Climate change, environmental degradation, and rising inequality, are the outcomes of an economic system that is fixated on maintaining economic growth. Forecasts reveal that the current rate of economic growth, projected into the future, will lead to ecological, climate, and economic disaster. However, trying to curb that growth could result, at least in the short term, in a severe economic and social crisis with rising unemployment and increased poverty.

This thesis will seek to address how a transition to an economy that respects ecological limitations and drastically reduces emission of greenhouse gases can be achieved while maintaining high employment, ensuring necessary government functions, and reducing poverty. Such a shift will require changing the paradox presented by the growth-oriented economy and moving towards a steady state economy through the alteration of some essential economic and social factors. Crucial to this thesis is the analysis of key variables of the economy and how they can be manipulated towards achieving a steady state economy while keeping employment, government spending, poverty, and greenhouse gas emissions at reasonable levels. Identifying these factors, describing how they can be manipulated, while analyzing the cost/benefit of their manipulation, can contribute to the discussion of how to re-focus our economic system towards fostering well-being for current and future generations.
Introduction

In the modern age, as well as a large part of recent history, the production and exchange of goods and services have been a crucial determinant of human well-being. The economy is the main force that affects people on an everyday basis. It is the force that for centuries has shaped the institutions of human society, and is either used as a tool for control or as an avenue for individual and collective flourishing.

The level of economic, population, and technological growth achieved since the industrial revolution has brought billions of people out of poverty and enabled considerable gains in human well-being. Humans, once subjected to the whims of the larger planetary ecosystem, now dominate the planet using the power of thousands of years of stored energy in the form of fossil fuels. This harnessing of fossil fuel enabled exponential growth to be achieved in population, economic activity (GDP), and technological advancements, but also in CO2 concentration in the atmosphere, biodiversity loss, and resource consumption. While this discovery and use of energy propelled humanity to achieve some immensely positive gains, growth in economic output does not lead to continuing increases in well-being. People living in industrialized countries that have passed a certain threshold of income and affluence generally do not experience proportional increases in happiness and well-being as the economy continues to grow. What then, is the justification for continuing economic growth?

The resource consumption, environmental degradation and climate change that result from this growth are seriously threatening the ability of human civilization to flourish on this planet. An economic system that rewards short-term thinking is no longer an option under the conditions of these long-term trans-generational problems. Questioning the growth paradigm and moving towards an economic system that respects the limits of the closed earth system is a necessity for the evolution of the economy and human society, and of the discipline of economics.

As calls for growth continue, evaluating the prospects of continued economic growth within fixed ecological systems with a finite amount of resources is an extraordinarily important task. The problems of un-restrained economic growth are foreseeable and avoidable. Policy makers must decide if change will be avoided and the consequences faced, or if the precautionary principle will be adopted and action is taken before the problems become irreversible. If the challenges posed by growth that threaten the ground on which our economic structure stands are accepted by policymakers, the focus of economic policy, instead of being on growth of the economy, becomes a question of how to most efficiently use the resources, energy sources, and services contained within the earth system, while maintaining our total stocks at regenerative levels.

In this paper, the problems associated with economic growth are outlined, the steady state economy alternative model to growth is described, and policy goals to ease the transition are enumerated. Under the current state of globalization, the world economy is highly interconnected and the problems and implications of growth are global in scale. This analysis does not focus on a specific national economy, but instead on the growth based economic model that originated in western industrialized countries, which has since been adopted by most countries around the world and by international economic institutions. The purpose of this thesis is to argue that there is a viable alternative to the problematic growth based economic model, and by manipulating a few economic and social variables, a relatively smooth transition to an alternative path is possible.
Part 1—Growth Dominated Ideology

Growth is deeply embedded into the structure of the current economic system. Feedback loops tend to send the economy going in two directions, towards either a growing economy or downward spiral. When an economy is expanding, money flows into investment and consumption, jobs are created and income expands, further increasing consumption and investment. When the economy is contracting, the opposite occurs. Consumption and investment decline, jobs are lost, incomes decline, furthering decreases in investment and consumption. This phenomena, referred to as the “boom-bust cycle” of economies, is managed through monetary and fiscal macro-economic policies that attempt to reduce the severity of the swings and keep the economy under long-term steady growth.

Political economists have noted the presence of the boom bust cycle of the economy for centuries, an analysis that helped weave growth into the social logic of the economy. When recessions or depressions are occurring, the effects on peoples’ lives are severe, and the natural reaction is to want to stop the downward spiral and return to a period of expansion or growth. Leaders, politicians, and policy makers, under the pressure of getting re-elected or avoiding any threat to their power, attempt to keep the economy in expansion and maintain a stable level of growth. This enables a rise in the standard of living for the citizens of their countries and keeps the engine of the economy moving in a “positive” direction.

Government leader’s responsibility for economic growth is a fairly recent development that occurred as the result of the Great Depression. Since the end of the Second World War, economic growth has been the dominant ideology behind economic policy in the industrialized and developing world. It was embedded into the institutions created in the decades following the war, most notably the OECD, World Bank, International Monetary Fund (IMF), and more recently the World Trade Organization (WTO), and continues to be thought of as the most reliable solution to solving the world’s problems like poverty, unemployment, environmental degradation, etc. Even in the former “communist” Soviet Union, calls for growth were reiterated, as Nikita Khrushchev bellowed, “Growth of industrial and agricultural production is the battering ram with which we shall smash the capitalist system” (McKibben, 2007). Across the world politicians have echoed the calls for growth and championed the use of Gross National Product (GNP) and Gross Domestic Product (GDP) as a measure of economic power and health, making it a national goal to increase GNP and GDP as much as possible. Policies for achieving economic growth in GNP and GDP were developed using David Ricardo’s theory of comparative advantage and spread around the world under the guidance of international economic institutions like the World Bank and IMF. The ideas of the growth economy, sold as a science by academic and government institutions, penetrated the economic policy of many countries across the world. The consensus that emerged among the international community that national economies should work together to achieve the highest possible amount of economic growth led to the biggest expansion of the world economy ever experienced, creating an eightfold increase in global economic output between 1950 and 2005 (World Trade Organization, 2008).

