



**LUND**  
UNIVERSITY

School of Economics and Management

Master Program in Economic History

## **Financial Innovation and Long Cycles in the US:**

### **The emergence and changing nature of financial instruments in relation to the technology shift**

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EKHR11

Master's Thesis (15 credits ECTS)

Spring 2009

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## **Abstract**

### **Financial Innovation: cause or consequence?**

The recent financial crisis and subsequent investigation into its causes leads many to propose that the primary suspect of instability is financial innovation itself. This paper introduces an alternative perspective that relates the perennially changing nature of financial innovation to the location of its emergence along the 'technology shift'. Financial innovation has the potential to be both useful and/or detrimental to the real economy. According to delineations of the technology shift derived from long term aggregate time-series – during the years 1929-2007 the emergence of those innovations largely useful to the real economy primarily happened within the transformation phase of the long cycle. Conversely, those of questionable merit are primarily found throughout three of the four sub-periods under analysis.

Key Words: financial innovation, financial crisis, technology shift

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**I.**

## The Gathering

For the past year or so an ongoing debate has been coursing throughout all of the social echelons of the United States. It is taking place in hair salons and front porches, as well as boardrooms, back offices, and the halls of academia. The latest juicy details are splashed across the front pages of newspapers nationwide with regularity. Moreover, the events that caused this collective discourse to take place are also imbuing outrage, and accordingly, the American public is demanding an explanation as well as the timely identification and capture of the wrongdoers. The subsequent investigation has exposed a vast and previously unknown realm where it appears as if greed and corruption ran rampant; and, it is beginning to look as if formerly unassailable heads will indeed actually roll. The topic on the tip of everyone's tongues is of course, the current financial crisis we have been forced to watch unfold before our very eyes.

“How did things come to this? What happened and who is responsible for this ever growing mess?” the public is demanding to know. Analysts, advisors, academics, consultants, political pundits, and anyone with platform big enough to stand on (digital and/or nationally syndicated soapboxes work best) are hard at work promoting their ideas on who exactly the guilty parties are and what kind of solutions will get us out of the nightmare we find ourselves in because of them. Explanations as to the primary origins of our financial downfall vary, and as a natural consequence, so too do the recommended solutions. The variance, however, is slowly coalescing into debates of upon whose shoulders the most amount of guilt should be laid. The primary suspects are now largely known: the public's eyes and ears have been set awash with tales of ‘exotic financial instruments’; the greedy kingpins of the investment world who used and abused them; the corrupt ratings agencies that turned a blind eye towards them; and enervated regulatory bodies who lacked the will to put a check on their unbridled use. The only question that seemingly remains is who, or what, is the *most* guilty with regard to our financial ruin.

The answer to that question for a growing amount of people seems to be financial innovation itself. The fact that financial innovation - in the form of the previously mentioned exotic instruments - played a key role in the whole process is undoubted, and its reputation in the minds of many is taking a beating because of it. More often than not these days, one finds the term couched in quotation marks. Thus when a reader sees the phrase - “financial innovation” - they are encouraged to view the entire category as suspect, and revoke the positive connotation usually associated with the term ‘innovation’. For example, economic pundit Barry Ritholz tells his viewers and readers that “financial innovation is just another word for

excessive and reckless leverage”.<sup>1</sup> This is an extreme way to put it - but then again that is what pundits do best, right? Yet however extreme, it also manages to capture exactly how a growing portion of the public feels. A more nuanced phrase that carries essentially the same derogatory message is the term ‘financial engineer’. Today’s financial engineer is the descendant of FDR’s ‘bankster’, and popular sentiment carries the same loathing for both.

Albeit with a less vitriolic tone, there are many within the economic branch of academia also expressing skepticism with regard towards financial innovation. Dani Rodrick, a professor of international political economy at Harvard University recently issued a challenge to the advocates of financial innovation, explaining that they owed the rest of us “a bit more detail about the demonstrable benefits of financial innovation...some of the ways in which financial innovation has made our lives measurably and unambiguously better.”<sup>2</sup> A more neutral stance is taken by Peter Tufano (2002, pp. 31-31) in a chapter on financial innovation written for *The Handbook of the Economics of Finance*. In it he explains that while most scholars in the field agree that financial innovation “has both positive and negative impacts on society, their conclusions regarding the *net* impact of financial innovation” on society are quite varied.

However, Tufano (2002, pp. 2-3) also teaches us that “financial innovation has been a critical and persistent part of the economic landscape over the past few centuries”, reminding us that from a long-term perspective “innovation ebbs and flows and...the Schumpeterian process of innovation – in this instance financial innovation – is a regular ongoing part of a profit maximizing economy”. William Poole, the President of the Federal Reserve Bank of St. Louis echoes this sentiment but with rather less neutrality. In his 2008 article entitled *Financial Innovation: Engine of Growth or Source of Instability*<sup>3</sup> he attempts to exonerate financial innovation by reminding us along with Tufano that “financial innovations have occurred throughout recorded history”, adding the caveat that “we should not forget the importance of financial innovation in promoting economic growth”. Interestingly, he too teaches us that “financial innovation, like innovation in other industries, is part of the [Schumpeterian] process of ‘creative destruction’ that drives market economies forward and raises living standards”, conclusively opining that “we should not fear financial innovation”.

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<sup>1</sup> <http://bigpicture.typepad.com/comments/2008/09/regulatory-exem.html>

<sup>2</sup> [http://rodrik.typepad.com/dani\\_rodriks\\_weblog/2008/09/nows-the-time-to-sing-the-praises-of-financial-innovation.html](http://rodrik.typepad.com/dani_rodriks_weblog/2008/09/nows-the-time-to-sing-the-praises-of-financial-innovation.html)

<sup>3</sup> [http://www.stlouisfed.org/news/speeches/2008/03\\_06\\_08.html](http://www.stlouisfed.org/news/speeches/2008/03_06_08.html)

Creative destruction and the boom and bust pattern of the business cycle, as well as the related financial crises that appear with cyclic regularity have long been topics of interest to economists and economic historians. Joseph Schumpeter taught us about the business cycle and the process of creative destruction. Later on his student, Hyman Minsky, gave us the ‘financial instability hypothesis’. In it Minsky (1992, p. 7-9) explains that “like all entrepreneurs in a capitalist economy, bankers are aware that innovation assures profits” - thus these “merchants of debt...strive to innovate in the assets they acquire and the liabilities they market”. The general notion Minsky then posits is that “over periods of prolonged prosperity, the economy transits from financial relations that make for a stable system to financial relations that make for an unstable system.” In other words, over time economies consistently make the transition from financially ‘robust’ to financially ‘fragile’ in a predictable and cyclic fashion.

