

These are perplexing times in the USA. From a political perspective, we are witnessing extraordinarily intense conflict around economic policy. Republicans are seeking to impose fiscal austerity by threatening not to raise the debt ceiling, which could force the US government into default and trigger a global financial crisis. We are heading into an election year with elevated unemployment, popular discontent, and an opposition party (the Republicans) with a radical anti-government agenda¹. On the economic front, there are signs that the recovery may be weakening even as Silicon Valley booms. High tech and high finance prosper as the broader economy remains relatively stagnant. The nation's social infrastructure appears to be deteriorating, with potentially serious consequences for future growth. On the whole, the data are depressing: the USA appears to be mired in a prolonged slump not unlike Japan's lost decades.

There are, however, some bright spots, especially with respect to technological innovation. I live in Silicon Valley, America's most innovative region, and last month I founded a startup company to commercialize my own research on next-generation communication tools for information workers, so I'm well-positioned to report on innovation in the USA. Innovation is highly relevant to Public Interest Capitalism, since our quality of life depends ultimately on our ability to develop technologies that solve our problems. And, as we know from the industrial revolution, technological innovation influences the path of economic development and the course of history. Thus I conclude this letter with some innovation-related developments that could have important social and economic implications for the USA and the world.

Weak US Recovery Weakens Further: Heading for a Double Dip?

The US economy weakened in the second quarter. As usual, Calculated Risk (CR) has an excellent and concise analysis of the macroeconomic situation:

The recent economic data indicated a slowdown in May: only 54,000 payroll jobs were added, auto sales declined significantly, retail sales were sluggish even excluding autos, growth in manufacturing slowed sharply, house prices continued to decline to new post-bubble lows (as of March), and home sales slowed.

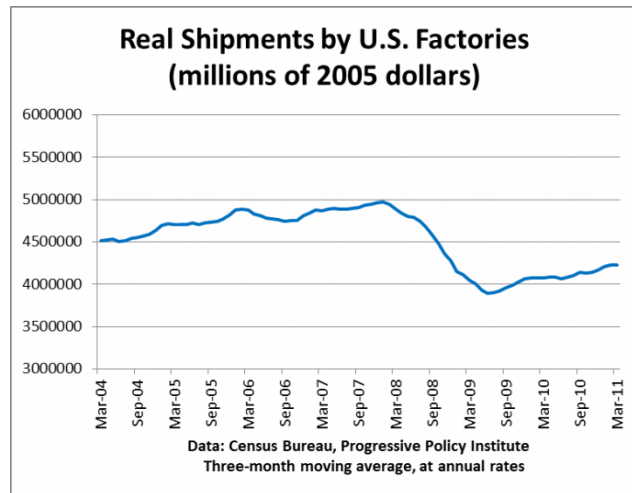
This raises a key question: Is the recent economic slowdown temporary or is the U.S. heading into a "double dip" recession?²

CR identifies a variety of temporary shocks and longer-term trends that could be responsible for the slowdown. Shocks include the Japanese earthquake and tsunami, a run-up in oil prices, and severe weather, while longer-term trends include reduced federal stimulus, state and local government cutbacks, and the European crisis, among others. In CR's view, it's too soon to tell whether the slowdown represents the start of another downturn, so we'll be watching the data carefully this summer for clues.

It's worth noting, however, that regardless of whether the recovery continues or not, the US economy has been performing very poorly for the past few years. A few charts can help put the situation in perspective. First, take a look at manufacturing output. These graphs are from Michael Mandel, former Chief Economist at BusinessWeek.

Adjusted for inflation, shipments by US factories (right) remain depressed. Here's Mandel's perspective:

Now that hardly looks like a recovery at all, does it? Real shipments plummeted 22% from the peak in the fourth quarter of 2007 to the second quarter of 2009. As of the first quarter of 2011, real shipments are still 15% below their peak. To put it another way, manufacturers have made back only about one-third of the decline from the financial crisis.³



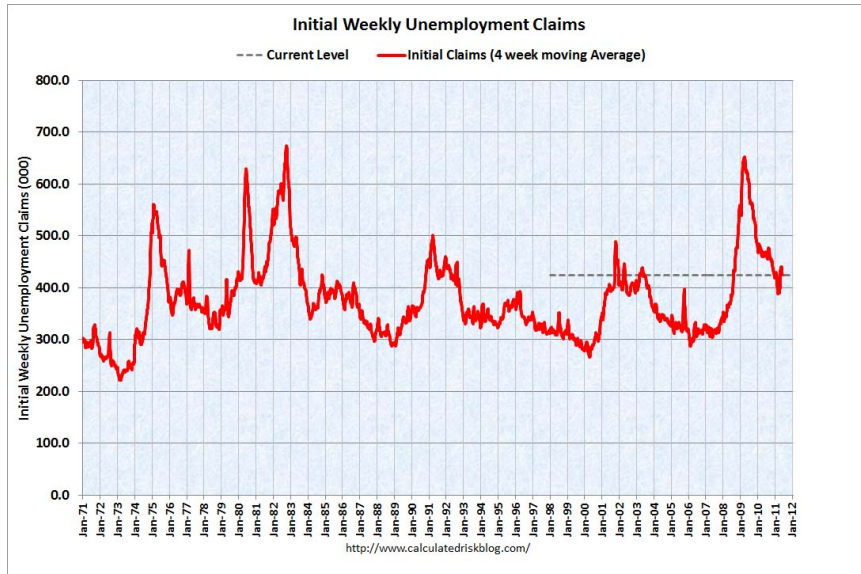
Mandel argues that the state of the US economy is substantially worse than the picture painted by the mainstream media, and the data appear to support his view. Indeed, reported GDP growth in the first quarter was only 1.8%, and the reality may be significantly worse. From economist Justin Wolfers:

