	3.47
1959	3.20	1978	3.54
1960	2.88	1979	3.40
1961	2.91	1980	2.90
1962	3.25	1981	3.41
1963	3.32	1982	2.93
1964	3.60	1983	3.34
1965	3.94	1984	3.61
1966	4.01	1985	3.65
1967	3.71	1986	3.88
1968	3.33	1987	3.45
1969	2.95	1988	3.50
1970	2.72	1989	3.61
1971	3.14	1990	3.25
1972	3.29		

Average:	**3.33%**
Standard Deviation:	**0.31%**

Source: Fiscal Associates Inc. Model

Based on the Department of Commerce data set and the U.S. tax law, we have calculated an economy-wide aftertax rate of return on capital for each of the last 37 years. The method used to make these calculations adjusts the gross return to capital for depreciation, inflation, taxes and risk and is described in Appendix A.[14] The results of the calculations are shown in Table I.

Other Measures of the Return on Capital. Table II shows the gross and aftertax returns to capital in manufacturing, calculated by the Office of Business Analysis, U.S. Department of Commerce.[15] These data, constructed from survey information collected by the Census Bureau, are consistent with the economy-wide estimates for the real aftertax rate of return to capital presented in Table I. The average aftertax rate of return for manufacturing is somewhat higher than for the economy as a whole, reflecting the somewhat higher risk.

TABLE II

Return on Capital in Manufacturing

	PRETAX			AFTERTAX		
Year	All	Nondurable	Durable	All	Nondurable	Durable
1961	11.43%	11.18%	10.33%	3.61%	3.53%	3.26%
1962	11.60	11.50	12.03	3.76	3.73	3.90
1963	12.65	11.95	12.50	4.10	3.87	4.05
1964	13.40	12.65	13.55	4.72	4.45	4.77
1965	14.28	12.93	15.20	5.30	4.80	5.64
1966	13.48	13.00	15.03	4.97	4.80	5.55
1967	11.93	11.78	11.95	4.35	4.29	4.36
1968	12.48	12.05	12.80	3.93	3.80	4.03
1969	11.05	11.65	11.83	3.44	3.62	3.68
1970	8.85	10.18	7.93	3.00	3.45	2.69
1971	9.60	10.08	8.83	3.41	3.58	3.13
1972	11.00	10.50	10.43	3.92	3.74	3.71
1973	12.35	12.23	12.05	4.38	4.34	4.28
1974	11.43	14.20	10.85	3.94	4.90	3.74
1975	11.13	11.48	8.80	3.87	3.99	3.06
1976	12.10	12.63	11.83	4.17	4.35	4.07
1977	12.25	12.18	12.58	4.26	4.23	4.37
1978	13.30	12.18	13.40	4.61	4.22	4.64
1979	12.88	13.88	12.20	4.75	5.12	4.50
1980	10.53	13.05	8.85	3.77	4.68	3.17
1981	9.60	11.70	9.15	3.40	4.14	3.24
1982	6.40	8.90	4.48	2.39	3.32	1.67
1983	9.00	9.60	6.25	3.29	3.50	2.28
1984	8.60	9.28	9.10	3.27	3.53	3.46
1985	6.95	7.68	6.80	2.60	2.87	2.55
1986	6.83	7.60	5.45	2.51	2.80	2.00
1987	8.75	8.75	7.85	3.69	3.69	3.31
1988	9.53	10.75	8.52	4.05	4.57	3.63
1989	7.03	9.05	6.20	2.98	3.84	2.63
1990	9.77	7.93	5.17	4.17	3.39	2.21
avg	10.72	11.14	10.19	3.81	3.96	3.60
std	2.10	1.75	2.86	0.69	0.56	0.93
std/avg	19.63%	15.72%	28.04%	18.07%	14.12%	25.87%

Source: Pretax returns are from Department of Commerce, Office of Business Analysis, "Quarterly Financial Ratios for Manufacturing Corporations." The authors constructed aftertax returns by applying economy-wide average marginal tax rates on corporations to the gross returns.

"In manufacturing, the aftertax rate of return has averaged 3.8 percent."

The aftertax rate of return in manufacturing has been remarkably stable over the past 30 years, although less stable than the rate of return for the whole economy. As one sector of the economy adjusts to changing market conditions, the economy-wide average reflects a much smaller variation.[16]

Why the Rate of Return on Capital Tends to be Constant. The empirical evidence summarized above suggests that the aftertax real rate of return on capital is one of the most constant relationships found in all of economics. But why is that so? Traditional neoclassical economics teaches that the rate of return on capital must reflect people's preference for future rather than current consumption. In other words, to be induced to save (forego current consumption) and invest (with the expectation of greater, future consumption), people must receive a minimum rate of return on their investment. Because the time preferences of people are unlikely to change very much over time, the rate of return on capital will remain roughly constant. Furthermore, the sheer size of the capital stock means that an increase in the rate of return for one asset will have little effect on the economy-wide rate. The average return on capital, therefore, moves very slowly.

In a modern, open economy another consideration comes into play — the international flow of capital among countries. U.S. firms compete for capital in an international marketplace. Thus the aftertax rate of return on capital in the United States is determined by the time preferences of people all over the world. Because the United States is a safe haven for capital, the rate of return here will be much lower than it is where investments are riskier, such as most Latin American countries. A 3.3 percent rate is the return necessary to induce international investors to invest in the United States rather than in other countries around the world.

Principle 6: Taxes on capital do not affect the aftertax rate of return on capital but instead affect the amount of capital available.

"Higher taxes on investment income reduce the size of the nation's capital stock."

Although an increase in a tax on capital causes a one-time reduction in wealth for owners of capital, it does not permanently affect the future aftertax rate of return on capital. After such an increase, the aftertax rate of return on capital will be below its historical average. Investors will respond by lowering their rate of investment. The capital stock will shrink (relative to what it would have been) until the rate of return reaches 3.3 percent. After the adjustment has taken place, the owners of capital will receive the same aftertax rate of return they received before the tax increase.

This does not mean that owners of capital will be indifferent to taxes on capital. These taxes lower the aftertax future income stream on existing capital assets. Thus a tax on capital lowers the value of capital assets and makes current owners of capital less wealthy. For any new purchase of an asset, however, capitalists will and can expect the normal rate of return of 3.3 percent.

Principle 7: Taxes on capital raise the cost of capital to business and make U.S. industry less competitive in international markets.

In order to supply capital, investors must receive a minimum aftertax real rate of return. In the long run, as we have seen, this rate is 3.3 percent for investments in the United States. The users of capital must pay a much higher rate, however. In addition to paying the suppliers a normal rate of return, the users must pay the cost of economic depreciation (the loss in value of physical assets) and the cost of taxes on capital. The total of these costs is called the cost of capital. [See Appendix A.]

The Cost of Capital in the United States. Table III shows the components of the cost of capital for all real assets in the U.S. economy over the period 1955 to 1990.[17] As the table shows:

- The economy-wide average cost of capital today is 9.7 percent, an 8 percent increase from what it was in 1955.
- Each of the components of the cost of capital — depreciation, taxes and the rate of return to the investors — contributes about one-third of the total cost.
- Corporate income, personal income and property taxes each account for between 10 and 11 percent of capital costs.

"When taxes combine with inflation, they choke off investment opportunities— including riskier, long-term investments."

The Tax Wedge. Taxes on capital create a wedge between the return to the suppliers of capital and the rate paid by the users. Because in the long run the suppliers of capital adjust their supply to cover all taxes, the full cost of this wedge must be paid by those who use capital in the process of production. Taxes on capital, therefore, raise the cost of capital to business enterprises. In so doing, they also raise production costs and make domestic producers less competitive in international markets.

Taxes, Inflation and Risk. In addition to the direct effect of taxes on the cost of capital, there are indirect effects. For example, in the absence of taxes, a 2 percent rate of inflation would increase the cost of capital (in nominal terms) by 2 percentage points. When taxes are present, the nominal cost of capital will increase by more than 2 percentage points, however. The reason is that the presence of taxes magnifies the effects of inflation.[18] Similarly, the presence of taxes magnifies the risk premium required in order to induce investors to make riskier investments. Because of taxes, therefore, inflation will choke off additional investment opportunities and investors will avoid riskier investments, including investments in research and development.

"The cost of capital includes the cost of taxes and depreciation, and the rate of return paid to owners of capital."

TABLE III

The Cost of Capital

		Components as a Percent of Total Cost		
Year	Total Cost of Capital[1]	Depreciation[2]	Rate of Return	Taxes
1954	9.03%	23.02%	36.76%	40.22%
1955	9.02	23.83	36.83	39.34
1956	9.20	24.01	36.08	39.91
1957	9.30	23.83	35.69	40.48
1958	9.37	22.77	35.44	41.78
1959	9.28	23.11	35.77	41.12
1960	9.47	23.01	35.06	41.93
1961	9.58	22.71	34.68	42.61
1962	9.35	23.02	35.53	41.45
1963	9.43	23.17	35.23	41.60
1964	9.16	24.59	36.26	39.15
1965	9.16	25.83	36.25	37.92
1966	9.25	26.30	35.91	37.79
1967	9.39	25.29	35.35	39.36
1968	9.88	23.97	33.60	42.43
1969	9.98	24.00	33.28	42.72
1970	9.85	23.68	33.72	42.60
1971	9.51	24.21	34.92	40.86
1972	9.53	24.90	34.84	40.26
1973	9.53	25.93	34.83	39.24
1974	9.66	25.56	34.37	40.07
1975	9.33	24.21	35.58	40.21
1976	9.31	24.34	35.68	39.98
1977	9.30	25.38	35.71	38.92
1978	9.35	26.36	35.51	38.13
1979	9.19	27.66	36.12	36.23
1980	9.46	26.34	35.09	38.57
1981	8.84	27.80	37.57	34.63
1982	8.85	27.97	37.50	34.52
1983	8.80	27.96	37.73	34.31
1984	9.07	28.73	36.62	34.66
1985	9.17	29.60	36.19	34.21
1986	8.86	30.23	37.48	32.29
1987	9.55	30.55	34.79	34.67
1988	9.58	31.43	34.65	33.92
1989	9.69	31.69	34.27	34.04
1990	9.72	31.91	34.17	33.92

[1]As a percent of the asset price.

[2]Economic depreciation, not tax depreciation.

TABLE IV

Relative Contribution of Taxes[1] to the Cost of Capital

Year	All Taxes	Corporate Income Taxes	Personal Income Taxes	Property Taxes	Excise Taxes[2]
1955	39.3%	13.7%	12.6%	10.1%	2.9%
1960	41.9	15.0	13.4	10.0	3.5
1965	37.9	11.7	10.4	12.5	3.3
1970	42.6	14.6	13.0	11.7	3.3
1975	40.2	13.4	12.6	11.2	3.0
1980	38.6	13.5	13.1	9.5	2.5
1985	34.2	12.1	8.5	11.2	2.5
1990	33.9	10.6	10.3	10.5	2.5

[1]Includes federal, state and local taxes.

[2]Includes subsidies.

"Taxes make up about one-third of the cost of capital."

Principle 8: The structure of U.S. capital taxes encourages investment in short-lived assets and discourages investment in long-lived assets.

Taxes on capital do not merely discourage investment. They also alter the types of investments that are attractive. Even if the tax rates themselves do not directly discriminate against any particular type of investment, the interaction of taxes with risk and with inflation distorts investment decisions.

"U.S. tax policy discriminates against manufacturing."

We have already seen how the presence of taxes causes investors to avoid riskier (but valuable and important) investments. Inflation creates even more perverse results. In general, income from capital is not indexed in the U.S. tax code. As a result, people with capital gains income pay taxes on inflationary gains, and investors in long-term projects are allowed to deduct only historical (depreciated) costs against inflationary revenues.

To avoid the damaging effects of taxes and inflation, investors in the United States are encouraged to choose short-term over long-term assets and assets that can be depreciated quickly over those with a longer life. Evidence of this perverse effect can be seen in Table III. As the table shows, depreciation as a percent of the total cost of capital has been rising over the past 40 years:

- In the 1950s, depreciation constituted between one-fifth and one-fourth of the total cost of capital.

