



The Economic Model

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[Article Structure: *Hyperlinks enable the toggling between the table of contents and section titles. Short definitions will pop-up when the cursor hovers over bold font. The list of definitions provided at the end of the document frequently expands on the pop-up.]*

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Why a New Economics Model Is Needed

Many of the relations and concepts presented here are intuitive or discussed in a vast volume of economic and other literature. The Economics of Choice, however, weaves these concepts together to form a comprehensive platform for economic thought that expands on mainstream economic thought and improves understanding. Its comprehensiveness lies in the way it emphasizes and puts in the forefront of economic thought individual and societal values, human and physical capital, technological progress, time spent at production and improvement in the measured and unmeasured sectors, natural resource scarcity, debt, and the **opportunity to pursue happiness (OPH)**.

Although resource scarcity is integral to and constantly affects the opportunity to pursue happiness, it is not well understood, nor is it adequately emphasized in mainstream economics. The Economics of Choice and mainstream economic models both hold that **labor** is one of the two primary economic inputs. In mainstream economics, however, physical capital is the other primary input (Dornbusch, Fischer and Startz 2008), whereas in the Economics of Choice natural resources are the other primary input. By explaining the relationship between natural resources, labor, and capital, the Economics of Choice connects mainstream economic thought and resource scarcity.

This economic model addresses some central questions from the perspective of happiness, productivity, natural resources, and financial stability.

- What causes the opportunity to pursue happiness to increase?
- Should all individuals benefit equally from gains in **productivity**?
- In economically advanced nations, is perpetual exponential growth the best way of increasing happiness?
- Is the sacrifice associated with high rates of productivity-driven growth worth the benefit?
- How is increasing resource scarcity affecting the opportunity to pursue happiness?
- Why is debt essential to economic growth and vitality, and when is it particularly dangerous?
- Is the economic and financial stability of the United States declining?

The Economics of Choice provides a framework for understanding and addressing these and numerous other questions.

The Economics of Choice: An Overview

All economic output is produced from two inputs, time spent doing work and natural resources. Natural resources are located, extracted, and transformed into capital and that capital is used to transform additional natural resources into goods and services. The amount of goods and services produced depends on how much time people spend at provision and how productive that time is. Time spent at improvement and innovation causes productivity to increase. Increasing natural resource scarcity causes productivity to decrease. Assuming that there are no imports or exports, the product produced in a society is equal to the sum of income from profits, wages, and **transfer** received by all individuals within

a society. If the population does not change, individual capacity to purchase goods and services is determined by the quantity of product produced and relative income.

Debt enables individuals and businesses to purchase product before they earn income, and the increased use of debt causes demand and economic output to increase in the short-term. Debt payments cause demand and economic output to decrease. When debt is used to sufficiently increase productive capacity or productivity, the associated increase in income more than offsets the adverse effect of debt payments. Economic output increases in the short term when debt is used by households to purchase leisure-enhancing goods or services, or when debt is used by government entities to provide non-productivity increasing services. This has an adverse long-term effect on demand and economic output.

Economics of Choice and The Opportunity to Pursue Happiness

Long- and Short-Term Growth

The two ways of increasing economic output are to spend more time producing goods and services and to increase the productivity of the time spent at work. Productivity improvement is associated with long-term sustainable growth, and increasing debt is frequently associated with unsustainable short-term growth. The mechanism, benefit, and sacrifice of long-term per capita growth is emphasized here. Short-term growth and the relationship between short- and long-term growth is explained in the section “The Financial Sector”.

The Opportunity to Pursue Happiness (OPH)

The capacity of individuals to pursue activities that they perceive will increase happiness expands with leisure time and **purchasing power**, the two dimensions of the opportunity to pursue happiness (OPH). The opportunity to pursue leisure activities like watching movies, hiking, and vacations increases with time for leisure. The quantity and variety of goods and services one can purchase also increases OPH. For example, the person who can afford to purchase a car or a tropical vacation has a greater OPH than the person who cannot.

Mainstream economic models tend to focus entirely on economic output or capacity to consume. The Economics of Choice expands this focus to include time for leisure. Although the Economics of Choice explains how leisure time and purchasing power increase, it does not address factors that affect OPH during leisure time. For example, the effect of pollution on the capacity to enjoy swimming during leisure time is not considered, but the relationship between time spent removing pollutants and OPH is.

Productivity, Innovation, and OPH

All people have 24 hours a day for work and leisure, including sleep. The production of goods and services occurs as a result of time spent locating, extracting, and transforming natural resources. It takes time to produce **capital** from natural resources, and additional time and natural resources to produce goods and services using that capital. It also takes time to improve production systems and introduce new capital, goods, and services. Long-term per capita economic growth occurs when people choose to spend enough time innovating better systems of production and new capital, goods, and services.

A choice arises when the time that it takes to produce a good or service decreases. When productivity increases, the time that it takes to produce a good or service declines, and the time saved can be spent at leisure, the production of more goods and services, productivity improvement, consumption, or a combination of these.

OPH increases with productivity. As stated above, people have 24 hours a day to spend on work, leisure, and sleep. The only way to increase time for sleep and leisure while increasing the production and consumption of goods and services is to increase productivity. When the time it takes to produce a good or service declines, time is saved, and the saved time can be spent on, leisure, production, improvement, or consumption. When productivity increases and the time saved is divided between leisure and the production of more goods and services, both leisure time and consumption increase. OPH increases with the opportunity for leisure and consumption.

For example, if the time that it takes to produce a car declines from 100 to 90 hours, the 10 hours of saved time can be spent at leisure, the production of an additional car, the production of other goods and services, the improvement of car production, or improving the production of other goods and services. When the time saved is spent at improvement, and the improvement is successful, additional time is saved, leading to additional choice and additional OPH. Per capita growth that is sustainable over long periods of time occurs when adequate time is spent at production and improvement.

In 1800, it took a day to cut one-third acre of wheat using a sickle (Story of Farming-Reaping). As a result of time spent at improvement, the time to cut wheat continually declined—first with the invention and use of progressively improved scythes, then with the development of horse-drawn reapers, and later with the introduction of fossil-fuel-powered tractors. Today, by use of a modern combine, an acre of wheat is cut and threshed in about four minutes (Jones, Haffner, Orgain, Schemper, and Zeorain, n.d.). Over the past two centuries, the time it takes to cut an acre of wheat has declined by about three days, and the time saved has been used to increase leisure and produce more goods and services. The increased production of goods and services has caused natural resource consumption to increase dramatically.

A person's OPH depends on a combination of leisure time and purchasing power. There is only one way to simultaneously increase purchasing power and time for leisure: increase productivity. Higher productivity allows less time to be spent on work, leaving more time for leisure. Purchasing power increases when **real income** rises or real prices decrease, both of which occur when productivity improves.

For a more in-depth discussion of this subject, please see the section, "The Fundamental Equation of the Economics of Choice".

[Natural Resources and OPH](#)

The production of **goods** and **consumption services** requires two inputs, time spent at work and natural resources. People produce goods and services by spending time locating, extracting, and transforming natural resources. The time it takes to locate and extract natural resources and transform them into goods and services declines with innovation—that is, the introduction of better tools, machines, equipment, and processes. Increasing resource scarcity, when not offset by innovation, increases the time it takes to locate, extract, and transform natural resources. Over the millennia, both the human population and per capita human production have increased because of innovations such as fishing

hooks, bulldozers, and petroleum refineries. Innovation enables people to consume a greater portion of Earth's natural resources while increasing resource scarcity has kept and continues to keep the increased consumption of natural resources in check. (Weyer 2020)

All economic activity must occur within the constraints of Earth's finite resources. Unless the processes and equipment used improve, the time needed to locate, extract, and transport natural resources increases with resource scarcity. That means the productivity of extracting those natural resources declines. In the past, productivity improvement through innovation of more efficient processes and new equipment has more than offset decreases in productivity associated with increased resource scarcity. As resource scarcity continues to increase, offsetting the associated decrease in productivity will become increasingly difficult and eventually impossible. This will cause OPH to decline.

Understanding the relationship between growth, resource scarcity, and OPH is vital and urgent because increasing resource scarcity is having an increasingly adverse effect on productivity. For example, the real cost of crude oil extraction is rising because it takes more time to extract oil from dense rock formations, via fracking, and from below the ocean than from conventional oil wells. The Economics of Choice provides a platform for understanding the effect of resource scarcity on OPH.

The article "Natural Resource Scarcity and The Opportunity to Pursue Happiness" provides an in-depth analysis of the relationship between increasing natural resource scarcity and OPH.