Finally, Lennart Schön – also influenced by Schumpeter, provides us with the highly compatible ‘technological shift thesis’<sup>4</sup>. In his 1998 article, *Industrial Crises in a Model of Long Cycles: Sweden in an International Perspective*, Schön (pp. 398-399) provides us with a long-run view of economic growth, explaining that under the auspices of a capitalist system, a society’s economic growth is inextricably intertwined with cyclical “changes in long term or structural conditions”, and that these cycles are connected to the ‘technological regime’ of particular general purpose technologies (GPTs). Broadly speaking, Schön (1998, p. 399) teaches us that there are three primary phases of this long cycle: ‘crisis’, ‘transformation’, and ‘rationalization’ – and that the nature of economic growth changes from one phase to the next. He contends that the ‘shifts’ from transformation to rationalization occur habitually ‘within a long structural cycle of approximately 40 years’, where 25 years are spent in transformation, and the remaining 15 in rationalization. Crises form the bridge from one phase to the other, as well as from one technological regime to the next, and are a time of intense ‘creative destruction’. Fascinatingly, he also explains that these cyclic structural shifts bring with them “shifts in behavior...in the economy and society” as well.

History shows us that financial innovation can indeed be a tremendous positive force for economic growth. Yet it is also true that the instruments derived from it sometimes lead to disastrous results, causing serious harm to society and the real economy. Moreover, Schumpeter, Minsky, Schön, Tufano, Poole, and many others all agree that innovation – including financial innovation - is cyclical in nature. The research question duly proposed then, is this: Can the technological shift thesis explain the changing nature of financial innovation in the U.S.? Using the taxonomies of both Minsky and Schön, it is expected to be

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<sup>4</sup> Along with Schumpeter and in the same tradition, Schön’s ideas are also heavily influenced by Swedish economist Erik Dahmén’s (1950, 1988) work on development blocks.

shown that the transition to ‘fragile finance’ happens during the later stages of the rationalization phase. It is at this point that dubious innovations are the most likely to arise from mounting pressures to maintain profit margins, possibly precipitating and amplifying the destabilizing effects of the next crises phase. Conversely, it is expected to be found that financial innovations occurring during the transformation phase assist in the expansion of a new development block - thus, they are largely beneficial to ‘real’ economic growth, and generally have a positive impact on society.<sup>5</sup>

In his 2008 article, *The Human Foundations of Financial Risk*, Alex Pollock explains that the process the American public has gone through in the past year that is detailed in the first paragraphs of this paper is a classic case of ‘post-bust’ behavior. “In the wake of a bust, there is always a predictable series of political activities: first, the search for the guilty; second, the fall of previously esteemed heroes; and third, legislation and increased regulation to ensure that ‘this will never happen again’. But with time it always does happen again.” He goes on to pose the question: “Could universal knowledge of financial history among financial actors change the recurring bubble and bust behavior?” And goes on to answer: “Perhaps it could, but the project is utopian.”

Requesting universal knowledge of financial history among financial actors is perhaps a tad bit utopian. What is not utopian however – what is absolutely practical and essential in fact – is that we continue expanding our common stock of knowledge with regard to innovation, growth and the financial industry. Furthermore, although research into economic cycles and financial innovation has occurred throughout the better part of the twentieth century, rarely have the two been fused together. Indeed, according to Tufano (2002, p. 37) “the subject of financial innovation remains one in which our intellectual maps show vast uncharted – and potentially interesting - lands to be explored”. This researcher hopes to make a useful addition to that exploration with this inquiry.

## II.

Before we go any further, an outline of the direction and pace of the paper will prove useful. To start off, a broad based discussion of the literature contained within the fields of financial innovation and the technology shift respectively occurs in section two, progressing into a more detailed discourse centered upon the ideas of both Lennart Schön (1989, 1998) and Carlotta Perez (2002, 2007), and followed up by an

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<sup>5</sup> However, there may be linkages found with the development of ‘bubbles’ within the new technology industries. Nevertheless, Schön’s thesis allows for their correction through the process of creative destruction during the ‘short crisis’ that links together the transformation and rationalization phases.

introduction to some of their key concepts. Section three comprises the essence of this paper. First, it provides us with the origins of the data gathered as well as an explanation of the applied method of investigation. It then moves on to a presentation of the quantitative data gathered with regard to detecting the presence of the technology shift in the US, and then again with respect to the qualitative data gathered on financial innovations – ultimately providing us with an integrated rendering of both, as well as a detailed analysis of the models’ implications. Lastly, section four offers some concluding remarks as well as a bit of discussion.

## **A drink before dinner**

Financial innovation is most certainly a key feature of a dynamic capitalist economy - and as such, it is quite surprising to discover that the field suffers from a relative dearth of research. For example, Tufano (2002, pp. 3) describes the existing body of work as ‘fairly modest in scope’, while Scott Frame and Lawrence White (2004, pp. 1-2) explain that in their quest to ‘scour the financial literature landscape’, they found that despite the field’s possession of a ‘broad descriptive literature’, only twenty four articles were concerned with empirically testing ‘hypotheses concerning financial innovation’. Tufano goes on to tell us that most of this relatively small body of existing literature is spread between six sub-fields: neo-classical interpretations of the role of financial innovation; hypotheses on the reasons behind its occurrence; analyses of the laws and policies of ‘tax rules, regulation and innovation’; ‘studies of financial innovation in the industrial organization literature’; studies of individual innovations; and the ‘handful’ of empirical studies previously mentioned. Cross-cutting themes of these studies include: the difficulties of taxonomical work (Graham & Dodd, 1934; Finnerty, 1988, 1992, 2001; Bank for International Settlements, 1986, Tufano, 2002; Battilossi, 2000); the role regulation plays in creating incentives for innovation (Miller, 1986; Kane 1986); and the role of the technological advances in telecommunications (White, 1996, 1997; Frame & White, 2009).

A small but growing neo-classically rooted literature on the ‘finance-growth nexus’ also deserves mention. A number of these papers (Bencivenga and Smith, 1991; Acemoglu and Zilibotti, 1997; Saint-Paul, 1992) focus on the effects financial intermediaries have on the rate of productivity, while Yuan Chou and Martin Chin (2004) attempt to construct a model that captures the effects of financial innovation on macro-economic growth. John Persons and Vincent Warther come closer to this paper’s contention that both the timing of creation, as well as the changing nature of financial innovation is characteristically cyclical with their 1997 article, *The boom and bust patterns in the adoption of financial innovation*.



However, their focus remains tied to investigating the rate of adoption of specific innovations by firms - rather than examining the nature of the innovations being adopted.