- Today, however, depreciation is almost one-third of the cost of capital.

The structure of U.S. taxes combined with inflationary monetary policies have discriminated against the manufacturing industries (where assets depreciate more slowly) and in favor of services and retail trade (where assets depreciate more quickly). This may be one of the most important reasons for the decline of the rust belt industries in the United States and the inability of many manufacturing concerns to compete successfully in international markets.

Principle 9: Because capital taxes lower the nation's output, an increase in capital taxes almost always results in less revenue for government.

"A $10 billion reduction in taxes on investment income will produce $120 billion of new revenue for government."

Because of their effects on investment and on the size of the capital stock, taxes on capital have severe effects on the economy as a whole. This is why governments that impose new taxes on capital almost always collect much less total revenue than they anticipated. Not only does the tax base (the capital stock) shrink, but so does aggregate output and national income. This means that government tax collections will be smaller for almost every other type of tax, including labor taxes.

In general, almost any (targeted) reduction in taxes on capital will result in a net gain in revenue for government. For example:

- A 10 percent cut in the tax rate on all capital income will cost government about $10 billion a year in lost revenue.

- Because of the tax cut, however, the cost of capital will fall by about 5 percent and, in response, new investment will increase the capital stock by 5 percent.

- This means that the economy as a whole will receive an infusion of about $750 billion in new capital, leading to an increase in the nation's output of goods and services of about $250 billion (net of depreciation).

- Of the $250 billion in increased national income, about $120 billion will go to government in taxes and about $120 billion will consist of an increase in aftertax wages.

Thus in return for giving up $10 billion in annual taxes, government revenues will rise $120 billion a year — a $110 billion profit — and wage earners will also realize a $120 billion increase in aftertax income.

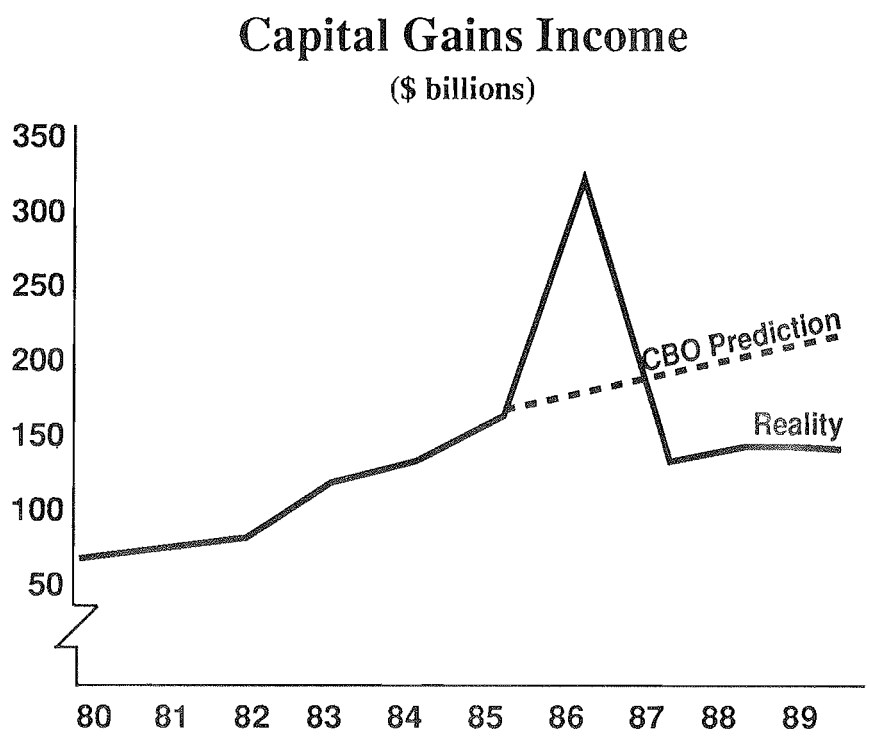
As an example of this relationship, consider the capital gains tax. Historically, there has been a negative relationship between capital gains tax rates and capital gains revenue collected by the federal government.[19] Whenever tax rates have been increased, tax revenues have dropped, and vice versa.

Perhaps because capital gains taxes have become a political issue, the major forecasting agencies of Congress have (1) denied the existence of this historical relationship, (2) gone to great lengths to explain it away or (3) maintained that the past relationship would not hold in the future. For example, both the CBO[20] and the JCT[21] resolutely maintained that the 40 percent increase in the capital gains tax rate in the 1986 Tax Reform Act would increase rather than reduce government revenue. This prediction has proved to be a considerable embarrassment to both agencies.

Before the tax hike took effect, there was a huge jump in capital gains income in 1986. For the three years following the tax increase, however, capital gains income was lower than it was in 1985. [See Figure VI.] The CBO prediction, by contrast, was way off:[22]

"The CBO assumed that higher capital gains tax rates would have no effect on the amount of capital gains tax revenue."

FIGURE VI



- The CBO forecast that capital gains income would be $225 billion in 1989 — 50 percent higher than it actually was.

- Since the $75 billion error is repeated in each year of a five-year CBO forecast, the total mistake will amount to $375 billion.

- As result, there will be about $20 billion less in annual tax revenue from capital gains than the CBO projected.

Similarly, as late as 1990 the JCT staff was still predicting that capital gains realizations would continue to increase annually during the 1990s. Their forecast for 1990 of $237 billion turned out to be $87 billion too high.

Principle 10: By moving to a more efficient tax system, the United States could collect the same amount of government revenue with much less harm to the private sector.

"Because marginal tax rates are higher than they need to be, we lose $411.1 billion a year in reduced output."

Every tax has a distorting effect on the private sector. For example, a tax on labor discourages people from working and, with less labor, capital is less productive. As we have seen, a tax on capital leads to less capital and, with less capital, labor is less productive. How we collect these taxes, however, makes a big difference. In principle, there are two additional distortions which characterize the U.S. tax system.

Distortion Due to Marginal Tax Rates. One type of distortion received a great deal of attention in the 1980s: the difference between average and marginal tax rates. When all income is not treated equally in the tax code, marginal tax rates have to be higher, relative to the average tax burden. Yet marginal tax rates are the ones that determine people's decisions about whether to supply capital and labor. When all capital (including residential houses) and all taxes (including sales and property taxes) are considered:

- In 1992, the *average* tax rate on labor income will be 36.1 percent (including all taxes), and the *marginal* tax rate will be 44.2 percent.

- The average tax rate on capital income will be 44.6 percent, and the *marginal* tax rate will be 55.7 percent.

- Because of these large discrepancies between average and marginal tax rates, the output of goods and services for the year will be $411.1 billion lower. [See Table VI.]

Distortions Due to the Mix of Capital and Labor Taxes. During the 1986 tax reform debate, considerable attention was given to the desirability of removing distortions in the tax system by taxing all capital assets in the same way. Unfortunately, the Reagan Administration and the Congress ignored an even more important distortion: the unequal treatment of capital and labor.

TABLE V

Loss of Output Due to Distortions in the Tax System[1]

(Expressed as a Percent of Net National Product)

Year	Total Loss[2]	Distortion Due to the Mix of Capital Labor Taxes[3]	Distortion Due to Marginal Tax Rates[4]
1955	14.5%	6.9%	7.0%
1960	14.9	7.0	7.4
1961	14.5	6.8	7.2
1962	13.8	6.3	7.1
1963	13.5	6.1	7.0
1964	12.3	5.9	6.1
1965	12.3	5.7	6.2
1966	12.4	5.6	6.4
1967	12.8	5.9	6.6
1968	15.1	7.4	7.2
1969	17.1	8.3	8.1
1970	17.1	8.6	7.8
1971	15.8	8.0	7.2
1972	16.6	7.2	8.8
1973	14.9	6.3	8.0
1974	16.7	7.5	8.6
1975	13.9	6.0	7.5
1976	15.6	6.8	8.2
1977	14.9	6.4	8.0
1978	14.7	5.3	8.9
1979	16.0	5.1	10.3
1980	16.9	5.6	10.7
1981	16.6	4.5	11.7
1982	16.5	4.7	11.3
1983	12.9	3.6	9.0
1984	13.5	3.5	9.7
1985	14.1	3.3	10.5
1986	14.1	3.5	10.3
1987	11.9	2.7	9.0
1988	13.9	4.9	8.5
1989	13.7	4.3	8.9
1990	13.5	4.7	8.5
1991	13.4	4.4	8.6
1992	13.5	4.5	8.6

"Distortions in the tax system cause the nation's output to be 13.5 percent lower than it otherwise would be."

[1]The calculations in this table are based on the average percentage change in the quantity of output from an indirect Cobb-Douglas production function implied by the shift in the supplies of labor and capital resulting from the assumed changes in taxes. The elasticity of labor supply is -0.3 and that of capital is infinite at a real aftertax rate of return of 3.3 percent. For further explanation of the method, see Appendix B.

[2]Not equal to sum of parts due to interaction. Figures assume that the marginal and average tax rates for capital and labor are all equal and raise the amount of revenue that was actually raised.

[3]Figures assume that the marginal tax rates on labor and capital are equal and raise the amount of revenue that was actually raised. The marginal rates, however, will be greater than the average.

[4]Figures assume that the marginal tax rates on labor and capital are each equal to their average tax rates and raise the amount of revenue that was actually raised.

Business enterprises combine capital and labor in production based on their aftertax prices. In an ideal tax system, the ratio of the aftertax prices of capital and labor would equal their before-tax ratio. To the degree that these ratios are not the same, firms are encouraged to combine capital and labor in inefficient ways — leading to less total output. Unfortunately, while eliminating one type of distortion, tax reform led to a worse one.

- Whereas in 1986, the average tax on capital income was 20.2 percent greater than the average tax on labor income, by 1992 the distortion will rise to 25.8 percent.

- The resulting efficiency loss will cost the U.S. economy $213.2 billion in reduced production. [See Table VI.]

"Because we over-tax capital relative to labor, we lose $213.2 billion a year in reduced output."

Total Efficiency Loss. As Table V shows, the first round of Reagan tax cuts moved us toward a more efficient tax system. The efficiency loss from the way we impose taxes fell from 16.9 percent of output in the last year of the Carter Administration to 12.9 percent in 1983 and reached 11.9 percent in 1987. Since then, a series of tax changes has reversed the direction:

- In 1990, the total efficiency loss caused by the way we impose taxes was 13.5 percent of output.

- In 1992, the total distortion will cost Americans $642.7 billion — about $2,650 for every man, woman and child in the country.

"Distortions in the tax system will cost Americans $642.7 billion in 1992—about $2,650 for every man, woman and child in the country."

TABLE VI

Loss of Output Due to Distortions in the Tax System

($ billions)

Year	Total Loss[1]	Distortion Due to the Mix of Capital and Labor Taxes	Distortion Due to Marginal Tax Rates
1955	$ 48.7	$ 23.4	$ 23.7
1960	62.8	29.5	31.1
1961	63.0	29.5	31.3
1962	65.0	29.4	33.4
1963	67.1	30.5	34.5
1964	65.5	31.1	32.5
1965	71.0	32.8	36.1
1966	78.2	35.3	40.6
1967	84.9	38.8	43.5
1968	108.8	53.1	51.8
1969	132.5	64.4	62.9
1970	137.8	69.7	62.7
1971	138.6	70.1	63.3
1972	160.1	69.1	84.9
1973	161.8	68.9	87.4
1974	195.3	87.1	100.7
1975	174.1	74.7	93.7
1976	218.8	95.6	115.3
1977	233.1	99.7	125.4
1978	261.6	95.2	158.0
1979	316.4	101.5	204.5
1980	361.5	119.0	229.7
1981	397.5	106.5	278.6
1982	402.8	114.7	275.2
1983	341.0	94.9	237.6
1984	401.5	103.3	288.2
1985	446.6	105.0	330.7
1986	470.7	117.3	341.3
1987	425.0	96.7	319.6
1988	534.7	189.1	329.4
1989	561.6	178.5	367.1
1990	582.9	200.9	365.0
1991	600.1	199.4	383.6
1992	642.7	213.2	411.1

[1]Not equal to sum of parts due to interaction.

