ADVISOR PERSPECTIVES

# A Critique of Grantham and Gordon
# The Prospects for Long-term Growth

By Laurence B. Siegel
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The vigorous global economic growth of the last two centuries is over, according to Jeremy Grantham and Robert Gordon. That prediction, if correct, has profound and worrisome implications for investors. And the short-term trend is indeed disquieting: Growth has been close to zero over the last decade in advanced countries. But the most likely outcome is that per capita GDP growth going forward will approximate its U.S. historical average of 1.8%, and it will grow faster in developing markets.

Gordon, a highly distinguished Northwestern University economist with a lifelong interest in productivity growth, recently published a paper, Is U.S. Economic Growth Over? Faltering Innovation Confronts the Six Headwinds, in which he argues that the revolutionary innovations that have driven past growth are not likely to be repeated any time soon. Even more recently, Jeremy Grantham, who has previously argued that increased natural resource costs are likely to choke off global growth, published his quarterly commentary, which supported and extended Gordon's position, with his characteristic focus on resource constraints.

Gordon identified six headwinds, mostly having to do with growth in the United States, which represents 5% of world population. And, indeed, if you only care about people in the United States, these are troubling times. These troubles will pass, but not before wrenching adjustments are made to education, entitlements, and industrial structure.

But the outlook for the developing world has never been better, a prospect to which Gordon gives insufficient weight.

Let's consider Gordon's headwinds – and why I believe he has overstated the dangers that they pose to growth. I'll then turn to Grantham's arguments, and conclude with an optimistic forecast for global GDP.

**The three industrial revolutions and the growth of real per-capita GDP**

Following convention, Gordon attributed the productivity surge of the last two and half centuries to three distinct Industrial Revolutions. The first saw the introduction of the cotton gin, the mechanized loom, the steam engine, the railroad, and the factory system. Gordon dated this first revolution to 1750-1830. (I use slightly different dates, 1776-1826.)

The second revolution ran from about 1876 to 1926 (my dates this time) and saw the invention of the telephone, audio and video recording and playback devices, electrical appliances, the delivery of electric current to businesses and households, the automobile,


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the airplane, radio, and the first flickers of television. The third epoch of innovation was the computer and Internet revolution. For the sake of data analysis, I'll say it started in 1976, when both Microsoft and Apple were founded, although Gordon argued, with some validity, that much of the benefit of computers came earlier.

At any rate, the dates I've chosen break up American history into 50-year periods, limited only by data availability, thus reducing the temptation to monkey with the data periods to get a desired result.

Figure 1 shows the growth rate of real per capita GDP in the United States over the full period considered and each of the subperiods – all three revolutions, plus the interim periods between them – although the first few years' data are missing.[1] While the growth rate looks almost constant in Figure 1, breaking the time into subperiods reveals considerable variation in growth rates, and the recent (post-2000) stagnation has been dramatic. Nevertheless, the average growth rate during industrial revolutions, 1.84%, is essentially identical to the average growth rate between the revolutions, 1.85%.[2] Note that we've examined U.S. data for lack of anything better before about 1950; the relevant growth rate is for the world, because investors can hold global portfolios that take direct advantage of worldwide GDP growth.

[1] I use the United States because of the superior quality of the data for the early years. Angus Maddison has collected real per capita GDP for the world, but, despite his heroic efforts, the data are sporadic until 1950. They show that the world had slower growth than the U.S. until about 1950, then faster growth since then. See Maddison, Angus, "The West and the Rest in the World Economy: 1000–2030," *World Economics*, October–December 2008; underlying data are available on the web site maintained by Groningen University in memory of the late author at http://www.ggdc.nl/maddison/.

[2] While the growth rate of real per capita income has slowed in the post-1976 period, the tremendous increase in the number of households over that period means that the growth rate of real income *per household* has not slowed nearly as much. In fact, the latter may have grown at the historical rate of 1.8%. (I don't have the data.) It takes a lot of money to support the unprecedented proportion of single adults and single parents in the population.