[How OPH Relates to Actual Happiness](#)

Happiness almost certainly increased when rising productivity between 1918 and 1950 led to a fantastic increase in opportunities for leisure and consumption. For laborer households in 1918, paid and household work was physically demanding; the primary use of leisure time was recovery from demanding work. Nutrition generally was not adequate, access to basic medical care was minimal, and the life expectancy at birth was less than 57 years. Also, during this time period, vacations were rare, and the most common leisure activity was occasionally going to the movies. In 1950 the 40-hour workweek was standard, paid vacations had become the norm, and household income was sufficient to provide the basics (Brown 1994) .

Yet, the pursuit of continued long-term per capita growth, particularly exponential growth, in affluent societies is questionable for the following reasons:

1. Once a certain level of income is reached, happiness does not increase, at least not significantly, with additional income (Daly and Farley 2011).
2. Activities such as spending time with close friends, building strong relationships, pursuing hobbies, and doing meaningful work cause happiness to increase (Buettner 2010), and time spent at improving productivity reduces the opportunity to pursue those activities.
3. Structural unemployment increases with greater rates of productivity improvement. Productivity improvement requires sacrifice and causes the structure of society to change. Businesses that are more successful at improving productivity and developing new products tend to increase their market share, sometimes leading other businesses to close. People become unemployed, need to learn new skills, and may need to relocate. These changes require sacrifice.

4. Fiscal and monetary policy used to achieve growth can cause financial instability and asset bubbles that eventually collapse.
5. Pollution, including greenhouse gas emission, tends to increase with economic output. Addressing the adverse effects of pollution takes time that causes OPH to decline.
6. Natural resource consumption and scarcity tend to increase with productivity gains, and constant increases in resource scarcity will eventually cause both productivity and OPH to decline.

Values and OPH

"A great civilization is not conquered from without until it has destroyed itself within. The essential causes of Rome's decline lay in her people, her morals, her class struggle, her failing trade, her bureaucratic despotism, her stifling taxes, her consuming wars." (Durant 1944, 665)

Economic output depends on how people choose to use their time, and that choice is a function of circumstance and people's values or belief systems. Factors such as geopolitical condition, socioeconomic condition, access to natural resources, and societal values determine circumstance. In any circumstance, values fundamentally affect how much time individuals spend at production, consumption, improvement, and leisure, in turn affecting economic output and OPH. The collective choices of individuals throughout society determine short- and long-term economic growth, economic development or decline, and circumstance.

Civilizations rise and fall. Economic development primarily depends on culture (Huntington 2000). Culture reflects the values of a nation's people, individual values affect how people use their time, and how people spend their time determines the impetus for economic development, per capita growth, and OPH. Economic development depends not only on how much time people spend at their jobs, but also how they spend their free time. Volunteer work, running households, and learning are critical to the improvement of **human capital**. Human capital underpins economic vitality.

The strength of a nation lies in its people. People choose to work, save, borrow, take personal responsibility, vote, take advantage of others, be honest, pollute, cooperate, learn, and volunteer. The choices that individuals, in aggregate make, determine the strength and vitality of a nation. Since individual values affect the choices made in any given circumstance, they are a powerful economic force.

For example, in the 1960s, Ghana and South Korea received equivalent amounts of aid, had similar per capita gross national product, exported comparable primary products, and had similar employment percentages in the service and manufacturing sectors. By the 1990s, little economic progress had taken place in Ghana, but the South Korean economy had grown substantially. "South Koreans valued thrift, investment, hard work, education, organization, and discipline. Ghanaians had different values." (Huntington 2000)

An example in which a national government provided pro-growth circumstance in two regions with different prevalent societal values took place during the latter part of the twentieth century. The Italian government provided the local and provincial government with equivalent financial and regulatory autonomy. Economic vitality and growth in Northern Italy greatly exceeded that of Southern Italy. The culture in Southern Italy was based on a top-down, authoritarian-style rule through which conflict was

commonly resolved by force. The culture in Northern Italy was based on a horizontal structure where equality, civic engagement, and responsibility were the norm. In Southern and Northern Italy, the prevalent mindsets were, respectively, “I need to protect what is mine and what can the government do for me” and “Let us share and what can I do to help.” (Putman 1993)

Measuring and analyzing how time use is changing within a society might provide a perspective on the underlying determinant of economic vitality and growth, societal values and human capital that is not captured, at least not adequately, by the financial measurement and analysis of an economy (Gershuny 2000).

Honesty and OPH

Successful Democratic societies depend on trust and integrity. There will always be ways to take advantage of others by using the law to one’s advantage. It is futile to attempt to create a law or write a legal doctrine that is concise and comprehensive enough to prevent manipulation for personal gain in all circumstances. Honest people occasionally have genuine grievances or disagreements. Law is effective, at least partially, in resolving such genuine disagreements. There will always be ways to use the law for personal gain.

People spend more time protecting themselves when the frequency or extent of loss associated with unethical behavior increases. Time spent protecting oneself cannot be spent relaxing, producing, or improving and causes OPH to decrease.

A few dishonest people and thieves within a society can thrive. At some point, rampant dishonesty or lack of integrity will destroy a democracy. A democracy or republic truly is only as good as the people therein.

Income and Income Distribution

People in households, businesses, and government entities spend time providing goods and services and earning an income. The **total benefit** of time spent doing work is the goods and services produced throughout society. Assuming that savings and debt stay constant, and net exports are zero, the relative income that individuals receive from wage compensation, profit, and transfer determines what proportion of the total benefit they can consume.

Individual purchasing power depends on relative income and the total number and variety of goods and services produced in society. If population and relative income do not change, then every individual’s capacity to consume increases with economic growth. If population and the production of goods and services stay constant, then the purchasing power of individuals changes with relative income. For example, if economic output and the population within a society stayed constant and profits from a rising stock market cause the income of investors to rise relative to non-investors, then the purchasing power of investors would increase at the expense of non-investors.

As a simple example, consider an isolated clan of 10 people who all pick blueberries. The clan’s productivity for a day is the total quantity of blueberries picked. If each member of the clan picks a bucket of blueberries every day and receives \$1 for those blueberries, then everyone can purchase a bucket of blueberries at the end of the day. If one person picks 10 buckets every day, the remaining individuals decide to relax and not pick, and everyone obtains \$1 at the end of the day, total output and

relative income stay the same; everyone is still able to purchase a bucket of blueberries and consume the same proportion of economic output. If daily productivity increases to 20 buckets of blueberries and relative income remains the same, then everyone can purchase 2 buckets of blueberries. If 20 buckets of blueberries are picked every day and 5 persons receive \$3 each while the remaining 5 receive \$1 each, then relative income changes, allowing 5 persons to purchase 3 buckets each, whereas the others can still purchase only 1 bucket of blueberries each.

If two individuals have the same purchasing power but one individual can purchase more goods and services because of better skill at negotiating and at taking advantage of sales, then the consumption prowess of that individual is greater. If individual consumption prowess is the same and debt and savings are assumed to be zero, then relative income determines the proportion of the goods and services produced in society that each individual can consume. To maintain relative income, the **nominal income** for all individuals needs to increase at the rate of productivity improvement plus the rate of **inflation**.

For a more in-depth discussion, see the section “The Income Distribution Equation”.

[The Service Sector](#)

It takes time to produce goods and services, and additional time to consume them. Production involves the process of producing goods and placing them on retail store or warehouse shelves. Consumption includes time spent driving to businesses such as grocery stores, determining what goods to purchase, removing them from store shelves, paying for them, packing and loading them, driving home, unpackaging, using them within households to produce other goods and services (such as meals and repair of leaky faucets), and discarding or recycling unused products and packaging. Alternatively, it takes time to purchase goods and services online. The purchaser essentially hires a business that provides the consumption service of picking the goods off warehouse shelves and delivering them to the desired location.

If the time that it takes to produce a good decline more than the time it takes to consume that good, then the ratio of production time to consumption time declines for that good. If the time it takes to produce all the goods consumed declines faster than the time that it takes to consume those goods, the total time spent at consumption relative to production increases. When production productivity increases faster than consumption productivity, the relative time spent at production must decline.

To maintain the balance between production and consumption, all people can increase the relative amount of time they spend at consumption (by reducing production time or increasing consumption time or doing both). Or, some people can specialize in consumption while others spend the same time as before at production. For example, if the time it takes to produce houses declines and the time it takes to maintain them remains constant, then the relative amount of time spent at consumption must increase. Balance between production and consumption is maintained if all homeowners increase the time they spend at home maintenance or if some or all homeowners hire businesses that provide home maintenance services, such as plumbing, painting, and landscaping. People can choose to purchase goods such as ladders, paint, tape, pressure washers, and rollers to paint their homes, or they can hire a business to purchase those goods and do the work on their behalf. The latter choice causes the provision of consumption services to increase. When production productivity increases faster than

consumption productivity, the proportion of individuals who work in manufacturing, construction, and mining tends to decline while employment in the service sector, providing consumption services, increases.