Source: Table V

How Government Taxes Capital

Each of the major taxes imposed on our economyis adirect or indirect tax on capital. Some are worse than others, however. What follows is an overview of how these taxes work.

Major Types of Taxes

Broadly speaking, U.S. taxes can be grouped into one of five categories: payroll taxes, sales taxes, personal income taxes, property taxes and corporate income taxes.

Payroll Taxes. Just as a tax on capital is also an indirect tax on labor, so a tax on labor is an indirect tax on capital. To the degree that a tax on wage income causes workers to reduce the amount of their labor, capital will be less productive and owners of capital will receive less income. Although payroll taxes affect capital, they are the least harmful of the five major types of taxes.

Sales and Output Taxes. Taxes on output include value-added taxes, excise taxes, broad-based sales taxes and severance taxes (including taxes on oil, gas and minerals). Regardless of how they are structured, each has roughly the same effect on capital.

"The taxes that do the most damage are the ones that fall heaviest on investment income."

The belief that sales taxes are passed along to consumers is widespread. Yet that view is misleading. If government places a 10 percent tax on all sales, consumers do not suddenly have 10 percent more income to spend. If consumer income stays constant and if the quantity of goods and services sold remains the same, the pretax prices of all goods and services will have to fall by the amount of the tax. It follows that taxes on sales must ultimately be paid by producers, not consumers. Moreover, since the gross (pretax) income of producers is divided about one-third/two-thirds between capital and labor, it follows that about one-third of sales taxes are paid by owners of capital.

Personal Income Taxes. Income taxes differ from payroll taxes in that they directly reach income from capital as well as from wages. For the most part, people pay taxes on capital income and labor income at the same rate. The "progressivity" in the U.S. tax code assures that higher income families pay higher tax rates, however. And since higher income people tend to have more capital income, the average tax rate on capital income in our economy is higher than the average tax rate on labor income. For this reason, proposals to make the tax system even more progressive are not neutral with respect to capital and labor. They would place an even heavier burden on capital income.

Property Taxes. One of the most important, and damaging, ways in which government taxes capital is through property taxes. Since property taxes must be paid out of income from property, they are actually taxes on capital income. A 1 percent annual tax on the value of property may appear to be a small penalty. But if the annual income from the property is only 2 percent, the tax is a 50 percent tax on capital income.

Corporate Income Taxes. Since corporate income is income to the owners of capital (stockholders), the corporate income tax is a pure tax on income from capital. Dollar for dollar, therefore, the corporate income tax is the most damaging with respect to overall effects on the nation's capital stock.

Case Study: Taxes in Texas

Fiscal Associates and the National Center for Policy Analysis recently applied the Fiscal Associates tax model to the economy of Texas. On the average, taxes on capital in Texas are 7.4 percent above the national average (measured in terms of the distribution of a dollar of sales), while taxes on wages are about 14.7 percent below the national average. Nonetheless, our general conclusions are probably applicable to most other states.

Table VII shows the economic effects of raising $2.3 billion per year (the projected Texas budget deficit in the spring of 1991) by using alternative taxes. Every tax increase would harm the Texas economy. But as the table shows, some taxes are worse than others and the degree of harm is directly related to the degree to which capital is taxed. Specifically:

- A value-added tax or a proportional income tax would be about twice as harmful as a payroll tax.
- A progressive income tax would be about three times as harmful as a payroll tax.
- Increases in property taxes would be more than six times as harmful as a payroll tax.
- Per dollar of revenue, a corporate income tax would be more than three times as harmful as property taxes and more than 20 times as harmful as a payroll tax.

TABLE VII

Consequences of a $2.3 Billion Per Year Tax Increase in Texas

Revenue Source	Effect on the Texas Economy[1]
Payroll tax[2]	-0.48%
Value-added or gross receipts tax[3]	-1.06%
Proportional income tax[4]	-0.91%
Progressive income tax[5]	-1.53%
Property tax	-3.22%
Corporate income tax[6]	-10.80%

[1]Reduction in gross state product.

[2]Rate = 1.16 percent.

[3]Rate = 0.77 percent on gross sales.

[4]Rate = 1.54 percent on all federal taxable income (with federal deductions and exemptions).

[5]Rate = 2.75 percent on AGI above $20,000 on joint returns.

[6]Rate = 15.6 percent. Note: The effects of this tax increase are so large that the predicted result is useful only for judging the relative impact of corporate income taxes compared with other taxes.

"Per dollar of revenue raised, a Texas corporate income tax is three times worse than a property tax, 10 times worse than a sales tax and 20 times worse than a payroll tax."

Ten Myths About Capital

The theory of capital outlined in this report is basically the analytic framework developed by Alfred Marshall, Irving Fisher and other 20th-century classical economists and extended in modern times by Dale Jorgenson, Robert Barro and others.[23] The theory is consistent with all relevant evidence about the role of capital in the U.S. economy. This theory is not the one that typically guides public policy formation in Washington, however. The following are some common myths that all too often lead to bad public policies.

Myth 1: Taxes on capital have no effect on the economy.

"Government forecasting agencies are the source of the myth that taxes on capital do not affect the economy."

The chief perpetrators of this myth are congressional forecasting agencies, specifically the CBO and the JCT. In projecting the effects of taxes on capital, these agencies typically take a proposed change in a tax rate and multiply it by the existing tax base to arrive at the revenue change for the federal government. They assume that a change in a tax on capital will cause no change in the capital stock, no change in net investment and no change in overall economic activity. These assumptions are baseless and inconsistent with empirical evidence.

Ten Myths

Myth 1: Taxes on capital have no effect on the economy.	**Fact:** Almost 40 years of empirical evidence confirms that changes in taxes on capital are very quickly reflected in change in investment flows.
Myth 2: Federal tax policy can change the aftertax return on capital.	**Fact:** Almost 40 years of empirical evidence confirms that the aftertax real rate of return on real capital is independent of federal tax policy.
Myth 3: Interest rates are the principal determinant of investment spending.	**Fact:** Numerous academic studies confirm that there is very little relationship between interest rates and investment spending, which is instead determined by the aftertax real rate of return on capital.
Myth 4: Federal deficits crowd out private investment.	**Fact:** There is virtually no relationship between the amount of private investment and the size of the federal deficit.
Myth 5: Lower taxes on capital in the 1980s did not stimulate new investment.	**Fact:** Investment increased for those types of assets for which taxes were lowered and decreased for those types of assets for which taxes were increased.
Myth 6: A lower tax on capital cannot stimulate larger investment without unrealistically large changes in private savings.	**Fact:** A principle source of increased investment is international capital flows, not just increased domestic savings.
Myth 7: U.S. tax law cannot influence foreign investment because foreigners do not pay U.S. taxes.	**Fact:** The principal source of "foreign" investment is a reduction in (or return of) U.S. funds invested abroad.
Myth 8: The U.S. government deficit is the primary cause of foreign investment in the United States.	**Fact:** U.S. investment, whether by domestic or foreign investors, is determined by the aftertax real rate of return on capital, not by government deficits.
Myth 9: Taxes on capital do not affect the international competitiveness of U.S. companies.	**Fact:** Although taxes on capital do not affect the long-run balance of trade, they do greatly affect which sectors of the economy will have a comparative advantage.
Myth 10: The federal deficit has no effect on the economy.	**Fact:** By lowering the perceived price of government services, deficits encourage a larger transfer of resources from the private to the public sector.

Myth 2: Federal tax policy can change the aftertax return on capital.

Until recently, the CBO and the JCT refused to publish any statement outlining the general theory of capital on which they based their assumptions. However, under prodding from Congress, the CBO has now published a treatise on its theoretical approach to capital gains taxes.[24] The centerpiece of the CBO theory of capital markets is the assumption that government can permanently change the aftertax real rate of return on capital. Similarly, the JCT believes that tax policy changes lead to a permanent (or extremely slowly adjusting) change in the aftertax return to capital.[25] These conclusions are directly contradicted by the last 37 years of empirical evidence. [See the analysis in Appendix C.]

Myth 3: Interest rates are the principal determinant of investment spending.

A commonly held view is that the cost of capital is the interest rate. It follows from this view that attempts to artificially lower market rates of interest will stimulate investment. In fact, there is no evidence to support this theory.

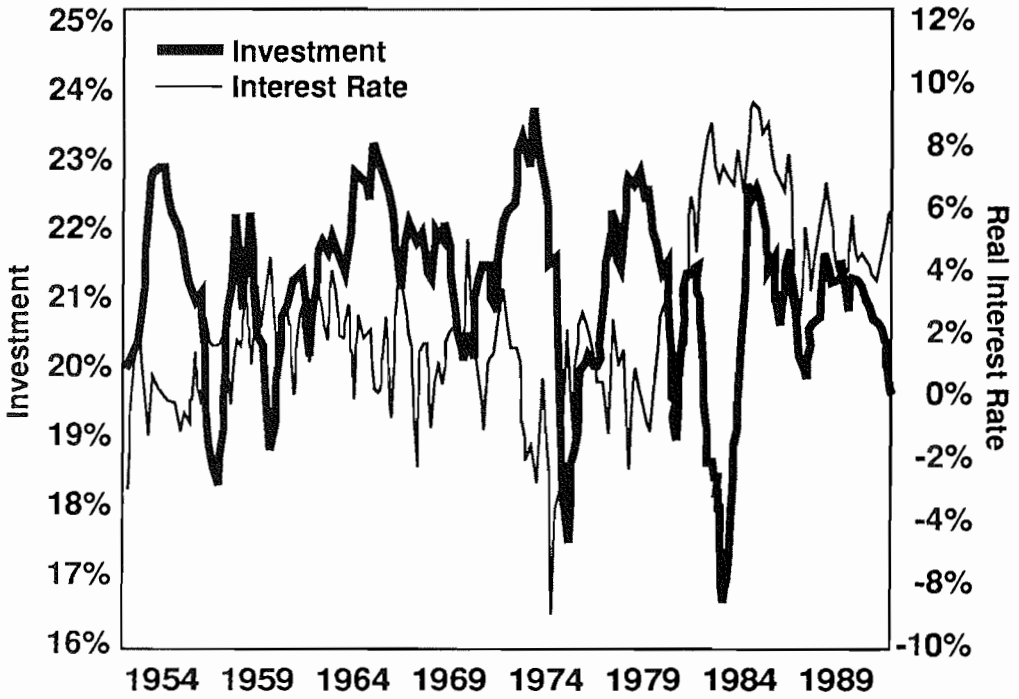
Investment and Interest Rates. As Figure VII shows, changes in investment are not related to changes in the real interest rate, at least as it is commonly measured.[26] The reason is that the cost of capital has very little relationship to the interest rate. The only element in the cost of capital affected by the interest rate is tax depreciation. [See Appendix A.] In general, a 10 percent decrease in the interest rate lowers the cost of capital by less than 1 percent.[27] By contrast, a 10 percent decrease in capital taxes lowers the cost of capital by three to four times as much.[28] Moreover, historically good economic times have been associated with high real interest rates and vice versa.[29]

The "New" Theory of Corporate Finance. Closely related to the view that interest rates determine investment is the assumption that debt financing is always cheaper than equity. In fact, over the 1980s a "new" theory of corporate finance evolved which held that firms would finance new investment solely through borrowing. This theory was short-lived, however, because it failed to predict the investment response to tax changes made during the 1980s.[30]

It is true that debt financing is favored in the tax laws due to the deductibility of interest. Overlooked, however, is the fact that as a business becomes more highly leveraged, its borrowing costs rise because creditors demand increased compensation to cover the greater exposure of the firm's equity. Furthermore, firms cannot borrow more without driving up the cost of their debt-financed capital because lenders demand a higher return to compensate for their increased risk. The more highly leveraged an investment, the higher the cost of financing through debt. Businesses, therefore, will use both equity and

FIGURE VII

Investment as a Percent of Private GDP and the Real Interest Rate



"There is virtually no relationship between investment spending and interest rates."

debt financing to the point at which the cost of an additional dollar of each is the same. In general, interest rates help determine the split between debt and equity financing, not the level of investment.