Prior to the post-war consensus on economic growth, theories developed by the classical economists of the 18th century questioned the relationship between economic growth and ecological limits. Classical economist John Stewart Mill, in his famous essay titled “The Principles of the Political Economy”, wrote:
“The increase of wealth is not boundless. The end of growth leads to a stationary state. The stationary state of capital and wealth… would be a very considerable improvement on our present condition….a stationary condition of capital and population implies no stationary state of human improvement. There would be as much scope as ever for all kinds of mental culture, and moral and social progress; as much room for improving the art of living, and much more likelihood of it being improved, when minds ceased to be engrossed by the art of getting on”.

Thomas Malthus, another classical economist and philosopher, made the prediction that growth in population always runs faster than growth in the resources available to feed and shelter people, leading to an inevitable decrease in population (Jackson, 2009). Malthus was incorrect in his prediction because he wasn’t able to foresee the important part that technology would play in allowing the throughput of resources to increase faster than population growth, exemplified by the fact that the world economy is now 70 times bigger and the population six times bigger (Jackson, 2009). In spite of Malthus’ prediction not holding true for the last 200 years, his warnings should not go unnoticed because there is simply no guarantee that technology will always allow resource throughput to outpace population growth.

Questions of growth resurfaced in the 1960’s during the emergence of the ideas that spawned the modern environmental movement. Kenneth E. Boulding, in his acclaimed 1968 essay *The Economics of the Coming Spaceship Earth*, compared the functioning of the economy to a cowboy with a limitless frontier on the horizon, always able to move and explore when things get difficult. He argued that humans had reached a point where the frontier has been fully explored and the economy now exists in the conditions of a closed system. In 1972, the book *Limits to Growth* summarized a study done by a group of researchers that used computer modeling to predict trends in “accelerating industrialization, rapid population growth, widespread malnutrition, depletion of nonrenewable resources, and a deteriorating environment” (Donella H. Meadows, 1972). The models showed that humanity was paced for a sudden decline in population and industrial capacity within the next 100 years based on the idea of ecological overshoot (Donella H. Meadows, 1972). Ecological overshoot is a phenomenon when a population exceeds the carrying capacity of an ecosystem. The consequence of this phenomenon is a decline in numbers until the populations demand on the ecosystem reach a level that can be assimilated by the ecosystem.

Growth economists of the 19th and 20th century dismissed warnings about the limits to growth from political economists of the 18th century, and viciously attacked the resurgence of those questions beginning in the 1960’s. Their arguments centered on the fact that no ecological limits had been reached thus far, and stopping growth would be an unnecessary sacrifice of prosperity caused by alarmists. Growth skeptics argued back that the economy only achieved such heights by externalizing costs and draining natural capital. Since Boulding’s assertion that the economic “frontier” was gone, the validity of his argument has become increasingly apparent as shown through the following problems associated with exponential growth.

**Part 2—Problems with growth**

**Population, Affluence, and Technology**

The problem of over population is a difficult and contentious issue. The Human population currently stands just above 7 billion, with expectations to rise to around 9 billion by 2050 (H. Charles, 2010). The issue with such a large population is that with a fixed amount of
resources, there are tradeoffs between the level of population and the level of affluence. Nine billion people aspiring to western style level of affluence simply is not sustainable or physically possible. The larger the population, the faster the ecological limits will be reached. This is illustrated using the IPAT equation measuring environmental impact developed by Paul Ehrlich and John Holdren:

\[ I = P \times A \times T \]

\( I \) = environmental impact, \( P \)=population, \( A \)=affluence, \( T \)=technology

The IPAT model is a “widely utilized as a framework for analyzing the driving forces of environmental change” (Richard Yorka, 2003). Each of the variables in the model must be considered when attempting to limit the environmental impact of the human population. The technology variable is the one that is most often cited by growth economists as the key to limiting our environmental impact, but unfortunately technology has not been able to reduce the overall level of environmental impact. Technology can limit the rate in which our environmental impact is increasing, but to actually reduce environmental impact (I), affluence and population must be lowered. The amount of human caused environmental impact on the planet is quite staggering, as 43 percent of the ice-free land surface of the planet has been converted by humans to be used for agriculture, cities, etc (Gillis, 2012). This level of human environmental impact on the planet has created glaring problems, including rapid extinction of other species, global threats from increases in global temperatures, and the degradation of eco-system services amongst others.

**Environmental Degradation**

The effects of the global growth economy on the world’s natural resources, ecological services, and biodiversity are well known and researched, and have caused alarm among scientists, environmentalists, and activists for decades. The United Nations 2005 “Millennium Assessment Report” warned that “human actions are depleting Earth’s natural capital, putting such strain on the environment that the ability of the planet’s ecosystems to sustain future generations can no longer be taken for granted” (McKibben, 2007). It is estimated that 60 percent of the world’s eco-system services have been degraded or overused since the mid 20th century, and under the current predictions for economic and population growth, the world is posed for an even greater increase in environmental degradation(United Nations Environment Programme, 2007). If the estimated 9 billion people in 2050 were to have levels of affluence enjoyed by current OECD countries, the world economy would need to be 15 times what it is today (Jackson, 2009). In terms of biodiversity, scientists have predicted that between 30 to 50 percent of all species will be extinct by 2050 (Thomas & Cameron, 2004). Many more warnings of environmental degradation can be cited, but the consensus of scientists is clear—the earth is being radically altered by human activity and the well-being of present and future generations is increasingly being put at risk.