Conversely, research on the technology shift hypothesis (Schön, 1998; Lundquist, Olander & Svensson-Henning, 2007a 2007b) has overwhelmingly tended to focus on the real economy and the manufacturing industry in particular. With the exception of Schön's 40 page booklet written in 1989 on the history and evolution of Sweden's Debt Office, entitled *From war economy to State debt policy*<sup>6</sup> - very little research on the relationship between technology shifts and the financial industry has been conducted. Instead, their efforts have rather been concentrated on discovering what effects the shift has upon long-term growth, regional development and social welfare. However, as Lundquist, Olander and Svensson-Henning explain in their 2007 article entitled *Decomposing the technology shift: Evidence from the Swedish Manufacturing Sector*, there is a related school of thought that is also working on the 'interdependence between technological development, and economic, institutional and social processes'. They tell us that the ideas of those who subscribe to the 'techno-economic paradigm approach' go quite well 'with the theoretical suggestions made by Schön on the diffusion of generic technologies, complementarities, and time bound characteristics of economic growth'. The techno-economic paradigm approach also falls within the Schumpeterian camp, and one of its primary proponents, Carlota Perez, has spent much of her career developing a thesis concerning the cyclic and mutually dependent nature of technological and financial innovation.

In her 2002 book, *Technological Revolutions and Financial Capital: The Dynamics of Bubbles and Golden Ages*, and her 2007 article, *Finance and technical change: A long-term view*, Perez provides us with a dynamic model of structural change that emphasizes the roles of both innovative entrepreneurs and financiers in equal amounts. She identifies two distinct overarching phases that occur during the 'life cycle' of a technological revolution - the 'installation' and 'deployment' periods – and in chapter 13 of her book, she proposes that the nature of financial innovations changes from phase to phase.

### **Great Minds...**

Although the language used to describe the sequence of events is different between the two authors – with Perez taking a rather layman friendly approach and focusing more on political and social processes,

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<sup>6</sup> The appendix contains what may be the first English printed presentation of Schön's technology shift hypothesis. Although the focus is primarily on the activities of the Debt Office – or more specifically, the logic behind its decisions of whether to pursue either an 'expansive' or 'restrictive' State debt policy, peripheral attention is paid to general changes in the behavior of Swedish finance during the rationalization and transformation phases respectively.

whereas Schön speaks with the precision of an economic specialist - their characterizations of what goes on during the various phases of the life cycle of a technological regime are remarkably similar. Perez's (2002, p. 36) distinction between the installation and deployment periods of a technological revolution is theoretically almost identical to Schön's (1998, p.399) description of the transformation and rationalization periods of the technology shift. In fact, it is important to note that what they are both describing, albeit in different ways and with some conflict in the details<sup>7</sup>, is the same general phenomenon.

Both authors contend that what defines a technological regime is not simply one revolutionary innovation. It is the innovation together with all the 'complementarities' derived from it that constitute a regime. Perez (2007, p. 3-4) draws both from Burton Seely Keirstead's (1948) notion of 'constellations' and Chris Freeman's (1982) related notion of 'new technology systems' when she describes a technological revolution as a 'cluster of technology systems'. These clusters, she explains, provide both a 'shared common sense model of best technical and organizational practice' as well as 'generic technologies that modernize the whole economic system'. Similarly, Schön is indebted to Erik Dahmén's (1950, 1988 p. 5) concept of 'development blocks' - defined as "a sequence of complementarities which by way of structural tensions...may result in a balanced situation". Furthermore, Lundquist, Olander and Svensson-Henning (2007, p. 146) go on to explain that Schön takes Dahmén's contention one step further by positing that complementarities are 'not just of technical, but also of institutional and organizational nature' as well. Therefore, although Perez's use of the label 'techno-economic paradigm' emphasizes the contents of the long cycle, whereas the phrase 'technology shift' highlights the transition between cycles, it is clear they are both describing and analyzing the same historical condition.

Because the works of these two researchers complement each other greatly, this paper will draw from both of them, using the strengths of one author's ideas where the other leaves gaps and vice versa.

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<sup>7</sup> There are at least two points of conflict in Schön and Perez' analyses that have the potential to ultimately work as wedges, enlarging the disparities between the two. The first is that Schön (1998, p. 409) contends the economy-wide burst of growth in the late transformation phase stems from a general increase in demand caused by the investments in the new tech. firms whereas Perez (2007, p. 17) argues that it is caused by the 'hyperinflation of assets' which work as an 'invisible hand for massive credit creation'. The second is their estimation of the timing of the transition between the transformation and rationalization phases, or installation and deployment, respectively. Schön (1998, p. 400) proposes that the two are linked through a 'short crisis' whose origins lie in the effects of the 'technological push' caused by the arrival of a technological regime. Conversely, Perez (2007, pp. 15-16) tells us that the 'passage' between the two phases can be 'short or quite long', going on to argue that the transition taking place in the first half of the twentieth century lasted from 1929-1943. This difference largely stems from the fact that Schön and Perez are focusing on different aspects of the technology shift, with Schön investigating movements within the economic sphere proper and Perez concentrating on changes occurring within social and political institutions.

For instance, Schön (1998, pp. 401-402; p. 409) provides the means with which to discern the existence of a technology shift through ‘quantitative analysis of aggregated time series’, whereas Perez offers only qualitative evidence. She does however, propose a new taxonomy of financial innovations, one which classifies them ‘according to their main purpose’ and ranks them from ‘most useful to the ‘real’ economy to the least useful’. Even more, Perez (2002, pp. 138-141) posits that ‘each phase [of the techno-economic paradigm] has characteristics that will bring forth certain types of financial innovation’ – and because her periodization of the technology cycle matches so closely with Schön’s in theory, her proposed schematization of the timing of financial innovation will also be taken advantage of in subsequent sections.

### **A Few Concepts**

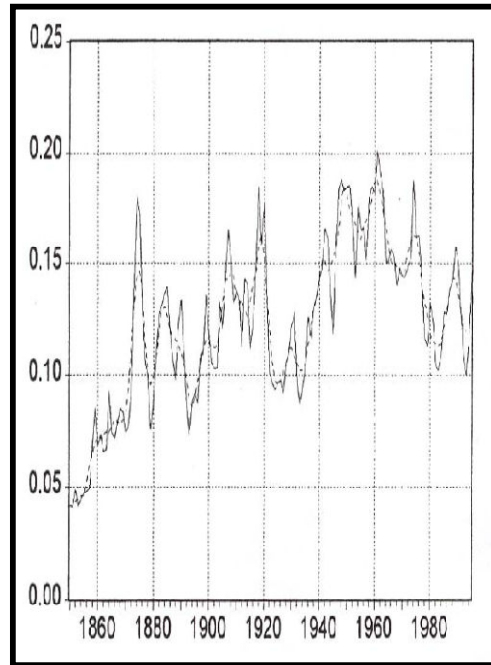
Soon we will review and analyze the empirical evidence brought forth with regard to the question of whether or not the timing and nature of financial innovation changes in relation to the phases of the life-cycle of a technological regime. Before we go any further however, a few concepts should be more precisely defined, and the methods of data collection and analysis will also be outlined.

