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Samuel Macchiarolo
Grand Valley State University

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Frederik Meijer Honors College, Grand Valley State University

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Prof. Matthew Daley

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Innovation has been a driving force for economic growth practically since the dawn of time. In the past two centuries, we have seen massive enhancements in innovation in the world, with everything from the development of steam engines for transportation to the modern-day internet where people can make electronic transactions of their own money with someone on the other side of the world with just a click of a button. Innovation is crucial to economic growth as it helps with factors such as job creation and competition within society and the economy, as many companies that do not innovate tend to fall behind. Innovation levels are also a major factor in terms of where economic growth is heading. An example of this would be the Great Recession of 2008 where the United States economy suffered greatly partly due to a slowdown in innovation before the crisis (Cette et al., 2016).

This paper will be examining factors that may have contributed to past economic recessions, particularly in the US, by looking at levels of both financial innovation and physical innovation, as well as research and development. The paper will take a deeper look into how previous economic recessions happened, how the changes in the level of innovation played a part in those recessions, why innovation levels change so much, and what can be done to eliminate the variation of innovation to help stabilize economic output.

A Brief Look at Economic Recessions

To see the effect of innovation and the role it has on economic growth, it is important to understand some baseline reasons as to why some of the past economic recessions occurred. If we were to look at some of the greatest economic downturns in the US, particularly the Great Depression of the 1930s and the Great Recession in the late 2000s, it can be seen that a large part

of these recessions, however, was the high levels of fraudulent and immoral activity around the financial system in the US during these times, along with the factor of a regressing level of innovation, particularly in the financial sector. Looking at the events before the Great Depression, the United States was moving away from a heavy industry era, dominated by steel, oil, and railroads, and was moving to a more consumer-based economy (Gordon, 2005). This allowed, eventually, for people to be able to invest their money into the New York Stock Exchange, which was booming at the beginning of the 20th century due to American banks having lower interest rates compared to their European counterparts (Gordon, 2005). Furthermore, many American investment bankers started putting money into the call money market, which allowed purchasers of stocks to buy part of the stock while getting the rest on loan, which worked all right as long as the stock continued upward (Gordon, 2005). But, if the stock price started to decline, then the original buyer would have to put more money up or risk being sold out, which made the market very risky and volatile (Gordon, 2005). It was risky, short-term profit gain investments such as these that helped create the crash of the New York Stock Exchange, as the thought in people's minds was that the market would keep rising, until eventually, the market crashed in October of 1929 (Gordon, 2005).

After the aftermath of the Great Depression, there was a legal investigation conducted by the United States Senate Committee on Banking and Currency, led by Ferdinand Pecora, on the Banks of Wall Street and stock brokerage practices (Perino, 2011). Pecora found vast amounts of abusive practices and risky moves that banks made that caused the economic crash (Perino, 2011). Banks such as National City would withhold information about their profits and the risks when offering securities to prospective investors, or in other words, they would purposely get people to make poor investments to make a profit (Perino, 2011). One victim of National City

Bank's risky practices was a long-time investor Edgar Brown. Brown had a large amount of money invested that was controlled by National City Bank, and they gave him the advice to borrow three times the money that he had ($100,000) and to invest in risky stocks rather than bonds, and later on, when he asked to slow down the pace that they were trading with his money, they refused to do so (Perino, 2011). In the end, he lost 75% of his wealth that was placed in the stock market because of their risky practices (Perino, 2011).

The 2008 recession was also due in part to fraudulent activity, this time in the housing market. Banks were finding risky mortgage loans to pursue profits because these financial institutions found that they could make more money by controlling all states of the mortgage securitization process instead of having separate firms taking up different parts of the mortgage process (Coghlan, et al., 2018). Eventually, when enough homeowners defaulted on their mortgages, it created a chain reaction that crashed the market (Coghlan, et al., 2018).

The fraudulent and immoral activities that banks were undertaking were one of the largest factors that ultimately caused previous economic downturns in the United States economy, and this is important to mention so as to not take away from the fact that people, particularly in the financial sector, had short term goals to make an easy profit, but in turn, took shortcuts to do so. To address this issue of avoiding merely short-term thinking in financial investments and activities, it is important to see why banks made these decisions and how differing levels of financial and physical innovations tie into firms trying to gain short-term profits.