National accounting aficionados know that hidden beneath the headline number is an alternative estimate of GDP. This alternative is often called GDP(I), because it is based on income data, rather than spending data. And GDP(I) is actually a more reliable estimate. Unfortunately, this more accurate indicator tells us that GDP grew by only 1.2%. That's bad news.

In fact, this alternative indicator says that GDP is still below its level from late 2006.

And the latest survey of macroeconomists by The Wall Street Journal shows little good news on the horizon. GDP is expected to grow by only 3.2% in 2012. While that sounds like a healthy clip, remember that Okun's Law tells us growth needs to exceed 3% before the unemployment rate will decline.⁴

Given such weak economic growth, it should be no surprise that the employment situation remains poor. Unemployment claims have ticked up recently, returning to levels comparable to the 1990 and 2001 recessions. Here's a graph from CR's chart gallery⁵:



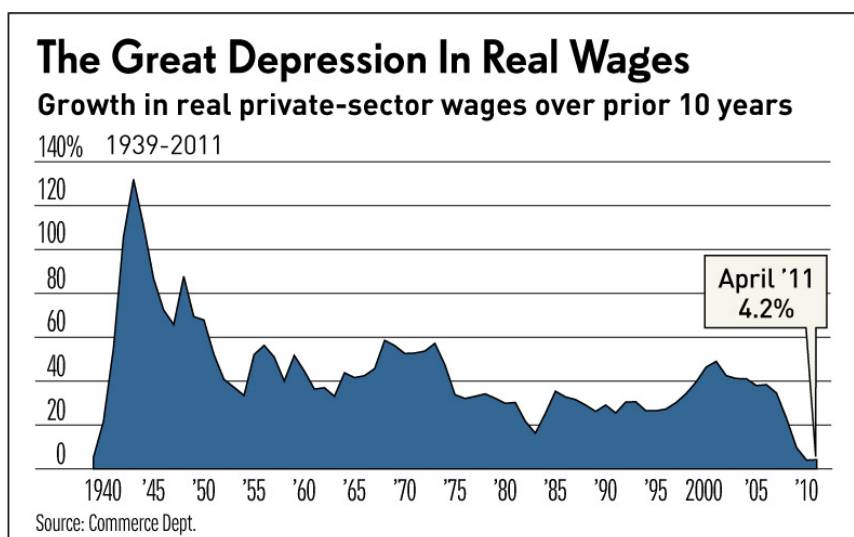
Recent graduates face a tough job market. From the *New York Times*:

Employment rates for new college graduates have fallen sharply in the last two years, as have starting salaries for those who can find work. ...

The median starting salary for students graduating from four-year colleges in 2009 and 2010 was \$27,000, down from \$30,000 for those who entered the work force in 2006 to 2008, according to a study released on Wednesday by the John J. Heldrich Center for Workforce Development at Rutgers University. That is a decline of 10 percent, even before taking inflation into account.

Of course, these are the lucky ones — the graduates who found a job. Among the members of the class of 2010, just 56 percent had held at least one job by this spring, when the survey was conducted. That compares with 90 percent of graduates from the classes of 2006 and 2007.⁶

A weak labor market puts downward pressure on wages. Here again, the data suggest that the USA is in worse shape than most people realize. Over the past ten years, wages have grown substantially slowly than at any other time in the post-war period. The following graph, from *Investor's Business Daily*, shows the gravity of the situation⁷.



So, from the perspective of wages and employment, the current climate feels more like a recession than a recovery—unless you happen to be a CEO or a hedge fund manager. More on that below.

Republicans Push for Austerity

It's not my intent to take political positions in this newsletter, but the Republican push for austerity has dramatic economic implications that need to be addressed. In the last issue of this letter, I submitted that austerity at the federal, state and local government levels may be the greatest threat to the recovery. Since then, Republican calls for austerity have intensified. In a nutshell, the Republicans are demanding large spending cuts:

With 2012 appropriations bills already moving through the House, White House budget talks return Tuesday to where they began six months ago: Republican demands for deep cuts from domestic spending and foreign aid.