According to Lundquist, Olander and Svensson-Henning (2007, p. 146), a *technology shift* can be summarily defined as the ‘launch and diffusion of new generic technologies with complementarities’. These generic technologies, or *general purpose technologies* (GPTs) are, according to Bresnahan and Trajtenberg (1995), ‘enabling technologies’ that create ‘new opportunities rather than offering complete, final solutions’. Examples of GPTs include the steam engine, the railroad, electricity, the combustible engine, and the microprocessor. Now, as every good ‘Intro to Microeconomics’ student learns and as Schön (1998, p. 398) reminds us - in order ‘to improve utilization of human resources to human needs’ we essentially have only two options – we either become more resource efficient, or we do ‘something new and different that better fits to resources and needs’. These two different behaviors – either becoming more efficient, or breaking with the mold and trying something new – are the basic behaviors that characterize the rationalization and transformation periods of the technology shift respectively.

More formally, Schön (1998, pp. 398-399) defines the *transformation phase* as “changes of industrial structures, where resources are reallocated between industries, and diffusion of basic innovations within industry... provides basis for such reallocation”. Conversely, he defines the *rationalization phase* as “the concentration of resources to the most productive units within branches and measures to increase efficiency in the different lines of production”. Schön (1998, p. 398-399) then posits that these temporal differences in behavior are apparent in several different identifiable trends, including the investment ratio

and the wage ratio<sup>8</sup>. During the transformation phase, he explains that investment tends to be long term in character and has a ‘limited immediate effect’ on productivity. Conversely, investments made during the rationalization phase are focused on increasing efficiency and therefore have a ‘more direct effect upon productivity, growth, and real income’.

FIGURE 1. The Ratio of Investments to Value Added in Swedish Industry, 1850-1995. Fixed Prices with Annual and Five Year Moving Averages



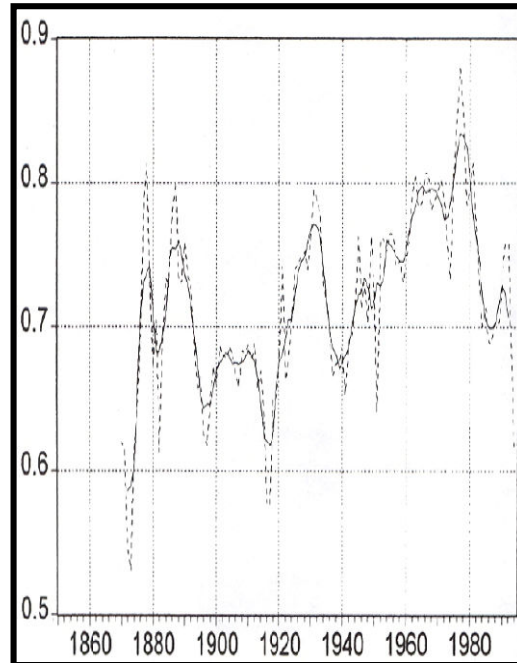
Source: Schön, Lennart, Transformation and imbalance. Patterns in Swedish economic development. Stockholm 1994; Swedish National Accounts.

Schön (1998, p. 400-401) explains that although Sweden’s investment ratio displays ‘the ordinary business cycle’ throughout the time period under analysis, there is also a ‘long-term cyclical pattern with low points in the early 1890s, early 1930s, and early 1980s’ that ‘coincide with international crises’. Moreover, following these crises are ‘periods of roughly 25-30 years with a rising investment ratio’, giving way to ‘15 years of falling ratio to the troughs in the years of crisis’. To be sure, the investment ratio graph in figure one shows a pattern in line with the expected behavior of investment as outlined by the technology shift thesis.

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<sup>8</sup> He also confirms the presence of the technological shift by looking at labor productivity rates, the relationship between ‘the price of machinery and the price of industrial consumption goods’, as well as analyzing the timing of the reallocation of labor. However, this paper will focus primarily on the investment and wage ratios as supporting evidence.

FIGURE 2. The Wage Share in Swedish Industry, 1870-1995



Source: Schön, Lennart, (Stockholm 1994); National Accounts.

The wage share ratio as displayed in figure two also corroborates the existence of the technology shift by highlighting the ‘alterations in income distribution’ between labor and capital. As Schön (1998, p. 410) points out, the ratio ‘shows significant fluctuations that correspond to both the 20- and the 40-year cycles’. It is low when the expansion of the investment cycle begins and ‘culminates in the crises’. Additionally, its ‘level is considerably higher’ during the rationalization phase. This second movement is also consistent with the notion that during the rationalization phase, firms rely more heavily on classical, or marginal, economic methods of raising or protecting their profit margin<sup>9</sup>.

For her part, Perez (2002, pg. 47) further refines the characterizations of the two halves of the long cycle by identifying two distinct sub-periods within each phase. The *irruption phase* occurs just after the introduction of the new cycle. It is a time when new technologies and their complementarities are beginning to show ‘their future potential and make powerful inroads in a world still basically shaped by the

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<sup>9</sup> Hence the infamous battle between labor and capital over ‘surplus value’ most likely has its roots in the rationalization phase of the technology shift.

previous paradigm'. She identifies the latter half of the transformation period as the *frenzy phase* – the time when an 'intense build-up of the new infrastructure and new technologies' takes place.