**Climate Change**

In addition to environmental degradation and biodiversity loss, another looming concern caused by the growth economy is climate change. Climate change is an externality problem that is unique because of its global causes and effects, long time frame, amount of uncertainty
surrounding its effects, and the scale in which it is occurring (Nordhaus W., 2006). Climate scientists have warned for decades that without strict action to curb climate change, the effects will be devastating for the economic, environmental, and political systems on which we rely. The core of the problem stems from the release of greenhouse gasses into the atmosphere, most notably carbon dioxide, causing global temperatures to rise. Increased average global temperatures puts food, water, and ecosystems at risk through shifts in climatic zones, while also increasing the frequency and strength of extreme weather events, potentially destabilizing the entire fabric in which the global economy functions. A key scientific study that attempted to calculate the economic effects of climate change in the future using computer economic modeling estimated that the damages in 2100 could reach 2.6 percent of GDP for the United States and 10.8 percent of the world economy (Ackerman, Stanton, Alberth, & Hope, 2008). This is a massive impact that has the potential to seriously threaten the functioning of the world economy. While the exact extent of the social, political, and economic effects of climate change remain uncertain, effectively addressing the causes of climate change requires a change in the way the global economy functions.

The traditional response from environmentalists, activists, and environmental economists to the threat of climate change is a strategy called “de-coupling”, or continuing to rely on economic growth in the economy, but achieving it in a way that does not lead to an increase in greenhouse gasses, breach ecological limits, or run out of resources (Jackson, 2009). Although this strategy sounds plausible in theory, in practice de-coupling must happen not only in “relative” terms, but also in “absolute” terms. The difference being that relative de-coupling is the decline of ecological inputs per unit of GDP versus absolute de-coupling which refers to actual reduction in total ecological inputs (Jackson, 2009). Relative de-coupling is essentially a question of efficiency, something that growth economies are very capable of achieving through the profit motive when put under the correct market conditions. Relative de-coupling has been occurring in industrialized nations at a fairly high rate for the last few decades, and is also increasingly occurring in the developing world as they improve their energy and material efficiency (Jackson, 2009). The problem is that relative de-coupling is not occurring at a rate through which absolute de-coupling is achieved. For this to occur the increased technological efficiency must outpace the rate of population growth and growth in consumption (Jackson, 2009). Under our current business as usual path for economic development and population growth, to reach the International Panel on Climate Change’s target of 450 CO₂ parts per million by 2050, the carbon intensity in the economy would need to be 21 times lower than 2007 levels(Jackson, 2009). While this might be a theoretical possibility with a concerted effort by the international community, there seems to be no credible movement in sight to actually de-carbonize the world economy and achieve this goal in time.

Inequality

One of the traditional arguments for maintaining growth is that it is the best way to alleviate poverty. Growth and the accumulation of wealth reduce poverty by creating employment opportunities and through philanthropy (Czech, 2007). This argument staunchly reinforces the social logic of the economic system, as no collective responsibility for ending poverty is needed. An ever-growing economic “pie” keeps the question of equal distribution off the table, because although the pie of wealth might not be distributed evenly, “it offers the prospects of more for all with sacrifice by none” (Daly, 1992). Because a limit on the size of the
pie does not exist in conventional economics, questions about fairness and the distribution of wealth are not routinely addressed. For example, Henry Wallich, former chairman of the Federal Reserve stated, "So long as there is growth there is hope, and that makes large income differential tolerable" (Das, 2013). In reality economic policies that promote growth do not always lead to a reduction in poverty, but instead only reward those people who already have accumulated wealth. This leads to large wealth inequalities within countries, which decreases the quality of life by generating social stratification.

Even huge gains in a country’s GDP do not guarantee that majority of the population will benefit. For example, the United States economy roughly doubled in size between 1980 and 2005. During this same period, the real income of the bottom 90 percent of Americans declined from $27,060 to $25,656 (McKibben, 2007). If a doubling of real GDP did not lead to increases in real income for the majority of people, questions must be raised about the validity in policies that promote this ideology.

**GDP Measurement Failure**

While our current economic system is pushing the limits of the earth’s ability to provide ecosystem services and resources, and to absorb waste and pollution, our way of measuring growth fails to assess whether this growth is economic or un-economic, that is, whether it provides more economic benefits than economic costs (Daly H., A Steady-State Economy, 2008). The main reason for this is the way that accounting is done under the GDP. GDP does not distinguish between the positive and negative effects of certain economic activity, and instead adds them both together as opposed to subtracting the negative effects. For example, GDP counts the income generated from cleaning up superfund sites on top of the production that originally caused it. The cleanup and rebuilding after hurricanes will be a boost to the economy as measured by the GDP as storms increase in severity because of climate change. Another drawback of GDP is that it does not take into account the absolute stocks of resources (natural capital), but instead only focuses on the total activity the goes on in the economy (flows). If you compare this to a checking account, with the total amount of money you have constituting the stocks and spending the flows, spending as much money as possible is not a good thing. The spending should depend on the benefits received and should be stopped when the marginal benefit equals marginal cost.

GDP also does not place any value on ecosystem services. When trees lining a river are providing flood protection for an adjacent town, this is an economic benefit. If the town cuts down the forest and builds flood walls that provide the same amount of flood protection, the GDP increases and yet it replaced a free service with an expensive project. If GDP took into account the value of ecosystem services, it would improve decision maker’s ability to make the most economical decision.