...even after concessions by President Barack Obama, the two sides remain more than \$1.1 trillion apart over the next 10 years, and Senate Republicans have yet to step forward to help broker a deal between the administration and the House GOP.⁸

In policy documents, Republicans claim that spending cuts will boost economic growth, a position that defies economic logic. Here's Paul Krugman's perspective:

The idea is this: we'll lay off government workers; this will raise unemployment, putting downward pressure on wages; and lower wages will lead to higher employment.

So, for this to work you first have to have a downward-sloping demand for labor as a function of the nominal wage rate. There's no reason to believe that's the case: in a liquidity trap, falling wages probably reduce the demand for labor, because they worsen the burden of debt.

And even if you somehow bypass this objection, the argument is still nonsense: it says that by reducing demand, you cut the price, which increases demand, which means that you end up selling more than before. Um, no — that's the kind of answer that, in Econ 101, has you suggesting that the student get special tutoring.⁹

IMF researchers side with Krugman:

Fiscal consolidation typically lowers growth in the short term. Using a new data set, we find that after two years, a budget deficit cut of 1 percent of GDP tends to lower output by about ½ percent and raise the unemployment rate by ⅓ percentage point.¹⁰

Thus, if the Republicans have their way, there's a real risk that the economic situation could deteriorate further. Krugman's characterization of the situation, which seems about right to me, is that the Republicans have embraced the failed doctrine of liquidationism. Liquidationism refers to Treasury Secretary Mellon's unsuccessful policy prescription during the Great Depression. Mellon called for allowing bankruptcies and asset fire sales to spread across the economy until falling prices somehow cleansed the markets and enabled economic renewal. According to Krugman:

Republicans are now fully committed to the doctrine that we must destroy employment in order to save it.

And Democrats are offering little pushback. The White House, in particular, has effectively surrendered in the war of ideas; it no longer even tries to make the case against sharp spending cuts in the face of high unemployment.¹¹

The Republicans are fighting hard for aggressive spending cuts, to the point of threatening to provoke a financial crisis. The federal government's borrowing is limited by law, so, when the budget is in deficit, legislators must raise the limit from time to time so that the government can continue to pay its bills. Republicans in Congress are threatening not to raise the limit. This would force the government to either default on its debt or cut spending immediately by 40%. Most commentators seem to agree that Republicans will back down at the last moment, but their willingness to use the threat of economic catastrophe as a bargaining chip seems rather remarkable. Here's how Princeton economist Alan Blinder, former vice chairman of the Federal Reserve, sees the situation:

For openers, suppose the federal government actually does reduce its expenditures by 40% overnight. That translates to roughly \$1.5 trillion at annual rates, or about 10% of GDP. That's an enormous fiscal contraction for any economy to withstand, never mind one in a sluggish recovery with 9% unemployment. Even contemplating such a possibility is evidence of a dark, self-destructive impulse.

Second, markets now assign essentially zero probability to the U.S. losing its fiscal mind. They'd be caught flat-footed if the threat of default suddenly started to look real, possibly triggering a world-wide financial panic. Remember how markets reacted to the Lehman Brothers surprise? As Mr. Geithner pointed out in New York on Tuesday, "As we saw in the fall of 2008, when confidence turns, it can turn with brutal force and with a momentum that is very difficult and costly to arrest."

And finally, as mentioned, should the view take hold that threats to default are now a permissible weapon of political combat in the world's greatest democracy, U.S. government debt will lose its exalted status as the safest asset money can buy—with unpleasant consequences for the dollar and interest rates.

Fights over the budget are normal and proper in a democracy, especially when the two parties hold dramatically different views. But threatening to default should not be a partisan issue. In view of all the hazards it entails, one wonders why any responsible person would even flirt with the idea.¹²

Bizarrely, a notable fraction of spending cuts are targeted exactly where they will cause the greatest pain and maximum economic damage: the long-term unemployed. Given the poor employment situation, these individuals undoubtedly have difficulty finding work. They have probably run through nearly all of their savings, so they likely spend whatever support they receive from the state immediately, implying a relatively large multiplier effect. Yet state governments appear eager to cut support for the long-term unemployed. From the *Associated Press*:

Michigan, Missouri and Arkansas recently reduced the maximum number of weeks that the jobless can get state unemployment benefits. Florida is on the verge of doing so. Unemployment in those states ranges from 7.8 percent in Arkansas to 11.1 percent in Florida.

The benefit cuts come as legislatures deal with the damage that the recession inflicted on state unemployment insurance programs. The sharp increase in the number of people who lost their jobs drained the reservoir of money dedicated to paying out benefits.

About 30 states borrowed more than \$44 billion from the federal government to continue payments to laid-off workers. Many states hastened the insolvency of their funds by keeping balances at historically low levels going into the downturn.

The burden of replenishing the funds and paying off the loans will fall primarily on businesses through higher taxes, but the benefit cuts are an effort to limit the tax increases.

