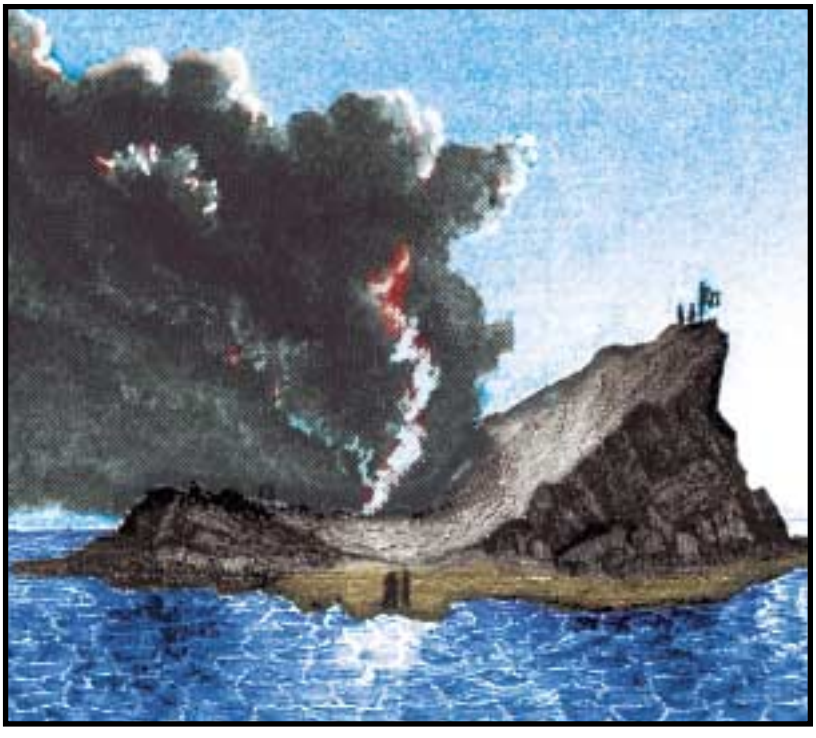
SUPPLY SIDE THERMODYNAMICS

BY JOHN RUTLEDGE



In 1981, I was lucky enough to be part of the group that produced the Reagan economic plan. At that time inflation was running at 15 percent annually. The federal top marginal tax rate was 70 percent, which had turned Americans into a nation of tax-shelter and inflation-hedging experts rather than investors, entrepreneurs and workers. Instead of buying financial assets—stocks, bonds, mutual funds—they bought tangible assets like commodities, farmland and gold coins. Instead of starting businesses, they developed shopping centers. Instead of working, they borrowed to buy real estate they did not need. To accomplish this they dumped financial assets, which drove down their prices and left us with 20 percent short-term interest rates, 15 percent Treasury yields and single-digit stock market multiples.

Twenty years later, all this has been turned on its head. Reagan's low inflation and low marginal tax rates undercut the after-tax return on tax and inflation shelters and enhanced the return on securities. In response, Americans shifted roughly $11 trillion out of tangible assets and into stocks and bonds. For the past two decades, this $11 trillion arbitrage event affected every one of our economic lives. In the face of such powerful forces of change, ordinary macroeconomic issues—budget deficits, trade deficits, savings rates—have been simply brushed aside.

Hard asset prices collapsed and financial asset prices soared. This dramatic increase in the value of a dollar of future income manifested itself in lower interest rates and higher valuation multiples. A $100,000 investment in the equivalent of 30-year zero coupon treasury bonds in August 1981 would be worth over $2,000,000 today.

These asset-market events had important effects on the production economy, too. Hard-asset deflation made the carrying costs of low-return real assets too heavy for U.S. companies to bear. American industry embarked on a decade-long ruthless restructuring wave that left them lean and mean. At the same time, falling interest rates and rising stock multiples reduced the after-tax cost of capital for American companies. The result was a tsunami of investment and innovation that improved corporate efficiency and lowered costs. Low tax rates created powerful work incentives.

Together, these factors returned the United States to its former position as the world's preeminent economic power. They also allow us to predict the next great wave of change. Like its predecessor, what is to come will be grounded in the same bedrock—the mathematics of thermodynamics. Both Albert Einstein and Richard Feynman referred to thermodynamics as the only physical laws that have never been broken—the only laws they believed would hold for all time.