If the measurement did take into account both the negative and positive effects of economic activity, the conclusion by every economist would be to stop growing the economy when marginal costs have surpassed the marginal benefits. Economists who focus on this issue have shown that in some highly industrialized countries the marginal utility of economic growth is already outweighed by the marginal costs (Daly H., A Steady-State Economy, 2008). This is why many people refer to a continued increase in GDP as “uneconomic”. This effect is illustrated by the following graph:
In spite of all the drawbacks of GDP as a national accounting system and policies designed to maintain its growth, it is clear that the poorest nations of the earth need to raise the level of activity in their economy to ensure that the basic needs of their citizens are met. The most common critique of the steady state theory is that economic policy geared towards no-growth will inhibit poor countries ability to grow their economies to alleviate high levels of poverty and raise their level of welfare. Classical economists and steady state economists agree that the GDP of poor countries must increase, but disagree about how this should be achieved. Growth economists, and in turn the institutions of the World Bank and IMF, think that the way to raise the living standards in the poor countries is for the rich countries to continue to grow their economies to create markets for poor countries’ exports, and to accumulate capital that can be reinvested in the poor countries (Daly H., A Steady-State Economy, 2008). Steady State economists tend to argue that poverty should be alleviated in poor countries by industrialized countries reducing their throughput growth to free up resources (natural capital) and ecological space to be used by poor countries, and to focus domestic efforts on technical and social improvements that can be freely shared with poor countries (Daly H., A Steady-State Economy, 2008). In the period since the international system has adopted the growth economists view, the number of absolutely poor has fallen, but the number of people relatively poor in comparison to the wealthy has “changed little since the 1990s, and is higher in 2008 than 1981” (Shaohua Chen, 2012). This implies that while economic growth has lifted people out of poverty, it hasn’t decreased the overall level of inequality.

Increasing GDP is not raising our Well-Being

Once a country has raised their GDP enough for its population to have its basic needs met, the question becomes whether continuing to raise the GDP is contributing to an increase in peoples well-being. If you compare measures of well-being in a country with the level of GDP, it shows that while in the beginning a small increase in GDP greatly increases a countries well being, further increases in GDP does not continue to raise well being and may in fact hamper it. The following charts, mapping various aspects of well-being with per capita GDP, illustrate this effect. The phenomenon they exemplify is a classic “law of diminishing returns”. The marginal utility of adding one more dollar of GDP decreases as the aggregate amount of GDP increases. The graphs show that once a country achieves a per capita GDP of around $15,000 (2005 dollars), the marginal utility of increasing GDP beyond this point greatly decreases and
essentially stabilizes. Below are graphs measuring life expectancy at birth, participation in education, and infant mortality and their relationship to GDP per capita.

Figure 1.1: Life Expectancy at Birth VS GDP Per Capita

Figure 1.2: Participation in Education VS GDP Per Capita
In addition to objective measures of well-being like infant mortality rates and participation in education, people’s subjective view of their happiness also does not continue to follow increases in GDP. Contrary to the economic assumptions of the growth economists, these graphs show that “more” is not necessarily better. For example, the following graph maps the percentage of Americans that consider themselves very happy. In spite of very significant gains in real income per person, the percentage that considers themselves “very happy” has remained essentially stagnant.


If the growth economy is degrading our environment, destabilizing the climate, heading for economic trouble in the future, and failing to increase our well-being, why is economic policy continuing to support it? If changing the way are economy functions is desirable, what alternative is available?

**Part II—The Steady State Economy**

**The Steady State Alternative**

The earth is a system that operates in a steady state. The inflow of energy received from the sun is equal to the outflow with no aggregate growth in energy or mass (Daly H., A Steady-
State Economy, 2008). The first law of thermodynamics supports this claim by establishing that neither energy nor mass can be created or destroyed (Czech, 2007). Any economic activity occurs within the closed earth system. Material taken from the earth and processed eventually returns to the earth in one-way or another. There is no “away” in the earth system. The second law of thermodynamics or “entropy” law tells us that it is impossible to achieve or exceed 100% energy efficiency. The implications of this are that although technology can certainly increase efficiency, there are limits that must be recognized. The Steady State Economy is an economic system that functions in a way that respects the laws of thermodynamics and ecological limits.

A steady state economy, coined by the ecological economist Herman Daly, is “an economy with constant population and constant stock of capital, maintained by a low rate of throughput that is within the regenerative and assimilative capacities of the ecosystem” (Daly H., A Steady-State Economy, 2008). Daly describes the steady state economic process or throughput of the economy as limited to activity required to maintain the constant stocks of people and capital (Daly, 1992). The use of goods and services, through the use of matter and energy, constitutes the “flow” of the economic process. The difference between this model and the conventional model of economics is that the goal is to maintain a constant stock of people and capital with the lowest possible amount of matter and energy required to live a decent life.

The steady state economists provide guidelines related to the scale of the economy, the distribution of its output, and the allocation of its resources. Scale refers to the physical volume of the throughput required to maintain the constant stocks of capital and population. In deciding the size of the scale, the goal is to be within the natural capacities of the earth ecosystem to regenerate the natural capital inputs (stock) and assimilate the waste of the throughput (flows) (Daly H., Allocation, Distribution, and Scale: towards an economics that is efficient, just, and sustainable, 1992). The flows are function of the stocks, and thus the scale is a function of the size of the stocks. Contrary to steady state economics, conventional economics has completely ignored the issue of scale and instead focused entirely on allocation and distribution.

Distribution, the second guideline for the steady state economy, refers to how the flows of the resource throughput are shared amongst the population (Daly H., Allocation, Distribution, and Scale: towards an economics that is efficient, just, and sustainable, 1992). Because the steady state economy has a limited amount of resource throughput and services, in effect, wealth distribution becomes a major issue. In a steady state economy more resources used for one person mean less for another. With the pie no longer increasing achieving a just distribution or limiting the degree of inequality becomes a necessity.