How Innovation Contributes to Economic Recessions

Along with financial greed and shortcuts made by financial institutions that caused these economic recessions, there is an argument that innovation has a large impact on these as well. Looking at the levels of physical innovation around the times that these activities were taking

place can help explain why bad practices occur in the first place, as well as how innovation can counteract the effects of an economic downturn. Particularly looking at the 2008 crisis, even though risky moves in the housing market receive much of the blame, "too few innovations introduced in the years leading up to the crisis also contribute to this collapse or, at a minimum, deepening the resulting recession" (Hausman & Johnston, 2014). The trend of financial and physical innovations in the years leading up to the financial crisis saw a drastic slowdown by US firms, especially compared to other nations like Israel and China (Hausman & Johnston, 2014). The US also sees this in the amount that it imports technology from other countries, as the advanced trading turned into a deficit in the early 2000s, thus making the US an importer of technology rather than an exporter according to Figure 2. This slowdown of innovation had many factors attributed to it which will be discussed throughout the paper.

Looking at the events leading up to the Great Recession, specifically through the 1990s to the early 2000s, it is regarded as a time of great economic stability and growth, as seen by the large increase in Real GDP in the US in Figure 1 (Federal Reserve Bank of St. Louis). This was due to a large burst of innovation and the use of information technology (Cette et al., 2016). But, this burst of innovation slowed down at a substantial rate in the years leading up to the 2008 recession (Cette et al., 2016). One statistic that proves the decreasing rate of physical innovation can be shown by the percentage of new products being sold in the US. In 2004, new products that were sold only accounted for 28% of total corporate sales, which is a drop of 4.6% as compared to 1990 when new products accounted for 32.6% (Hausman & Johnston, 2014).

Now that we see a correlation between lowering innovation and economic slowdowns, we can ask why innovation slows down in the first place. For starters, by looking at how larger firms try to please their investors, it can be said that "fewer innovations stem from overt efforts

to appease increasingly risk averse and short-term oriented stockholders" (Hausman & Johnston, 2014). As history suggests, short-term gains make stock prices go up to increase the financial rewards for managers, firms, and investors (Hausman & Johnston, 2014). We have seen this before in the housing market crisis and the collapse of the New York stock exchange where banks were finding shortcuts and short-term gains to produce profits for themselves. These firms also ignore long-term investments in innovation, whether it be to make their product more efficient or financial firms not investing in firms with a focus on innovation because they are trying to be more consistent with their earnings to please their investors which only adds to the problem as it can create stagnation in the economy, thus slowing down growth over time (Hausman & Johnston, 2014). Furthermore, because firms aren't trying to innovate to entice their consumers and investors due to the variability of how innovation can affect a firm's product and finances, they depend on lowering their costs to provide those short-term gains, especially when consumer spending declines (Hausman & Johnston, 2014). This was a prominent feature that we saw in the 2008 recession as millions lost their jobs with peak unemployment reaching around 10% (Coghlan, et al., 2018).

To further prove this point we can look at how large firms react to investing in research and development, or the lack thereof. In many cases, large firms take less of an undertaking in investing in research and development, as well as staying away from investing in other firms that undertake radical innovation (Hausman & Johnston, 2014). Instead, they strive to have "stable, predictable earnings and dividend payments" (Hausman & Johnston, 2014). History has shown that investors will punish risk-taking firms by reducing their stock price, particularly firms that are risky in terms of their push for innovation (Hausman & Johnston, 2014). This shows that the "stock market is better at evaluating simple numeric data, especially income, and not good at

valuing intangibles, uncertain innovation, or technological change" (Hausman & Johnston, 2014).

So overall, we can see that these venture capitalists will focus their efforts on helping the firms that they are already invested in that will give them consistent returns, rather than funding new start-ups (Hausman & Johnston, 2014). Instead of investing in tech and product innovations, firms are trying to invest in financial innovations in order to cut costs and have short-term gains. This creates a very conservative product market as firms will be less willing to invest to make products better because it will lower their stock price, but it will also create more risk in the financial markets as financial firms may take on riskier investments to make a profit.

Benefits of Innovation

Innovation through the past two centuries has helped in times of economic recessions by helping the economy dig itself out of the hole that it created. Many experts agree that "innovation is positively related to increased profitability through a) increased consumer spending and b) reduced competition" (Hausman & Johnston, 2014). This is due to innovation helping create new jobs, new technologies, and increased efficiency, as well as creating new markets, both domestic and foreign, for firms to sell their goods and services (Brancati et al., 2021). Economic recessions also provide a significant opportunity for firms to try innovative strategies rather than trying to conserve capital (Rae-Dupree, 2008). For instance, some of the best products and services came out of economic hardships, such as Apple and Microsoft (Rae-Dupree, 2008). Although today, much of the technology produced is imported as the production has been shifted overseas to cut costs, as seen once again in Figure 2. This could create issues for the US economy in terms of being innovative in the push to cut costs and gain a

profit rather than making a better product in the end that could help produce more jobs and research and development within the US.