Myth 4: Federal deficits crowd out private investment.

Another commonly held view is that federal deficits crowd out private investment by reducing the funds available to finance the purchase of real assets, driving up interest rates and raising the cost of capital to private investors. It follows that private investment can be increased if the deficit is reduced, either by reducing spending or by raising taxes.

"There is virtually no relationship between investment spending and federal deficits."

A major problem with this argument is that, as noted above, interest rates do not determine investment. Moreover, even if there were a relationship between interest rates and investment, federal borrowing has little effect on interest rates. Outstanding debt in U.S. credit markets was about $13.4 trillion at the end of 1990.[31] Moreover, capital trades in a world market whose debt is many times that of the United States. The impact on credit markets and interest rates of an additional $50 billion to $100 billion in federal borrowing is virtually negligible.[32]

Nevertheless, this debate seems to resurface every ten years. The impact of federal deficits on interest rates was last revisited in the early 1980s. An extensive literature survey by the U.S. Treasury Department concluded that the effect of the federal deficit on interest rates is, at best, uncertain.[33] Our own statistical analysis shows that although there is a close relationship between investment and the rate of return on capital, there is no statistically significant relationship between the rate of return on capital and the federal deficit:[34]

- During the 1980s, the real aftertax rate of return on capital went down, not up, while the deficit was increasing.
- At the same time that government deficits were increasing, so was investment.

Myth 5: Lower taxes on capital in the 1980s did not stimulate new investment.

The behavior of investment spending during the Reagan years provides dramatic evidence of how quickly investment responds to tax incentives. Yet, because the tax law was changed frequently and because incentives often went in opposite directions for different kinds of capital, the evidence is obscured when all investment spending is lumped into a single category.

The Investment Response to Tax Changes. On the whole, the Reagan record contains ample proof that investors respond to incentives. As Figure VIII shows:

- When the change in the tax rate on capital equipment switched from a 9.5 percent increase to a 5.9 percent decrease, the rate of investment almost doubled — rising from 2.5 percent to 4.4 percent per year.
- When the change in the tax rate on nonresidential structures went from a 12.7 percent decrease to a 4.6 percent increase, the rate of investment fell by more than two-thirds — falling from 2.4 percent per year to an anemic 0.7 percent.
- When the change in the tax rate on residential structures switched from an 8.3 percent decrease to a 4.3 percent increase, the rate of investment fell by more than three-fourths — dropping from 13.3 percent per year to 3.0 percent.

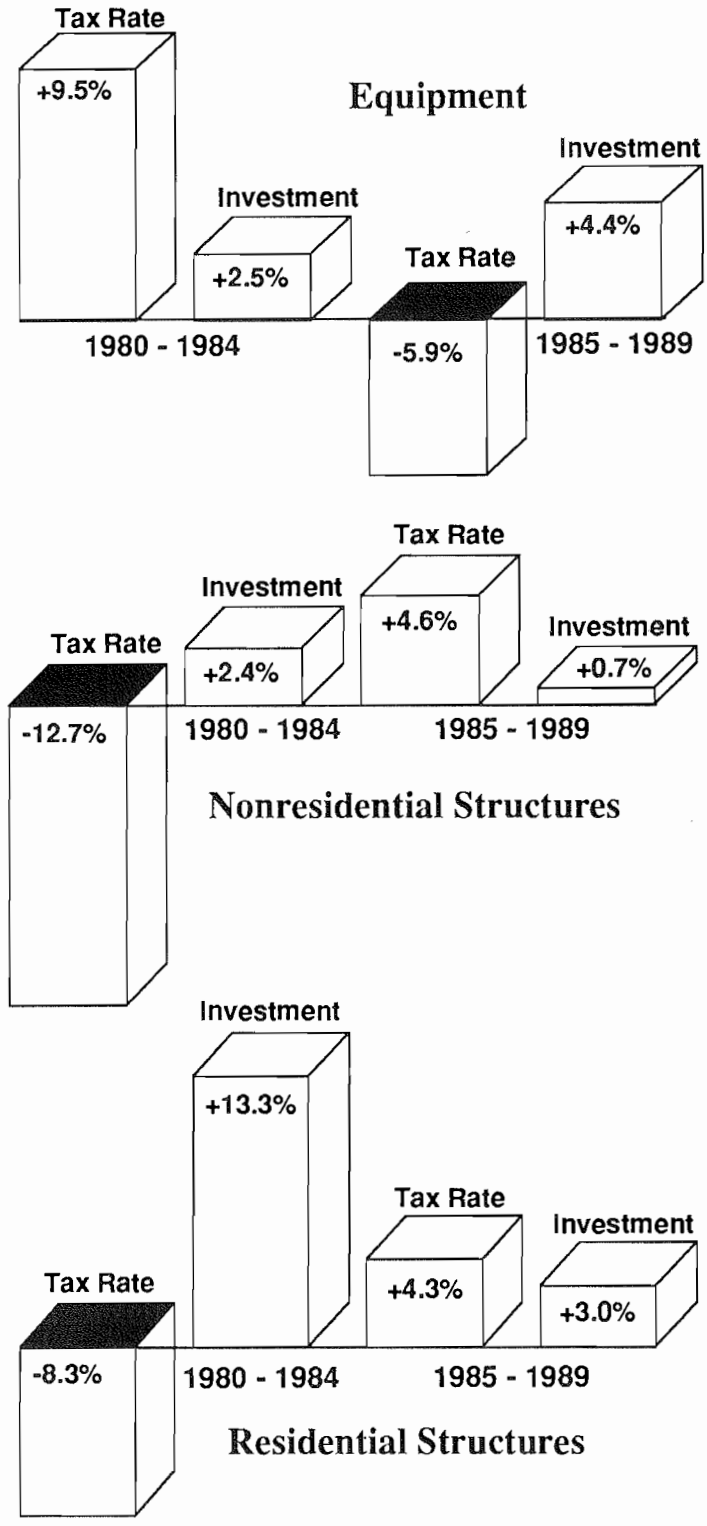
"Because of lower taxes, the rate of investment in equipment almost doubled during the 1980s."

Tax Changes in the Reagan Years. In 1981, the Reagan Administration pushed through a tax reduction that had been building momentum in Congress since 1978. The Economic Recovery and Tax Act (ERTA), passed in August 1981, cut individual marginal tax rates across the board and replaced the outmoded Asset Depreciation Range (ADR) schedule with the Accelerated Cost

"The Reagan years furnished overwhelming proof that investors respond to tax changes."

FIGURE VIII

Taxes and Investment[1]



[1]Shows the change in the average tax rate in the cost of capital and the compound annual rate of growth in the capital stock over the periods shown.

Source: *Survey of Current Business*, October 1990, p. 32, "Table 4: Constant-cost Net Stock of Fixed Reproducible Tangible Wealth 1925-1989," and Fiscal Associates Model

Recovery System (ACRS) for investment write-offs. On the personal side, ERTA provided a 23 percent reduction in marginal tax rates over a three-year period, beginning in October 1981. On the business side, ERTA provided more generous depreciation deductions through ACRS and an expanded investment tax credit to be phased in over five years.

Many commentators claimed that these tax cuts were "massive" and "overgenerous."[35] The business tax cuts, however, were only partially implemented. The Tax Equity and Fiscal Responsibility Act of 1982 (TEFRA) and the Deficit Reduction Act of 1984 (DEFRA) repealed most of the 1981 tax cuts for producers' equipment and about one-quarter of the tax cut for business structures.

We estimate that beginning in July 1981, ERTA reduced the cost of capital for equipment by about 5 percent. When fully phased-in, ERTA would have reduced equipment cost by about 8 percent. Yet the phase-in never occurred. Instead, TEFRA (1982) took back all but 1 percent of the tax cut for equipment the very next year. Structures fared better. In July 1981, the cost of capital for structures was reduced by 17 percent and was scheduled to be reduced by another 1 percent in 1986. TEFRA (1982) took back one-half a percent and DEFRA (1984) took back an additional 2.5 percent.

Unfortunately, at the time the federal government was reducing taxes on business capital, state and local governments were raising taxes. The combined result was an net increase in taxes on equipment and a halving of the supposed reduction in taxes on structures. Table VIII shows the net result of the offsetting tax changes.

Many believe there were large changes in the incentive to invest as a result of ERTA. In fact, there was virtually no change in the cost of equipment during the period. The aftertax rate of return to structures did increase and, as a consequence, the overall rate of return to capital also increased. The increase in investment in buildings began immediately and continued even through the 1981-82 recession. In contrast, industries in which equipment is more important felt the full measure of the economic contraction. Due to its heavy reliance on machinery and equipment, the manufacturing sector was disadvantaged relative to the service sector. The foreign trade sector was also hurt. Table IX, which shows the change in GNP on the same basis as Table VIII, demonstrates the uneven effect of the tax cuts.

"A shift from manufacturing to the service sector occurred because of Congress's retreat from the original Reagan tax cuts."

Studies which point to low rates of equipment investment merely demonstrate that taxes have a major effect on investment. The boom in commercial real estate during the 1980s and the dramatic shift from manufacturing to the service and trade sectors can be traced in good measure to the differential reductions created by the retreat from the original Reagan tax cut. Had not a large part of the 1981 business tax cuts been repealed for equipment, the 1981-82 recession would

TABLE VIII

The Net Effect of Reagan "Tax Cuts"

(Average Percent Change From 1982 through 1985 Relative to 1979 Levels)*

	Change in Cost of Capital	Change in Effective Tax Rate	Percent of Total Capital
Business Equipment	0.54%	2.34%	20.7%
Business Structures	-7.71%	-9.52%	24.1%
Business Fixed Investment	-3.05%	-7.96%	44.8%
All Business Capital	-2.54%	-7.59%	74.2%
Corporate Business	-2.59%	-6.45%	42.7%
Noncorporate Business	-3.07%	-11.02%	31.5%

*Includes the effect of higher taxes at the state and local level.

"Investment spending rose the most in those sectors where tax rates fell the most."

TABLE IX

Change in Real GNP

(Average Percent Change From 1982 through 1985 Relative to 1979 Levels)

	Percent Change	Percent of Output
All Private Industries	6.60%	100.0%
Agriculture, Forestry, And Fisheries	12.44%	2.9%
Mining	-5.26%	4.6%
Construction	-8.50%	5.2%
Manufacturing:	-0.29%	24.0%
Durable Goods	-3.81%	14.1%
Nondurable Goods	5.20%	9.9%
Transportation And Public Utilities	7.58%	10.6%
Wholesale Trade	22.42%	8.1%
Retail Trade	10.17%	10.8%
Finance, Insurance, And Real Estate	8.77%	16.9%
Services	14.00%	16.8%

"Tax changes favored services and retail trade over investment in manufacturing."

have been less severe and the recovery more balanced. Furthermore, the second phase of depreciation reform would have provided a second stimulus in 1986.

Myth 6: A lower tax on capital cannot stimulate larger investment without unrealistically large changes in private savings.

It is a mistake to believe that there is a fixed relationship between private savings and private domestic investment. Some assert that, because savings and investment are related in a national income accounting framework, there is an immutable requirement that a change in private savings will result in a change in private domestic investment.[36] In fact, we cannot infer from accounting identities that private savings finances only domestic investment or that domestic investment is financed only by U.S. savers. As Table X shows, the flow of investment funds both out of and into the U.S. each year is considerable. The outflow is that part of U.S. private savings which is invested abroad. The inflow is the part of new U.S. investment financed by foreigners.

"A large part of foreign investment in this country is U.S. citizens bringing their capital back from overseas."

