The Empirical Evidence that Schumpeter's Creative Destruction is True and Important

Short running title: Schumpeter Evidence

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Abstract

Dynamic competition through the process of creative destruction encourages the innovation in product and process that lengthens and improves lives. This is the core version of Schumpeter's central message of creative destruction. The old extended version claimed, in addition, that monopolies were the most fruitful source of new leapfrogging innovation. The new extended version claims, to the contrary, that small, non-incumbent firms are often the most fruitful source of new leapfrogging innovation. We examine the growing evidence that the core version and the new extended version are true and important.

JEL codes: O30 - Technological Change, General.

Key words: technology, growth, productivity, Schumpeter

Introduction

Schumpeter's central message is that the process of creative destruction describes the form of competition in capitalism that is capable of dramatic improvements in the quantity and quality of our lives (Diamond, 2004). Many have noted a recent Schumpeter renaissance (e.g., DeLong and Summers, 2001; Friedman, 1999; Rosenberg, 2000; Samuelson, 2003, p. 467; Useem, 2001). In addition, Schumpeter's message is being illustrated, rigorously documented, extended and elaborated by a group of important business practitioners and academics, notably including monographs by Foster & Kaplan; Christensen; Christensen & Raynor; and Zook & Allen.

In *Capitalism, Socialism, and Democracy*, Schumpeter had a lot to say about his process of "creative destruction," not all of which is given equal emphasis by those using the phrase today. I think it is useful to distinguish a core version, from two different extended versions, that build on the core version in contrasting ways. The core version states that major technological advance is the main source of economic growth and improvements in the quality of life. It further states that a significant part of the incentive to produce leapfrogging innovations is the prospect of achieving monopoly profits. Traditionally the main source of monopoly profits would have been through patent rights. But currently a full account of monopoly profits would also include network externalities as a source (as with eBay and Microsoft).

The "original extended version" would, in addition, state that large, monopoly firms are the most able and the most likely to produce new, leapfrogging innovations.

This version is the one usually, but not always, associated with Schumpeter's own views. This latter claim has been shown to not generally be true. Referring to this version, Scherer reports that in his substantial 1965 empirical study:

> The results suggested that Schumpeter's assertions in *Capitalism, Socialism, and Democracy* were more wrong than right. Giant monopolistic corporations were not uniquely efficacious engines of technological advance. (2005, p. 394)

Also relevant is the Acs and Audresch (1990) research showing that optimal firm size for innovation significantly varied by industry. (But did these studies deal with the sort of major leapfrogging innovation that Schumpeter discussed?) Most notably, Christensen and his co-authors (2000, 2003, 2004) have presented substantial theory and evidence of how hard it is for an incumbent firm to successfully introduce a disruptive innovation.

The "new extended version" identifies smaller, often start-up, firms as the most likely source of new leapfrog innovation. The evidence of rapid and increasing turnover among the largest, most powerful, firms, by various measures, is evidence for the new extended version, but not for the old extended version. This evidence would include that discussed in Foster and Kaplan's *Creative Destruction*, in Zook and Allen's *Profit from the Core*, and in *Stall Points*. Also, and perhaps most powerfully, the evidence and theories in a variety of books, articles and case studies by Christensen and co-authors, support the new extended version. I argue elsewhere (2004) that the new extended version is what the vast majority of authors have in mind when they apply the phrase "creative destruction" to competition among computer and internet related

firms.

I will first discuss the challenges that face an evaluation of the evidence of the core version of creative destruction, addressing questions such as: is creative destruction the most important feature describing capitalism's success at improving and lengthening our lives? Then we will discuss some of the available evidence. Finally, we will summarize some of the evidence for the extended version.

Evidence for the Core Version

Schumpeter famously claimed that to discuss capitalism without mentioning the process of creative destruction would be like discussing the play Hamlet, without mentioning the Danish prince. But, in fact, the most common way to discuss capitalism, in Schumpeter's day and our own, is to omit creative destruction, and focus instead on price competition as the essential element. So the question becomes one of whether price competition is more important in benefiting consumers or the new products and processes that result from the leapfrogging competition of creative destruction?