John Rutledge is chairman of Rutledge Capital, a private equity and hedge fund management firm based in New Canaan, Connecticut.

THROWING HEAT

Thermodynamics is the study of change—the transformation of matter from one form into another. It is the physics of hot coffee cups and cold ice cubes that we live with every day. It is the physics of systems of particles. There is no thermodynamics of a single particle.

If a system of particles is moving in the same direction—the baseball, on its way from Nolan Ryan's hand to the catcher's mitt, in Chart A at right—we call it coherent energy, kinetic motion or simply *work*. If a system of particles is moving chaotically, jostling against each other but not going anywhere as a group—the baseball in Chart B, which has been heated in an oven to 350 degrees—we call it incoherent energy, thermal motion or just *heat*. The rate at which its particles jostle against each other—the incoherence of the system—is its temperature. The faster they vibrate, the higher the temperature.

Economics studies the interactions of systems of people in markets. Just as in physics, our concerns are work and heat—only we call them "output" and "cost." The particles of economic analysis—individual people—think, scheme, love and hate. Otherwise, they behave just the same as the particles in physics.

This framework gives us a simple way to think about economic policies. The objective of economic activity is to transform energy into useful work, the products and services we create to satisfy human wants and needs. From this perspective we should measure Gross National Work, not Gross National Product, which lumps in the market value of the "heat" we generate—transaction costs and litigation expenses, for instance. Excessive tax rates, subsidies to inefficient producers and trade restrictions are examples of bad policies; they create heat and destroy work. Policies that increase work are good policies.

From this perspective, the proper target for monetary policy is zero real asset inflation, i.e., zero capital gains for the existing stock of tangible assets, into which no further work—energy—is being invested. This would focus investors' attention on the underlying cash flows of an investment and force wealth-creating energies into the security markets where they can finance new capital formation. For central bankers, it means following a price rule with stable land, property and commodity price values (see "Follow the Money," TAS, Jan/Feb 2002).

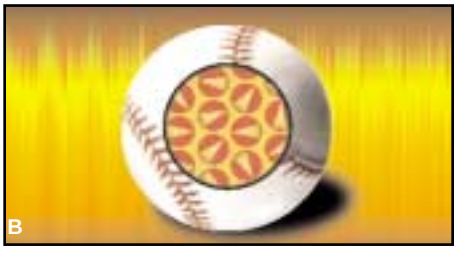
Like physics, economics is a statistical science—our predictions only hold on average. We rely on an idea called the Central Limit Theorem, which says the average of a large number of strange things behaves in a normal, more or less predictable way. And the spirit of Heisenberg's Uncertainty Principle holds for economics just as it does for physics: We have no more ability to predict the behavior of one individual than a physicist does of predicting the behavior of a single particle. That's why command economies—where dictators, demagogues or central planners exert unusual influence—often degenerate into chaos.

The laws of thermodynamics state, among other things, that a temperature differential cannot persist between two objects that are in contact with each other. Their temperatures will tend to converge until they reach the point of thermal equilibrium, at which the temperatures are equal. Thermal equilibrium is the physicist's definition of death—nothing more happens. Anyone who puts hot French fries and a cold Coca-Cola in the same bag learns this lesson the hard way.

For physicists, temperature differentials are an energy source—the primary engine of change. Heat dispersion is what makes things happen. An example is the storm fronts you see on the weather map—temperature and atmospheric pressure differentials that lead to thunderstorms, tornadoes and hurricanes. Similar forces cause volcanic eruptions, earthquakes and everyday chemical reactions.

In the same way, we can track differentials in economics—storm systems that sweep across the economy. Economists call this phenomenon arbitrage. A price differential cannot persist between two identical goods or services where buyers and sellers are in contact. In fact, we use this idea to define the term "market"—a domain within which prices tend toward equality. People buy low and sell high, driving low prices up and high prices down until they are equal. As they do so, they transform vast amounts of energy into work.

Arbitrage is what we all do every day. We arbitrage gasoline prices between local gas stations. We arbitrage prices of bottles of shampoo at the grocery store. We arbitrage waiting times when we choose which line to stand in at the checkout counter. We arbitrage labor decisions, savings decisions, investment and trade decisions, whether across town or across the world.