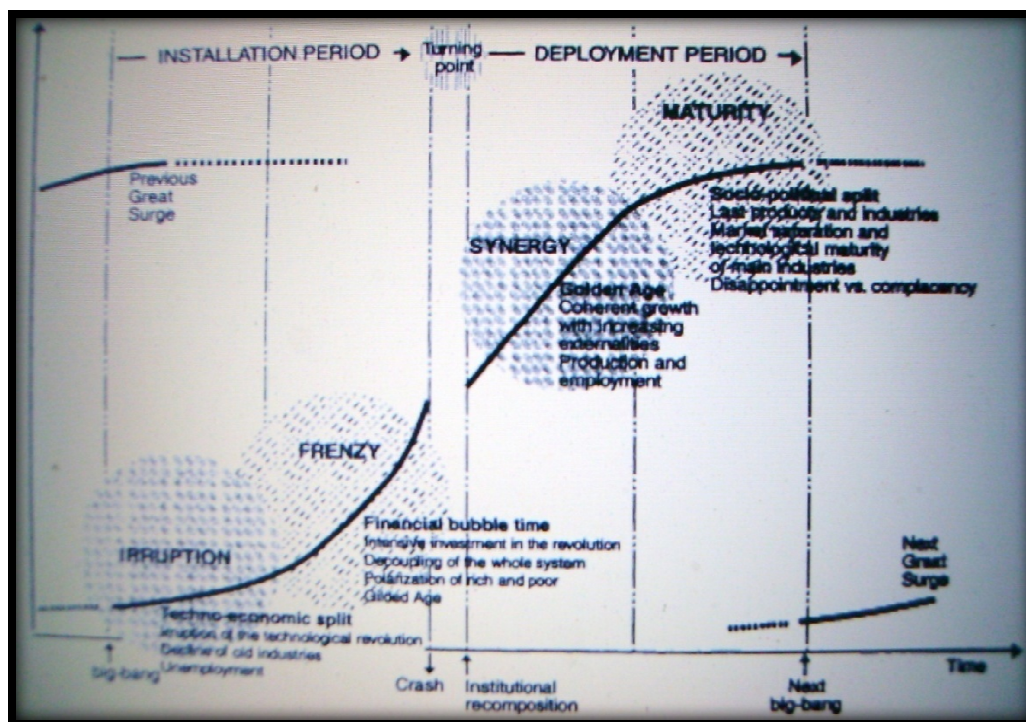
However, she also contends that this is a period when 'structural tensions in the system' begin to flourish, eventually coming to a head, and thus bringing the 'frenzied' pace of development to halt. The tensions are ultimately brought to resolution during what she terms the 'turning point' between the two halves of the technological cycle. She posits that turning points are typified by recessions that 'follow the collapse of a financial bubble' and are the point at which 'the required regulatory changes are made to facilitate and shape the period of deployment'. Although her description of both the cause and content of the turning point differs somewhat from Schön's (1998, pp. 400, 408), this point in the cycle can nevertheless be considered as the theoretical equivalent to his assertion that crises stemming from a 'technological push' are the events that link together the transformation and rationalization periods.

The two sub-periods comprising the second half of the technology shift are labeled by Perez (2002, p. 47) as the *synergy* and *maturity* phases respectively. During the synergy phase, 'all conditions are favorable to production' and the new 'technological paradigm is clearly predominant'. The fourth and final sub-period of the structural cycle, the maturity phase, is characterized by the introduction of the last complementarities, while 'dwindling investment opportunities and stagnating markets' begin to occur 'in the main industries of the revolution'<sup>10</sup> within the core economies.

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<sup>10</sup> The methodology used in Lundquist, Olander, and Svensson-Henning's 2007 paper *Creative destruction and economic welfare in Swedish regions: Spatial dimensions of structural change, growth and employment* explicitly addresses the changing nature of industrial activity during the various phases of the technology shift and applies a quite useful theoretical stylization that is similar to, but more in depth than Perez's characterization.

FIGURE 3. Recurring phases of each great surge in the core countries



Source: Perez, 2002. *Technical Revolutions and Financial Capital: The Dynamics of Bubbles and Golden Ages*<sup>11</sup>

To this Perez (2002, pp. 71-72; 138) adds yet another layer of sophistication when she posits that the nature of financial innovation changes from sub-period to sub-period. To understand why, we must first address her distinction between *finance capital* and *production capital*. As she explains, neither category ‘refers to the actual capital, but rather to their agents and purposes’. In both instances, ‘the term ‘capital’ is used to embody the motives and criteria’ that cause particular agents to ‘perform a particular function in the process of wealth creation’. Thus, the financial capital category includes those agents ‘whose purpose remains tied to having wealth in the form of money (liquid or quasi-liquid) and making it grow’. In other words, it is those intermediaries who fulfill ‘the function of making money from money’. Conversely, those agents falling under the category of production capital include those ‘who generate new wealth by producing goods or performing services (including transport, trade, or other enabling services)’. Perez goes on to remind us that “by analytical definition these agents do this with borrowed money from financial capital...their purpose as production capital is to produce in order to be able to produce more”.

<sup>11</sup> Please forgive the poor quality of this illustration. It is included in only order to show the movements of the four sub-periods. The illegible text is merely a summary description of the behaviors typified by each period – which has been summed up for the readers in previous paragraphs. The label for the Y-axis should read: “degree of diffusion of the technological revolution”. The X-axis is ‘Time’.

In addition, she also makes the argument that economic growth during the transformation phase of the cycle is primarily driven by finance capital, while growth occurring during the rationalization phase comes from the hand of production capital<sup>12</sup>. Generally speaking, the logic behind this contention is that the carriers of the new GPT are typically young, inexperienced and underfunded firms who need the backing of an experienced, savvy financier in order to successfully bring their product to market. Conversely, the rationalization phase is a time when those selfsame ‘upstart’ firms are now the bedrock of the current technological regime. The logic of the market turns away from cultivating ‘game-changing’ technologies and begins to focus on productivity gains from increased efficiency – which naturally falls to the expertise of the (now) experienced agents of production capital.

Because of this changing ‘lead and follow’ relationship between financial and production capital during the two phases, the ‘direction and intensity of innovation in the financial sphere itself’ is also ‘profoundly affected’. Consequently, Perez (2002, pp. 138-140) goes on to proffer a both a new typology of financial innovation – one that allegedly captures the difference between those innovations that ‘provide the life-blood for entrepreneurship and production’ and those that ‘take blood out of the [real] economy through manipulating paper wealth’ – as well as a model demonstrating how the changing disposition of financial innovation moves in rhythm with the technological shift.

TABLE1. A tentative typology of financial innovations.

<i>Type and Purpose of Financial Innovations</i>		
<b>A.</b>	Instruments to provide capital for new products or services	<ul style="list-style-type: none"> <li>*For radical innovations (bank loans, venture capital and others)</li> <li>*To enable large investments and/or spread risks (joint stocks, bank syndicates and so on)</li> <li>*To accommodate the financial requirements of new infrastructures (for both construction and operation)</li> <li>*To facilitate investment or trade in novel goods or services</li> </ul>
<b>B.</b>	Instruments to help growth or expansion	<ul style="list-style-type: none"> <li>*For incremental innovations or production expansion (like bonds)</li> <li>*To facilitate government funding in certain circumstances (war, colonial conquest, infrastructural investment, welfare spending)</li> <li>*For moving (or creating) production capacity abroad</li> </ul>

<sup>12</sup> See chapter 7 section B, *The changing relationship between financial and production capital*, in her book for an excellent discussion detailing the logic behind this suggestion.