One main difficulty in answering this question is that "capitalism" has been applied to a variety of portfolios of institutions. Since the dominant theory of capitalist competition has been the theory of price competition, institutions in the United States and Europe have been optimized to promote price competition. So if we looked at actual historical capitalism over the last couple of centuries, we would expect to find evidence biased in favor of the importance of price competition. An unbiased

comparison would compare the gains from price competition under a version of capitalism optimized for price competition, with the gains from new product innovation, under a version of capitalism optimized for leapfrog competition.

But since the institutions of capitalism have never been optimized for leapfrog competition, the best we can do is to compare the gains from price competition with the gains from leapfrog competition, remembering that the results will be biased against leapfrog competition.

Besides the bias, another basic difficulty arises in making the comparison. We have highly mathematical models of price competition, and widely understood graphical approximations of these models. Of related and perhaps equal importance, we have well-understood and frequently applied methods for measuring the benefits from static competition (notably the consumer surplus concept). In contrast we do not have any widely-accepted mathematical models, or graphical approximations, explaining the process of creative destruction. And even more importantly, we have found it extremely difficult to measure the benefits of the new product or the new process.

Some significant progress has been made, and we summarize here a couple of papers that illustrate the progress. One particularly illuminating paper is Nordhaus (1997), in which the author compares changes in the true price of light, with changes as measured by traditional price indexes. Traditional price indexes would be based on changes in the price of the good that produces the light (e.g., the bulb) rather than changes in the price of the service being produced, in this case illumination. One advantage of the case of light is that measures of illumination for various light-

producing goods are readily obtainable and do not require the estimation of hedonic price functions, as is required, for instance, in obtaining a price index for the services from computers. For his case, Nordhaus concludes that "*traditional price indexes of lighting vastly overstate the increase in lighting prices over the last two centuries, and the true rise in living standards in this sector has consequently been vastly understated*." (p. 30, italics in original)

In order to understand how representative the lighting sector is of the economy as a whole, Nordhaus classifies (pp. 58-60) sectors of the economy into one of three categories: "run-of-the-mill," "seismically active," and "tectonically active." The run-of-the-mill sectors are ones in which either products have changed relatively little since 1800, or else ones for which current price indexes will likely be able to capture most of the changes in quality. The seismically active sectors are those in which the products are still recognizable from 1800, but the quality and characteristics have changed so substantially that current indexes do a poor job of measuring changes. The tectonically active sectors are those in which the changes in product and production process are so large that the current price indexes do not begin to capture the gains.

Of total consumption dollars in 1991 in the U.S., the run-of-the-mill sector was 27.7%, the seismically active sector was 35.8%, and the tectonically active sector was 36.6%. The bias in the current price indexes would thus be expected to be quite large. To illustrate how large, Nordhaus estimates how much the change in real wages from 1800-1992 would be if we make reasonable assumptions about the size of the bias. Using current price indexes, the real wage in 1992 was 13 times the real wage in 1800.

By the lowest reasonable estimate of the bias, the real wage in 1992 was 40 times the real wage in 1800. By the highest reasonable estimate of the bias, the real wage in 1992 was 190 times the real wage in 1800.

Another paper that illustrates the progress that is being made in measuring the consumers' gain from leapfrogging technological innovation, is a paper by Brynjofsson, Hu, and Smith (2003). Gates (1995) and others had argued that the primary benefit of the internet to consumers was that it would result in lower prices for goods and services. This would occur primarily through quicker, more accurate, and cheaper information about the products and services. In the Brynjolfsson et al paper they measure the gains in consumer surplus for one sector of the internet: online booksellers. They then use techniques recently developed by Hausman and others, to measure the gain to consumers from the greater variety of books made available through internet booksellers. For the single year 2000, they estimate that the increased consumer surplus from increased price competition from internet booksellers falls in a range between $100.5 million and $103.3 million (p. 1591). But for the same period, they estimate that the increased consumer surplus from an increase in variety of books from internet booksellers falls in a range between $731 million and $1.03 billion (p. 1590). These results imply that at a minimum the internet's contribution to leapfrogging innovation is 7.3 times as large as the internet's contribution to lower prices.