The last guideline for a steady state economy refers to the “relative division of the resource flow” among different products, or, in other words, the allocation of resource flows (Daly H., Allocation, Distribution, and Scale: towards an economics that is efficient, just, and sustainable, 1992). Allocation deals with the amount of resources spent for example on food versus cars or clothes, and how that allocation is achieved. In a steady state economy, just as in a typical growth economy, allocation is determined in the market by the needs and wants of the population. Conventional efficiency is essential for this allocation and is achieved through supply and demand and a flexible system of prices (Daly H., Allocation, Distribution, and Scale: towards an economics that is efficient, just, and sustainable, 1992). Markets, while known to have certain failures, are the most efficient way to allocate resources in the economy.

The concept of efficiency in a steady state economy must include not only efficiency of allocation, but also ultimate efficiency amongst the stocks and flows of the economy. The following equation shows the relation between these two things:
Ultimate efficiency = benefit/cost

Or

Ultimate efficiency = artifact services gained/ecosystem service sacrificed

Efficiency is defined as achieving a certain benefit (services derived from natural resources) with the lowest possible costs (in terms of sacrifice of ecosystem services), or achieving the highest possible benefit with a given cost.

This means that for each resource used, the highest possible benefit over time from that use should be realized. This is complete reversal from our current economy where most products are turned into waste very quickly and planned obsolesce of durable goods limits the benefit that can be received from the product. The products in a steady state economy would be designed to be easily recycled in order to provide the highest possible benefit for the amount of resources used.

It is important to point out that although the steady state economy calls for a constant stock of people and physical artifacts, it does not mean that the product mix of the aggregate total stock of artifacts is held constant or the current distribution of goods maintained. This means that although there would be no aggregate growth in quantity, qualitative change would naturally occur through technological changes, cultural preferences, etc. (Daly, 1992).

Qualitative change in the makeup of the economy would also be an important part of the transition to a steady state economy as the current sectors of production that require large resource throughput would be replaced with those that support a resource throughput within the regenerative capabilities of the earth’s ecosystem.

PART III- Transition To a Steady State

The problems associated with a growth economy presented in part 1 create a paradox for citizens, policy makers, and institutions. On one hand, the environmental and resources crisis resulting from the growth economy are well known and causes for concern. On the other hand, if growth is drastically reduced or the economy shrinks because of resource constraints or environmental disasters, this could set off a devastating downward spiral in economic activity. The reasons that many people have been fixated on the promises of the growth economy are concrete and real—when the economy is not growing, jobs are lost, investment slows, public debt increases, and people bear this real cost. A long-lasting recession or depression may result in widespread poverty, increases in crime and civil unrest. The natural reaction is to want to return to the state in which these problems are not occurring—return to growth. This is the growth paradox—inability to grow in the short run hurts, but continuing to grow long term has the potential for irreversible devastation of life-sustaining ecosystems, which will eventually undermine the ability of the world economy to provide goods and services for the needs of growing populations. The idea of a steady state economy can serve as a guidepost for designing policies aimed at a transition from a growth economy that destroys life support systems to a sustainably scaled economy that maintains them. If a steady state economy is desirable as opposed to the unstable growth economy that degrades the environment and is headed for
economic and social disaster, policy goals must be determined in order to peacefully transition away from growth. While individual initiative can have an effect towards making the economy more sustainable, collective action on a national and international level is also urgently needed to adequately address the problems of growth in a timely manner, especially the issue of climate change due to the irreversibility of its effects. The following section outlines five policy goals to shift the economy towards a steady state.

New Economic Accounting System and Corresponding Economic Models

In order to develop policy goals that will help the growth economy transition towards a steady state economy, a different national accounting system must be used as a benchmark for the economic health of the nation. Including natural capital in the measurement, as well as differentiating between the costs and benefits of economic activity, will help guide policy makers and public opinion towards a steady state economy.

One possible replacement for GDP as a measure of economic growth is the Genuine Progress Indicator (GPI). GPI factors in negative costs such as “resource depletion, pollution, and long-term environmental damage” (Groves & Webber, 2010). Valuing these factors is sometimes difficult, but has been proven to be possible and accurate when the correct information is used. GPI enables measurement of the economic health of its citizens at a “specific time given the impacts of past and present activities”, as opposed to GDP, which only measures output in a given year (Lawn, 2002). If a long-term structural investment were implemented in the economy to achieve a sustainability goal, the GPI would be lower at this point but higher in the future once the benefits start to be realized. GDP would show an opposite effect where the initial investment would be recorded in the GDP, but not the future benefits. The GPI measures changes of total stocks of natural capital as well as economic income (flow), and thus makes it a more accurate measure of sustainable economic welfare.

It should be noted that various other methods of measuring economic welfare exist besides GPI. While the exact accounting system that is used varies in each of the alternatives, the common theme is attempting to account for existing stocks of natural capital and the impacts of economic activity on them.