Service societies develop when production productivity increases faster than consumption productivity, and this was the primary cause of the decline in American manufacturing. The relative decline in manufacturing employment shown in Figure 1 began well before the loss of manufacturing jobs to foreign competition in the 1980s.

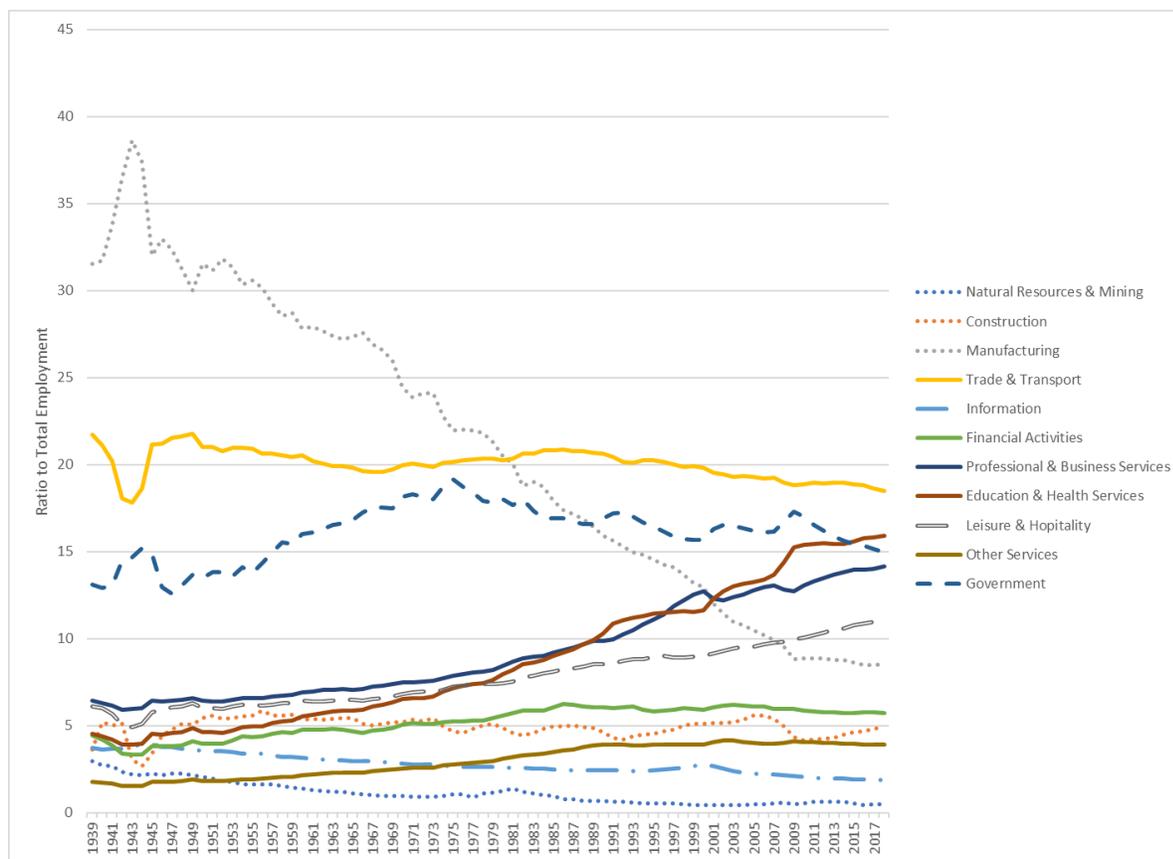


Figure 1. U.S. employment by sector. Data from Bureau of Labor Statistics-CES Super Sectors.

Technology is having a tremendous effect on consumption productivity. For instance, online shopping and smartphones have greatly reduced the time it takes to consume goods and services. The time saved during the consumption of goods and services is used for leisure, the purchase of additional goods and services, or the production and improvement of goods and services. Time saved in the **unmeasured sector** of the economy can be used to increase production and improvement in the **measured sector**.

How is the time saved actually used and affecting the measured sector of the economy? Is it being used to increase skill and knowledge or to spend more time at leisure, production, or improvement? If the answer is more time for leisure, are people also borrowing more to enhance the additional time they are spending at leisure? Has the increase in consumption productivity caused the stop in manufacturing

decline shown in Figure 1? How people throughout society choose to use their time is a primary determinant of long-term economic growth.

The Unmeasured Sector of the Economy

The work done within business or government, as measured and included in GDP by the U.S. Bureau of Economic Analysis, constitutes the measured sector of the economy. All other work occurs in the unmeasured sector. Outputs in the measured and unmeasured sectors of society are intertwined and symbiotic. Work done in the measured sector affects work done in the unmeasured sector, and vice versa. Productivity increases in one sector affect the other sector. Productivity in both sectors is interdependent, is critical to long-term economic vitality, is linked to aggregate individual action, and affects OPH.

Time spent working in the unmeasured sector, in such activities as voting, volunteering, raising children, and running households, has a powerful long-term effect on economic output and vitality in both the measured and unmeasured sectors of the economy. Household chores, such as washing clothes, cooking meals, and nurturing children, are critical services that underpin social and economic vitality. Volunteer work, such as coaching, organizing school fundraisers, and helping the needy, promotes connectedness, learning, cooperation, and trust while providing an opportunity to youth and those in need. Adults, particularly parents, determine in large part the experiences that form values and belief systems during childhood, youth, and, to some extent, young adulthood. They do so through their work in the unmeasured sector of society. Belief systems or values largely determine long-term economic growth by affecting individual choice.

The production of goods and services occurs in both the measured and unmeasured sectors. Productivity in the unmeasured sector, as in the measured sector, improves with successful investment. Purchases of capital in the measured sector and of **time-saving goods** in the unmeasured sector serve essentially the same purpose: investment in increased productivity or productive capacity. Opportunity for well-being increases when time-saving goods are used to reduce the time needed to provide goods and services in the unmeasured sector. Productivity in the unmeasured sector increases when the production of time-saving goods becomes more efficient in the measured sector because prices decline and more time-saving goods are used. When productivity in the unmeasured sector increases, the greater personal choice it allows can lead to increased labor participation in the measured sector. For example, time-saving goods such as central heating systems, refrigerators, and laundry machines contributed to the increased labor participation rate of women in the measured sector from 20 to 60 percent between 1900 and 2000 (Fischer and Michael 2006). The effect that technology such as smart phones currently has on productivity in the unmeasured sector of the economy is probably not understood adequately.

Ecological and Environmental Economics

Ecological, environmental, and resource economics have much in common with the Economics of Choice, but their emphases are different. From the perspective of ecological economics, the cost of extracting a given quantity of resources is the energy consumed (Daly and Farley 2011); from the perspective of environmental economics, it is the pollution produced (Kolstad 2011). The Economics of Choice recognizes that when the extraction of resources takes more energy, the production of energy needs to increase, and that takes additional time. Likewise, the time that it takes to clean up and deal

with the consequences of pollutants is not available for leisure or the production and improvement of goods and services. Therefore, the most fundamental cost of increased energy consumption and pollution is a decrease in OPH. For example, pollution is causing climate change, and the time spent in activities aimed at reversing that change or protecting people from the associated consequences—from extracting minerals used in the production of coastal barriers needed for protection against rising sea levels to negotiating climate change policies —reduces OPH.

The Financial Sector

The capacity to borrow is essential to economic growth and vitality. When savings or income are not sufficient, debt enables households to purchase the time-saving goods used to increase efficiency within households, and businesses to employ the individuals and purchase the capital and material needed to meet customer demand.

Expansionary fiscal policy and **expansionary monetary policy** increases short-term growth through increased debt-driven expenditures. The long-term effect of fiscal and monetary policy depends on whether increased short-term expenditures are successfully used to increase productivity and productive capacity.

The Importance and Danger of Debt

Product can be purchased with money, which can be obtained from previous work, transfer, the sale of an asset, or a promise to do work sometime in the future. Individuals and businesses earn income as a result of time spent working. They can save some of the income until they have sufficient savings to purchase a desired good or service, or they can borrow money, purchase the desired items, and then work to pay for the product, plus interest and fees, sometime in the future. When debt is used, product is purchased before income is earned, thus moving the capacity to purchase forward.