The results of Nordhaus and Brynjolfsson et al are suggestive, but since they each deal primarily with the single cases of lighting and the internet, they are

vulnerable to criticism by skeptics. So we may ask whether, in the absence of definitive evidence determining whether price or leapfrog competition most benefits the consumer, is there any other way to establish a presumptive case for one or the other, to use in making immediate policy decisions? Perhaps we could consider a thought experiment suggested by passages from both Adam Smith (1937, p. 12) and Schumpeter (1950, p. 67). Here is the thought experiment: would you rather be the richest person on the face of the earth in the year 1900, or would you rather be someone at the U.S. poverty threshold in the year 2000?

If price competition is what mainly matters, you'd probably be better off as the richest person in the year 1900. Price competition might reduce prices over the course of a century, but not enough to make the buying power of a poor person in 2000 greater than the buying power of a rich person in the year 1900. But if during the century enough new technologies are invented, or diseases cured, that are accessible even to the poor, then in terms of the objective conditions of life, a poor person in 2000 may be better off than a rich person in 1900.

Now most of us without reflection would probably say that we preferred to be the richest person on the face of the earth in the year 1900. But sometimes reflection can be useful. Consider the case of John D. Rockefeller, probably the richest person on the face of the earth in the year 1900.

Rockefeller's daughter Edith had two sons, Jack and Fowler, whom Rockefeller "doted" on. In late 1900, at roughly the age of four, both boys came down with scarlet fever. Rockefeller was devastated and offered a New York physician a half a million

dollars if he could cure the boys. If we correct for inflation over the past 105 years, that would be over $11 million, in 2005 dollars.[1]

Edith's relationship with her father frequently had been strained: she was a free spirit, and he was not. But at the end of this episode, she wrote a letter to John D. Rockefeller, saying:

> "As long as I live I shall never forget the great love and the untiring effort which you put forth to save dear Jack's life." . . . "Absolutely forgetful of self and showing a love much like the Christ love." (Edith Rockefeller McCormick as quoted in Chernow, 1998, pp. 417-418)

Jack died of scarlet fever on January 2, 1901.

The Merck Manual, a leading physicians' medical desk reference, says: "Scarlet fever (scarlatina) is uncommon today, presumably because antibiotic therapy prevents the infection from progressing or causing epidemics." (Beers and Berkow, 1999, p. 1152) The "drug of choice" for scarlet fever is penicillin (p. 1153). Although "discovered" by Fleming in 1928, penicillin only became broadly useful after 1940, when Florey, Chain and Heatley discovered a practical way to extract penicillin from mold (see: Lax, 2004).

In 1900, many came down with scarlet fever, and there was a significant risk of death from the disease, even if you were the grandson of the richest person on earth. In 2000, in the West, few come down with scarlet fever, and there is no significant risk of death from the disease, even if you are living at the official U.S. poverty threshold.

This sort of argument is not totally without precedent in the mainstream

economics literature. DeLong (2000, pp. 21-23) presents some data on the spread of new products, and mentions that he would not be alive if he had been born a century ago, because he suffered from an ailment that a century ago would have killed him at birth. Gordon (2000, pp. 57-60) rehearses an array of major technological innovations, and appeals to our subjective judgment of their significance to support his conclusion that the internet is a less important innovation in improving our lives. The enormous changes in health and longevity over the last 150 or so years, have been vividly described by Fogel (2005).