Once a national accounting system like GPI is adopted, creating economic models that use this measurement to inform policy is the next step towards transitioning to a steady state economy. The biggest problem with the current economic models is that the land/resources factor in the production process is generally downplayed and overlooked. Although classical economists placed an equal weight on all three factors of production, the growth economists of the 20th century stressed the importance of labor and capital in the production function. In the 20th century, developed countries were urbanizing, significantly removing citizens from the land and shielding them from direct contact with environmental degradation, thus supporting the abstraction of economic models from the importance of land (Czech, 2007). Also during this period an uneasy agreement developed between labor and capital when the capitalist class of the industrial age, motivated by the fear of disgruntled workers turning to socialist ideology, allowed the formation of labor unions that acted as the intermediary between the capital owning and working class. This alliance, while it was later broken during the slow decline of labor unions beginning in the 1970’s, set the stage for the domination of the land by two powerful social classes in the name of growth. The lack of a unified “landlord” or resource owning class led to artificially low resource prices to the benefit of the incomes of the labor and capital social classes (Daly H., In Defense of a Steady State Economy, 1972).
resource class is rooted in the social structure of modern society—the largest resource owners are either the government, poor and un-organized landowners, or even capital entities themselves who all have allowed capital and labor to dominate the land in favor of continued economic growth (Daly H., In Defense of a Steady State Economy, 1972). The Romer model, an important production function that was developed during this time, reflected the omission of land by stating the production function as:

\[ \text{Production} = \text{Productivity of Labor (Capital)} \times \text{Labor} \]

If the GPI is used as the measure of economic welfare, the production function is bound by the input of land or natural capital. That production function is as follows:

\[ \text{Production (Y)} = \text{Land (Natural Capital)} \times \text{Labor (L)} \times \text{Capital (K)} \]

or

\[ Y = (E) \times (L) \times (K) \]

Another important economic model that would be changed under the adoption of the GPI is the circular flow diagram of the economy. The conventional circular flow diagram, shown in every introductory macro-economic course, explains the flow of the economy as a monetary interaction between households and firms, with households supplying the production inputs (labor, land, capital) to produce goods that are then sold back to households who use the money gained as wages, interest, dividends and profits to purchase them (Czech, 2007). This model fails to show that the economy functions within the system of the environment, and is constrained in scale by ecological limits. Figure 1a shows the conventional circular flow diagram, whereas diagram 1b shows the circular flow diagram in a steady state economy.
Simon Kuznet, under commission of the Department of Commerce, developed GDP as an economic measurement system in the 1930’s due to the lack of information surrounding the Great Depression (Landefeld, 2000). The possibility that continued economic growth might in fact be “un-economic” warrants a new interest by government in researching an appropriate measurement system for the national economy, whether it is the Genuine Progress Indicator or another system. Research in this field will help steer economic policy towards goals in the country’s best interest, rather than continued growth in economic activity.

**Population and Affluence Stabilization To Achieve Environmental Impact Reduction**

Reduction of the world’s environmental impact through the stabilization of population and affluence is a necessity for the attainment of a steady state economy. It is useful to refer back to the IPAT model of environmental impact where $I=\text{Environmental Impact}$, $P=\text{population}$, $A=\text{affluence}$, and $T=\text{technology}$. As described in Part 1, the current level of population ($P$) and affluence ($A$) is having an immensely negative impact on the planet and will eventually be brought down within the carrying capacity of the earth eco-system one way or another. The goal of the steady state economy is to implement necessary policies that voluntarily reduce the level of environmental impact caused by population and affluence to sustainable levels. This decrease in environmental impact ($I$) can be assisted by adoption of adequate technologies but cannot achieved without adjusting population and/or level of affluence.

The first step in reducing environmental impact is the stabilization and eventual reduction in population. Population growth has been the driving force for economic growth because economies need to grow just to keep up with the increases in population so standards of living don’t decrease. In order to reduce environmental impact, but continue to enjoy a reasonable standard of living, the first step is a stabilization of population. The majority of the population growth comes from developing countries, which is typical in the industrialization process for a nation. There are several effective ways population stabilization can be achieved in developing countries, including increased access to birth control, increased education opportunities for women, and improving public health (Collins, 2009). These non-intrusive birth policies are the most ethical methods for encouraging population stabilization in developing countries, and should be paid for by some assistance from developed countries. In most industrialized countries, birth rates are close to the death rates and thus population is experiencing little growth or sometimes a reduction. Many industrialized countries experiencing population reduction have implemented policies to encourage population growth because of a fear of shrinking workforce.
to support the national economy. In a transition to a steady state economy, these policies would be removed and the population decline would be accepted, as a growing workforce for an ever-increasing economy is not desirable.

Affluence, under its current definition of per capita consumption, also requires stabilization and eventual reduction to decrease to reduce total environmental impact. This does not imply a reduction of affluence to the minimum for survival, but it does mean significantly reducing the amount each person is consuming, especially in the United States where consumption levels are very high. As the figures in Part 1 demonstrate, the material wealth of a nation does not lead to continued increases in well-being, so a reduction in consumption, while reducing environmental impact, will not necessarily reduce well-being.

While much of the lowering of affluence will transpire mostly through policy tools to increase resource prices explained in a following section, changing the way that people view the definition affluence is essential for a transition to a steady state economy. Instead of the current definitions relationship to consumption, the steady state economy requires people to recognize affluence as their ability to lead healthy and happy lives, with meaningful work and participation in community, all while lowering their impact on the environment.

Low Resource Throughput within Regenerative and Assimilative Capacities of the Earth

Conventional economists and steady state economists differ fundamentally on how resource throughput should occur in an economy. As previously stated, the steady state economy aims at the lowest amount of resource throughput possible to maintain the constant stocks of population and capital, and thus efficiency is maximized by producing the largest output with a given amount of resources. The difference between steady state economists and conventional economists on resource use lies in their theories about resource scarcity. Conventional economists freely admit to the scarcity of resources, but they consider these to be only relative scarcities and deny the existence of absolute scarcities (Daly H. E., 1974). The difference is that goods and services with relative scarcities can be replaced by another good, while goods with absolute scarcities have no replacement. The solution to relative scarcities is substitution. Limiting the total exhaustion of absolute scarcities requires the total quantity of extraction to be limited (Daly H. E., 1974). The argument by conventional economists is that all resources can be substituted, and the market provides the most efficient mechanism through which this process occurs. The market prevents certain resources from becoming completely exhausted through the increase in price as supplies dwindle. Many ecological and steady state economists argue that because of market failures like externalities, asymmetry of information, and the tragedy of the commons, markets are insufficient in themselves for providing the most efficient use and allocation of resources. They agree that relative scarcities cause efficient substitution in a way that minimizes absolute scarcity, but still leads to an increase in absolute scarcity (Daly H. E., 1974). Ecological economists point to the various species of fish that have been driven to extinction by over-fishing as just one example of how markets have not prevented resource exhaustion.