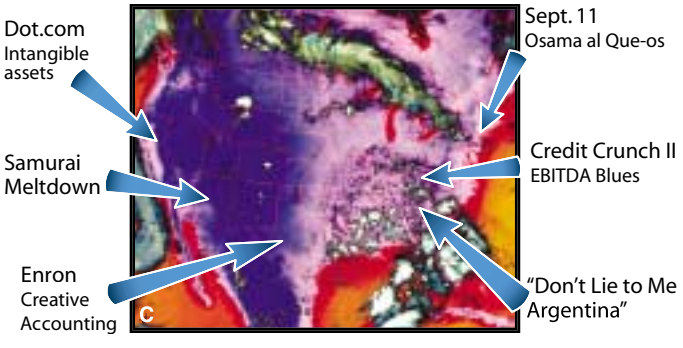


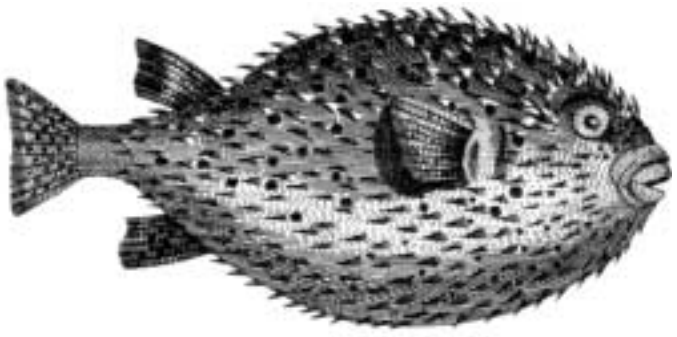
There is, in fact, only one positive statement in all of economics: "People arbitrage relative price differentials." And that idea—that people make choices to improve their wealth—is the essence of supply-side economics. Just as with thermodynamics, the power of supply-side analysis derives from its simplicity and its universal applicability.

The corollary is this: If an analysis cannot be reduced to a description of people engaging in arbitrage activities, it is simply not economics. Unfortunately, classical macroeconomics as it is usually taught and practiced—focusing on mechanical rules to predict people's expenditures—fails this test.

UP FROM THE PHILLIPS CURVE

Classical macroeconomics teaches that governments can control the economy by manipulating spending and tax rates. Students learn about the Phillips Curve—a rhetorical smokescreen for





politically driven tax, spending and regulatory policies, which leads to the nonsensical conclusion that the act of people working creates inflation. They learn that interest rates are determined by the Federal Reserve, by budget deficits and by flows of funds between savers and investors, rather than the portfolio decisions of wealth holders. Worst of all, they learn that our collective wealth and standard of living are determined by how much money we spend, not by how hard we work, what we create, or how much we save and invest.

Macroeconomics textbooks typically begin by describing how to define and measure economic activity on a hypothetical island economy. Some people on the island catch fish, others pick coconuts. They exchange fish and coconuts with each other (presumably so they get all two major food groups). The island's GDP is measured by adding together the fish and coconuts produced in a year, using the market exchange rate. Although in practice GDP is invariably measured by adding up people's spending, it is intended (and usually assumed) to be a measure of productive *work*, much as we would measure the output of a business with a profit and loss statement. Since both fish and coconuts are perishable–you catch it, you eat it—GDP also equals total consumption for the year. Saving and investment both equal zero. And there are no capital markets—no assets—in the island economy. The perishable nature of both fish and coconuts means it is not possible to produce in one period and consume in the next.

Some writers, such as the great French economist Maurice Allais, have introduced the idea of longer-term assets to the island by allowing its inhabitants to write handshake IOUs, effectively saying, "If you allow me to eat some of the fish and coconuts that you produce this year, I will promise to allow you to eat some of the fish and coconuts I produce next year." In doing so, Allais showed that some demographic patterns can result in a negative real interest rate. People near retirement age, for example, have incentives to "save" by feeding young people today who will, in turn, feed them later when they are too old to work. If there are many people near retirement relative to young workers, an old worker may have to pay a young worker two coconuts today to get one coconut back in the future—a real (coconut) interest rate of *minus* 50 percent.

The interesting questions of capital markets only arise, however, when there are many assets, when real goods are storable and when people are able to make choices among alternative ways to store wealth. I actually live on the island of Maui, so I know something about island economies. There are fish in the ocean in front of my house and coconuts in the back yard, just like in the textbooks. When I go to sleep every night, however, I don't worry about the fish or the coconuts. I worry about the volcano the island is sitting on. If it erupts during the night, tomorrow is going to be a very bad day.