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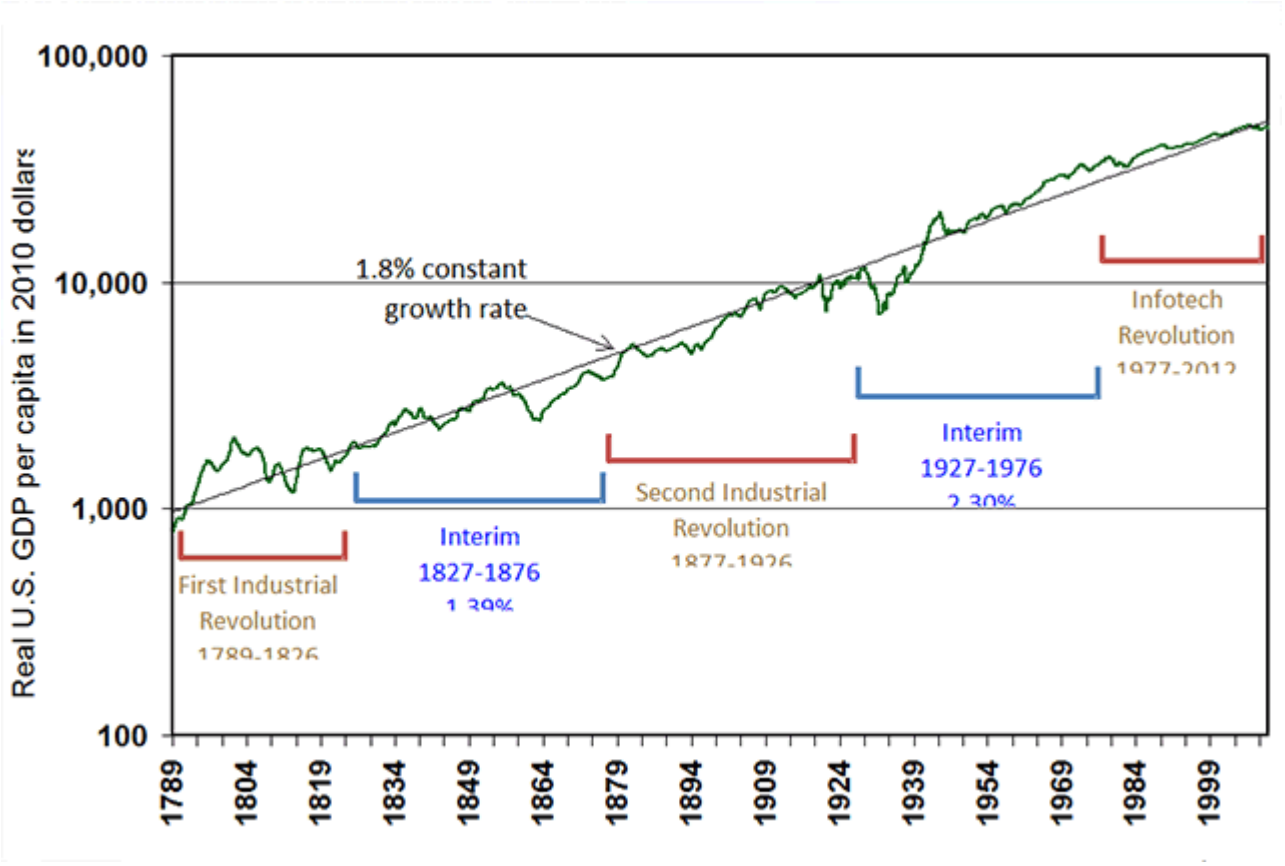


While the almost-exact equality of within-revolution and between-revolution rates is purely a coincidence due to the dating used, the lack of a relationship between industrial revolutions and growth rates calls out for explanation. My conjecture is that it takes a long time for cutting-edge, productivity-enhancing technology to be absorbed into the general economy, causing the benefits of a given industrial breakthrough to be spread out over generations or even centuries. It is said, for instance, that half the world's population has never made a phone call.[3] If this is even approximately true, the world is still experiencing welfare gains from the adoption of a device invented 136 years ago. No wonder industrial revolutions don't line up neatly with periods of rapid GDP growth!

Another example of this principle, cited misleadingly by Gordon, is transportation speed. The speed at which passenger travel occurred, he writes, "increased steadily until the introduction of the Boeing 707 in 1958. Since then, there has been no change in speed at all, and, in fact, airplanes fly slower now than in 1958 because of the need to conserve fuel." This observation misses the point. We know perfectly well how to fly at three times the speed of sound, and the military does it every day, but it's fuel-intensive and costly.