Debt is important because it enables businesses and households to increase **investment spending**. The underlying cost of investment spending is the time spent improving productive capacity, increasing productivity, and developing new products. Investment spending, when the associated amount of time spent is sufficient, causes productivity and productive capacity to increase and is critical to long-term economic growth.

Productivity improvement, the development of new products and services, and the production of goods, services, and other products require **material**, labor, and capital. Additional material, labor, and capital are generally needed to increase the rate of productivity improvement, new product development, and production output. Without debt, businesses need to save money before investment spending occurs, and the delay causes economic growth and vitality to decline.

Debt payments are dangerous because they reduce disposable income, or the amount of income that individuals, households, and businesses can use to purchase goods, services, and other products. For example, if a household's after-tax income from wage compensation, rent, investment profits, and any other income sources is \$100,000 and combined mortgage, car, and other debt payments are \$25,000 a year, then the household's disposable income is \$75,000 a year. If the household buys an RV and those loan payments are \$10,000 a year, then disposable income declines to \$65,000 a year and the capacity to purchase goods and services declines by \$10,000.

Debt used to increase investment spending or for the purchase of time-saving goods increases productivity, and thus income per unit of time worked, in the measured and unmeasured sector of the economy. The increase in income can more than offset the adverse effect of debt payments. Debt used to purchase **leisure-enhancing goods** or **leisure-enhancing services** or to fund government programs that do not cause productivity to increase is particularly dangerous because there is not an associated increase in income.

Debt, Economic Stimulus, and Short-Term Growth

Households, businesses, or government entities borrow money and make debt payments during every period of account. An economy is stimulated when the creation of debt exceeds debt payments and the difference is used to purchase product. Assuming that the entire increase in debt is used to purchase product, the total debt-driven economic **stimulus**, during any period of account, is the sum of the differences between the increased money borrowed and the increased debt payments within all households, businesses, and government entities. For example, if a household, during one month, borrows \$100,000, makes \$10,000 in debt payments, and uses the difference to purchase goods and services, the net effect on national economic output is \$90,000 in stimulus. If a speculator borrows \$100,000 and uses it to purchase part of a publicly traded company, and the company places that investment into savings, then the net effect on economic output is zero. However, if that company uses the \$100,000 investment to purchase tools, machines, or equipment, then the economy is stimulated by that amount.

As debt increases, the principal portion of debt payments also increases, so more money needs to be borrowed to have the same economic stimulus. For example, if a nation's debt increases by \$1 trillion and the principal debt payments during that period of account are \$10 billion, the net economic stimulus is \$990 billion. To maintain the \$990 billion of economic stimulus during the next period of account, the nation's debt must increase by \$1,010 billion if the debt payments increase to \$20 billion.

Leverage increases when the ratio of debt to income or debt to economic output increases. The burden of debt payments tends to increase when the ratio of debt to economic output increases. Continual increases in the debt-to-income ratio eventually become unsustainable. Unsustainable levels of debt eventually lead to **deleveraging**, or a reduction in debt. The iterative process of increasing annual borrowing and debt can continue for decades before that happens. Deleveraging during financial crises is associated with depressions or severe recessions.

Debt and Long-Term Economic Growth

Economic output is equal to time spent at work multiplied by the productivity of that time. Long-term growth has two primary causes, productivity improvement and a sustainable increase in time spent at work. Time spent at work that increases with the population is sustainable, but continual per capita increases in time spent at work are not sustainable. Therefore, economic growth that exceeds the effect of population growth and productivity improvement is not sustainable. Short-term, debt-driven growth is commonly caused by an unsustainable increase in the time individuals spend at work.

Economic output increases when people spend more time at work or when that time becomes more productive. The primary cause of short-term per capita growth is time spent at work. For long-term per capita growth, the main cause is productivity improvement. Please see the sections "Productivity,

Innovation and OPH” and “The Fundamental Equation of the Economics of Choice” for further explanation of long-term per capita growth.

Expansionary fiscal and monetary policy frequently causes short-term per capita growth through a debt-driven increase in demand. People spend more time at work to meet increases in demand, and this causes short-term economic growth. When the federal government uses debt to increase spending on new product, such as military equipment or infrastructure, people spend more time at work to meet the increase in demand for the product. If the federal government uses an increase in debt to fund increased social spending, then individuals throughout society spend time at work to meet the increase in demand. When the Federal Reserve lowers interest rates, people and businesses borrow and spend more, debt increases, and people spend more time at work to meet the associated increase in demand.

Over the short term, in conditions of financial stability, it is relatively easy to increase economic growth by expanding the use of debt. In the short term, economic output increases by the same amount whether expansionary fiscal or monetary policy leads to the purchase of a \$50,000 leisure-enhancing RV or a \$50,000 productivity-improving excavator. There is a significant difference in the long term.

Productivity increases with the successful use of debt to purchase new capital in the measured sector, or time-saving goods in the unmeasured sector of an economy. When time saved in the measured or unmeasured sector of an economy is used to produce additional goods and services in the measured sector of the economy, measured economic output and income increase, and the increase in income can more than offset the adverse effect of debt payments. For example, suppose a household or a laundry business borrows money to buy a new clothes dryer. The dryer reduces the time it takes to do laundry by one hour every week. If the hour saved, whether in the laundry business (the measured sector) or the household (the unmeasured sector), is spent producing a chocolate cake in the measured sector every week, the weekly measured economic output and income (income being composed of profits, labor income, and taxes paid) increases by the sales price of the cake. The increase in income offsets the adverse effect of debt payments without more time needing to be spent at work.

Debt is used to purchase goods, services, and other products. The demand for a product increases with purchases. Businesses purchase capital, and that capital, in conjunction with hiring more people, is used to meet the increase in demand. Economic output and income increase in the short-term with the consumption and production of more products. Unless productivity increases or more time is spent at work, debt payments eventually cause the purchase of goods, services, and capital to decrease. Over the long-term per capita economic output expands when increases in income from productivity gains and the sustainable expansion of productive capacity exceed the adverse effect of debt payments.

Example: How the Use of Debt Affects Short- and Long-Term Economic Output

The following scenarios illustrate why the increased use of debt always stimulates an economy in the short term but not necessarily over the long term. For simplicity, the assumptions are that there is no inflation, that no interest is paid on debt, and that all government and private-sector debt is repaid after one year. Economic output starts at \$1 trillion (\$1,000 billion).

In the first scenario, the federal government uses debt to increase retirement income by \$10 billion, and the recipients spend the entire \$10 billion of increased income on goods and services that do not increase productivity. Businesses borrow an additional \$5 billion to hire the people and purchase the capital needed to produce the goods and services to meet the \$10 billion increase in demand. Because economic

output increases with consumption and investment spending, economic output increases by \$15 billion during the first year, so the economy grows by 1.5 percent (15 billion is 1.5 percent of a trillion).

To maintain the retirement income, the federal government borrows an additional \$10 billion during the second year. The \$10 billion borrowed in the first year must be paid back during the second year. The economic stimulus is equal to the difference between the increased debt (\$10 billion) and the \$10 billion in debt payments, or zero. The \$10 billion increase in government debt-funded spending by the retirees is offset by a \$10 billion reduction in overall taxpayer spending because taxpayers had to pay that amount in taxes to repay the first year's debt. Because of investments made during the previous year, productive capacity is still sufficient; therefore, businesses do not need to invest during the current year. The net result is a \$5 billion decline in investment spending. Because of the one-year debt term, the businesses also repay the \$5 billion in debt. Economic output declines by \$20 billion in the second year because of a \$5 billion reduction in business investment, business debt payments of \$5 billion, and a \$10 billion increase in government debt payments. To summarize, economic output increased by \$15 billion the first year (i.e., economic output was \$1,015 billion) and then declined by \$20 billion (i.e., economic output was \$995 billion) the second year.

In the second scenario, the \$10 billion the government borrows is used to miraculously complete new infrastructure within one year, causing productivity throughout society to increase by 1 percent. As in the first scenario, the government also borrows \$10 billion in the second year, businesses borrow and invest \$5 billion during the first year and nothing during the second, and debt is financed for one year. Without the increase in productivity, economic output would decline by \$20 billion during the second year as it did in the first scenario. The new infrastructure, however, causes the time spent at transport to decrease, and that productivity improvement causes economic output to increase when the time saved is used to produce additional product. If the time spent at work is identical to that needed to produce the original output of \$1 trillion, the 1 percent gain in productivity causes a \$10 billion dollar increase in economic output in the second year.

To summarize, economic output is \$1,015 billion for both scenarios during the first year and \$995 and \$1,005 billion for scenarios 1 and 2, respectively, during the second year.