The Reagan tax cuts resulted in a dramatic change in these international flows. An estimated $250 billion in what would have been U.S. investment abroad was instead diverted to U.S. sites from 1983 through 1989.[37] Similarly, the tax changes encouraged new foreign investment of $420 billion.[38] One dollar of every seven (14.3 percent) of new investment in the U.S. from 1983 through 1989 was provided by a change in the allocation of these two international accounts. This change in the portfolio allocation demonstrates how wrong it is to assume a fixed relationship between private domestic savings and investment.

Myth 7: U.S. tax law cannot influence foreign investment because foreigners do not pay U.S. taxes.

Contrary to the claims of some analysts, foreign investors in the United States often do pay taxes. More important, the flow of international capital into the United States is often more influenced by portfolio adjustments on the part of U.S. citizens than by decisions of foreign investors.

Table X shows the adjustment in international investment flows to the Reagan tax cuts. The higher rate of return on capital in the U.S. relative to the rest of the world caused U.S. investors to reduce their investments abroad and foreign investors to allocate more investment toward the U.S. The combination of the two portfolio adjustments constituted a large swing in "net foreign investment." Most of the increase in funds flowing to the U.S. between 1980 (pre-tax cut) and 1984 was due to U.S. investors reducing the amount sent abroad by $67.5 billion, not to foreigners increasing their investment.

TABLE X

The Components of Net Foreign Investment: The Flow of Investment To and From the U.S.

($ millions)

Year	U.S. Foreign Investment	Foreign Investment In the U.S.	Net Foreign Investment
1971	$ 13,921	$ 248	-$ 13,673
1972	16,751	17,651	900
1973	19,818	6,610	-13,208
1974	32,260	11,853	-20,407
1975	35,565	16,827	-18,738
1976	45,348	25,187	-20,161
1977	27,829	6,360	-21,469
1978	64,750	33,176	-31,574
1979	58,187	57,581	-606
1980	83,382	68,514	-14,868
1981	104,294	73,503	-30,791
1982	95,353	100,672	5,319
1983	44,005	91,042	47,037
1984	15,866	108,399	92,533
1985	42,778	166,008	123,230
1986	116,429	241,498	125,069
1987	106,272	165,222	58,950
1988	90,684	203,981	113,297
1989	121,312	263,967	142,655

Source: Commerce Department, Bureau of Economic Analysis, "U.S. Assets Abroad and Foreign Assets in the United States."

"The increase in 'net foreign investment' in the early 1980s was due to Americans reducing their investments abroad."

Myth 8: The U.S. government deficit is the primary cause of foreign investment in the United States.

It is true that foreign investment flows increased significantly over the period 1983 through 1989, while the U.S. government deficit was rising. The proportion of the U.S. debt owned by foreigners fell over this period, however. The proportion of federal government interest paid to foreigners fell to 14 percent in 1985, its lowest since 1971. The average proportion of interest paid to foreigners by the federal government was 17 percent during the 1970s, 19.1 percent from 1979 through 1982 and only 15.9 percent for the period 1983 through 1989.

The empirical evidence is that the expanded foreign investment went into increasing U.S. productive capacity. The additional capacity provided by foreigners increased the output of U.S. workers, contributing to an increase in their wages and substantially boosting national income (after the profits due the foreign owners were subtracted). Some foolishly argue that the payments to foreign owners of capital leave the U.S. worse off. This ignores the economic fact that more foreign investment must be used in combination with more U.S. labor (and other factors) to produce more output. At the margin, U.S. workers will receive 12 additional dollars in wages for each dollar paid to the foreign owners of capital, and federal, state and local governments will receive another $12 in additional tax revenues.

Myth 9: Taxes on capital do not affect the international competitiveness of U.S. companies.

"The U.S. tax system discriminates against investment in manufacturing and in research and development."

Although taxes on capital do not affect the long-term balance of trade, they do greatly affect which sectors of the economy will have a comparative advantage. As noted above, the structure of U.S. capital taxes discriminates against investments in manufacturing and in research and development. As a result, the tax system raises production costs in these industries relative to sectors such as services and retail trade. This means that America's traditional exporting industries are being burdened and face the threat of being priced out of international markets.

Myth 10: The federal deficit has no effect on the economy.

The federal deficit does not affect interest rates. Moreover, interest rates have only a very small effect on investment. Many have concluded from these two facts that federal deficits do not matter.

In fact, federal deficits matter for a different reason. Taxes represent the "price" of government. When taxes are insufficient to cover government spending, the true price of government becomes distorted. To taxpayers and politicians, government appears to cost less than it really does. In the 1991 fiscal year, for example, taxes fell short of federal spending by $269 billion. As a result, the cost of government will appear to be 20 percent less than it really is.[39]

"The federal deficit matters because people are misled about the real cost of government spending."

With any subsidized good, an artificially low price results in overconsumption. The fact that taxpayers and politicians perceive federal spending to be less costly than it really is may help to explain why federal outlays in 1991 will hit a record 25.1 percent of GNP.[40] In contrast, state governments, which generally cannot use deficit financing, in many cases are choosing to curtail spending rather than raise taxes.

Underpricing government through higher deficits could have deleterious economic effects. If taxpayers accept higher levels of spending than they would be willing to pay taxes to support, economic growth could suffer.[41] Thus, higher federal deficits would lead to less long-term investment, not because of interest rates, but because of higher government spending and the resulting preemption of private uses of output.

Conclusion: Policy Implications

The economic principles of capital outlined in this report have profound policy implications.

Among these are the following:

1. Small reductions in taxes on capital result in large increases in investment spending and national income. In general, every $1 reduction in annual capital taxes will lead to about $25 in increased national output every year.

2. Reductions in taxes on income from capital are almost always self-financing, producing far more additional revenue for government than the initial revenue loss. In general, every $1 reduction in annual capital taxes will lead to a $12 increase in total annual tax revenues.

3. Reductions in taxes on capital primarily benefit wage earners. In general, every $1 reduction in annual capital taxes will lead to a $12 increase in aftertax wage income.

Reducing taxes on capital income, therefore, is about as close as one can come in the policy arena to a free lunch. Everyone gains, including government and wage earners who own no capital.

"Every $1 cut in taxes on investment income creates $12 of new revenue for government and $12 of additional aftertax wages."

Currently, there are several pro-growth policy proposals before Congress. These include (1) inflation indexing for tax depreciation (neutral cost recovery), (2) inflation indexing of capital gains and/or a reduction in the capital gains tax rate and (3) creation of reverse IRA accounts, which allow aftertax deposits and tax-free withdrawals.

Each of these proposals would initially raise the before-tax rate of return on capital, stimulate investment and lead to an expansion of the capital stock. Although the initial changes expand options for owners of capital, more than 90 percent of the benefit of the changes would flow to recipients of labor income. Each would create jobs, increase wages, promote economic growth and increase net government revenues.

Footnotes

[1] Gary Robbins and Aldona Robbins, "Prejudicing the Policymaking Process: The Importance of Economic and Budgetary Forecasts," Institute for Policy Innovation, IPI Report No. 106, September 1990.

[2] The best analysis of the economic effects of supply-side policies is in Lawrence Lindsey, *The Growth Experiment : How the New Tax Policy Is Transforming the U.S. Economy* (New York: Basic Books, 1990). Lindsey began his research convinced that supply-side responses were negligible. After examining the evidence, he became one of the strongest proponents of supply-side policies.

[3] See Congressional Budget Office, "Effect of Lower Capital Gains Taxes on Economic Growth," *CBO Papers*, August 1990; and Joint Committee on Taxation, "Explanation of the Methodology Used To Estimate Proposals Affecting the Taxation of Income From Capital Gains," Washington, DC: U.S. Government Printing Office, March 27, 1990.

[4] See the analysis in Appendix C.

[5] Insiders report that an internal Bush Administration memorandum warned that the Clean Air Act and the Americans with Disabilities Act would reduce U.S. economic growth by one-half of a percentage point. This supply-side forecast was apparently ignored, however.

[6] Aldona Robbins and Gary Robbins, "If the Budget Summit Was a Success, Why Is the Five-Year Deficit Heading Toward $1 Trillion?," National Center for Policy Analysis, NCPA Policy Backgrounder No. 109, March 11, 1991.

[7] See Aldona Robbins and Gary Robbins, "Tax Fairness: Myths and Reality," National Center for Policy Analysis, NCPA Policy Report No. 90, March 11, 1991.

[8] For the specific methods of forecasting, say, a change in the capital gains tax rate, see Gary Robbins, "Taxing Capital Gains," National Center for Policy Analysis and the Institute for Policy Innovation, NCPA Policy Report No. 143, October 1989, Appendix C; and Appendix B of this report.

[9] Based on preliminary 1989 tax return data. Wages as a share of income is calculated as wages and salaries from tax returns divided by adjusted gross income. The remaining types of income such as interest, dividends and proprietor's income are assumed to be attributable to capital. Internal Revenue Service, *Statistics of Income Bulletin*, Spring 1991, Washington, DC, 1991, Table 1, p. 16.

[10] This estimate is based upon the following ordinary least squares regression for the period 1954 to 1990:

$$\log W = -2.66107 + 1.186851 \log K/L \quad R^2 = 0.98$$
$$(-92.1) \qquad (41.6)$$

where W is the real hourly U.S. wage rate, K/L is the real capital stock divided by the number of hours worked and t-statistics are in parentheses.

[11] Investment is expressed as a percent of private product, which is gross national product less gross product from the rest of the world less taxes paid by the Federal Reserve Board.

[12] In technical terms, the marginal value product (MVP) of capital decreases with the amount of capital. The MVP is the amount of revenue generated by the additional output produced by one more unit of capital.

[13] Note that even this list does not include all the different types of capital in our economy.

[14] As shown in Figure II, capital's gross return is roughly one-third of output. Depreciation refers to the rate at which real assets wear out or become obsolete.

[15] There are some differences in measurement between the Commerce rate of return and our own. Commerce measures the current income flow from existing assets, while we measure the expected income of new capital. We are careful to adjust for the quality of new and old investment in order to allow comparison of assets of different vintages. Over the long run, these differences average out because the investment process tends to bring the return on all existing capital into balance with new capital. At the start of an investment cycle brought on, for example, by a tax change, the value of existing capital will be different from the cost of new capital. Investment brings the value of older capital into balance with that of newer capital. For instance, if existing capital is yielding an aftertax return greater than the long-term equilibrium return, new capital will be purchased to bring the return back to the long-term target.

[16] Another important point is that the gross return has a larger variance than the net return, indicating that changes in the tax system must be quickly reflected in the pretax as well as the aftertax return. If this were not the case, the variance in the aftertax

return would be higher. Gross receipts rise faster than taxes. Investment response to the tax change, however, dampens the change in the aftertax return.

[17] Real assets include equipment, structures and land held by corporations, noncorporate businesses and individuals. The primary nonbusiness asset is owner-occupied housing.

[18] Conventional wisdom is that the ownership of real assets hedges against inflation. The value of capital's share of output tends to increase with inflation because, by definition, the price of output tends to go up with inflation. What is ignored, however, is the interaction of taxes and inflation. Mathematically, for $r = y*(1-t)/(1+z)$ to remain constant, $y = r*(1+z)/(1-t) = r/(1-t) + zr/(1-t)$, where r is the real aftertax return, y is the gross return, t is the tax rate, and z is the inflation rate. When z is zero, the gross return is the net return divided by one minus the tax rate, or r/(1-t). When inflation is positive, the gross return must be increased to reflect both taxes and inflation.

[19] See the literature review in John C. Goodman, Aldona Robbins and Gary Robbins, "Elderly Taxpayers and the Capital Gains Debate," National Center for Policy Analysis, NCPA Policy Report No. 153, July 1990, pp. 22-23.

[20] See CBO, "Effect of Lower Capital Gains Taxes in Economic Growth."

[21] See JCT, "Explanation of the Methodology Used to Estimate Proposals Affecting the Taxation of Income from Capital Gains," p. 18.