States usually provide up to 26 weeks of benefits to laid-off workers. Michigan and Missouri have cut that to a maximum 20 weeks. Arkansas went to 25.¹³

According to the article, the goal is to limit tax increases. This is consistent with the anti-tax ideology currently prevailing in the Republican party. Republicans vehemently oppose tax increases, and many Republican politicians have signed anti-tax pledges, creating a major obstacle to compromise. From the *Washington Post*:

today's GOP adheres to a "no new taxes" orthodoxy that has proved far more powerful than the desire to balance the budget. As House Speaker John A. Boehner has said: Raising taxes is "unacceptable and a non-starter."

This orthodoxy is now woven so deeply into the party's identity that all but 13 of 288 GOP lawmakers in Congress have signed a formal pledge not to raise taxes. ...

It is so widespread that more than a dozen governors and hundreds of state legislators now count themselves as adherents. And it is so well defended that its followers are constantly patrolling at both the state and federal levels for new forms of trespass.¹⁴

In some cases, state governments are even scaling back federally-funded unemployment benefits. From Bloomberg:

Arizona lawmakers declined to act on a call by Governor Jan Brewer to extend federal jobless benefits, allowing support for 15,000 people and almost \$3.5 million per week in federal aid to expire.

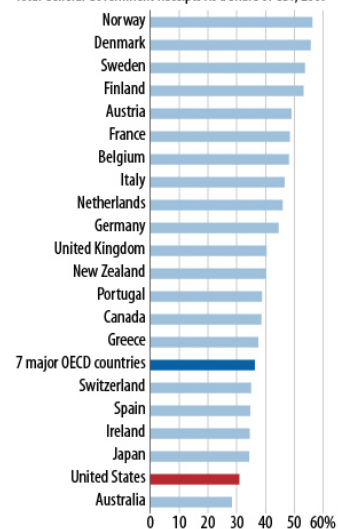
Republican lawmakers, who control the Legislature, argued that unemployment checks deter job-seeking. They also expressed concerns about the federal deficit and the amount of U.S. Treasuries held by China. Instead, they pushed for "job-creation" tax breaks for corporations.¹⁵

Taxes in the USA

Given the economic and political significance of taxation and government spending, it seems worthwhile to consider some basic facts about taxation in America. These charts are from the Center on Budget and Policy Priorities.¹⁶ To begin with, the USA, like Japan, has relatively low tax rates by international standards (right). This is all the more surprising considering the country's massive military budget, which account for about 20% of government expenditures.

The United States Is a Low-Tax Country

Total General Government Receipts As a Share of GDP, 2009



Source: Organisation for Economic Co-operation and Development
Center on Budget and Policy Priorities | cbpp.org

Now, consider historical trends. Income tax rates for typical families (the median family, left), corporations (center), and the wealthy (right) have been declining for more than fifteen years.

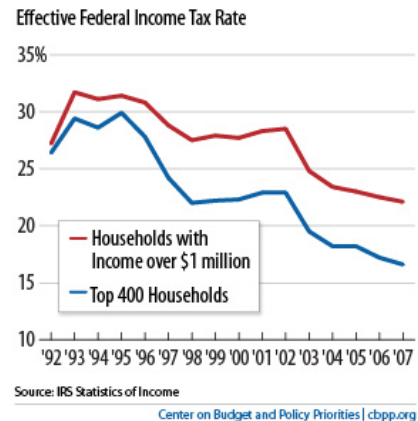
Federal Income Taxes on Average Families Are Historically Low



Corporate Tax Revenues Are Historically Low



Effective Tax Rates on Wealthiest People Have Fallen Dramatically



Note that the tax rate for the 400 highest-income households (right, blue line) is actually about 5% lower than the tax rate for households earning over \$1 million (right, red line). On a personal note, my relatively modest income last year was taxed at 26%, several percent higher than the typical household earning over \$1 million. The rich enjoy lower effective tax rates for at least two reasons. First, they receive much of their income in the form of capital gains, which are taxed at a lower rate than ordinary income. Second, they are adept at avoiding taxes. The April 7 issue of *Bloomberg Businessweek* featured a cover article entitled “How to Pay No Taxes: Eleven shelters, dodges, and rolls—all perfectly legal—used by America’s wealthiest people”¹⁷. The article begins:

For the well-off, this could be the best tax day since the early 1930s: Top tax rates on ordinary income, dividends, estates, and gifts will remain at or near historically low levels for at least the next two years. That’s thanks in part to legislation passed in December 2010 by the 111th Congress and signed by President Barack Obama.

“This is clearly far and away the most generous tax situation that’s existed,” says Gregory D. Singer, a national managing director of the wealth management group at AllianceBernstein (AB) in New York. “It’s a once-in-a-lifetime opportunity.”