Long-term economic growth that exceeds the increase in population occurs with the development and application of improvements and new technology and, thereby, productivity improvement. Productivity improvement occurs with the process of **capital deepening**, which is explained in the section, "The Fundamental Equation of the Economics of Choice". Debt used to increase productivity via capital deepening causes long-term sustainable economic growth that exceeds the rate of population increase. Per capita income increases with such growth, and the increase in income offsets the adverse effect of debt payments.

Note that inflation does not change the adverse effect of debt payments and the need to use debt responsibly. Inflation transfers the burden of debt payments from those who borrow to those who save.

[The Long- and Short-Term Effects of Debt in the United States](#)

The following discussion does not consider the massive increase in monetary and fiscal stimulus that was implemented in 2020 to counter the effects of the novel coronavirus.

Income earned by individuals, households, or businesses and revenue received by government entities can be saved or used to purchase product. In the short term, increased savings cause a decrease in the purchase of goods and services and, therefore, economic output. Expenditures over the long-term

increase when those savings are used to purchase product. Over the short term, income is essentially enhanced when the increase in debt exceeds the increase in debt payments and any increase in savings. The following assessment does not consider the effect of a change in savings. It also does not consider changes in financial or foreign debt.

The American public wants economic growth, and expansionary monetary and fiscal policy is being used to accomplish that growth through increased debt. As shown in Figure 2, total government, business, and household debt, relative to gross domestic product (GDP), continues to increase. The continual year-over-year increases in debt are promoting year-over-year short-term growth. If the short-term use of debt increases productivity sufficiently, the increase in debt is sustainable. If the increase in debt is continuously used to expand year-over-year, leisure-enhancing expenditures, financial stability decreases, and the consequence will eventually be a severe economic downturn.

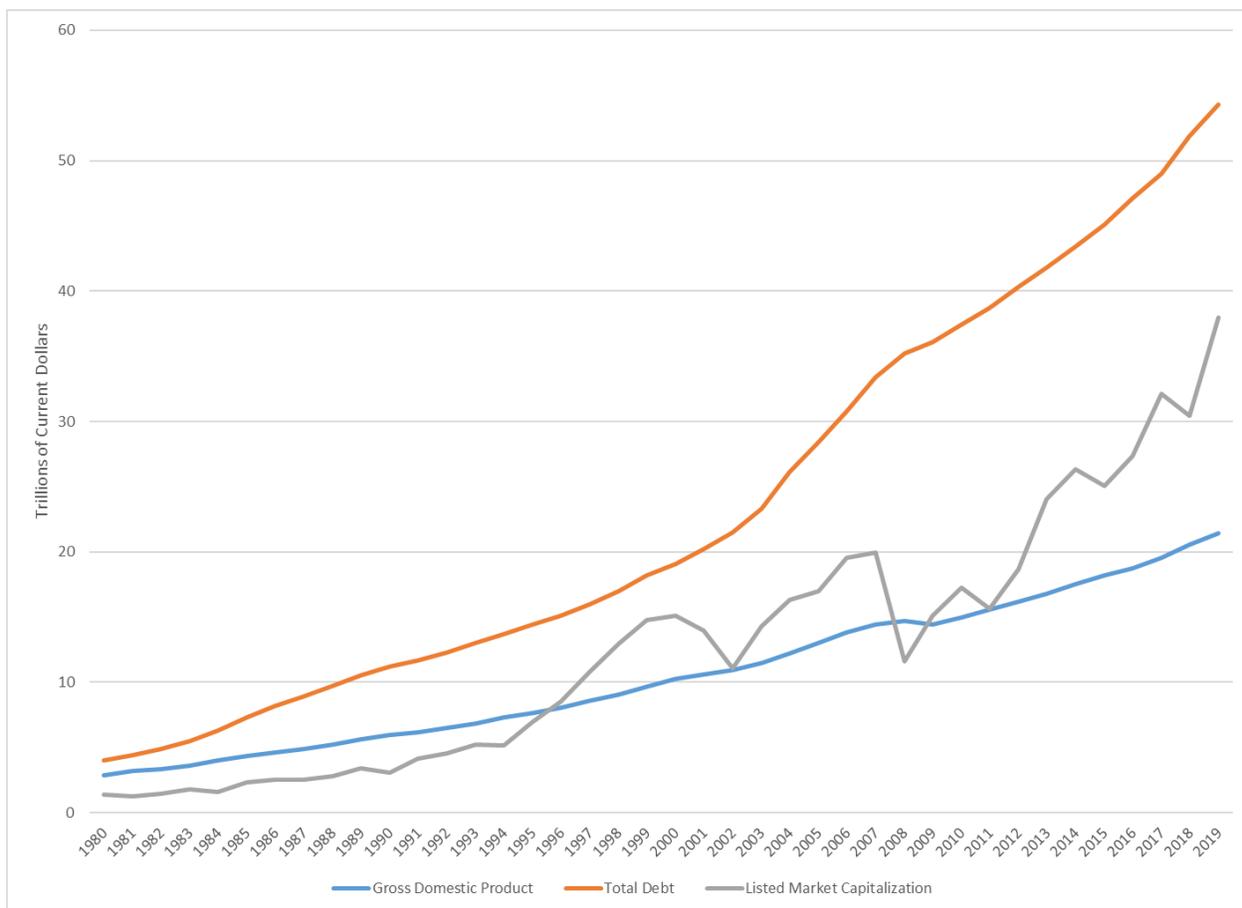


Figure 2. United States GDP, debt, and market capitalization. GDP data: Bureau of Economic Analysis, 2020. Debt data: Board of Governance of the Federal Reserve System 2020, "Flow of Funds". Listed market capitalization data: World Federation of Exchanges 2020; 2019 market cap estimated by Gerd Weyer.

Table 1 is an analysis of data from Figure 2, used to illustrate the effect of increased debt and total debt on economic growth. Total debt in the United States increased \$2.9 trillion between the end of 2017 and the end of 2018. The stimulus associated with increased debt is equal to this amount. The increase in debt is the total money borrowed by government entities, businesses, and households minus the principal debt payments made. Since the actual economic growth of \$1.1 trillion was less than the \$2.9

trillion in estimated debt stimulus, the economy would not have grown without the debt-related stimulus.

Table 1. The effect of increasing debt on U.S. economic output

Calendar Year		2017	2018	Analysis
GDP	Trillions of current US dollars	19.52	20.58	Gross Domestic Product: Source-BEA Table 1.1.5
Total Debt		49.00	51.90	The sum of Government, Business, Household, and Financial debt
GDP Increase			1.06	Real, inflation adjusted, economic output, or the production of goods and services increased by 2.9% in 2018. (Source: BEA Table 1.1.1) The 1.06 trillion dollar or 5.4 percent increase shown is comprised of the 2.9% increase in goods and services and a 2.5% increase in inflation.
Total Debt Increase			2.90	
Economic Stimulus			2.90	The economic stimulus is equal to the increase in debt. The 2.9 trillion dollar increase in debt caused economic output to increase by that amount. Economic output without the increased debt would have declined by 1.84 trillion dollars.

At the end of 2018, total debt in the United States was \$51.9 trillion. Principal and interest payments tend to increase with debt. Assuming that interest rates and debt terms do not change, the relative burden of principal and interest payments increases when individual or national debt increases faster than income. That is, a declining proportion of the income received can be used to purchase product, and a greater proportion must be used to make debt payments. As the burden of debt increases, the likelihood of default increases.

Monetary and fiscal policy is currently used to expand household, business, and government expenditures that are funded by debt, and this is causing economic growth in the short term. The long-term effect of this increase in debt, relative to that of 1981, might be significantly worse because of how debt is being used. The ratio of total debt to GDP was 1.37 in 1981 and 2.52 in 2018. In addition, the ratio of business debt to total debt declined from .37 in 1981 to .29 in 2018 (Board of Governors of The Federal Reserve System 2020). Assuming that business debt is typically used to increase productivity, whereas only a fraction of household and government debt is used that way, the present use of total debt, compared with debt use in 1981, might have a smaller positive effect on productivity and, therefore, capacity to make debt payments.

Carmen M. Reinhart and Kenneth S. Rogoff (2009), in their book *This Time Is Different: Eight Centuries of Financial Folly*, thoroughly analyze the causes of economic crises. All the financial crisis precursors listed in the following quotation currently exist in the U.S. economy. "This literature on financial crises suggests that markedly rising asset prices, slowing real economic activity, large current account deficits, and sustained debt buildups (whether public, private, or both) are important precursors to a financial crisis."