[22] Rep. Dick Armey and the Joint Economic Committee Republican Staff, "Distorting the Data Base: CBO and the Politics of Income Redistribution," April 1991.

[23] The structure of the investment decision follows in the long tradition of neoclassical capital theory. The general outline and justification for the approach is shown in Dale W. Jorgenson, "Anticipations and Investment Behavior" in J.S. Duesenberry, G. Fromm, L.R. Klein and E. Kuh, eds., *The Brookings Quarterly Econometric Model of the United States* (Washington, DC: Brookings Institution, 1965). The Brookings effort was the first of the large-scale econometric models and has provided the general structure for many subsequent models of the U.S. economy.

Investment is modeled as being determined by the productivity of capital in the production process and the "rental" cost of using it. The rental cost is determined by the cost of economic depreciation (deterioration of the assets' value), taxes to be paid from capital's income and a normal rate of return. For a nontechnical description of the investment process, see Robert J. Barro, *Macroeconomics* (New York: John Wiley & Sons, 1987), ch. 9.

The major difference in our approach and that of others is in determining the "normal rate of return." In the conventional applications, an interest rate is selected as the proxy for the rate of return. We go to great lengths to solve for the actual, economy-wide internal rate of return. As is seen through the simple plots of investment against interest rates and our rate of return, investment is most closely related to the internal rate of return. The appropriate formulation of the model of investment is generally not in question. Rather, the question is how to measure the "price" of capital.

[24] See "Effect of Lower Capital Gains Taxes on Economic Growth."

[25] This argument is developed in "Factors Affecting the International Competitiveness of the United States," pp. 29-54.

[26] The real interest rate shown is the 10-year government bond rate minus the current increase in the GNP deflator. Other government or corporate bond rates show the same pattern. Since an obvious alternative to investment in real assets is investment in financial assets, the expected return on both must be closely related. However, ex post facto, this relationship often is not apparent. Note that while investing in interest-paying financial assets requires investors to form expectations about future rates of inflation, investors in real assets are somewhat insulated from the effects of inflation because the value of output produced by those assets will tend to rise with the rate of inflation.

[27] The only financial asset in the investment decision is the present value of tax depreciation, which represents one-tenth of the total cost of capital.

[28] Remember that taxes account for 34 percent of the cost of capital.

[29] See Robert Barro, "Pray for High Interest Rates," *Wall Street Journal*, October 1, 1991, p. A20.

[30] See Alan J. Auerbach and Kevin Hassett, "Recent U.S. Behavior and the Tax Reform Act of 1986: A Disaggregate View," National Bureau of Economic Research, Working Paper No. 3626, February 1991. Using a "new" technique to measure the cost of capital that is similar to, but less disaggregated than, what we outline in this report, the authors confirm the importance of tax policy for investment in equipment. The new technique was necessitated by the fact that earlier predictions concerning the impact of tax reform, which used interest rates as the cost of capital, were inaccurate.

[31] *Federal Reserve Bulletin*, June 1991, Table 1.59, p. 9.

[32] What must be remembered is that *all* lending rates would have to adjust, not just those on government borrowing.

[33] U.S. Treasury Department, "The Effects of Deficits on Prices of Financial Assets: Theory and Evidence," Office of the Assistant Secretary for Economic Policy, Washington, DC, March 1984.

[34] The results of a Cochrane-Orcutt regression of the real aftertax rate of return to capital as a function of the deficit over the period from the first quarter 1955 through the fourth quarter 1990 is as follows:

$$\underset{}{RATR = 3.3428 - 0.0333128*DEFICIT + 0.865051*RHO \quad R2 = 0.7431}$$
$$\underset{}{\qquad\qquad\quad (1.62) \qquad\qquad (20.62)}$$

where RATR is the quarterly real aftertax rate of return on capital and DEFICIT is the total government surplus (-) or deficit (+) on a NIPA basis divided by gross private domestic product, and RHO is a measure of the extent to which the error terms are autocorrelated, or move together through time. T-statistics are in parentheses.

[35] Even the *Economic Report of the President* for 1982 contains the misleading assertion that ERTA immediately reduced the effective tax rate on business equipment to -17.5 percent. That is, the government was "paying" investors in business equipment an additional 17.5 cents for each dollar they earned. This calculation is faulty on two counts. First, it is based on ERTA features scheduled for 1986 which were repealed in TEFRA and, therefore, never came into effect. Second, the calculation assumes an arbitrary baseline level of taxation that should be paid on that capital. The "subsidy," therefore, was not really a subsidy but a reduction in the level of taxes below what the authors assumed should have been paid. See *Economic Report of the President, 1982*, pp. 122-125. For another discussion of the real effects of ERTA on capital costs, see Norman B. Ture and Carlos E. Bonilla, "ARCR-ITC, CCRS, and NCRS Cost Recovery in an Inflationary Economy," in Dale W. Jorgenson and Ralph Landau, eds., *Technology and Economic Policy* (Cambridge, MA: Ballinger, 1986), pp. 171-90.

[36] In a closed economy with no government, savings must equal investment by definition. With a government sector, savings plus taxes must equal investment plus government spending. With a foreign sector, savings plus taxes must equal investment plus government spending plus net exports. These accounting identities, however, tell us nothing about the behavioral relationships.

[37] This was estimated by applying the 1979 through 1982 average allocation of private savings between foreign and domestic investment to the actual levels of U.S. private savings to construct a baseline.

[38] This was estimated by applying the 1979 through 1982 average allocation of private investment between foreign and domestic ownership of new investment to the actual levels of U.S. private domestic investment to construct a baseline.

[39] The circumstances under which people's perceptions are not distorted are called "Ricardian equivalence." See Robert J. Barro, "Are Government Bonds Net Wealth?", *Journal of Political Economy*, December 1974, pp. 1161-1176. Most economists assume these conditions are not met. For more recent treatments of the issue, see Paul Evans, "Is Ricardian Equivalence a Good Approximation?" *Economic Inquiry*, October 1991, pp. 626-644; and Charles B. Cadsby and Murray Frank, "Experimental Tests of Ricardian Equivalence," *Economic Inquiry*, October 1991, pp. 645-664.

[40] The only time federal spending has been higher as a share of GNP was during World War II. Executive Office of the President, *Budget of the United States Government, Fiscal Year 1992*, February 1991, Table 1.3, Part Seven-17.

[41] A number of studies have found a negative relationship between economic growth and government above some minimal level. For example, see Daniel Landau, "Government Expenditure and Economic Growth: A Cross-country Study," *Southern Economic Journal*, January 1983, pp. 783-92; Michael Marlow, "Private Sector Shrinkage and the Growth of Industrialized Economies," *Public Choice*, Vol. 49, 1986, pp. 143-54; James R. Barth and Michael Bradley, "The Impact of Government Spending on Economic Activity," National Chamber Foundation, Washington, DC, 1988; and John McCallum and Andre Blais, "Government, Special Interest Groups, and Economic Growth," *Public Choice*, Vol. 54, 1987, pp. 3-18.

Appendix A

Cost of Capital Calculations

The cost of capital depends upon economic depreciation, taxes on capital and the real aftertax rate of return. We measure the cost of capital by means of a "service price" calculation for each of 37 different types of assets covering 73 different industries. This appendix describes those calculations.

Developing a measure of the cost of capital requires an accounting framework to track production inputs and outputs. We can either count the physical units under consideration—capital, labor and output—or count the currency spent in acquiring the physical units. Each approach has its advantages and disadvantages.

The advantage in accounting by measuring currency flows (the nominal value accounts) is that most published statistics are collected in this form. These accounts, however, have three serious drawbacks: (1) the value of the item in the transaction must be adjusted over time to reflect changes in quality; (2) nominal accounts must be adjusted to reflect the effects of inflation over time; and (3) the complete terms of asset sales transactions often are obscured by conditions which are not measured. For instance, contracts which require nonmonetary compensation misstate the actual price involved. A specific example is a requirement that a minimum financial equity in an investment be provided in order to secure a loan. This "credit worthiness" requirement has the effect of raising the actual cost of the loan above its stated level.

Accounting by means of physical units (real accounts) makes tracking ownership of the asset considerably easier. Although the value of the physical asset must still be adjusted for changes in quality over time, the need to account for general price changes and "hidden" terms of trade are removed. For these reasons, we adopt the real accounting system.

In a simple two-factor world, the firm's total revenue, or value of output, must exactly equal the total compensation paid to labor plus the total return to capital. The cost (or price) of labor, which is the weighted average compensation rate for the accounting period, is a relatively simple measure to derive. The cost (or price) of capital is more difficult to measure because capital assets and, therefore, their compensation span more than one accounting period. Any analysis of the cost of capital services must develop a way to translate the future returns and expenses associated with a capital asset into current period equivalents. To make the translation we calculate *the service price of capital.*

The fundamental measure of the cost of capital is total business revenue less the compensation of employees divided by the level, or stock, of capital. This *average cost of capital* must be equal to the weighted average marginal contribution of each type of capital. Businesses will tend to employ the services of additional capital until its marginal contribution to total revenue equals its cost. This is true for each asset used in an investment project as well as for the overall project. Alternatively, the ratio of the marginal contributions of any two assets must tend to equal the ratio of the costs of the assets. When this

condition is met for all assets, the market is in equilibrium from the standpoint of the demand of the firm for factors of production.

The service prices we calculate for each asset category represent the current marginal products required per dollar of investment in that asset by each industry. They are the before-tax rates of return that the assets must produce in order to cover economic depreciation, anticipated taxes and a "normal" rate of return to the investor.

Economic Depreciation. Any new asset begins to deteriorate as soon as it is purchased and put in place. The deterioration takes two specific forms: physical wear and decreased value because of the introduction of newer, more efficient versions of the same asset. The economic effect of these forms of deterioration is to limit the time during which the asset will contribute to output. At some point in time, the asset will no longer produce sufficient output relative to new assets, and it will be discarded.

In order to measure economic depreciation, the value of real assets over time must be adjusted to reflect these two forms of deterioration. The adjustments are necessary to obtain: (1) estimates of the effective stock of capital at any point in time and (2) an estimate of the expected pattern of output of a prospective investment. The former is required to evaluate the contribution of capital to output and, thereby, the return per unit of *existing* capital. The latter is necessary to evaluate the economic viability of a prospective investment, or the potential return to each *new* unit of capital.

Adjustments for quality changes are made in the development of price deflators used to compute the constant dollar income accounts by the Commerce Department. We use these deflators to adjust for overall changes in the quality of new assets of a particular type. However, these deflators do not allow us to infer the change in the relative value of assets of different ages or vintages.

An empirical estimate of the pattern of economic depreciation could be inferred from market data on the rental or sales price of used assets over time. These transactions, however, rarely take place. Recent studies have sought to obtain direct resale information, but these data cover a small portion of the population of all business assets. Less direct information on actual discard practices of firms which own the assets is obtained through survey information collected by groups such as the IRS and trade associations. These data serve as the basis for most estimates. An accurate estimate of economic depreciation would also require a constant updating of the depreciation estimates.

Because these types of measurements are well beyond the scope of this study, we assume a constant decay pattern of value using the latest IRS estimates of average economic lives. This information is used in general mortality models to estimate the relative efficiency of individual assets over their expected life and to derive estimates of stocks of individual assets.

Taxes. Taxes are levied on assets directly, on the output produced by assets and on the return accruing to the owners. Examples of taxes on assets are property or wealth taxes. Sales or value-added taxes are placed on the value of the output of assets. Taxes on the return accruing to the owners of capital

are personal income taxes on dividends, net business income, rental income and interest; and corporate income taxes (usually income less tax depreciation).

To calculate marginal tax rates, we derive personal federal income tax rates from the Fiscal Associates' Tax Model.[1] Corporate federal income tax rates are the statutory maximum. State corporate and personal income tax rates are estimated by dividing the amount paid in state income taxes by the federal income tax base. Excise taxes are assumed to apply to total GNP. Property taxes are computed using the nominal value of the appropriate type of capital.