According to the article, the statistics presented above actually overstate the tax rates paid by high-income individuals:

The true effective rate for multimillionaires is actually far lower than that indicated by official government statistics. That’s because those figures fail to include the additional income that’s generated by many sophisticated tax-avoidance strategies. Several of those techniques involve some variation of complicated borrowings that never get repaid, netting the beneficiaries hundreds of millions in tax-free cash. From 2003 to 2008, for example, Los Angeles Dodgers owner and real estate developer Frank H. McCourt Jr. paid no federal or state regular income taxes, as stated in court records dug up by the Los Angeles Times. Developers such as McCourt, according to a declaration in his divorce proceeding, “typically fund their lifestyle through lines of credit and loan proceeds secured by their assets while paying little or no personal income taxes.” A spokesman for McCourt said he availed himself of a tax code provision at the time that permitted purchasers of sports franchises to defer income taxes.

For those who can afford a shrewd accountant or attorney, our era is rife with opportunity to avoid, or at least defer, tax bills, according to tax specialists and public records. It's limited only by the boundaries of taste, creativity, and the ability to understand some very complex shelters.

To conclude the discussion on taxes, let me return for a moment to the political situation. The intense Republican opposition to tax increases seems particularly peculiar given that US taxes are low by international and historical standards. Bruce Bartlett, a former economic advisor at the White House, writes:

federal taxes are at their lowest level in more than 60 years. The Congressional Budget Office estimated that federal taxes would consume just 14.8 percent of G.D.P. this year. The last year in which revenues were lower was 1950, according to the Office of Management and Budget.

The postwar annual average is about 18.5 percent of G.D.P. Revenues averaged 18.2 percent of G.D.P. during Ronald Reagan's administration; the lowest percentage during that administration was 17.3 percent of G.D.P. in 1984.

In short, by the broadest measure of the tax rate, the current level is unusually low and has been for some time. Revenues were 14.9 percent of G.D.P. in both 2009 and 2010.

Yet if one listens to Republicans, one would think that taxes have never been higher, that an excessive tax burden is the most important constraint holding back economic growth and that a big tax cut is exactly what the economy needs to get growing again.¹⁸

Good Times for a Lucky Few

Despite the generally poor state of the US economy, a fortunate minority are enjoying boom times. For the most part, they're the usual suspects; let's run down the list.

CEOs:

Chief executives at the biggest U.S. companies saw their pay jump sharply in 2010, as boards rewarded them for strong profit and share-price growth with bigger bonuses and stock grants.

The median value of salaries, bonuses and long-term incentive awards for CEOs of 350 major companies surged 11% to \$9.3 million, according to a study of proxy statements conducted for The Wall Street Journal by management consultancy Hay Group.¹⁹

Hedge fund managers:

Last year was very lucrative for some of the biggest and best-performing hedge funds' chiefs. Wealth was so concentrated that a mere 25 people pocketed a total of \$22.07 billion, according to this year's annual ranking by AR Magazine, which tracks the hedge fund industry. At \$50,000 a year, it would take the salaries of 441,400 Americans to match that sum.²⁰

Founders and venture capitalists in a relatively small number of hot tech companies:

LinkedIn's IPO has produced more than \$2 billion in paper profits for backers, including Sequoia and Greylock, while Groupon's two top outside investors, New Enterprise Associates and Accel, may own a \$5 billion stake when the daily-deal site goes public.²¹

As I mentioned above, these fortunate few are also enjoying extraordinarily favorable tax treatment.

A Brief Update on the Money Game

One of the serious problems plaguing the USA is the out-of-control financial sector, which appropriates a surprisingly large fraction of the nation's wealth. It's important to recognize that this problem has not been addressed in the wake of the financial crisis: on the contrary, matters have deteriorated further. Peter Boone and Simon Johnson write in the *Financial Times*:

If Monday's interim report of Sir John Vickers' commission highlights one thing, it must be this: the banking system, on both sides of the Atlantic, is more dangerous now than before the financial crisis began in 2008. The only difference is that few now think Citi, HSBC or any of the major banks could go bankrupt, like Lehman Brothers. Before 2008 "too big to fail" guarantees were a possibility; now they are a certainty – enabling banks to borrow cheaply, and take risky bets with a great deal of leverage. Executives get the upside, taxpayers get the downside.²²

Interestingly, the Federal Reserve has now allowed the large banks to increase dividends and buy back shares. JPMorgan Chase is buying back \$15 billion and Wells Fargo about \$6 billion. This is part of the game: when times are good, distribute as much cash as possible to shareholders; when times are bad, turn to the government for a bailout. The Federal Reserve justified allowing the resumption of cash distributions to shareholders on the basis of stress tests showing that the banks are amply capitalized. As Simon Johnson points out, however, taxpayers have reason to worry. The stress tests, he says,

are highly suspect because they were run by the banks themselves and the results will not be published in any detailed way; this is disturbingly similar to the European bank stress tests of summer 2010, which were a complete disaster²³

So expect more excitement from the financial sector.