<b>C.</b>	Modernization of the financial services themselves	<ul style="list-style-type: none"> <li>* Incorporation of new technologies (communications and transport, security, printing, and so on)</li> <li>* Development of better forms of organization and services to clients (from telegraph transfers, through personal checking accounts and high street banking to automatic tellers and E-banking)</li> <li>* Introduction of new financial instruments or methods (from checks to virtual money, local, national, and international services, and various types of loans and mortgages)</li> </ul>
<b>D.</b>	Profit-taking and spreading investment and risk	<ul style="list-style-type: none"> <li>Instruments to attract small investors (various forms of mutual funds, certificates of deposit, bonds, IPOs, 'junk bonds')</li> <li>* New instruments to encourage and facilitate big risk-taking (derivatives, hedge funds, and similar)</li> </ul>
<b>E.</b>	Instruments to refinance obligations or mobilize assets	<ul style="list-style-type: none"> <li>* To reschedule debts or restructure existing obligations (re-engineering, Brady Bonds, swaps, and others)</li> <li>* To buy active production assets (acquisitions, incorporations, mergers, take-overs, and junk bonds)</li> <li>* To acquire and mobilize 'rent'-type assets (real-estate, valuables, futures and similar)</li> </ul>
<b>F.</b>	Questionable Innovations	<ul style="list-style-type: none"> <li>* Discovering and taking advantage of legal loopholes (fiscal havens, off the record deals and so on)</li> <li>* Discovering and taking advantage of incomplete information: 'making money from money' (foreign exchange arbitrage, leads and lags and similar)</li> <li>* Making money without money (from pyramid schemes to insider trading and outright swindles)</li> </ul>

Source: Carlota Perez 2002. *Technological Revolutions and Financial Capital: The Dynamics of Bubbles and Golden Ages* (p.139)

Perez (2002, p. 140) teaches us that financial innovations of type A and B are the most useful to growth and production in the real economy. They are associated with the 'role of finance as an intermediary' and work 'either to initiate activities (A) or for growth, expansion, and extension (B)'. Type C innovations work to 'improve the performance of the financial world itself', while innovations of type D are characterized by Perez as 'a form of marketing for financial services' which also eases the way for increased 'profit – taking of the original creditors'. Type E innovations work as 'channels for change of ownership'<sup>13</sup>, and lastly, innovations of the type F variety are defined as 'the various manipulative practices

<sup>13</sup> In his book, *The Theory of Business Enterprise*, Thorstein Veblen provides an excellent discussion concerning the detrimental effects caused by disturbances of ownership within the industrial system, positing that they can cause serious damage to the productivity of the real economy while simultaneously being the greatest source of 'pecuniary gain' to the financial sphere – thus highlighting a serious conflict of interests between the forces of production capital and financial capital respectively.

– mainly legal, though often illegitimate - ...most of which tend to be social undesirable but not easily curtailed’.

TABLE 2. The shifting behavior of financial capital from phase to phase of each surge

Phase	Prevalent Types of Innovations						Prevalent Characteristics of Finance During the Phase
	A	B	C	D	E	F	
<b>Irruption</b>	•	•	•	•	•	•	Maximum intensity of real financial innovation
<b>Frenzy</b>				•	•	•	Escape control, attract funds, speculate, inflate assets
<b>Synergy</b>	•	•	•				Adaptive innovations to accompany growth
<b>Maturity</b>		•			•	•	Accompany outspreading, escape control and manipulate

Source: Perez, 2002 p. 141

Table two displays Perez’s hypothesis with regard towards the changing nature of financial innovations. It is interesting to note that her expectations differ slightly from the expectations outlined in the introduction to this paper. In part, this is because her proposal hinges upon the delineation between financial capital and production capital - and the transferal of dominance between the two during the transformation and rationalization phases respectively. Interestingly, the main points of contention between the two proposals lay primarily within the frenzy stage, but also to some extent within the synergy phase as well. As previously stated, this researcher expects that financial innovations proving most useful to the real economy will largely occur during the transformation phase, while those appearing in latter half of the rationalization phase will prove most harmful. Perez however, infers that financial innovations occurring during the second half of the transformation phase are just as likely (if not more so) to wreak havoc on the economy than those appearing under the aegis of the maturity period. Moreover, while no detailed expectations are held by this researcher with regard towards innovations occurring during the synergy phase, a general notion - following the logic of her hypothesis - is put forward that the innovations occurring during these years will in principle be characteristically un-useful to society and the real economy. Naturally, this contrasts with Perez’s proposal that they will be characteristically useful.

### III.

#### The Meal

Because this research question is somewhat multidisciplinary in nature, the data gathered for empirical analysis is necessarily drawn from a variety of resources. There are two rather disparate primary

elements that must be fused into one cohesive, analyzable, whole – and collation will involve several, oftentimes lengthy, steps. Before that can be done however, data must be gathered on all fronts – including the collection of aggregate time series data on the technology shift, as well as, in Frame and White’s words, a scouring of the financial literature landscape, in search of financial innovations and their date of birth.

### **Quality ingredients, new recipe**

Although Perez (2002, pp. 60-62) makes the argument that attempts to test a long-wave hypothesis through the use of ‘long-term aggregate series’ are both ‘senseless’ and ‘a trap’, it is nevertheless this paper’s contention that aggregate time series can in fact be used as economic indicators of long term cyclical trends. Schumpeter’s (1939, vol.1 pp. 43-44) suggestion that ‘aggregate figures conceal more than they reveal’ may indeed be correct – however, these figures are serving as ‘tips of the economic iceberg’. Thus, they should be valued for the services they are capable of providing rather than disparaged for those they cannot. For metaphorical instance, those in the natural sciences do not denigrate the presence of erupting volcanoes or earthquakes for not explicitly explaining the movements of the tectonic plates...on the contrary, if it were not for their occasion, it would be much harder to discern the movements of the plates at all.

To that end, aggregate data for the U.S. is collected from the Bureau of Economic Analysis (BEA), and the wage and investment ratios duly figured in an attempt to reveal the movements of the technology shift. Other sources for data on rates of annual investment and employee wages were investigated, the Bureau of Labor Statistics and *Historical Statistics of the United States* for example, but ultimately the most reliable data for annual figures going back the farthest in time comes from the BEA - going back to 1929 and extending through 2007. Thus with these dates in mind, the first boundary line of the research is drawn.