[3] This may be apocryphal. There exist, of course, no definitive statistics on this. But, whether it's literally true or not, it certainly has – if you'll excuse the pun – the ring of truth. Kofi Annan, Al Gore, Newt Gingrich, and a number of prominent technology executives have all said it.


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We've chosen not to spend valuable resources on faster passenger travel. It's fatuous to think we never will or never could.

We should thus expect the dissemination of already-invented technology to be reflected in world GDP growth well into the *next* century. There will undoubtedly be more technological innovation, but we do not need to have another industrial revolution to get meaningful increases in the global standard of living. (That said, we may well be in the beginning stages of a biotech revolution, one that will continue to improve health outcomes and make the global food supply cheaper and more varied than it is now.) What we do need is continued improvement in efficiency – doing more with less, making existing resources work harder, finding new resources to replace those that become scarce and expensive, and creating new human capital through education that fits the skills that the future will require.

**Robert Gordon's six headwinds**

Gordon's essay is skillfully argued, offering many illuminating facts about the profound change in the daily lives of ordinary people between, say, 1870 and 1950. Having made the transition from a relatively primitive way of life (in which, for example, women spent much of their day carrying water) to a modern way of living, we cannot experience the same transition again, he argues.

There is something to his claim. Another 50-fold increase in the U.S. standard of living over the next 250 years is not in the cards. I agree with Gordon that the second industrial revolution, representing the bulk of the transition from a primitive standard of living, was the most important one, and the hardest to replicate. He concluded from this fact that further improvements in the standard of living will be less profound and will have a smaller impact on per capita GDP.

Maybe the improvements will be less profound for Americans – although it is hard to foretell the distant future – but we are not the only people in the world.

There are a great many people who have barely begun to experience the second industrial revolution, much less the third. Women all over the world still carry water day in and day out. We in the developed world don't see it, except perhaps on Peace Corps assignments. As more people are liberated from the extreme effort and mental drudgery of manual labor, they need not invent new technologies to add to the growth rate of global GDP – they just need to be able to use the telephone, the automobile, the computer, and so on. A report from sub-Saharan Africa shows that the value placed by the poor on mobile phone access is so high that they are willing to forego meals to afford phone service. This is may sound like an irrational choice, but it's actually supremely rational: The transactions in which they can engage over the phone will make future meals that much more secure and affordable.


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Gordon identified six headwinds for future economic growth. Let us examine why each of them is less of a global concern than Gordon suggests. (The quotations I include below are all Gordon's.)

**1. "The 'demographic dividend' is now in reverse motion."**

This first headwind requires some explanation, because Gordon's use of the term "demographic dividend" differs from the conventional use. The conventional demographic dividend is the increase in productivity that comes from a temporarily large ratio of workers to children-plus-retirees, which we experienced thanks to the sudden extension of life expectancy between the late 1800s and today. If people start living long enough to extend their working lives but not long enough to have much of a retirement, that boosts GDP. When the number of retired people climbs, as it has recently, the demographic dividend begins to dissipate; if people are having fewer children at the same time, the dividend may disappear entirely.

Gordon, however, treats the "demographic dividend" as a much narrower phenomenon: In his construction it was "the movement of females into the labor force between 1965 and 1990, which raised hours-per-capita and allowed real per-capita GDP to grow faster than output per hour."

The entry of women into the workforce is a second-order effect. Women have always been productive, but their production was not well-captured by GDP measures until they moved in large numbers into the paid sector.

It is not a coincidence that the period of fastest economic growth occurred when increasing life expectancy was enabling most people to live productive lives in middle age, but not allowing them to retire.

This provocative reassessment challenges us to make better use of our elderly. Most older Americans wish to be economically active in some way, but their wisdom is more valued in the marketplace when they are scarce, not increasingly abundant, as they are today. As a result, jobs that use the skills of older workers effectively have been hard to come by. The trend toward retiring gradually rather than suddenly, whether because of insufficient savings or because of a desire to remain active, may be a step in the right direction.