The Third-Worldization of America

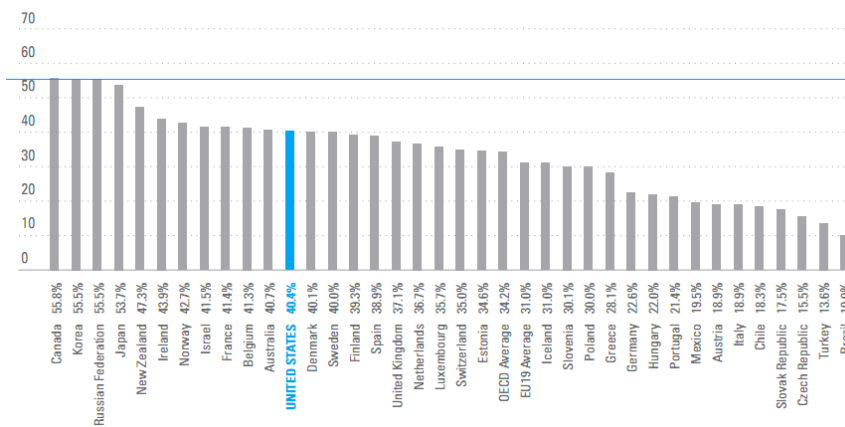
Although I promise to conclude on an optimistic note, I'd like to share a smattering of articles that have caught my attention over the last few months because they seem to indicate a shocking decline in America's social infrastructure. For lack of a better term, I'll call this trend the third-worldization of America. A clumsy neologism, I admit, but I think you'll agree that it's distressingly apt. The third-worldization of America is visible in falling educational achievement, illiteracy, crumbling infrastructure, poor labor conditions and lax environmental regulations.

Consider college completion rates. According to OECD data analyzed by CollegeBoard²⁴, the US is a world leader in college completion rates for 55 to 64-year-olds, behind only Russia, Israel and Canada. In the 25 to 34-year-old age cohort, however, the US has slipped to twelfth place, while Korea and Japan have risen to second and fourth, respectively (see chart below).

Percentage of 25- to 34-Year-Olds with an Associate Degree or Higher, 2007

Source: Organisation for Economic and Co-operative Development, 2009

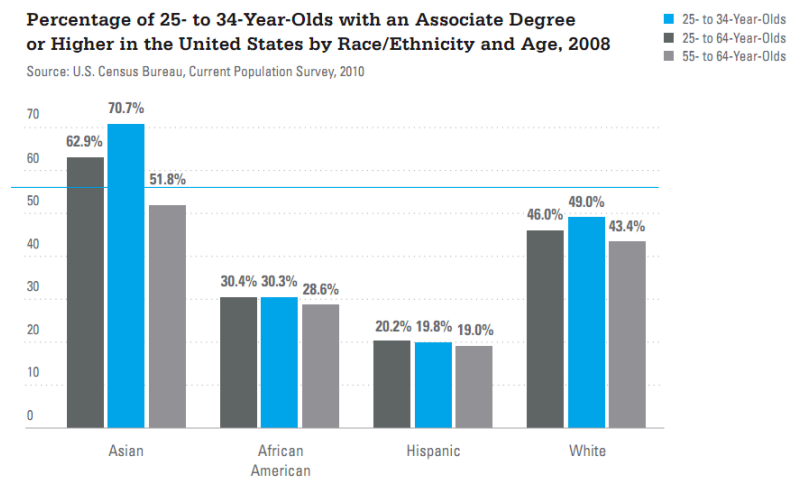
11 Countries
United States
24 Countries



Interestingly, the USA would be in fifth place or higher but for the poor educational achievement of African Americans and Hispanics. How to interpret this racial dimension of America's third-worldization is an open question.

Percentage of 25- to 34-Year-Olds with an Associate Degree or Higher in the United States by Race/Ethnicity and Age, 2008

Source: U.S. Census Bureau, Current Population Survey, 2010



Low levels of educational achievement are reflected in adult literacy statistics that can only be called appalling. From the *Daily Mail*:

Nearly half the population of Detroit are unable to read, research has revealed.

The study, released by the Detroit Regional Workforce Fund, found that 47 per cent of adults in the Motor City are 'functionally illiterate'.

That means they struggle to complete daily tasks such as reading a bus timetable, filling out a job application form or reading a label on a medicine bottle.²⁵

If the USA underinvests in human capital, it also underinvests in physical infrastructure. From the *Economist*:

America, despite its wealth and strength, often seems to be falling apart. American cities have suffered a rash of recent infrastructure calamities, from the failure of the New Orleans levees to the collapse of a highway bridge in Minneapolis, to a fatal crash on Washington, DC's

(generally impressive) metro system. ... In the WEF 2010 league table America now ranks 23rd for overall infrastructure quality, between Spain and Chile. Its roads, railways, ports and air-transport infrastructure are all judged mediocre against networks in northern Europe.²⁶

The article rattles off one problem area after another, including congested roads, slow and unreliable rail service, and an obsolete and overburdened air traffic control system. The article continues:

All this is puzzling. America's economy remains the world's largest; its citizens are among the world's richest. The government is not constitutionally opposed to grand public works. The country stitched its continental expanse together through two centuries of ambitious earthmoving. Almost from the beginning of the republic the federal government encouraged the building of critical canals and roadways. In the 19th century Congress provided funding for a transcontinental railway linking the east and west coasts. And between 1956 and 1992 America constructed the interstate system, among the largest public-works projects in history, which criss-crossed the continent with nearly 50,000 miles of motorways.