The $10-trillion-a-year U.S. economy sits on top of a volcano, too—our $100 trillion balance sheet. Even small disturbances in such a huge base of assets can make waves—thermal disequilibriums, in physics terms—so large that they swamp the effects of the changes in spending, savings, budget deficits and other "flow" measures that macroeconomics concerns itself with. These tidal waves of change are transmitted to people's lives through changes in asset prices.

WHERE'S HAMLET?

In the late 1970s, Jimmy Carter was president. Inflation, tax rates, government spending and interest rates were all rising, growth was stagnant and the dollar was dropping like a brick. Real estate and commodities were soaring. The stock and bond markets were a mess.

Accepted wisdom then was that inflation did not matter much for the real economy. After all, labor and product contracts could be indexed; interest rates would rise by just enough to compensate savers for their expected loss of purchasing power—a view mistakenly attributed to the great economist Irving Fisher—leaving real interest rates unchanged. Fisher—like Knut Wicksell, John Maynard Keynes and Eugen von Boehm-Bawerk—understood the lessons of the periodic deflations and financial panics that had plagued Western countries through the 1930s. Monetary, credit and tax disturbances have major effects on both real interest rates and on real economic activity.

Accepted wisdom was not doing a very good job explaining the 1970s. About that time, I found an extraordinary set of data that reported the market value of people's holdings of tangible assets—land, houses, capital goods, consumer durables and commodities. The numbers were huge, bigger than anything macroeconomists were writing about.

What intrigued me most was that macroeconomics had no analytical pigeon hole for this data. In a flow chart contained in his 1969 presidential address to the American Economic Association, James Tobin of Yale identified "the interest rate" as a parameter set by the central bank. Asset arbitrage—which students of Tobin's later had the hubris to call "Modern Portfolio Theory"—was confined to security markets. Interest rates influenced the production economy through their effects on investment decisions, but the real economy did not in turn influence interest rates. Real assets, at least as far as the model was concerned, did not exist.

How could that be, I wondered? Interest rates were simply prices of a particular subset of people's assets. The largest asset class was real estate, not securities. Didn't this leave out the star of the play? It sounded like the joke going around about the U.S. government's refusal to recognize the one billion people in China: How could we ignore our biggest asset?

My colleagues and I at the Claremont Economics Institute built what we called the asset market shift framework, to give Hamlet back his speaking part. We used it to great profit during the latter stages of the Carter inflation, to predict the effects of rising inflation and tax rates on interest rates and commodity markets. This framework unified the behavior of the hard-asset markets with the security markets and explained why variations in inflation and tax rates exert powerful real effects on interest rates, asset values and real wealth accumulation. We used it later as a theoretical framework for the Reagan eco-

nomic plan, which critics dubbed the "Rosy Scenario." Twenty-two years later, rosy looks pretty good.

In November 1981, I wrote a piece describing this idea for *The Wall Street Journal's* op-ed page, titled "Why Interest Rates Must Fall in 1982." At that time, Wall Street economists were divided between those who, like Dr. Doom—Henry Kaufman of Salomon Brothers, believed Reagan's tax cuts would lead to big budget deficits and rising interest rates—and those who argued that Reagan's tax cuts would stimulate more savings and drive interest rates down.

I argued that the course of interest rates would not turn on either savings or deficits. Instead, the Reagan Administration's economic plan was going to turn the asset markets on their head by forcing massive private-sector arbitrage. And this in turn would reverse all the major trends of the 1970s. Interest rates would fall, regardless of the budget deficit. Deficits and savings rates would be rounding errors, in the biggest portfolio event of the century.

I didn't get many dinner invitations from fellow economists after that. But I did make a lot of money.

POWER TOOLS

As economists, we have two theories about prices in our tool box. The first—supply and demand—is the price theory of Alfred Marshall and George Stigler. It works well for haircuts, guitar lessons and other perishable goods and services—things with a high rate of current production and small existing stockpiles. The second—portfolio theory—was worked out by Irving Fisher, Knut Wicksell, John Maynard Keynes, Milton Friedman and James Tobin. It works for long-lasting goods—Rembrandts (he's not painting any more), '57 Chevys (the best car ever made, pronounced with a hard *ch*, as in Cheech and Chong,) and beachfront property (they aren't making any more).