[For Economists and Those Who Want a More In-Depth Understanding](#)

[The Fundamental Equation of the Economics of Choice](#)

Individuals have 24 hours a day for work, leisure, and sleep. If 8 hours are spent sleeping, then 16 hours are spent at leisure and work. Work is divided between time spent at consumption, production, and improvement. Economic output is equal to time spent at production multiplied by the productivity of

that time. Productivity, in all sectors of society, improves as a result of time spent at improvement. Productivity and opportunities for leisure and consumption increase because of time spent at improving efficiency throughout society.

The productivity of time spent at improvement increases with human capital. Human capital increases with time spent improving skill and knowledge. Time spent improving productivity generally becomes more effective with increased skill and knowledge.

It takes time to create and implement productivity improvements. The time spent at improvement is not available for leisure and the production or consumption of goods and therefore causes OPH to decline in the short term. The successful implementation of productivity improvements causes productivity and thereby OPH to increase sometime in the future.

For example, assume it takes 100 hours to produce a car. Time is spent at improvement to reduce the time it takes to produce the car. In the short term, 110 hours of work are needed to produce the car and spend 10 hours at improvement. The 10 hours spent at improvement are not available for leisure or production. Productivity increases if the time that it takes to produce the car declines to 95 hours because of the 10 hours previously spent at improvement. The 5 hours of saved time are available for leisure, consumption, production, and improvement. OPH increases when the 5 hours are used to enhance leisure or produce more goods and services. Dedication of the 5 hours to improvement, when successful, causes productivity—and, thereby, the opportunity to pursue leisure or the capacity to consume—to increase sometime in the future.

Productivity increases with capital deepening. Capital deepening is a recursive process that occurs because of the interaction of two related processes: the introduction of new or improved capital and the increased use of that capital throughout society. More precisely, capital deepening occurs when the **inherent productivity of capital** increases and **capital diffusion** occurs. The inherent productivity of capital increases when capital's usefulness increases or when the capital is produced in less time.

A capital's usefulness increases with better fit, form, or function. For example, a broom's fit improves when the bristles catch the waste that needs to be moved more effectively. The broom's form, or physical size, is better when it can be stored more easily or a size decrease enables more efficient access to dirt, and function, or the number of tasks it can be used for expands when the bristles can be readily replaced so that additional surfaces can be swept with greater efficiency. Innovation or time spent at improvement causes the inherent productivity of capital to increase.

Capital deepening occurs as follows: Time is spent improving the design and manufacturing processes of existing capital or introducing new capital. As a result, the inherent productivity of capital increases. Capital diffusion occurs when more capital with greater inherent productivity is produced and is used to produce goods and services. This diffusion increases productivity, subject to **diminishing returns to capital**. As productivity increases, production time is saved, and time for leisure, consumption, the production of additional goods and services, and improvement increases. The development of capital with even greater inherent productivity occurs when enough time is spent at improvement. Diffusion of the improved capital continues until better solutions become available or diminishing returns to capital make further investment unprofitable. Capital deepening and productivity continue to increase with the intertwined and recursive process of increasing diffusion and the increasing inherent productivity of capital.

The following contrived scenario illustrates the process of capital deepening. Imagine a society that spends time using shovels to prepare land for agriculture, and additional time developing a rototiller. The introduction of the rototiller represents an improvement in the inherent productivity of capital because it reduces the time needed to prepare the land. After the rototiller is developed, productivity increases with diffusion, or the increased use of rototillers. The number of farmers limits the productive use of additional rototillers. Time is spent producing rototillers, using those rototillers to prepare the land, growing agricultural products, and developing farm tractors. The introduction of tractors represents a further increase in the inherent productivity of capital. Productivity and OPH continue to improve with the diffusion of those tractors throughout society.

Total time spent working (T_T) within a society, is divided among time spent at production (T_g), producing capital (T_k), and improvement (T_e). Time spent producing capital corresponds with diffusion and time spent at improvement causes productivity through the inherent productivity of capital and other methods to increase. Time spent producing capital and making improvements reduces the time for leisure or production, and therefore OPH, in the short run. When successful, it causes productivity and, thereby, OPH to increase in the future.

Economic output (GDP) is equal to time spent at production (T_g) multiplied by the productivity of that time (Pr_g). Productivity is a function of time spent producing capital (T_k) and time spent making improvements (T_e). Therefore, $GDP = (T_g)(Pr_g) = H[f(T_g, T_k, T_e)]$. In that equation, H represents the effectiveness of time spent producing goods, producing capital, and making improvements. H is a function of human capital, the availability of natural resources, geopolitical and socioeconomic condition, national laws and regulations, pollution, societal belief systems, and other factors. Because it generally takes far less time to copy an existing product than to invent a new one, improvement time is far more productive when spent copying rather than inventing. Therefore, the availability of products to copy generally has a positive effect on H_e in developing nations.

The amount of goods and services produced in an economy during a given initial period (Y_1) is equal to the time spent producing goods and services (T_{g1}) multiplied by the productivity of that time (Pr_{g1}). Economic output during an equal period sometime in the future (Y_2) is equal to the current level of output (Y_1) plus the change in output (ΔY). Output in the future is also equal to the time spent at production during that future period (T_{g2}) multiplied by the productivity of that time (Pr_{g2}). Productivity is a function of time spent producing capital (T_{k3}) and improving efficiency (T_{e4}) during the current period and during previous periods.

Time is generally spent producing capital during every period of account, but the time spent producing capital during one period of account frequently does not cause productivity to increase until a later period of account. Time spent producing the capital, such as buildings and machines, used during the current period of account may have occurred during the current period and multiple previous periods of account. Time spent producing the capital (T_{k3}) used to produce current (Y_1) or future economic output (Y_2) generally occurs during different periods of account, so the subscript 3 is used.

Productivity is a function of time spent at capital production (T_{k3}) and improvement (T_{e4}) during the current and previous periods of account. Time spent at improvement may occur during periods of account that are different from time spent producing goods, services, and capital, so time spent at improvement is represented by the subscript 4. Time developing new technology, for example, may

have been spent a decade before the technology is used in the goods, services, and capital being produced.

Over time, capital wears out or becomes obsolete. To offset the effects of depreciation and obsolescence, a certain amount of time needs to be spent making improvements (T_{em}) and replacing capital (T_{km}). Capital deepening occurs when the time spent producing capital and improving efficiency more than offsets the effects of depreciation and obsolescence.

Productivity increases when the time spent producing capital (T_{k3}) and making improvements (T_{e4}) exceeds the time needed to offset the effects of depreciation and obsolescence. Assuming that there is a linear relationship between the increase in productivity and the difference between the time spent at improvement and time needed to maintain ($T_{e4} - T_{em}$), and time spent producing and maintaining capital ($T_{k3} - T_{km}$) the associated effect on increased productivity can be expressed as $(H_k)(T_{k3} - T_{km})$ and $(H_e)(T_{e4} - T_{em})$.

Equation 1 embodies the fundamental relationship among natural resources, time spent working, and economic output. Economic output is equal to time spent at work multiplied by the productivity of that time. Economic output sometime in the future (Y_2) is equal to the sum of current economic output (Y_1) plus the change in output (ΔY) or the time spent producing goods and services ($T_{g1} + \Delta T_g$) multiplied by the productivity of that time ($Pr_1 + \Delta Pr$). The change in productivity (ΔPr) is determined by time previously spent producing capital ($T_{k3} - T_{km}$) and making improvements, ($T_{k3} - T_{km}$) as well as the effectiveness of time spent at work. The effectiveness of time spent at work is determined by factors H_e and H_k .

Equation 1

$$Y_2 = Y_1 + \Delta Y = (T_{g1} + \Delta T_g)(Pr_1 + \Delta Pr) = (T_{g1} + \Delta T_g)[Pr_1 + (H_k)(T_{k3} - T_{km}) + (H_e)(T_{e4} - T_{em})]$$

If the total time spent working, and the division between producing goods and services, producing capital, and improving productivity is either estimated or tracked over time, that information can be used to estimate the factors H_k and H_e . Once the factors H_k and H_e are known and understood, future economic output might be predicted from the way's individuals are spending their time. Policy decisions should become better with an increased understanding of the relationship between time spent working, natural abundance, economic vitality, and OPH.