Tax Depreciation. Tax depreciation is an artificial construct which specifies in law the rate at which the original cost of an asset can be deducted from income for tax purposes. Economic depreciation, which is the decline in the value of an asset, depends more on the market and technical progress than on tax law. Given the dynamics of the marketplace, tax depreciation can never coincide with economic depreciation except by sheer chance.[2]

The rate at which any asset wears out or becomes obsolete (economic depreciation) varies across industries. Allowable tax lives also differ across industries, and allowable depreciation methods vary among the several alternative tax regimes in place in the U.S. during the period 1954 to 1990. These regimes include:

(1) Bulletin F Guideline Lives,
(2) Class Lives, using Asset Depreciation Range (ADR) write-off methods,
(3) ADR, using that life within the given range that minimizes the service price (accounting for different investment tax credit rates according to the chosen depreciable life),
(4) Accelerated Cost Recovery System (ACRS) as originally passed in 1981 under the Economic Recovery Tax Act (ERTA),
(5) ACRS as amended in 1984 through 1986, and
(6) Modified ACRS passed in 1986 and currently effective.

Real Aftertax Rate of Return. The normal rate of return earned by investors is not readily observable and must be inferred from other data. We represent it as the *real* (or inflation-adjusted) *aftertax rate of return*. This return is the risk-inclusive premium that an investor must receive in order to forego a dollar's worth of consumption today.

Mathematical Derivation of the Real Aftertax Rate of Return on Capital

We estimate the real rate of return on capital by first constructing disaggregated series of investment in 37 types of depreciable capital across 73 industries for corporate and noncorporate enterprises. The basic information on investment is provided by the Commerce Department. We used the census of manufacturing to disaggregate investment by the type of enterprise. This provides more than 4,000 historical time series of investment from 1865 to the present.

Economic depreciation schedules are constructed following IRS Bulletin F Useful Lives. These schedules represent the most comprehensive collection of survey information on the actual replacement practices of firms. The depreciation information is used in two ways: first to construct "efficiency functions" relating the remaining productivity of an asset at each point in its useful life,[3] then to construct the rate of loss in value of an asset (i.e., "economic depreciation").

For business assets which depreciate, the nation's total capital stock at any time **t** can be represented as follows:

$$(1)\quad K_t = \sum_i K_t^i = \sum_k E_k^i * I_{t-k}^i \qquad k = 0, 1, 2, \ldots t$$

where

K_t is the real value of the total capital stock at time **t**

K_t^i is the real value of the stock of capital type **i** at time **t**

E_k^i is the efficiency of capital type **i** after **k** years of use

I_k^i is the real value of investment in capital type **i** at time **t-k**

In addition to the calculations described by equation (1), investment in nondepreciable assets for each industry is added by using a unitary efficiency function. Residential housing is added for the household sector. The total economy-wide capital stock then is the sum of the individual stocks.

The calculation of the service price of capital is the general method used to relate the components of the investment decision to the supply price of capital. The method was first developed by Dale Jorgenson in the early 1960s.[4] It is based on a multi-period representation of the income and expenses associated with an investment. The multi-period framework is necessary because capital assets can be expected to be used over several periods.

Central to the method is the requirement that at equilibrium the *discounted present value* of the expected income less expenses must equal the purchase price of the asset. The expenses are normally taken to be economic depreciation and taxes, less tax offsets such as tax depreciation and the investment tax credit.[5] The internal rate of return on an investment in capital type **i** is r^i.

Now suppose that for each type of capital there is a single tax rate, t_t^i, which is applied to the gross return on capital. Then we can write

$$(2)\quad ya_t^i = y_t^i * (1 - t_t^i) \qquad i = 1, 2, \ldots\ldots$$

and

$$(3)\quad y_t^i * (1 - t_t^i) = r_t^i + d_t^i \qquad i = 1, 2, \ldots\ldots$$

where

ya_t^i is the aftertax return per unit of capital type **i** at time **t**

y_t^i is the pretax return per unit of capital type **i** at time **t**

t_t^i is the marginal tax rate on capital type **i** at time **t**

r_t^i is the internal rate of return per unit of capital type **i** at time **t**

d_t^i is the "economic depreciation" rate of capital type **i** at time **t**

Equation set (2) defines the aftertax gross rate of return. Equation set (3) decomposes the gross return into an internal rate of return and economic depreciation. Rewriting (3) gives

(4) $y_t^i = (r_t^i + d_t^i)/(1-t_t^i) \quad i = 1, 2, ...$

where y_t^I, the pretax rate of return, is the minimum return investors must earn in order to be willing to invest in capital type **i** at time **t**. Thus, y_t^I is the service price of capital type **i.**

For the economy as a whole, gross income from production must equal the payments to the factors of production. Moreover, short-term equilibrium in the market for capital requires that demand equal supply. Thus

(5) $y_t * K_t = Q_t - w_t * L_t$

where

y_t is the economy-wide service price of capital at time **t**

Q_t is the real output at time **t**

w_t is the average wage at time **t**

L_t is the number of units of labor at time **t**

Equation (5) says that the economy-wide service price of capital times the capital stock must equal income to capital, which also equals real output minus gross income to labor. Note that y_t is not directly observed. However, $y_t * K_t$ is easily calculated from national product accounts as the residual of real output minus labor income.

From (1) and (4) we know that

(6) $y_t * K_t = \sum_i K_t^i * (r_t^i + d_t^i)/(1-t_t^i)$

The gross return to capital is a weighted average of the return to the components of the capital stock.

Now define

$$(7)\ \sum_i K_t^i * r_t^i / (1 - t_t^i) + \sum_i K_t^i * p_t^i / (1 - t_t^i) + \sum_i K_t^i * r_t / (1 - t_t^i)$$

where

p_t^i is the aftertax risk premium paid to holders of capital type **i** at time **t,** weighted by the capital **i**'s proportion of the capital stock.

r_t is the economy-wide aftertax rate of return at time **t.**

Equation (7) decomposes the aftertax return to capital into an economy-wide, "normal" rate of return and a risk premium, which represents a deviation from the normal return for each type of capital. The terms p_t^i may be either positive or negative, and by construction

$$(8)\ \sum_i K_t^i * p_t^i / (1 - t_t^i) = 0$$

Thus, equation (6) becomes

$$(9)\ y_t * K_t = \sum_i K_t^i * r_t^i / (1 - t_t^i)$$

Note that each of the terms K_t^i may be calculated using the method described by equation (1). Thus as long as the tax rates are known, we can solve equation (9) for r_t, which is the economy-wide aftertax rate of return on capital.

In practice, the taxation of capital is far more complicated than the relationships depicted here. Moreover, the relationship between r^i and t^i is often nonlinear. We estimate marginal tax rates for each of the types of capital using the data sources discussed above, and the Fiscal Associates tax model uses linear approximations in order to solve for r_t in a manner comparable to that described above.

The real aftertax rate of return to capital, r_t, is solved as the value which equates the supply and demand price for capital. The demand price is the price faced by businesses using the capital services. We use data from the U.S. National Income and Product Accounts and other government sources to construct consistent measures of real private output, real labor costs and the level of real capital stocks. Real output less real labor costs divided by the level of capital provides a measure of the weighted average price that businesses must pay for capital services economy-wide. This rate is the gross return (or marginal value product) which must pay for all charges against new capital discussed previously, plus any financing costs.

We estimate r_t of the service price for each type of capital, weighted by the amount of that capital that exists in the U.S. economy, equal to the gross return on U.S. capital. Thus, r_t is the same for each type of capital. Our estimates of yearly r_ts are given in Table 1. Over the period 1954 to 1990, the average economy-wide value of r_t is 3.3 percent.

Footnotes

[1] The Fiscal Associates Tax Model contains several hundred representative taxpayers constructed from IRS data. The constructed tax information for each individual is used to calculate the average and marginal tax rates for the cell representative. The weight of the cell is then used to calculate the economy-wide weighted average marginal and average tax rates. Marginal rates for specific types of income such as wages, interest, dividends, rent, profits and capital gains are constructed using income as well as population weights. Average rates are used to calculate the revenue effects of individual income tax changes. The changes are calculated both in the aggregate and distributed by base-year income classes.

[2] The tax depreciation write-offs used in deriving the service price are calculated according to the relevant taxation regime. In all cases, a half-year convention is used. The appropriate tables found in the tax regulations are used to calculate personal property allowances under ACRS. Where appropriate, investor choice is allowed such as that either the original depreciable basis is adjusted downward by 50 percent of the investment tax credit or a 2 percent reduction in the allowable credit is taken. The allowance schedule for 18-year real property was constructed using the 175-percent declining balance method. Under the ADR and class life systems, either a declining balance method (with a switch to straight-line at the appropriate time) or sum-of-the-years'-digits method is chosen. For Section 1245 property, either 200-percent declining balance or the sum-of-the-years'-digits method is used, depending upon which yields the greatest present value of depreciation allowances. For Section 1250 property (which we equate with BEA's building categories), the method is limited to the 150-percent declining balance method.

The nominal depreciation allowances are multiplied by the appropriate tax rates in order to express their impact in aftertax terms. Depreciation deductions, which are financial rather than real assets, must be adjusted for expected inflation. The nominal corporate interest rate is used to discount future expected depreciation deductions.

[3] The assumed average economic life for each asset/industry category is the applicable class life under the old Asset Depreciation Range (ADR) system. These lives were first introduced in 1962 under the Guidelines depreciation system. In some cases, the Commerce Department's Bureau of Economic Analysis (BEA) asset categories that were used do not correspond exactly to IRS class life categories. In those cases an average or representative life was chosen.

Variation in expected asset lives is simulated by the use of a truncated normal distribution centered on the assumed average economic life. This distribution is used to derive an asset "discard" function. The discard function assumes that some (small) proportion of an original investment in a certain type of asset is discarded beginning at 50 percent of the assumed average economic life. It also assumes that some (equally small) proportion of the original investment is maintained up to 150 percent of the assumed average life. Other capital assets constituting the original investment bundle are discarded at ages in between 50 percent and 150 percent, with the greatest number being discarded at the average economic life.

In addition, a concave efficiency function is assumed for all nondiscarded assets to reflect factors such as technological change. This function assumes that the loss of productive efficiency for each particular asset is smallest in the early years and greatest in the final years. (This is the reverse of a geometrically declining efficiency schedule in which the greatest absolute efficiency losses are incurred immediately.)

Combining the discard function with the concave efficiency function yields an overall efficiency function for a given investment bundle. The general shape of this function indicates an initial slow rate of efficiency loss for the investment, a faster rate as the original investment ages and assets are discarded and a slower rate again as the upper tail of the discard function is approached. The overall function becomes zero at 150 percent of the average economic life. This method is identical to that used by the Office of Business Analysis, Department of Commerce in generating its capital stock database.

[4] Dale W. Jorgenson, "Capital Theory and Investment Behavior," *American Economic Review*, Vol. 53, May 1963, pp. 247-59.

[5] Because the equilibrium conditions require that the discounted present value of expected income less expenses equals the purchase price of the asset, the service price relationship can be rearranged to yield the value of the output an asset must produce in the initial accounting period. That is, the service price relationship can be used to create a separate "supply" relationship relating the value of output each asset must produce during the current accounting period to support a given real aftertax rate of return. The sum of these relations link the supply of capital for the economy to the value of output that capital must produce. The supply of capital is a function of the decisions of individual investors who ultimately make the investment decision based on the real aftertax rate of return on investments.

Appendix B

Forecasting the Effects of a Change in Taxes on Capital

A decrease in the tax on investment income raises the rate of return to capital. In response, there will be an increase in the amount of capital services offered for use in the production process and an associated increase in the amount of labor services hired. These additional labor and capital inputs will lead to a higher output. In what follows, we show how we forecast the effects of this change.