But modern America is stingier. Total public spending on transport and water infrastructure has fallen steadily since the 1960s and now stands at 2.4% of GDP. Europe, by contrast, invests 5% of GDP in its infrastructure, while China is racing into the future at 9%. America's spending as a share of GDP has not come close to European levels for over 50 years. Over that time funds for both capital investments and operations and maintenance have steadily dropped.

Under president Obama's leadership, the USA is also backtracking on environmental regulation. From an editorial in the *Los Angeles Times*:

Shortly after his party's "shellacking" in the midterm election, President Obama ordered government agencies to ensure that new regulations took economic growth into consideration and that old ones be revoked if they "stifle job creation or make our economy less competitive." Five months later, it's becoming pretty clear what he meant: The environment and public health will be thrown under a bus for the sake of his reelection in 2012.

The latest victim of the administration's new political direction is a proposed Environmental Protection Agency rule to limit emissions from industrial boilers, which power oil refineries, chemical plants and other factories. The EPA indefinitely rescinded the proposal this week, citing Obama's January executive order on regulations and claiming that the agency hadn't had time to properly address industry concerns about the rule since a draft was released in September. The EPA first proposed a version of the boiler rules in 2004, and it has had ample time and input to get it right by now.²⁷

Perhaps the most dramatic example of America's third-worldization is that the Swedish company IKEA has started outsourcing to Danville, Virginia in order to reduce costs. From the *Los Angeles Times*:

Laborers in Swedwood plants in Sweden produce bookcases and tables similar to those manufactured in Danville. The big difference is that the Europeans enjoy a minimum wage of about \$19 an hour and a government-mandated five weeks of paid vacation. Full-time employees in Danville start at \$8 an hour with 12 vacation days — eight of them on dates determined by the company.

What's more, as many as one-third of the workers at the Danville plant have been drawn from local temporary-staffing agencies. These workers receive even lower wages and no benefits, employees said.

Swedwood's Steen said the company is reducing the number of temps, but she acknowledged the pay gap between factories in Europe and the U.S. "That is related to the standard of living and general conditions in the different countries," Steen said.

Bill Street, who has tried to organize the Danville workers for the machinists union, said Ikea was taking advantage of the weaker protections afforded to U.S. workers.

"It's ironic that Ikea looks on the U.S. and Danville the way that most people in the U.S. look at Mexico," Street said.²⁸

What's Next: Biofuels and Innovation à la Google

Although it's important to recognize the severity of America's political, economic and social troubles, the country's great capacity for innovation also merits attention. I'd like to highlight two particularly interesting innovation hotspots: biofuels and Google.

Biofuels created by microorganisms or plants offer a promising alternative to fossil fuels. Biofuels are carbon neutral, since carbon is absorbed as the microorganisms or plants grow and then released when the fuel is burned. Thus, biofuels may be able to meet our energy needs as fossil fuel reserves are depleted, while reducing global warming. The biofuels industry also shows how America's innovation habitat nourishes new technologies. Innovation often begins in university labs with funds from the US government. Here's an example in the biofuel industry, from *Science Daily*:

University of Minnesota researchers are a key step closer to making renewable petroleum fuels using bacteria, sunlight and carbon dioxide.

Graduate student Janice Frias, who earned her doctorate in January, made the critical step by figuring out how to use a protein to transform fatty acids produced by the bacteria into ketones, which can be cracked to make hydrocarbon fuels. The university is filing patents on the process. ...

The research is funded by a \$2.2 million grant from the U.S. Department of Energy's Advanced Research Projects Agency-energy (ARPA-e) program, created to stimulate American leadership in renewable energy technology.²⁹

Breakthrough inventions, however, are only the first step. As Dr. Richard Dasher, director of the US-Asia Technology Management Center at Stanford University, pointed out to me in a recent conversation, even with a great technology, it's extremely difficult to turn that technology into a large, global business. Silicon Valley's entrepreneurial ecosystem is remarkably good at providing promising startups with the financial and managerial resources they need to grow rapidly. On the whole, corporate governance mechanisms do a relatively good job of ensuring that those resources are used effectively.

Consider the example of Solazyme, a leading biofuel company based in South San Francisco, the northern fringe of Silicon Valley. Since it was founded in 2003, Solazyme raised over \$125 million from investors including Chevron, Morgan Stanley, and Unilever³⁰. The company received a \$22 million grant from the Department of Energy to help fund the purchase of a biorefinery³¹. In June, the company closed its initial public offering, which raised more than \$200 million, net of sales by existing stockholders³². Thus, in only eight years, this company has raised more than \$300 million in capital. It's too soon to tell whether

Solazyme will be successful, but the example shows the ability of the American economy to place large bets on promising technologies.