The change in economic output (ΔY) is a function of the change in productivity ($\Delta Pr = Pr_2 - Pr_1$) and time spent at work ($\Delta T_g = T_{g2} - T_{g1}$), and is equal to $(Pr_1)(\Delta T_g) + (\Delta Pr)(T_{g2})$, where $(Pr_1)(\Delta T_g)$ is equal to the original level of productivity multiplied by the change in time spent at work, and $(\Delta Pr)(T_{g2})$ is equal to the time spent at production during the second period of account multiplied by the increase in productivity. The increase in productivity (ΔPr) is equal to $(H_k)(T_{k3} - T_{km}) + (H_e)(T_{e4} - T_{em})$. Therefore, the change in economic output is equal to $(Pr_1)(\Delta T_g) + [(H_k)(T_{k3} - T_{km}) + (H_e)(T_{e4} - T_{em})](T_{g2})$. If the time spent at production (T_g) does not change, then the change in economic output is equal to the change in productivity $(H_k)(T_{k3} - T_{km}) + (H_e)(T_{e4} - T_{em})$ multiplied by the time spent at production. If productivity stays constant, then the change in economic output is equal to productivity multiplied by the change in time spent at work. Equation 2 shows economic growth expressed as a ratio of increased output to original output ($\Delta Y/Y_1$).

Equation 2

$$\Delta Y/Y_1 = \{(Pr_1)(\Delta T_g) + (Pr_1[(H_k)(T_{k3} - T_{km}) + (H_e)(T_{e4} - T_{em})](T_{g2})\}/Y_1$$

Equation 3 is the growth accounting equation that is currently used by economists to explain long-term economic growth.

Equation 3

$$\Delta Y/Y_1 = (\text{labor share} \times \text{labor growth}) + (\text{capital share} \times \text{capital growth}) + (\text{TFP})$$

There is much similarity between equations 2 and 3. The growth accounting equation (Equation 3) attributes economic growth to three components, labor, capital, and total factor productivity (TFP). TFP is also referred to as technological progress, multifactor productivity, and the Solow residual, in honor of Robert Solow (Hulten 2001). Labor, capital, and technological progress are also important elements in the Economics of Choice model. Economic growth in the Economics of Choice model, as shown in Equation 2, is determined by the increase in labor (time spent at work- ΔT_g) and the productivity of that time. The productivity increase is determined by a combination of increased capital and time spent at improvement, or innovation, which causes technological progress and all other improvements within society.

The Income Distribution Equation

If there are no imports or exports, economic output and income are equal. The total benefit of time spent at production is equal to the number of goods and services produced within society. The proportion of the total number of goods and services that an individual or household can purchase, or **benefit received**, is equal to relative individual or household income earned as labor compensation, profit, or transfer, during any period of account, such as a day or year, multiplied by the total benefit. Productivity gains, assuming that the per capita time spent at work stays constant, cause the total benefit to increase. Competition causes the total benefit to be distributed among wage earners, business owners, and consumers. Productivity improvement, because of competition, generally causes the purchasing power of individuals to increase.

The following simplified example illustrates why purchasing power generally increases with productivity. A boy obtains free supplies from his parents for a lawnmowing business, pays a friend \$10 per mowed lawn, and charges his customers \$20 per mowed lawn. His friend mows 1 lawn per hour, 4 hours a day. The boy's daily sales are \$80 (4 lawns at \$20 a lawn). His costs, equal to his friend's income, are \$40 (\$10 \times 4 lawns). His profit is \$40 (\$80 dollars in sales minus the wage cost of \$40). Then productivity increases with the receipt of a new lawnmower, and the time needed to mow a lawn declines to a half-hour. The purchasing power of the boy, his friend, or his customers increases when one or more of them receives the benefit of increased productivity. Profit and wage income increase from \$40 to \$80 (wages = \$10 per lawn \times 8 lawns, and profits = sales of \$160 – the \$80 in wages) if the customers receive none of the benefit. If both profit and wage income stay at \$40 a day, the entire benefit of productivity improvement is received by the customer, since the price for mowing a lawn declines from \$20 to \$10.

The following equation, derived from the analysis of income statements, relates productivity to the distribution of benefit among members of society. Some individuals in society produce the goods that all

individuals in society consume. The benefit received by those who produce the goods consumed by all changes with productivity, or economic output per unit of time, and relative benefit received.

Equation 4

$$\text{Benefit received by those who produce goods} = \text{Productivity} / (1 + F + I + P + S + TX)$$

In this equation, F is the benefit received by those who control natural resources, and charge a fee for access to them, divided by the benefit received by those who produce goods and services. The factor I is the ratio of the benefit received by those who spend time at improvement to the benefit received by those who produce goods and services. Similarly, P is the factor associated with business profit, S relates to the benefit received by speculators, and TX corresponds to taxes paid. If the ratios F , I , P , S , and TX are less than 1, the relative benefit received by those who produce goods and services is greater than the benefit received by those who control natural resources, spend time making improvements, own businesses, make profits by speculating, or receive the benefit of transfer via taxes. The relative increase in benefit received, per unit of time worked, is the same for all individuals in society when the ratios F , I , P , S , and TX stay constant and productivity increases.

For example, assume that six persons share the benefit of 10 buckets of blueberries picked by one person in a day. That person, the picker, keeps 5 buckets of blueberries, and the other members of the society, get the 5 remaining buckets of blueberries. One of those members controls natural resources, one (the improver) spends time at improvement, one (the owner) owns the blueberry business, one is a speculator, and one receives the tax benefit. If the remaining 5 buckets are distributed evenly, each other person gets 1 bucket of blueberries, and F , I , P , S , and TX are each $\frac{1}{5}$ because the picker obtains 5 times as many blueberries as each of the others.

$$\text{Benefit received by the picker} = 10 / (1 + \frac{1}{5} + \frac{1}{5} + \frac{1}{5} + \frac{1}{5} + \frac{1}{5}) = 10/2 = 5$$

Then the time spent at improvement causes the productivity of time spent picking blueberries to increase from 10 to 20 buckets of blueberries per day. If the factors F , I , P , S , and TX all remain at $\frac{1}{5}$ then relative income remains the same, the picker keeps 10 buckets of blueberries, and each other person gets 2 buckets of blueberries per day instead of 1.

$$\text{The benefit received by the picker} = 20 / (1 + \frac{1}{5} + \frac{1}{5} + \frac{1}{5} + \frac{1}{5} + \frac{1}{5}) = 20/2 = 10$$

The improver's share can be found using the ratio I , or the benefit received by the improver relative to the picker. $I = \text{Improver} / \text{Picker} = \frac{1}{5} = \text{Improver} / 10$. The benefit received by the improver = $10(\frac{1}{5}) = 2$

If instead the improver obtains the entire benefit of the increase in blueberry production, from 10 to 20 buckets per day, that person receives 11 buckets of blueberries. If the picker still receives 5 buckets of blueberries per day, then the factor I is equal to 2.2, the benefit received by the improver divided by the benefit received by the picker ($11 \div 5 = 2.2$). Plugging this information into Equation 4 gives: $5 = 20 / (1 + 2.2 + F + P + S + TX)$

To summarize, although the picker's productivity increased from 10 to 20 buckets a day, the number of buckets of blueberries she receives every day remains 5, whereas the person who invented the improvement can now purchase 11 buckets of blueberries a day instead of 1. The remaining persons share the remaining 4 buckets of blueberries per day. If the remaining blueberries are shared equally, the factors F , P , S , TX are each still equal to $\frac{1}{5}$.

For a relevant example consider the relationship between increasing crude oil scarcity and OPH. Using the notation in Equation 4:

- F is the ratio of benefit received by countries or entities that control access to oil fields relative to the benefit received by those who locate, extract, and transport crude oil to the point of use.
- P is the profit made by companies such as Exxon-Mobile, relative to the benefit received by those who locate, extract, and transport crude oil to the point of use.
- S is the profit made by speculators relative to the benefit received by those who locate, extract, and transport crude oil to the point of use.
- I is the income earned by individuals who spend time at improvement relative to the benefit received by those who locate, extract, and transport crude oil to the point of use.
- TX are the taxes paid relative to the benefit received by those who locate, extract, and transport crude oil to the point of use.

The productivity of locating, extracting, and transporting crude oil to the point of use, as explained in the article “Natural Resources and OPH,” declines when the effect of increasing crude oil and other resource scarcity is not more than offset by time spent at improvement. Using Equation 4, if productivity declines, and relative income stays constant, then the OPH for those who control natural resources, profit, speculate, make improvements, benefit from taxes, and extract crude oil declines.

If the time that it takes to produce crude oil declines and wages, extraction fees, speculation profit and taxes all remain constant then the cost of production increases and corporate profits decline unless crude oil prices increase. OPH for consumers decreases when real prices increase. Over the long-term, market forces will generally cause a decline or increase in OPH to be distributed between all entities.

Equation 4 can be expanded to include additional segments of society. For example, the benefit received by individuals who work in the financial sector could be separated and included.