The task then turns to amassing a list of financial innovations occurring between the years 1929 – 2007. A massive overview of the financial innovation literature is conducted and an initial list composed of 97 innovations created<sup>14</sup>. However, as Stefano Battilossi notes in his 2000 article entitled *Financial innovation and the golden ages of international banking: 1890-1931 and 1958-1981*, financial innovation is a ‘notoriously elusive and controversial concept’. For instance, according to Tufano (2002, p. 4) some authors use the term to describe ‘shocks to the economy (i.e. monetary policy) as well as responses to these

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<sup>14</sup> The primary sources include: Battilossi, 2000; Tufano, 1989 and 2002; Silber, 1983; Frame and White, 2004 and 2009; Miller, 1986.

shocks’, while others ‘divide them into product or process innovations’ - thus setting aside newly introduced policy or regulations and solely focusing upon the response from the financial industry itself.

With the exception of two items, ‘innovations’ in monetary or fiscal policy, or government regulations, are not emphasized in this paper. However, the creation of the Federal Deposit Insurance Corporation (FDIC) and the Federal National Mortgage Association (FannieMae) are necessarily included because their introduction changed market behavior in very fundamental and long-lasting ways. By guaranteeing the safety of up to \$250,000 dollars in deposits made in member banks, the FDIC alone brought about an end to ‘runs’ on banks and bank panics in the United States. Similarly, the creation of FannieMae in 1938 induced the birth of a whole new market, the secondary mortgage market - another event that changed the financial landscape of the country in incalculable ways.<sup>15</sup>

Moving along, the next step in the process consists of creating a periodized list of the innovations according to the timing of their first appearances on the economic scene<sup>16</sup>. This was the most arduous of tasks for two reasons: both because the ‘date of birth’ of financial innovations is rarely mentioned in the literature<sup>17</sup>; and because some ‘innovations’ of the twentieth century are merely reincarnations of older concepts. The instruments falling under the latter category have been granted the title of ‘innovation’ either because they have been drastically ‘modernized’ by means of improved processes or new technology - or bans preventing their use have been lifted. Altogether, the combined process of dating innovations and eliminating ‘double entries’ (i.e. products or processes with different names but very similar structure), ultimately trimmed the original list of 97 innovations down to 53 entries.

Finally, these 53 innovations were then assigned to one of the six categories outlined by Perez’s (2002, p. 139) proposed typology, and according to their analytical characteristics<sup>18</sup>.

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<sup>15</sup> Other important government policies are captured here by the instruments or bodies created in response to governmental action. For instance, the contribution of the Home Owner’s Loan Corporation to the economy is encapsulated by its enduring innovation of the 20 year self amortizing mortgage.

<sup>16</sup> Rather than dating observations by the timing of their first appearance, the alternative of dating them by the years of heaviest rates of use was considered, as this would have gone nicely with Schön and Perez’s emphasis on dispersion of innovations throughout the economy. However, information of this sort is quite hard to come by and in most instances impossible to obtain because no such records are kept.

<sup>17</sup> With the exception of a few infamous innovations such as the ATM machine and credit cards.

<sup>18</sup> It is acknowledged that ascribing the innovations to categories based upon their applied characteristics rather than their analytical characteristics may alter the outcome of the analysis. However, an accurate classification of the innovations according to applied characteristics would necessitate both the insight of an incredibly experienced financial specialist as well

TABLE 3. Classification of financial innovations 1929-2007<sup>19</sup>.

Type	A	B	C	D	E	F
<b>Innovation</b>	<b>Venture Capital (1946)</b>	*FDIC insurance (1933)	*Fixed rate, self-amortizing mortgage (1933)	*hedge funds (1949)	*repurchase agreements (1950)	*International Money Market (1972)
		*Secondary Mortgage Market (1938)	*Credit Card (1951)	*certificates of deposit (1961)	*leveraged buyout (1955)	*foreign currency futures (1972)
		*Standby letters of credit (mid 1960's) <sup>20</sup>	*ATM (1969)	*money market mutual funds (1971)	*floating rate notes (1970)	*off balance sheet vehicles (late 70s/early 80s)
		*Note Issuance Facilities (1978)	*Debit Card (1972)	*derivatives (1972)	*securitization- Mortgage backed securities (1970)	*structured investment vehicles (1988)
		*Chicago Board Options Exchange (1973)	*Chicago Board Options Exchange (1973)	*Black-Scholes model (1973)	*financial futures (1972)	
		*Point of Sale Terminals (1973/1974)	*Point of Sale Terminals (1973/1974)	*exchange traded options (1973)	*management buyout (1974)	*consumer home loan bundling (2002)
		*Automated Clearing Houses (1974)	*Automated Clearing Houses (1974)	*bonds w/ put options or warrants (1977)	*interest rate futures (1975)	
		*IRA Accounts (1974)	*IRA Accounts (1974)	*Special purpose vehicle (late 70s/early	*junk bonds (1977)	
		*Asset and liability	*Asset and liability	(late 70s/early	*contingent commitment	

as a heavy handed dose of subjective reasoning – the latter of which it is desirous to avoid. Moreover, classification according to analytical characteristics is thought to be the more conservative of the two options - both extremes of the typology (A and F) are largely avoided - thus innovations that may fall under these respective categories using applied characteristics are shifted down only one type, to either B or E , leaving aggregate patterns still readily discernable.

<sup>19</sup> The items in red are ‘reincarnated’ innovations. That is, they are concepts or instruments that were either previously banned, or have been modernized or regulated to such an extent that they are considered to be new.

<sup>20</sup> The five innovations lacking a specific year of ‘birth’ and instead dated with a range of years are still considered to be acceptable for use because the years given are within a very narrow range and manage to fall within a single phase of the technology shift.

management (1975)	80s)	banking (1979)
*NOW accounts (1981)	*over-the-counter derivatives (early 80s)	*stock index futures (1982)
*CHIPS (same day settlement) (1981)	*stripped bonds (1982)	*adjustable rate mortgages (1982)
*Sweep accounts (early 80s)	*consumer online stock trading (1995)	*options on indexes (1983)
*Internet ASP (1994)		*municipal bond futures (1985)
*small business credit scoring (1995)		*collateralized debt obligations (1987)
*consumer online banking (2001)		*sub-prime lending (1993)
		*credit default swaps (1997)