**2. Educational attainment in the U.S. has hit a "plateau."**

If one is trying to forecast global GDP, we should not be concerned about changes in country rankings. The U.S. led the second and third Industrial Revolutions, but there's a good chance someone else will lead the next one. As an American, I'm deeply concerned about the shortcomings of the U.S.'s (primary and secondary) educational system, but I'm


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delighted to see that Chinese, Indian, African, and Latin American people are getting a chance and doing very well relative to their own recent past.

**3. Inequality is on the rise.**

"The most important [headwind] quantitatively in holding down the growth of our future income is rising inequality," according to Gordon. "If what we care about when we talk about 'consumer well being' is the bottom 99 percent, then we must deduct 0.55 percent from the average growth rates of real GDP per capita presented here and elsewhere."

This amounts to a forecast that the recent increase in inequality, which dates back only to about 1980 (before that, inequality was *decreasing*), will continue indefinitely. Further increases in inequality (as measured by the welfare of the top 1% of the income or wealth distribution compared with the other 99%) will only occur if increases in productivity are concentrated among the top 1% or if the top 1% can somehow exploit the others unfairly, capturing others' productivity gains for themselves.[4]

Both seem extremely unlikely. The biggest productivity gains tend to come from people in the top 15% of the income distribution – engineers, entrepreneurs, doctors, and so forth – who may *then* enter the top 1%, if they can capture some of the gain. At any rate, I am more concerned about the tension between the top 15% (roughly corresponding to the intellectually gifted) and those of average or below-average ability. In a preindustrial or industrial society, the job description of "pick up this heavy object and move it over there" can be filled by the otherwise untalented. In the future, we will not need many such workers.

But the problem of worker obsolescence has existed since the days of Ned Ludd (the worker after whom the machine-smashing Luddites were named) and people of average ability still live better than ever before. There has been some regression in the last decade, as there has been in other recessionary decades. But changing technology has always created new jobs for the relatively less-skilled, and the natural rate of unemployment has hovered around 4% for as long as unemployment rates have been measured. We underestimate the dexterity and adaptability of ordinary people at our peril.

**4. "The interaction between globalization and ICT (information and communication technologies) is a daunting headwind."**

Basically Gordon is noting that rapid communication interacts with the increasing skill base of non-U.S. workers in a way that moves even high-skill jobs offshore. This amounts to an

[4] In other words, if the top 1% can arrange to pay the bottom 99% less than their marginal product. Just stating the problem this way makes such an outcome seem unlikely – 99% of the people do not work for the other 1%. About 17% work in various levels of government, and another 10% work for nonprofit organizations. Those in the private sector mostly work for corporations, the ownership of which is very widely dispersed among U.S. and non-U.S. pension funds and individual investors, and for small-business entrepreneurs whose incomes do not typically put them in the top 1%.


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argument that global wealth shares will be rearranged in a way that is unfavorable to the United States. Gordon writes that the convergence of these effects "inevitably has a damaging effect on the nations with the highest wage level." He's right – labor will be employed where it is cheapest, when all factors, including the relative productivity of labor in different countries, are taken into account. But that rearrangement will only take place if there is a net welfare gain across all parties. Thus, this supposed "headwind" is actually a tailwind to the developing world – and it's about time.

**5. Increasing efforts to consider environmental concerns**

"Energy and the environment represent the fifth headwind," Gordon says. "Part of any effort to cope with global warming represents a payback for past growth."

As I argued in another article, "Fewer, Richer, Greener," a clean environment should be seen as a consumer good that contributes to well-being like any other. Unfortunately it does not show up in GDP data unless it is explicitly paid for. Pollution avoided through cleaner technology or through resource conservation is a positive good, but not a component of GDP. A stable climate may be seen in a similar light, as a type of infrastructure investment that is valuable, but which does not show up positively in GDP data.

Overall, real (inflation-adjusted) commodity prices have been in a downward trend for more than two centuries. The history of capitalism has been described (by Charles Gave, of GaveKal) as the history of falling real commodity prices. The latest uptrend, covering roughly a decade, could be the end of the history of capitalism or it could be among the largest of many fluctuations that have occurred within the context of that steady decline without constituting a reversal of it. If world population growth were accelerating, I might entertain the possibility that falling real prices (although not capitalism itself) are coming to an end. With population stabilizing almost everywhere, however, the long-term downtrend in real commodity prices, including energy, is likely to continue.