Two policy tools that can be used to transition the economy to low resource throughput are depletion quotas and the adoption of a carbon tax. Depletion quotas provide for the most direct way to control the amount of resource throughput required to maintain the stocks of population and capital. Once there is a general idea about the scale of these two constant stocks, the question becomes what amount of resource throughput is required to maintain them, while staying within the carrying capacity of the earth. Auctioned depletion quotas, as opposed to
taxes, offer a definite cap on the quantity of resources extracted to be set by the government (Daly, 1992). It is true that in a supply and demand model, a price plus a tax equals a certain quantity, but demand curves shift and are difficult to estimate in advance (Daly, 1992). This makes depletion quotas the optimal mechanism to limit resource throughput as the quantity of the resource extracted can be adjusted to the optimal sustainable quantity under the control of the government.

The implementation of the depletion quotas would start by the government auctioning the rights for the resource quotas. Resource buyers, after purchasing the quota rights, would enter the secondary market of resource sellers and firms could trade the resource extraction rights amongst themselves to find the most efficient allocation of the rights. The price paid for the resource incurred by the end consumer would be higher as a result of the quotas, as they now are paying the quota price plus the cost to the producer (Daly, 1992). A higher resource price means a reduction in the amount of the goods bought and sold using the resource, and the encouragement of a more efficient use of resource by producers and consumers (Daly, 1992).

The second policy tool to transition the economy towards a low resource throughput is a carbon tax. This policy, as opposed to the resource depletion quotas, would be an appeal to resource substitution related to energy use. While the goal of this policy is low resource use, it specifically targets climate change as a way to lower resource use and encourage efficiency. Climate change is an externality problem, a problem that requires government intervention to internalize social costs to promote market efficiency and investment in low carbon industries and infrastructure. Pricing carbon is a clear and undeniable necessity for curbing the effects of climate change, and as Economist William Nordhaus stated in his keynote address at the 2009 Climate Negotiations, “is a necessary condition for implementing carbon policies in a way that will reach the multitude of decisions and decision makers over space, time, nations, and sectors” (Nordhaus W. D., 2009). The carbon tax would shift resource use and consumption away from resource and carbon intense industries towards renewable and low material industries by making goods that are carbon intense more expensive. The tax would be easiest laid upon the sale of carbon intense energy. Energy firms that burn coal for electricity or produce gasoline would be charged the tax that would then pass that extra cost onto the consumer. This would not only cause individual households to consume less energy, but also consume less goods because of the price increases experienced due to increased transportation and production costs. When goods are more expensive, less people will demand it. The carbon tax would cover a large amount of goods circulating in the economy, as most goods are transported using gasoline or use carbon-based energy in the production process. The higher costs of carbon-intensive goods would be an incentive for transitioning towards carbon-free or low carbon products and energy sources.

**Investment**

The role of investment is crucial in achieving a steady state economy because it is the driving force of productive change in any economy. The amount of investment that’s needed to radically shift the economy towards a low carbon and material output is astronomical, although changes like this have occurred in instances of rapid industrialization and changing into a wartime economy. To achieve the International Panel on Climate Change’s 450 ppm target with the estimated 9 billion people by 2050, the carbon intensity per dollar in the world economy needs to be 21 times less than it is now or a 4.9 decrease per year by 2050 (Jackson, 2009). This scale of change has never taken place on a worldwide level and, while it is theoretically
possible under this scenario where a 1.4% growth in world income per year is assumed, it becomes more achievable when there is a stabilization of economic and population growth. Regardless if incomes and population continue to rise or not, radical levels of investment in technology and efficiency are necessary to achieve anywhere close to the levels discussed in this scenario.

The traditional reason for investment is the increase in labor productivity. In a transition to a steady state economy, labor productivity decreases in importance and instead is replaced by goals of “resource productivity, renewable energy, clean technology, green business, climate adaptation and ecosystem management” (Jackson, 2009). If the national accounting system of GPI is adopted and the benefits received from eco-system services and the costs of depleting natural capital become apparent, investments to improve these parts of the economic equation become vastly more important. Preventing flood damage by investing in the natural floodwater protection provided by the natural eco-system surrounding the river is better economic policy than clearing that area and building synthetic flood control systems. In the old measure of economic health, building the man made flood control project would be a positive thing because it contributes to overall GDP, but in the new model it makes more sense to invest in the pre-existing eco-system service.

Investment in the steady state economy becomes more reliant on public investment than private investment. Public investment allows for lower returns over a long period, versus private investment that focuses on short-term periods with high returns (Jackson, 2009). Increasing the value and productivity of natural capital that has been extensively over used in the past is something that requires a large amount of investment over a long time period. Some projects will experience the investment in one generation, but not see the returns and increased productivity until a generation later, such as reforestation or coastal risk management. Because many ecological investments have low returns in a monetary sense, making these investments at a pace that doesn’t slow the economy to a point where money is unavailable for investment in the future is something that must be considered (Jackson, 2009).