These tough economic situations allow people to adopt new strategies and try to find new ideas and technologies to get ahead in business, either to start one or to keep their business afloat (Rae-Dupree, 2008). We saw this during the Great Depression, as the "1930s was one of the most productive times in the 20th century" because people adopted technologies from the 1920s and made those technologies more efficient (Hausman & Johnston, 2014). We even see this through the 1980s as computers took off during a slow economy as a way for firms to have a leaner workforce (Hausman & Johnston, 2014). Along with this increase in the use of computers, many former jobs are being automated and replaced by machines, so more jobs need to be created to keep up with the rising population to keep people employed. Without constant innovative ideas and solutions, especially during times of economic turmoil, it is bound for the economy to slow when the right steps aren't taken to find new ways to make money.

Historically in economic hardships, we have seen that companies that invest in physical innovations tend to benefit sooner than companies that do not take advantage of the opportunity, as companies investing in these innovations give themselves a competitive advantage once the economy starts to gain ground again (Hausman & Johnston, 2014). History also suggests how war can accelerate the process of innovation as well. Because of massive funding efforts to accelerate innovation during times of war, as we saw in WWII when the United States was building massive infrastructure and innovating on all fronts, such as medicine and transportation (Gordon, 2005). Plus, in WWI, the United States saw an increase in its gross national product from 21% to 25% during the four years of the war (Gordon, 2005). Due to the nature of having

to innovate during times of war, the US usually sees a period of economic growth after the war because of the new technology made that stimulates the markets of the US.

Causes of Decreased Innovation

After examining the correlation between how innovation can contribute to economic growth or economic instability, it is important to understand what can reduce levels of innovation in the US. One reason is the effect that education has on innovation, as today in many classrooms students are required to conform to the tasks that are given to them rather than thinking on their own, so rather than finding new knowledge to explore, students are being taught what is already found. This "poor investment in creating new knowledge" can contribute to lower levels of educational innovation, as we have seen with fewer publications of new sciences and new technologies (Hausman & Johnston, 2014). Schooling has become a place where students are taught to remember data and facts rather than given the skills to add value to what has already been found. For example, most classrooms have traditional lectures as the form to teach students, but even if students feel they learn better during lectures rather than active learning, studies have shown that active learning yields higher scores (Reuell, 2019). This active learning teaches students how to add to their knowledge rather than memorizing the facts they need for the grade. Furthermore, almost all kids are given some sort of test to show their knowledge. Still, unfortunately, this creates a habit for students to remember the information they need for the test and then forget about it afterward. It does not show an accurate depiction of what the students have learned, but institutions seem to do this because it is easier to grade rather than using another form of seeing the progress of students. In other words, education is done in a way today that tries to get a stable return on investments, just like the financial sector does. The students who then go to college tend to pick more employment-based degrees such as various business

degrees because earning money is taught to be more important rather than producing or creating something. Overall, the issue is that education is taught to memorize information rather than adding more value to the information and ideas that are taught in schools.

It is also worth mentioning the increased inflation costs of higher education due to many universities' focusing on providing athletic departments and lavish facilities (Gordon, 2012). This increase in the cost of higher education is also seen in Figure 3, as the inflating cost of college tuition surpasses the inflation of costs in the US in the past 40 years.

The rate of innovation is declining overall as well. According to Huebner, most of the rapid progression in technology has happened in the past 250 years, which could very well be a unique episode of human history (Huebner, 2005). Either way, studies have shown the rate of innovation is declining, and that we are currently at an estimated 90% economic limit of technology (Huebner, 2005). This could change, however, as new forms of technology are growing, such as the increase in AI technology and green technologies that have not been thought of yet before.

Conclusion

The idea of economic growth is regarded as a process that will continue forever (Gordon, 2012). The very basis of a quality economic year in today's world is an increase in GDP, as shown in Figure 1 (FRED). If we are reaching our limits of technology, the limits of our brain function, or even limits due to lowering birth rates in the 21st century as compared to the 20th, humans may hit a wall of innovative decline because there is potentially not much more room for growth (Gordon, 2012). The issue is that the system that so many depend on thrives on only growth, and for that, we need constant innovations, both financial and physical (Huebner, 2005). So the question is, how much do we need to spend on innovation? Right now, it is not enough.

There are some things however that we could potentially do to try and fix this issue. For starters, we have seen a massive decline of 45% in funding for research in the physical sciences from 1976 to 2004 (Hausman & Johnston, 2014). Along with this, only 11% of stimulus money from the US government goes towards innovative research, and much of that is in the green technologies market, which is a step in the right direction in terms of creating new jobs (Hausman & Johnston, 2014). But this amount of funding is not substantial enough to help fix the issue of our decreasing innovative rate, especially seeing how financial investments have a history of pushing away innovative ideas and research, along with the lack of productive investments in education that allow students to think outside the box.