Google illustrates how successful companies can place similar bets. Although Google's core business is Internet search, the company is making substantial investments in autonomous vehicles and renewable energy. Here's a description of the autonomous vehicle project:

Our goal is to help prevent traffic accidents, free up people's time and reduce carbon emissions by fundamentally changing car use.

So we have developed technology for cars that can drive themselves. Our automated cars, manned by trained operators, just drove from our Mountain View campus to our Santa Monica office and on to Hollywood Boulevard. They've driven down Lombard Street, crossed the Golden Gate bridge, navigated the Pacific Coast Highway, and even made it all the way around Lake Tahoe. All in all, our self-driving cars have logged over 140,000 miles. We think this is a first in robotics research.

Our automated cars use video cameras, radar sensors and a laser range finder to "see" other traffic, as well as detailed maps (which we collect using manually driven vehicles) to navigate the road ahead. This is all made possible by Google's data centers, which can process the enormous amounts of information gathered by our cars when mapping their terrain.

To develop this technology, we gathered some of the very best engineers from the DARPA Challenges, a series of autonomous vehicle races organized by the U.S. Government.³³

A few observations about the project. First, the research was triggered by the Defense Advanced Research Projects Agency, which organized autonomous vehicle competitions and offered substantial prizes (up to \$2 million). As in the case of biofuels (and, for that matter, the Internet), the federal government is providing resources and leadership to kick-start innovation. I might add that I have applied for a Small Business Innovation Research (SBIR) grant from the National Science Foundation to help fund my own startup company.

Second, Google is serious about commercializing the technology, and the potential economic value is enormous. These cars are already on the road, and Google has been lobbying the Nevada state government to relax regulations to facilitate testing³⁴. Self-driving cars could improve fuel efficiency, reduce traffic jams and accidents, and enable new modes of car sharing. This is not a trophy technology designed to impress visitors to the company's research lab.

Third, it's kind of shocking that Google is taking the lead in this technology. Why not Toyota or Honda, both of which have ample financial resources and highly sophisticated robotics expertise? Perhaps this reflects the ability of Google's management team to place big bets on risky, high-potential technologies.

That's not Google's only big bet. This month, Google announced that it will create a new R&D team dedicated to renewable energy:

Google has advertised five new positions in its Renewable Energy Engineering wing in Mountain View. One will be charged with managing Google's own energy usage to help keep the company cost-efficient and carbon-neutral. The other four spots are much more mechanical-engineering heavy than the typical Google hires. ...

The key phrase throughout the advertised positions is “utility-scale.” The language of the mechanical engineer advertisement is especially revealing: “You will not be designing laboratory experiments; you will be designing useful systems that must deliver cost-effective results in the real world.” This isn’t pie-in-the-sky R&D. This is about products.³⁵

Here again, Google’s focus is on getting technologies out of the lab and scaling them up. Google has already invested hundreds of millions of dollars in renewable energy, including solar and wind farms. In April, Fast Company interviewed Google’s Director of Green Business Operations, Rick Needham:

In the past two weeks, Google has made two staggeringly large renewable energy investments: a \$168 million investment in the Ivanpah solar farm, and a \$100 million investment in the world’s largest wind farm. ...

So what does Google look for in potential projects? “There are two things we look at. One is that we want to make a good return on capital given the risk of the project. The second way we decide is, we want to have an impact on the scale of the project, and an impact because of the technology being deployed,” explains Needham. “One reason we’re looking at larger scale projects is that they’re larger impact in and of themselves. The other thing is that they’re the proof point of technology on a scale that allows those technologies to be financed and deployed at other locations.” ...

Google is open to looking at more high-risk projects, too. “We’re willing to take a calculated risk. For a riskier project, we would expect higher returns,” says Needham. One example: last year, Google invested in the Atlantic Wind Connection, a \$5 billion, 350-mile transmission project that could connect 6,000 megawatts of offshore wind turbines to the grid. If it works, the project could make building offshore wind turbines easier and cheaper.

“We certainly are deploying our capital to make good returns, but the other part is how we can help deploy innovative technology, or technology at a scale that can really move the needle,” says Needham.³⁶

The key to enabling innovation may be a culture that respects failure. In Silicon Valley, Dasher observes, failure is recognized as a cost—sometimes a high cost—of getting educated. Eric Schmidt, while he was still CEO of Google, said of his company:

We try things ... we celebrate our failures. This is a company where it’s absolutely okay to try something that’s very hard, have it not be successful, and take the learning from that.³⁷

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Please send comments, questions, or subscription inquiries to me at djb@davidjamesbrunner.org. If I receive comments or questions that may be of interest to other readers, I’ll publish excerpts in the next issue. Excerpts will be published anonymously unless you give me explicit permission to include your name.

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