Empirical Evidence in Support of the Extended Version

A common form of evidence for the new extended version consists of data showing how hard it is for large dominant firms to remain large and dominant for an extended period. One good source for this sort of data is Foster and Kaplan's *Creative Destruction*. For example, they examine the fate of the firm's in Forbes 1917 list of 100 largest firms. By 1987, 61 of these firms no longer even existed. And of the 39 that still existed, only 18 were still among the largest 100. Figure 1 lists these 18 firms. Of the 18, only two had a growth rate in 1987 that was higher than the average for U.S. firms.

Foster and Kaplan also present evidence in their book (p. 11) that in 1998 the turnover rate of the S&P 500 was approximately 10%, implying that the average firm could expect to remain in the S&P 500 for only approximately 10 years. This contrasts with a turnover rate of about 1.5% in the 1920s and 1930s---a rate that implies an

expectation of a roughly 65 year average tenure in the S&P 500. The declining length of tenure in the S&P 500 might be evidence to support the claim of some (e.g., Greenspan; see Useem, 2001) that the process of creative destruction has been speeding up in the United States. The increasing pace of creative destruction is also independently supported in Chun, Kim, Lee and Morck, 2004.

Figure 2 from the Corporate Strategy Board is part of an extensive report that the Board presented to its large-scale corporate clients, documenting how hard it has been for large companies to maintain credible growth records. Zook and Allen (2001, p. 12) also provide additional evidence of how hard it is for large firms to sustain growth.

Conclusions and Implications for Action

Although the evidence for the truth and importance of creative destruction is being increasingly accumulated and recognized, I argue elsewhere (Diamond, 2004) that the importance of creative destruction is not being very effectively communicated to a wider audience, nor is it being applied to relevant policy issues, such as antitrust.

The "core version" of Schumpeter's process of creative destruction states that technological advance is the main source of economic growth and improvements in the quality of life. It further states that a significant part of the incentive to produce leapfrogging innovations is the prospect of achieving monopoly profits. The "old extended version" adds to the core, the view that large incumbent firms are most likely to be the source of leapfrogging innovations. In contrast, the "new extended version"

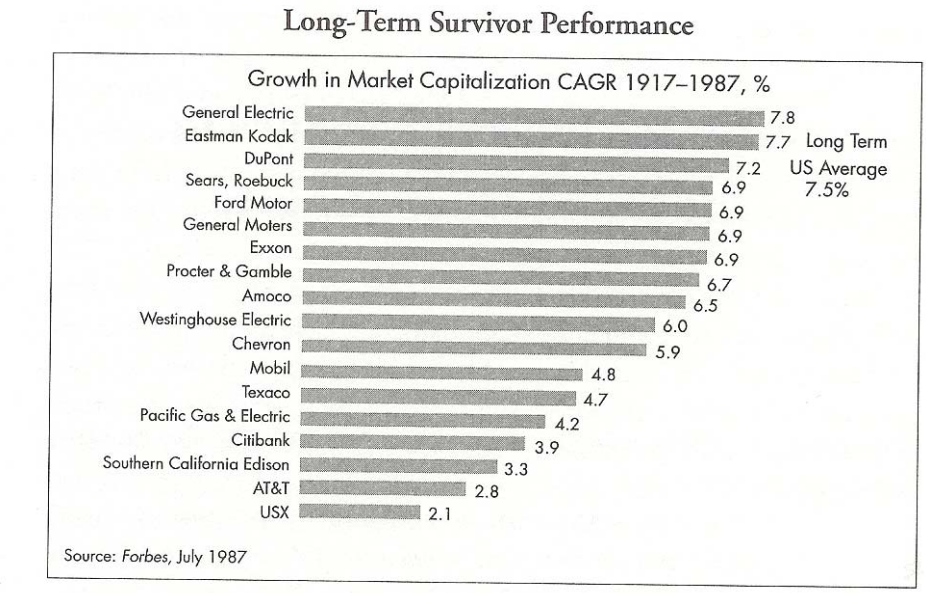
adds to the core, the view that small, new firms are most likely to be the source of leapfrogging innovations.