The distribution among all members of a society of the goods and services produced within the society is of vital importance. Determining an equitable distribution of income involves answering the following questions and many more:

- Should the benefit of productivity increases be distributed equally?
- Is equal distribution equitable?
- What proportion of the goods produced in society should go to speculators, business owners, entrepreneurs, production workers, inventors, retirees, and so on?

[The Production Function](#)

A production function in economics is a statement of the relationship between production inputs and outputs. The production function used in the Economics of Choice states that economic output (Y) is a function of natural resource abundance (N) and time spent at work.

$$Y = f(N, T)$$

Mainstream economic thought holds that economic output (Y) is a function of technology (A), capital (K), and labor (L).

$$Y = Af(K, L)$$

These two production functions are related: labor (L in the mainstream function) is the same as time spent at production (an element of T in the Economics of Choice function), and capital is a function of time previously spent at improvement and producing capital from natural resources.

The mechanism of growth described in the Economics of Choice connects the fundamental relationship among labor, resource scarcity, and OPH to the growth accounting equation and mainstream economic thought in general. Time spent at work, in the Economics of Choice, is divided among the provision of goods and services, the production of capital, and improvement. Economic output is equal to time spent at work, providing goods and services (i.e., labor), multiplied by the productivity of that time. The productivity of time spent at production is a function of time previously spent at improvement and capital production. Over time, systems of production become better, capital accumulates, and technology advances because of time dedicated to improvement. Continuous long-term growth in both per capita economic output and OPH occurs when individuals dedicate enough time to improvement and the production of capital, goods, and services.

Improvement of the NIPA Tables and the National Income Identity

The choices that individuals throughout society make, and how we spend our time, is a primary determinant of economic vitality and growth. How people divide their time between consumption, leisure, production, and improvement has a profound effect on OPH. The **national income and product accounts (NIPA)** could be reorganized to help economists and others increase understanding of how individuals are spending their time. One suggestion is to divide the consumption of durable goods between leisure-enhancing goods and time-saving goods so that relative changes can be tracked over time.

The national income identity, $GDP = \text{consumption} + \text{investment} + \text{government} + \text{net exports}$, is used to calculate economic output in the measured sector of the economy. The formula's role suggests that its terms, including investment, should include only spending that has a direct effect on measured economic output. Currently, however, the NIPA tables and the national income identity include housing in investment spending. This practice should be changed because houses do not cause an increase in productivity or productive capacity, in the measured sector of the economy.

Homes do improve productivity in the unmeasured sector of society and enhance leisure. Homes in the unmeasured sector of the economy are the equivalent of factories in the measured sector of the economy. Time-saving goods, such as knives, cutting boards, stoves, refrigerators, table saws, and laundry machines, combined with electrical outlets and central heating within households, enable the production of a greater variety of goods and services in less time.

Homes are also used to enhance leisure. Hot tubs, master suites with his and her walk-in closets, pool tables, and formal dining rooms enhance leisure and not productivity in the measured or unmeasured sector of the economy.

Time-saving goods such as induction stove tops are included in consumption spending when individuals purchase them from a store, and investment spending when they are included in the price of a new home. Cars, like homes, enhance leisure and cause productivity in the unmeasured sector of the economy to increase. Yet a household's purchase of a car is included in consumption spending, whereas

the purchase of a house is included in investment spending. One option for improved understanding in the NIPA tables is to completely separate investment spending that improves productivity in the measured sector from the purchase of time-saving goods that improve productivity in the unmeasured sector.

Key Definitions

benefit received: The number of goods and services an individual or household can purchase. The benefit received increases with total benefit and relative income. Assuming that there are no imports or exports, the sum of income earned from labor compensation, profits, and transfer by all individuals within society is equal to the total benefit. The benefit received is equal to purchasing power when there is no debt or savings.

capital: Products, including buildings, infrastructure, equipment, machines, and tools, that businesses or governments use to produce goods and services.

capital deepening: The increased per capita use of capital by means of capital diffusion and the inherent productivity of capital.

capital diffusion: Increased per capita use of capital with constant inherent productivity of capital.

chain of provision: The operations performed to transform natural resources into goods and services. In modern societies, the operations to produce one good or service are usually performed in many businesses. The production of capital used to produce a good is part of the chain of provision.

consumption services: Unless stated otherwise, the term *services*, in this document, refers to consumption services. Services purchased by households or individuals. Consumption services are either leisure-enhancing or time saving. Services provided to businesses are part of the chain of provision, contribute to the production of goods and services, and are not consumption services.

diminishing returns to capital: When the inherent productivity of capital is constant, the increase in economic output per unit use of additional capital declines.

deleveraging: The widespread reduction of government, business, and household debt that typically occurs during a financial crisis. As the ratio of debt to economic output or household and business income increases with the repeated use of debt, it generally becomes increasingly difficult to make the associated payments, and deleveraging occurs when government, businesses, and households default on their loans.

expansionary monetary policy: Action, such as lowering interest rates and purchasing assets, taken by central banks, or the Federal Reserve in the United States, to stimulate the economy.

expansionary fiscal policy: Policy such as reduced taxes and increased spending implemented to increase economic output.

goods: Product purchased by private individuals or households. Goods are produced by individuals, businesses, and government entities in the measured and unmeasured sectors of society.

human capital: The capacity and propensity, embodied in a group of individuals, to produce and improve. Capacity corresponds to knowledge and skill, whereas propensity consists of desire, passion, and commitment to improvement and production.

inflation: A general increase in prices or a decrease in the purchasing power of a given quantity of money. For example, inflation might cause the number of apples that can be purchased with \$10 to decline from 5 to 2. (Inflation in this example causes the price of an apple to increase from \$2 to \$5.)

inherent productivity of capital: The variety and speed of operations that can be performed as a result of using a specific tool, machine, or building and the efficiency of capital production. The inherent productivity of capital changes when capital is produced more or less efficiently or if there is a change in the variety or number of operations that can be performed, using that capital.

investment spending: Expenditures directed at improving products, productivity, or productive capacity or developing new goods or services.

labor: Time spent producing goods and services. In the Economics of Choice, time spent doing work is divided between time spent producing goods, time producing capital, and time improving productivity. Time spent at work producing goods and services is equivalent to labor. Time spent at work is also divided between production and consumption.

leisure-enhancing goods: Goods purchased to enhance leisure.

leisure-enhancing services: Consumption services that enhance leisure.

leverage: The use of debt to purchase more product. Particularly debt used to speculate.

material: Product, components, or natural resources that are consumed during the production process. Steel, wheels, bearings, breaks, cable, and bolts are all materials consumed or used in the production of a bicycle.

measured sector: Economic output produced by businesses and government entities. GDP as measured by the U.S. Bureau of Economic Analysis using the national income identity $GDP = \text{consumption spending} + \text{investment spending} + \text{government spending} + \text{net exports}$.

national income and product accounts (NIPA): A comprehensive record of income generated and goods and services sold in the United States compiled by the Bureau of Economic Analysis.

nominal income: The sum of real income plus increases in measured income associated with inflation. Per capita income and purchasing power increases when the per capita production of goods and services increases. Real per capita income does not increase if the per capita production of goods and services stays constant and prices increase because of inflation.

nominal growth: The sum of real growth plus increases in measured growth associated with inflation.

opportunity to pursue happiness (OPH): Individual capacity to purchase goods and services and spend time at leisure. Purchasing power and leisure are the two dimensions of OPH.

product: Goods, services, material, capital, and infrastructure. This is a general term that encompasses all physical items produced or services provided by businesses, individuals, or government entities.

productivity: Economic output per unit of time. Productivity increases when the time it takes to produce or consume a good or service declines. The number of goods or services produced or consumed during a time period; the number of identical tasks that can be completed in a time period.

purchasing power: The capacity to buy goods and services. Purchasing power increases when a greater quantity or variety of goods and services can be purchased.

real growth: Change in output caused by increased or decreased volume of goods and services produced rather than inflation.

real income: Increases in income that cause the capacity to purchase goods and services to increase. Increases in income that are not associated with inflation.

stimulus: Economic inputs that promote the increased production of goods and services. Increased debt and increased money supply are two examples of stimulus. Reduced interest rates are another.

time-saving goods: Goods used to produce other goods or services in the unmeasured sector of the economy. Time-saving goods in the unmeasured sector of the economy serve the same function as capital in the measured sector. Lawn mowers and dishwashers are two examples.

time-saving services: Consumption services that save individuals or households time.

total benefit: The sum of all goods and services produced within a society during a time period.

transfer: The receipt of purchasing power or money by means of gifts or social programs without doing work.

unmeasured sector: Economic output that is not included in the measured sector. Economic output produced within households.

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