For example, just when things started to look really dire for energy prices, natural gas was discovered in the United States on a scale that drove the price down to less than $2 per million British thermal units (BTUs).[5] On an energy-equivalent basis, that's as if oil were selling for $13 per barrel instead of $90. This should not be a total surprise; when the price of something is high, entrepreneurs are motivated to find substitutes. That is how markets operate.

**6. "The twin household and government deficits represent the final headwind."**

This claim is hard to figure out. If a household spends more than it produces, then it must later produce more than it spends. One can either work harder or spend less. It's not

[5] Data as of April 2012. Natural gas prices have since risen to above $3 per million BTU.


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clear which solution American households, in aggregate, will adopt, but it is very possible that we will collectively elect to produce more, not less.

The existence of government as an agent or intermediary makes the decision to increase production less likely. Tax increases and government spending cuts are the mechanism by which public debt is retired. There is an old saying in economics that "if you want more of a good, subsidize it; if you want less of a good, tax it." Higher taxes tend to depress production by reducing the incentives to produce.

So I'd err on the side of caution and say that this headwind is a legitimate concern over the intermediate-to-long run. Over the very-long term, though, the last baby boomer will die, and the problem of a large population of entitlement collectors supported by a smaller population of producers will go away. The age pyramid will turn into an age pagoda everywhere.[6] The institutional arrangements for having a smaller population of workers supporting a larger population of children and retirees will have been established. People will work longer and save more for their old age, either through pension systems or private saving. It's just that reaching this equilibrium could take a long time.

**The true history of global growth**

The idea Gordon cites that, before 1750, economic growth proceeded at the paltry 0.2% annual growth rate is also flawed (although plausible if one looks uncritically at available data). John Locke in 1700 said that a day laborer in London lives better than a king (meaning an Indian chief) in America; Adam Smith said something similar in 1776. These comments reflect robust economic growth in Britain before 1700. Only a fool would suggest that Leonardo's Florence, Shakespeare's London, or Mozart's Vienna were not better off – by more than 0.2% per year – than those same cities a century or two earlier. But when growth did occur prior to the 1700s, it was quickly undone by disease, or by ridiculous and tragically destructive wars. (The Thirty Years' War eliminated a third of the population of Germany.) The failure of then-available technology to communicate innovative techniques across space and time also helped ensure that gains were always fleeting.

So *global* growth really did proceed at the 0.2% annual snail's pace. But, when and where conditions were favorable, growth was considerably higher. People have always expended great effort to make their children's and grandchildren's lives better than their own, and they will continue to do so.

**Jeremy Grantham's one big headwind**

[6] In the conventional age-distribution diagram in demography, the prevalence of young people in traditional societies makes the diagram look like a pyramid. As people live longer and have fewer children, the distribution of population across age categories becomes more even and the diagram looks like a pagoda.



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The fox knows many things, said Aesop, but the hedgehog knows one big thing. (He meant it as a compliment to the hedgehog.)

In "On the Road to Zero Growth", the quintessential hedgehog Jeremy Grantham has proposed that our depletion of easily exploited natural resources has caused the 200-year downtrend of real commodity prices to reverse itself and turn upward. This, Grantham argues, makes it almost impossible to achieve high economic growth rates; the past history of rapid growth, according to this view, is the history of cheap energy.

While Grantham's commentary addresses other issues, including some of those raised by Gordon, resources and the environment, in his view, trump all the others.

Grantham notes that the cost of commodities, expressed as a share of total input costs, fell from nearly 100% in the Middle Ages to 3% in the U.S. in 2000, but they have risen to 7% in the U.S. since then. This last increase represents a massive cost shock, and it is a good explanation for recent stagnation. Some of the cost increase is our own fault (where are the nuclear power plants?), but if this trend continues indefinitely it will be catastrophic for global economic growth.

The hitch is that Grantham offers no evidence that the recent upsurge in commodity prices is anything other than one of the many short-term commodity price spikes that have punctuated the centuries-long downward trend. He just asserts that this time is different because this time it's cost-driven.