Being able to finance these vast amounts of investments will be crucial for transitioning to a steady state economy. Much of the new public investment focused on maintaining the constant stocks of population and capital will be financed through the revenue gained from the depletion quotas or carbon tax. Further, in order to free up money for private investment, the ratio between consumption and saving must be changed towards a higher savings rate. Consumption, much of which is financed through debt, has driven large increases in GDP in the last few decades. In an economy that does not require the raising the GDP, more money can instead be allocated to saving and then used as investment for maintaining the capital stocks. Current economic policies are designed to stimulate consumption during recession instead of allowing the savings rate to rise as it naturally does. In the transition to a steady state economy, economic policy would support this shift to savings as the GDP starts to fall.

Work in the SSE

An economy in transition to a steady state would likely undergo some massive restructuring. Highly resource-intensive sectors would shrink, driven by resource caps and carbon taxes. Workers in these sectors would lose job, while there would be a need for additional workers in expanding, less resource intensive sectors. The skill sets needed in the expanding sectors may not match the skill sets of those who become unemployed. This implies a greater role for the government in facilitating a transition of the labor force from one sector to another.
While the market would still be the main determinant for which sectors grow or contract, the government would be responsible for helping to allocate workers across these sectors. In addition to a large government institution focusing on job training, investments in the overall education system would help facilitate the possibility of workers shifting across various sectors, as they would already have a high level of educational training.

When an economy is not growing, another reason unemployment tends to rise is because of continued increases in labor productivity. As noted in the investment section, increased labor productivity in a steady state economy ideally becomes less of a goal in place of investment that creates longer lasting products and greater efficiency. In spite of this, it is unlikely that increases in labor productivity will stop altogether.

One way to combat the unemployment created from increased labor productivity is to reduce the total hours worked by the labor force by implementing a maximum working week (Jackson, 2009). This policy would shift the productive work that would have been done by those who were working long hours to those who become unemployed and are looking for work. This policy would require government support for special job training to match those losing jobs to the sectors that need workers.

Another effect of a maximum work-week is that the work/leisure balance shifts more towards leisure. Under a maximum work week policy, the labor hours lost from increased labor productivity are not necessarily seen as a bad thing, but instead increase the time that workers can spend on leisure. Much of the increased labor productivity between 1980 and 1995 in Europe was used in this way, encouraged by national labor policies (Jackson, 2009). Increased leisure time does not always have a good effect on the environment if people are spending their time driving their cars across the country or taking an across the world vacation. The mechanisms that would help curb this activity are the price mechanisms such as cap and trade systems or carbon taxes.

The other factors that affect work in the steady state economy are inequality and poverty. In a conventional economy, the way to address poverty is to raise the total size of the economy so more wealth can “trickle down” to those at the bottom. An unlimited growing economy leaves chances for prosperity for all, but at the cost of the environmental quality. In a steady state economy, a cap on the overall size of the economy means rethinking the ways we traditionally have dealt with poverty and inequality. The total scale between those that are the richest and poorest needs to be significantly reduced in order to have a just and fair society. The vast majority of people agree that poverty is something that is undesirable, and is something that should be reduced. If the dominant solution for dealing with poverty is increasing the total size of the economy, the argument for the redistribution of wealth becomes much more relevant in an economy that does not have the goal of growth.

One way to achieve a redistribution of wealth is through a minimum and maximum income. There is already widespread support among industrialized nations for a minimum wage, and most have implemented some sort of policy to facilitate one. Some countries set the minimum wage at a level that enables the person to live off the wage, while other countries have a minimum wage that is lower than a living wage. In a steady state economy, the minimum wage would ideally be a living wage that enables a person to enjoy a reasonable quality of life. The wage serves as the minimum boundary for the scale of inequality between people that is accepted. The minimum wage could be financed out of the general revenue created by the ecological taxes and or permit auctions in a cap and trade system (Daly, 1992).
The social logic of the growth economy has kept maximum caps on income from being discussed as a desirable tool among policy makers. In a steady state economy, a maximum income would be implemented by setting the marginal tax rate for income at 100 percent once a person has reached a certain income level. This policy would limit the scale of inequality by creating the upper boundary on the amount of income that one person could receive. This policy would have several other effects on the behavior of individuals. People would have a greatly reduced incentive to accumulate wealth, climb income ladders, and grow their businesses for their own personal gain. Instead there would be a greater focus on the quality of life that people are enjoying with the reasonable level of income that they are receiving. Perhaps businesses would choose to distribute a greater share of the wealth created by their successes to their workers instead of watching it get taxed away Business owners would have a greatly reduced incentive for monopolistic practices and other market distortions as they would not enjoy an unlimited portion of the reward (Daly, 1992).

**Conclusion**

Steady state economists and ecological economists have been clear in their research of the human economy in relation to the environment—the earth’s ecosystems have limits that will eventually be met if environmental impact through population and economic growth continues to increase. The effect of reaching these limits will be a reduction in population or affluence until the human population is brought within the carrying capacity of the earth’s systems. This process could result in severe economic, social, and political strife within the human population.

The earth is an ecosystem that operates in a steady state. The question remains unanswered if the human population will choose to adapt its systems to operate in harmony with the earth’s ecosystem, or be forced to do so by an overshoot of the carrying capacity. Consensus in the form of an international agreement on a specific course of action is unlikely at this time, but actions can be taken now to prepare for this situation regardless of how we get there. Citizens are not waiting for their respective governments to take action to conduct change, but are creating the systems that will lead to a sustainable future. Citizenry pressure can force the necessary institutional action towards policy goals like the ones enumerated above.

If growth is “un-economic” in the sense that it is creating more costs than benefits, economists need to recognize this and use it to inform policy makers in decision-making. This simple act of transparency in relation to the health of the economy could have profound impacts on the actions of citizens and policy makers. No longer would the endless pursuit of growth be the goal of the nation. Removing this goal could instigate a shift in asking what is important for a nation—economic growth or living healthy, happy, sustainable, and equitable lives for current and future generations. I think this is a question worth asking.
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