Some other things that could be done are to push firms to push innovative products so as to avoid pricing wars, which would lead to tougher conditions for smaller companies that tend to be more innovative in their approaches (Hausman & Johnston, 2014). We see this today within the fashion industry as they create lower quality products for super cheap costs at the expense of other businesses, as well as the environment and poor working conditions (2021). If we can give more incentives for firms to innovate in the forms of subsidies or more support through the stock market to build resources for creating, managing, and commercializing innovating processes, it would greatly contribute to overall innovation in the US and around the world (Hausman & Johnston, 2014). Right now, the green technologies market has massive potential for pushing technological innovations with everything from sustainable energy sources to more efficient long-term farming solutions (Hausman & Johnston, 2014).

In conclusion, it is important to keep investing in innovative technologies and processes since many financial firms steer away from it and our educational system seems to drive students away from innovative thinking. Innovation has been shown to be related to how well we are able

to operate as an innovative society, and because our innovative pace is rapidly declining and we are potentially reaching our known technological limit, it is important to improve our education and financial decisions and to venture into unknown areas such as green technologies to keep our society moving forward.

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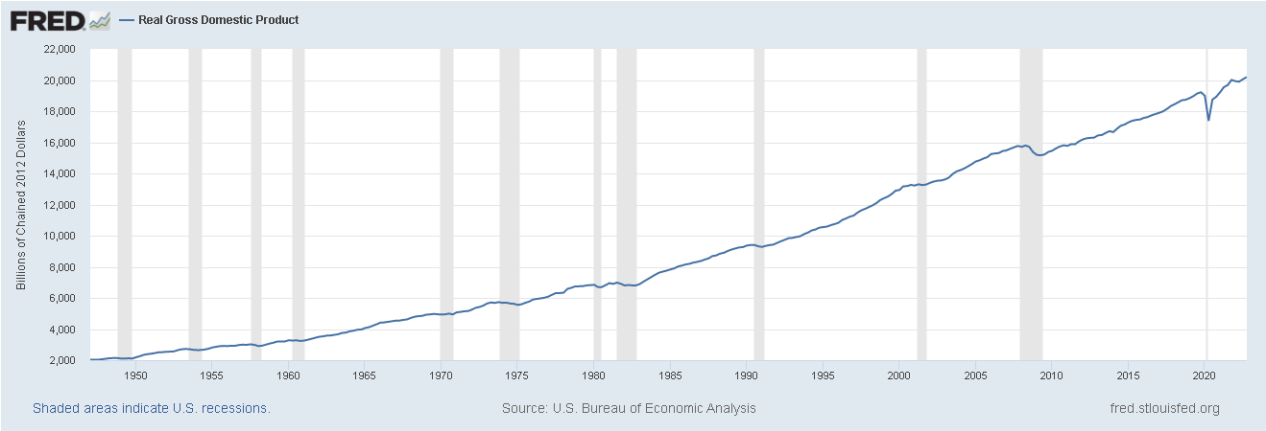
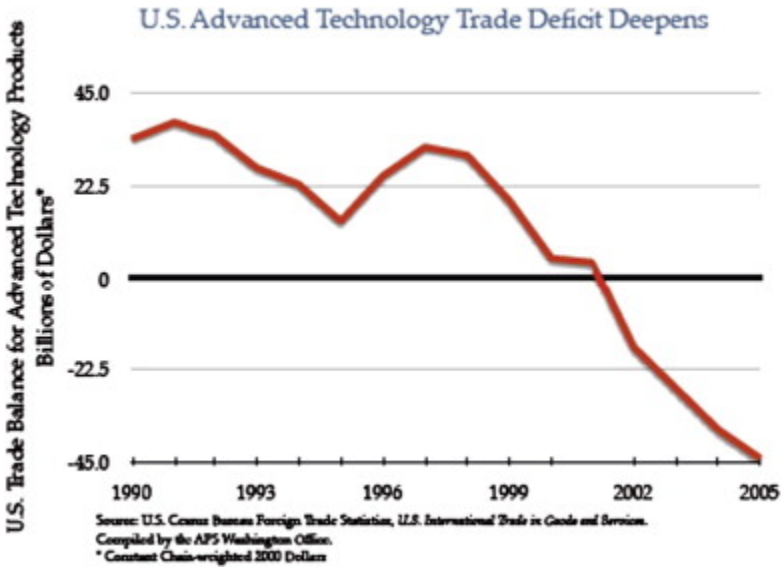
Graphs

Figure 1: Real GDP (US)



(Federal Reserve Bank of St. Louis)

Figure 2: Advanced Technology Net exports



(Hausman & Johnston, 2014)

Figure 3: CPI Index U.S. City Average of all Urban Customers vs CPI Index of College Tuition and Fees