But, as Grantham rightly points out, the cost of commodity extraction is always set by the tension between resource exhaustion, which drives prices up, and improvement in extraction technology and the discovery of new supplies, which drive prices down. (He addresses substitution and conservation, both of which also drive prices down, later in his commentary.)

Now, this tension must necessarily be resolved separately for each commodity. Even if there is a surge in demand for goods in general, driving commodity prices higher in aggregate, the rate at which resources are exhausted and the rate at which technology makes extraction cheaper are determined separately for each commodity. There is no reason to think that a technological change that makes copper easier to mine should occur at the same time as a weather condition leading to a good wheat harvest or the discovery of a new oil field. There is just no reason why the supply curves for different commodities (other than close substitutes) should change together.

And yet that is exactly what they appeared to do from 2000 to 2012. Commodity prices soared together from 2000 to 2007, crashed in 2008, and then soared once again from 2009 to 2012. This is obviously a beta effect, a common factor operating on all commodities regardless of their cost conditions. What was the cause? Global growth may be a factor, but growth has been modest since 2009, and it was strong before 2000. A


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much more plausible culprit is portfolio flows into commodity index funds and index derivatives, driven by pensions, endowments, and sovereign wealth funds. If that's what's to blame, it is unlikely to be repeated.

Thus, the evidence of a paradigm shift from a downtrend to a permanent uptrend in commodity prices, as posited by Grantham, is scant. The future of input costs – particularly energy costs – looks much like the past. Energy costs are likely to continue to decline in a stair-step fashion, with secular cost decreases caused by technological changes – the advent of fracking, wider use of nuclear power, innovations in alternative energy – punctuated by cyclical cost increases caused by resource depletion, wars, and rising demand.

Grantham also offers an unrealistically pessimistic forecast for the contribution of the service sector to overall economic growth. While he acknowledges its growing importance and the problems with productivity measurement, he ascribes the role of the service sector to "luxuries or, shall we say, non-essentials, the desirability or perceived quality of which often increases with the number of attendants and personal face-to-face time." But service sector growth will come from industries like education and health care – hardly luxuries. Moreover, the health care industry is massively inefficient and ripe for productivity gains. Even though some of those new efficiencies will not directly boost GDP – because of the measurement problems that Grantham cites – the inefficiencies will attract new entrants, which will boost GDP, as was the case in the manufacturing sector when it was the dominant force in the US economy.

**The bullish case for growth**

Consumption cannot grow forever. Some consumption is of physical, nonrenewable resources, and the volume of cumulative nonrenewable resources consumed cannot exceed the volume that exists on Earth. Even at a zero growth rate, resources continue to be consumed, subject to physical limits. Thus, a worldwide slowing of growth at some point in human history is inevitable.

We are, however, nowhere near that point.

The physical environment is in pretty good shape. It is cleaner in developed countries than it was in those same countries when they were developing, and the same potential exists in countries that are still developing today. While some resources have been depleted so that the easiest-to-obtain supplies are gone and what remains is costly and difficult to obtain (oil being the most prominent example), that very cost makes the discovery and development of substitutes possible, necessary, and likely. We have barely breached the surface of nuclear, solar, geothermal, wind, and tidal power. Recent fossil fuel discoveries have been a pleasant and unforeseen surprise (though we'd be foolish to rely on more such good fortune). People have been finding cheaper substitutes for existing resources since the beginning of human history, and there is no sign that we will stop any time soon.


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We have heard concerns about the permanent slowing or stopping of global growth after every depression or severe recession. In the 1890s, the idea was circulated that everything worth inventing had already been invented. In the 1930s, it was popular to say that capitalism had created the mechanism of its own destruction. In the 1970s, concerns focused on foreign competition and resource constraints, and some people forecast mass starvation. Today's concerns are no different in principle, and they are no more realistic.

The problems we face are real, but they are hardly insurmountable.

Economic growth does not come from discoveries of natural resources (although those help), but from innovations that permit us to do more with less. That is the economist's definition of an improvement in technology, and it is the definition we should always bear in mind. Thus economic growth comes from people trying to better their own lives and those of their children, and it comes from the dissemination of information on how to do so across time and space. If we can avoid the plagues of war and disease that kept economic growth from catching fire before the 1700s, we can rely on the natural desire to improve one's lot in life as the engine of economic growth in the future, and we can expect it to continue.

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