To get the right answers, you need to use the right tool. To find that in this case, we can use a parameter I will call *alpha*, calculated by dividing the existing stockpile by a year's production. Most products are somewhat storable but wear out over time. They have alphas larger than haircuts and smaller than Rembrandts. Medical services, food and apparel all have alphas close to zero. As far as pricing goes, they behave like services. Land, homes, copper, gold, even automobiles (there are 150 million used cars in the United States, about 10 years' production) will have alphas between 15 (for cars) and infinity (for land). Hard assets, in other words.

Bonds may seem ephemeral, but their prices behave like Maui beachfront. On March 31, 2002, the total existing stockpile of government debt—the national debt—was $6.01 trillion. Of that total, $3.39 trillion was held by the public; the rest was owned by government agencies. By contrast, this year's federal budget deficit will be about $130 billion, i.e., the federal government will produce and sell $130 billion of *new* debt. Using these numbers, we can calculate the alpha for government debt as either 46.2 or 26.2, depending on which measurement of ownership you prefer to use in the numerator. Either way, the outstanding stock of government bonds is many years' new supply.

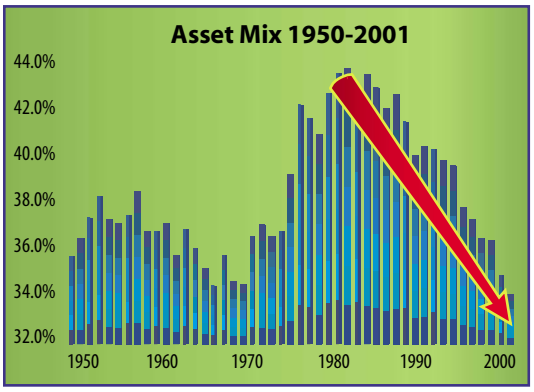
What this means is that the supply of bonds will be almost invariant to price—the supply curve is effectively vertical. Put another way, bond prices—and therefore interest rates—on any given day will be insensitive to government financing activities. Interest rates are determined by demand; they will be whatever they need to be to make people willingly hold the existing stock of bonds. The mechanism that makes this work is portfolio balance—the asset market analog of thermodynamic adjustment.

The U.S. asset markets are huge. At the end of last year, the three sectors reported by the Federal Reserve Board—households and nonprofit organizations, corporations and noncorporate business—held a total of $72.9 trillion, equal to 9.8 times our annual disposable income. Tangible assets stood at $30.7 trillion, including $22.9 trillion in real estate, $3.9 trillion in capital equipment, $2.9 trillion in used cars and washing machines, and $1.3 trillion of inventory. The remaining $42.3 trillion—58 percent of the total—was financial assets.

Factoring out businesses shifts the balance slightly. Households and nonprofit organizations alone owned $47.9 trillion of total assets at the end of 2001, split almost exactly one-third/two-thirds between hard and financial assets. Liabilities totaled $8.1 trillion, just under 17 percent of total assets—not much leverage, in spite of what you read. Household net worth was a whopping $39.9 trillion.

So much for the facts. Portfolio balance, to use our physics terms—asset market equilibrium—refers to the situation in which returns on tangible and financial assets are exactly equal. In other words, there are no arbitrage opportunities—no price differentials—for investors to exploit. But anything that materially alters the relative risks or returns of the two asset classes will tilt the scale, leading investors to adjust their portfolios to seek a higher return. Prices change until investors are again content to own the existing assets—until equilibrium is restored.

Hence the importance of splitting the national balance sheet into hard versus financial assets—inflation and tax rates affect their returns so differently. Inflation makes a positive, direct contribution to the total return on tangible assets in the form of capital gains, and investors will shift their portfolios in response. Doing so drives tangible asset prices up and financial asset prices down—i.e., interest rates up—until equilibrium is restored. Similarly, an increase in tax rates reduces the relative after-tax return of financial assets, since the yield on tangible assets is



generally nontaxable. This will shift demand toward tangible assets, drive their prices up and financial asset prices down, until balance is once again restored.

Irving Fisher wrote about all this more than a century ago, when he examined the link between inflation and interest rates—real interest rates. John Maynard Keynes understood it as well: Chapter 17 of his *General Theory* is the most cogent description of asset arbitrage ever written. Asset arbitrage explains why real asset prices should be used to benchmark inflation, not consumer prices or GDP deflators, because the spread between tangible and financial asset yields is the key driver of investor behavior. Measured properly, this tangible real rate is the economic analog to the temperature differential that serves as the fundamental energy source in thermodynamics.