Empirically, the Cobb-Douglas production function is an accurate long-term representation of the production process. Cobb-Douglas relationships will provide estimates of changes in the amounts of capital services, labor services and output resulting from an increase in tax rates on investment income. The following notations are used in the Cobb-Douglas derivations:

Q = private output produced,

r = the real aftertax rate of return to capital,

y = the cost per unit of capital (or the service price),

t_c = the marginal tax rate on capital,

w = the cost per unit of labor,

t_L = the marginal tax rate on labor,

$\tilde{w}$ = the aftertax wage rate,

L = the number of units of labor used in production,

K = the number of units of capital used in production,

yK = the total amount received by capital, and

wL = the total wage bill.

A Cobb-Douglas production function represents the production process as,

$$(1) \qquad Q = A*L^{a}K^{(1-a)}$$

where A is the state of technology, a is a parameter of the production function, which measures the

responsiveness of output with respect to labor inputs and **(1-a)** is the parameter which measures the responsiveness of output with respect to capital inputs. When factor markets are in equilibrium and each factor of production is paid its marginal product, the shares of labor and capital in output are:

(1a) $wL/Q = a$ and

(1b) $yK/Q = (1-a)$.

Therefore,

(2) $wL/a = Q = yK/(1-a)$.

Rewriting (2),

$wL/yK = a/(1-a)$ or $yK/wL = (1-a)/a$.

Solving for **K**,

(2a) $yK = [(1-a)/a]*wL$

(2b) $K = \{[(1-a)/a]*(1/y)\}*wL$.

The cost per unit of capital is proportional to the real aftertax return on capital and the taxes on capital. [See Appendix A.] Using C to denote the proportional term, the capital service price may be written as,

(3) $y = C*r/(1-t_c)$.

Substituting for **y** in (2b), **K** can be written as,

(3a) $K = \{[(1-a)/a]*(1-t_c)/C*r\}*wL$.

Remembering that the real aftertax return on capital will return to its long-term level, **a** and **r** in (3a) are constants. Rearranging the constant terms,

(4) $K = B*(1-t_c)*wL = B*AT_c*wL$,

where $\mathbf{B = [(1-a)/a]/C*r}$ and $\mathbf{AT_c = (1-t_c)}$ is the aftertax return on capital.

The new level of K after a decrease in taxes on investment income is denoted as **K'** and is equal to,

(5) $K' = B*(1-t_c)'*w'L'$

where $\mathbf{(1-t_c)'}$ is the new tax and **w'** and **L'** are the new levels of **w** and **L**.

The new level of K is equal to the original level of **K** times the proportional change in **K**, denoted by **dK/K**, or

(6) $K' = K*(1+dK/K)$.

Similarly, the new levels of **w**, **L**, and $\mathbf{AT_c}$ can be written as,

(7) $w' = w*(1+dw/w)$, $L' = L*(1+dL/L)$, and

$AT_c' = AT_c*(1+dAT_c/AT_c)$.

Using relations (4), (5), (6) and (7),

$K' = K*(1+dK/K) = B*AT_c*(1+dAT_c/AT_c)*wL*(1+dw/w)*(1+dL/L)$.

Dividing through by **K**,

8) $(1+dK/K) = (1+dAT_c/AT_c)*(1+dw/w)*(1+dL/L)$.

Substituting the shares of labor and capital from (2) into the production function in (1),

$Q = A*(aQ/w)^a*[(1-a)Q/y]^{(1-a)}$.

Factoring out **Q** and dividing both sides by **Q**,

$1 = A*[a*(1/w)]*[(1-a)*(1/y)]^{(1-a)}$,

then rearranging and substituting (3) for **y**,

(9) $\{1/[A*a^a*(1-a)^{(1-a)}]\} = w^{-a}*y^{(a-1)} = w^{-a}*(C*r/AT_c)^{(a-1)}$.

Multiplying both sides of (9) by w^a and denoting the constant on the left-hand side of the equation as { },

(10) $w^a*\{\ \} = (C*r/AT_c)^{(a-1)} = [AT_c/(C*r)]^{(1-a)}$.

Remember that the expression { } and C are constants and that **r** will return to its long-term value. As the tax on investment income decreases, the aftertax return on capital, denoted as $\mathbf{AT_c}$, must rise. Increased investment will cause the gross return on capital, **y**, to fall. The increased demand for labor will cause the cost per unit of labor, **w**, to rise.

In other words, rewriting (10) in terms of w', we have,

$$w'^{a}*\{\ \} = [AT_c'/(C*r)]^{(1-a)}.$$

Substituting from (7) for **w'** and for $\mathbf{AT_c'}$,

$$w'^{a}*\{\ \} = [w*(1+dw/w)]^{a}*\{\ \} = [AT_c*(1+dAT_c/AT_c)/(C*r)]^{(1-a)}.$$

Dividing through by **w** using (10),

$$(1+dw/w)^{a} = (1+dAT_c/AT_c)^{(1-a)},$$

and raising both sides to the (**1/a**) power,

$$(11) \quad (1+dw/w) = (1+dAT_c/AT_c)^{(1-a)/a}.$$

In other words, (11) will estimate the change in the per-unit cost of labor resulting from a decrease in the tax on capital. Using empirical estimates which generally find the parameter **a** equal to two-thirds, the expression [(**1-a**)/**a**], which represents the elasticity of substitution between capital and labor, will equal 0.5. The change in **w**, therefore, will be about one-half the change in the tax on capital. For example, a 10 percent decrease in the tax on capital will lead to a 4.88 percent increase in the wage rate.

This increase in pretax wage rates will lead to an increase in aftertax wage rates and, hence, an increase in the amount of labor services supplied. The elasticity of labor supply is,

$$(12) \quad E_L = (dL/L)/(d\tilde{w}/\tilde{w}),$$

where $\tilde{w} = w*(1-t_L)$ and

$$\tilde{w} * (1 + d\tilde{w}/\tilde{w}) = w * (1 + dw/w) * (1 - t).$$

Dividing through by $\tilde{w}$ and substituting from (11),

$$(1 + d\tilde{w}/\tilde{w}) = (1 + dw/w) = (1 + dAT_c/AT_c)^{(1-a)/a},$$

Subtracting 1 from both sides,

$$(13) \quad d\tilde{w}/\tilde{w} = [(1 + dAT_c/AT_c)^{(1-a)/a}] - 1,$$

Solving equation (12) for **dL/L** and substituting in (13),

$$(14) \quad dL/L = E_L * d\tilde{w} = E_L * \{[(1 + dAT_c/AT_c)^{(1-a)/a}]-1\},$$

Substituting (14) into (8),

$$(15) \quad dK/K = E_L*d(1-t)/(1-t).$$

$$(1+dK/K) = (1+dAT_c/AT_c)*(1+dw/w)*(1+dL/L)$$
$$= (1+dAT_c/AT_c)^{1/a}*(1+dL/L)$$
$$= (1+dAT_c/AT_c)^{(2/a-1)}*E_L+(1+dAT_c/AT_c)^{1/a}*E_L+(1+dAT_c/AT_c)^{1/a}.$$

Beginning with a production function (1), the conditions for equilibrium in factor markets (1a) and (1b), a capital supply equation (3) and a labor supply equation (7), we have shown that the proportionate change in capital and labor can be expressed in terms the elasticity of labor and the change in the aftertax rate of return on capital. Thus if we know the labor supply elasticity, the solutions found in (14) and (15) can be used to determine the new level of output, Q_t, from (1).

Appendix C

The CBO's Analysis of Taxes on Capital

The question of how the economy will respond to a change in the taxation of capital should be central to forecasting the effects of tax policy changes. This question, however, is usually ignored in most of the analysis provided by the official revenue estimators. When forced to confront the question, they have either claimed that no single answer can be given or that the response of capital to changes in the rate of return is virtually zero.[1]

The specific problem is: How much does the level of capital services in use change when taxes on capital are increased? In its capital gains study, the CBO states that its best analysis of the question indicates that, for each one percent change in the return on capital, saving (and presumably investment) would increase by 0.4 percent.[2] How consistent is this estimate with observed rates of return?

The observed real aftertax rate of return is currently 3.3 percent. The CBO's long-term estimated response implies that if marginal tax rates on capital were reduced by 10 percent, we would expect the real aftertax return to new investment to be 12.6 percent higher using today's relationships between return, depreciation and taxes. According to CBO, the level of investment would increase by 5 percent (12.6 x 0.4). This would cause the level of the capital stock to increase by 0.25 percent in the first year.[3] The higher level of investment would continue to increase the stock each year by a decreasing amount because of the depreciation in prior investment.

The increased level of capital services would mean that the gross return to capital would be lower. The reduction in the gross return to capital is determined by the increase in the amount of capital and the technological relationship between output and the levels of capital and labor used to produce it. Technology determines the "best" combination of workers and machines needed to produce a given amount of output.[4]

The technology employed from period to period is extremely stable, since only a small part of the capital stock (one-twentieth) is replaced each year. Optimization mathematics provides a check of this stability proposition. It is easily shown that the best combination of capital and labor can be expressed as the share of total payments provided capital and labor. The relative share given to capital has been virtually constant at one-third over all of the post-World War II period.

The constant-share property allows us to derive the demand for capital as a function of the price paid for the service. At a given output level, the quantity demanded at each price is the share times the value of the output divided by the price. Or alternatively, the price offered by producers is the share times the value of the output divided by the quantity. This implies that the 0.25 percent increase in capital resulting from the new investment would lead to a 0.25 percent decrease in the service price of capital.

After the quantity adjustment, the rate of return would be only 11.45 percent higher than that prior to the tax cut. Because the increased investment would continue into the future, the rate of return would

continue to fall toward its long-term value — 11.35 percent by year two, 9.24 percent by year six, and so on. It would take 14-1/2 years for one-half of the original differential to be removed, 45 years for 90 percent, and 91 years for 99 percent of the differential to disappear. This is an extremely long adjustment process. Is it consistent with the observed pattern of the real aftertax rate of return?

This can be answered by referring to the Kennedy and Reagan tax cuts illustrated in Figure V. The Kennedy cuts represented a roughly 8 percent cut in the marginal tax rate on capital while the Reagan cuts were about 6 percent. The CBO elasticity implies that the rate of return would be at 80 percent of its peak level (9.24/11.45) after six years. This did not happen, however. In both cases the rate of return had fallen back to its long-term level within three years, and the adjustment process was much faster. Reviewing the steps in the adjustment process leads to only one conclusion about the actual investment response: It was much greater than the 0.4 used by CBO.

One must conclude that capital is several times more responsive than posited by the CBO estimate. Our estimates suggest that somewhat more than 60 percent of the total adjustment occurs within two years. While we estimate the change in the stock of capital, this change can also be translated into the investment terms used by CBO. We find that investment responsiveness must be in the range of 2.0 — more than five times higher than the 0.4 used by CBO. Our long-term estimates (after adjustments) are virtually identical to those of CBO — the capital stock would be 3.75 percent higher in response to the tax cut. The difference, however, is that we observe historical adjustments occurring in about five years while the CBO asserts it would take about 100 years, or 20 times longer.

This numerical example also illustrates that a low response of capital to changes in the aftertax rate of return requires that the pretax rate of return vary less than the aftertax rate. Empirical evidence, as shown in Table II, however, demonstrates that the opposite is true. In every case, the pretax rate has a higher standard deviation relative to the mean than does the aftertax rate.

Footnotes

[1] Some studies have attempted to measure the response of capital to tax changes with generally poor results. Most have attempted to use the financial rate of return (interest rates) which, as we have seen, is a poor predictor of investment behavior. Not surprisingly, the response they find is extremely small. These measurement problems are further complicated by the use of capital investment — a flow — instead of the appropriate measure — the stock.

[2] CBO, "Effect of Lower Capital Gains Taxes on Economic Growth."

[3] The capital stock is some 20 times greater in size than investment.

[4] Given the cost of capital and the wage rate, the least-cost combination of workers and machines is basically a function of physical relationships. For example, what is the best number of workers to run a blast furnace? Is it better to have an extra worker roaming the process to help out where needed or allow the overall process to slow as bottlenecks are resolved by themselves? These mechanical questions about the physical process are answered by the cost of the extra worker and the nature of the delays to be overcome.

About the Authors

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