We have argued that the benefits of leapfrogging innovations are difficult to measure, but that recently progress is being made, mainly through the careful examination of particular cases, such as advances in lighting and the introduction of the internet. While case studies are accumulated and generalized we argue that a thought experiment may be useful in gauging the importance of creative destruction. The thought experiment, made concrete through the example of John D. Rockefeller, asks the reader to consider whether they would prefer to be the richest person on earth in the year 1900, or a person just at poverty level in the year 2000?

We also discuss the evidence against the old extended version of creative destruction and in favor of the new extended version. We find that there is substantial and growing evidence that leapfrogging innovations are at least as likely to arise from small, new firms, as from old, large firms.

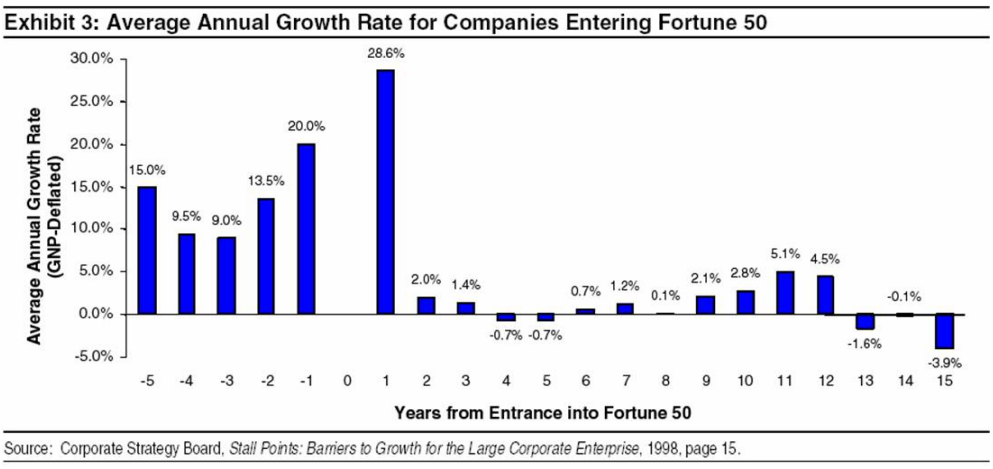
In future work, I plan to answer an important question that is neglected in the current paper: how big is the destructive part of creative destruction? Or put differently: how much are workers hurt? Cox and Alm (2003, and 2004 with Holmes) show some evidence that workers may actually benefit from creative destruction, in the sense that the jobs created are better jobs than jobs destroyed. But this evidence needs to be further analyzed.

Figure 1: Of 18 Out of 100 Who Remained in Largest 100, All But Two Underperform U.S. Average Growth



(Reproduced from: Foster & Kaplan, 2001, p. 8.)

Figure 2: Few Companies Sustain Growth



(Source: *Stall Points*, 1998, p. 15, as reproduced in:

http://www.csfb.com/home/research_and_commentary/html/docs/30996848.pdf)

Footnotes

*I first encountered Schumpeter at Wabash College in a wonderful course on *Capitalism, Socialism and Democracy* taught by Ben Rogge. The essence of Rogge's account of Schumpeter was presented in the title essay of his *Can Capitalism Survive*? (1979) Angela Kuhlmann and Brent Erickson provided research assistance. The current paper is intended to be a more focused elaboration of a portion of "Schumpeter's Central Message," which was a more diffuse paper presented at the biennial meetings of the International Schumpeter Society in Milan, Italy on June 12, 2004. (Several sentences from that paper are reproduced in this paper.) An earlier version of the current paper was presented to the 2005 meetings of the Association of Private Enterprise Education.

[1] To make this calculation, I used historical data from pp. 210-211, of Part 1 of Bureau of the Census 1975, for the years from 1900 through 1967. For the years 1967 through February 2005, I used data from the Bureau of Labor Statistics, reported online by the St. Louis Federal Reserve at: http://research.stlouisfed.org/fred2/data/CPIAUCNS.txt.

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