Now back to the real world. During the past 20 years, American households—responding to low inflation and tax rates—have systematically reduced their tangible asset holdings as a percentage of total assets, from 43 percent in 1981 to 32 percent today (see chart above). This has pushed interest rates to their lowest point in 40 years and stock price multiples to historic highs. It has also played havoc with the economics of durable goods industries, which have been forced to compete with mountains of their own previously produced products selling at continuously discounted prices.

Home prices are a perfect example. A benchmark of U.S. stocks as measured by the S&P 500 Index was valued at two median homes during most of the 1980s. The ratio increased to four homes in 1996, and peaked at more than eight homes during the dot-com boom in late 1999, before falling to about six homes today. Throughout this period, home builders, commodity producers and durable goods manufacturers faced a powerful headwind, leading to margin pressure and continual fixed-asset write-offs. Owners and producers of financial assets, in contrast—stock market investors, brokerage firms and mutual funds—enjoyed easy profits. Schools, guidance counselors and graduating students followed the gradient leading to the greatest wealth. We went from being a nation of real estate brokers to a nation of stockbrokers in one generation.

DISEQUILIBRIUM

There is a dirty little secret in all this. Economists know a lot about what things look like in equilibrium, when nothing that matters is happening. We know almost nothing about what happens in disequilibrium, when the real money is made or lost.

The same thing is true in physics, but physicists are more honest about it. Thermodynamics textbooks always confess that the formulas only work for *reversible* processes—those that change in such infinitesimally small increments that they can be viewed as if they are effectively in equilibrium at all times. Irreversible processes, by contrast, tend not to have well-defined paths. Think of the explosion of an atomic bomb.

Economists deal with this problem in the natural way: We assume it away. One way is to assume that there is an imaginary auctioneer—the tiny homunculus of philosophy—who calls out hypothetical prices until he finds a price at which supply and demand balance. Then, and only then, do transactions occur. Alternatively, we assume that price change is determined by an arbitrary rule—for instance that prices will change in proportion to excess demand, a notion that has dominated economics discussions since Paul Samuelson's *Foundations of Economic Analysis*, published more than 50 years ago This rule has the virtues of implying that a price in equilibrium will remain there, since excess demand is zero. And it makes a certain amount of sense if we view excess demand as a stimulus.

But thermodynamics tells us a different story. Ludwig Boltzmann, a 19th-century German scientist and the true father of the field, developed an equation—Boltzmann's Probability, also known as Boltzmann's Distribution—that we can use without revision to explain the speed of price change in disequilibrium. Its key is the understanding that, in formal terms, all chemical reactions are cooling processes. And chemical change, like all other physical processes, happens through discrete events in which molecules form and re-form bonds to move to lower energy states, under the direction of the law of entropy.

As it turns out, only two factors determine the speed of a chemical reaction. The first is temperature. In asset markets, this would be measured as the difference in relative returns for different assets, which provides the incentive for a market participant to engage in arbitrage behavior. The greater the difference, the more energy—incentive—there is for change.

The second is a minimum energy requirement—the threshold required to break an existing bond. In economics, this would be the brokerage commission or other transactions cost, which must be exceeded before arbitrage becomes worthwhile. This threshold factor makes economic change lumpy—just like quantum physics—and leads to the conclusion that economics, like physics, is inherently a statistical science.

In 1972 I wrote a book called *A Monetarist Model of Inflationary Expectations,* in which I made a formal study of the information market. My conclusion was that economies of scale in information processing would eventually drive transactions costs to zero, making rapid price change inevitable. Transactions costs have since fallen by more than 90 percent—in Boltzmann's language, they can no longer be counted on to serve as an effective buffer on the speed of price changes. This has some very obvious implications: Price disequilibria—markets, in other words—will be more erratic and volatile. Historical volatility estimates will consistently underestimate future volatility. And options will consistently underprice risk.

A GLEANER'S MARKET

Asset market disturbances, like a change in the inflation rate or a change in the capital gains tax rate, are one-trick ponies. Like hurricanes, they stir a lot of things up and can change some things permanently, but when they are over, they are over. For good or ill, the hurricane created by the post-Reagan disinflation is over now. Balance sheets have now fully adjusted to today's inflation and tax rates. This leaves us with two things to

do—clean up the mess and start watching out for the next dislocation.

There is still plenty of cleaning up to do. Most of it takes the form of squeezing the hubris out of the people who got the erroneous impression that it was their efforts, rather than a rising tide of price change, that made them rich. Day traders and momentum investors are one such group. The managers of Enron, TYCO International, Global Crossing and others who found accounting rules too confining are another. Dot-com bingers, venture capital investors, pension fund managers, conflicted analysts and investment bankers are a third. Unfortunately, the clean-up will also spawn witch hunts, like the one playing out on C-SPAN every day.

The final mess we have to clean up is inside our heads. We all have to learn that the incredible Reagan Run of the last 20 years is over. From now on we are going to have to actually earn the money.

Bummer.

For two decades, the biggest mistake an investor could make was to be out of the market. We made our money by betting on rising valuations, not rising company performance. Momentum investing worked; value investing didn't. Stocks in the S&P 500 made money; small caps didn't. An entire generation of investment professionals—four out of every five people now working on Wall Street—was hired fresh out of school and trained during this period. A bull market—Wall Street's self-important term for this massive asset shift—is all they have ever seen.

Barely two years later, we face a very different world. Real growth of between 3 and 4 percent a year, due to strong productivity gains, is great. But inflation between 1 and 2 percent annually means that nominal GDP growth—and therefore revenue growth for most businesses—will average as little as 4 percent. That implies single-digit earnings growth and single-digit stock market returns. The winners will be companies that are able to demonstrate consistently above-average top line growth, systematic cost reductions and pricing power. Identifying them is the work of old-fashioned, bottom-up, value-oriented security analysis. There aren't many people around today who remember how to do that.

The asset market shifts we experience in the next decade will be different, too. Instead of the wholesale repricing of the entire balance sheet, we will be in a gleaner's market—smaller, shorter-lived and more geographically dispersed opportunities. Barring some new, huge outside event, this is a market where hedge funds will have a distinct advantage over larger, slower-moving, long-only mutual funds. The troubles we have been seeing with the big Wall Street institutions in recent months may be a harbinger.

These mini-shifts will be like small storm systems—not important enough to make the 10 o'clock news, but big enough to shake things up for the local residents. Typically, they will occur in situations where disequilibrium happens in an area below the horizon of the usual analyst's radar.

One example is the utility and energy-trading sector—the eye of the witch-hunt hurricane. Investors are selling good franchises along with bad ones. Value investors who know the difference will be rewarded handsomely once the witch-hunt is over.

A second example is Japan. The economists at the Bank of Japan think they have been stimulating the Japanese economy for more than a decade with budget deficits and low money interest rates. While they have been *talking* stimulus, they have been *walking* tight money. Land and other real asset prices in Japan have been deflating for more than a decade. Tangible real interest rates have hit 10 percent.

Japanese companies—long fixed assets and short yen debt—have been crushed under the burden of never-ending write-offs, leading to a series of recessions. Their problems cannot be resolved until land prices stop falling. Recently, money growth has exploded and the yen is falling. If this signals a reversal in the decade-long deflation, it will be a great opportunity for investors.

A third example is Germany, where capital gains tax rates on cross-shareholdings were reduced to zero earlier this year for public companies. Although political and labor market problems will keep the German economy from growing rapidly, the tax law changes will push a wave of restructuring, making merger arbitrage yet another interesting area. In the U.K., too, pressure to devalue the pound before joining the European Monetary Union will undermine the return on some industrial assets and fan the fires of property inflation—already 16.5 percent last year.

There is no shortage of portfolio disturbances elsewhere. Korea is going gangbusters, raising the return across the board on Korean assets. Asian economies are recovering. Latin America is morally, politically and economically bankrupt. U.S. restrictions on steel imports pushed up flat-rolled steel prices by as much as 50 percent in a month, leading to a 50 percent increase in the market capitalization of specialty producers like Timken. Restrictions on lumber have added $1,000 to the cost of building a U.S. home. Europe, Canada and Japan are retaliating with restrictions of their own. Oil prices are 40 percent higher than last year, which has spiked energy-sector returns—and stock prices—to unsustainable levels.

All these are situations where policy change has driven a wedge between the relative returns of different assets. A change in the income tax rate drives a wedge between the relative value of work and of leisure. A tariff drives a wedge between the prices of traded and untraded goods. The wedge is the temperature differential from thermodynamics—a disequilibrium. Wherever you find it, arbitrageurs and economic change are close behind.