Source: information on dates and characteristics found in Fung and Hsieh (1991); Kareken (1987); Chance (1998); Hayashi, Stuart and Weiner (2003); Cowan (2003); Molyneux and Shamroukh (1996); Greene and Wachter (2005); Abken (1994); Hester, Carron and Goldfeld (1981); Gompers and Lerner (2004); Cole, Browning and Schroeder (2003); Lowenstein (1985); Harrington (1992); Eun and Resnick (2000); Russell (2007); Miller (1986); Chang and Shanker (2006); Fisher, McKie and Mancke (1983); McMahon (2004); Purcell (2002); Mesler, VanDeventer, and Imai (2004); Twiford (1979); Chicago Board of Exchange; Slovin, Shushka and Hudson (1988); Kamery (2005); Silber (1983); The New York Times; Kerr (2008); Lucas, Goodman and Fabozzi (2006); Fuller and Collett (2008); Gerardi, Sharpiro and Willen (2007); Mester (1997); Tavakoli (2001)

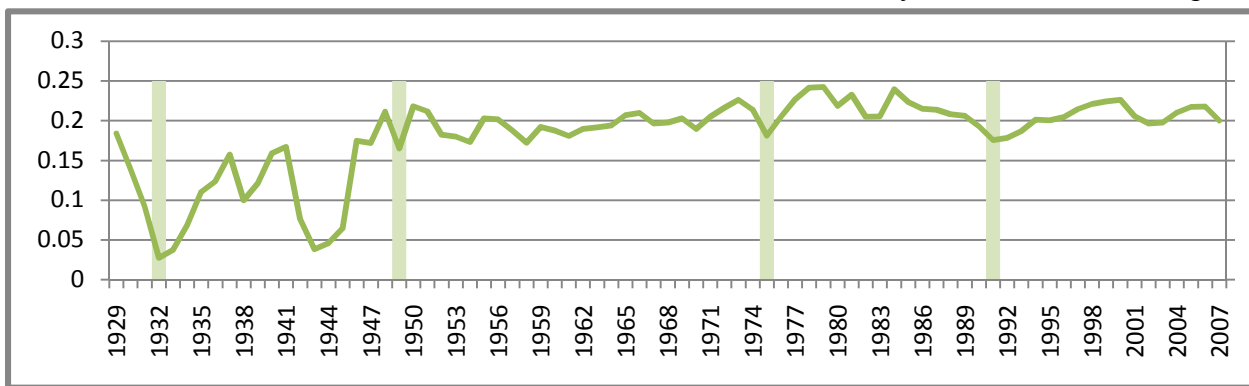
Now the challenge turns towards fusing together the quantitative and qualitative evidence brought forth on the behalf of the technology shift and financial innovation respectively – into a unified picture of the movements of both.

### **First Course:**

While Schön (1998, pp. 397; 401-409) uses evidence from Sweden’s manufacturing industry in order to examine the technological shift, the data presented here for the US is representative of the entire economy. Schön explains that his use of the manufacturing sector as a lens stems from the fact that

generally speaking, this sector is characteristically highly driven by competition, particularly at the international level. Hence, this is the industry that is typically affected first and foremost by the movements of the long cycle. Therefore, isolating it from the rest of a national economy allows us to observe the development of the long cycle in relief. Conversely, the view from the GDP level contains sectors that are affected by the shift differently at all the various points along its advance. Therefore, the view we see from this highly aggregated perspective is necessarily less sharp around the edges. Furthermore, another difference that lends it weight towards more stable ratios over time with respect towards the evidence presented for the US, is the disparity between it and Sweden's differing dependencies 'upon the world market'. As Schön explains, Sweden is a 'small and industrially specialized country' and accordingly, it is 'very sensitive to fluctuations in aggregate activity'. While on the other hand, economic actors in the US cater to an extremely large domestic economy - the presence of which helps to soften the blow of volatile global forces. Consequently, the ratios presented below are less dynamic and far more stable over time than the ratios Schön presents for the manufacturing industry in Sweden. Nevertheless, they still contain evidence with regard towards the whereabouts of the technology shift in the US.

FIGURE 4. The ratio of investments to value added in the US economy, 1929-2007. Current prices.

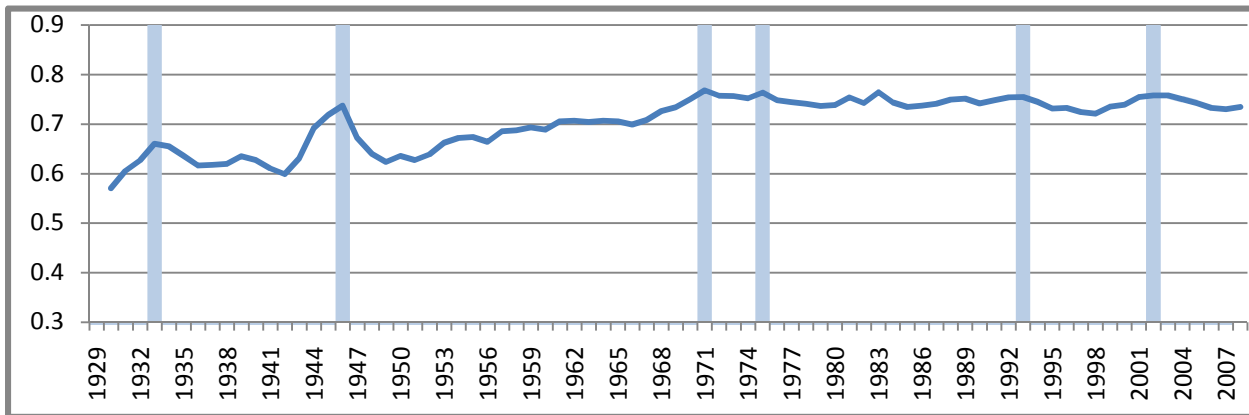


Source: BEA. NIPA tables, data extracted March 7, 2009.

Although some may question the practice, the use of current prices in this long-term time series does not affect the relationship between investment and value added, and that is what we are interested in observing. As discussed above, the most easily identifiable trend in the series is its stability over time, especially between the years 1950-1974, commonly referred to as the 'golden era' of economic growth. This time period can also be related to the rationalization phase of the technology shift, as the investment ratio shows a steady rate that declines rather sharply beginning around 1973. In fact, with but one (rather

glaring) exception<sup>21</sup>, the lowest points of the investment ratio all correspond to periods of global financial fragility, thus not only corroborating Schön's (1998, p. 401) contention that the technological shift possesses an international dimension, but also providing us with the turning points of the of the phases themselves.

FIGURE 5. The wage share in the US economy, 1929-2007. Current prices.



Source: BEA NIPA tables, extracted May 15, 2009

If one judges from looks alone, the wage ratio does not appear as convincing as the investment ratio - but nevertheless, it does provide supporting evidence. As previously mentioned, Schön (1998, p. 410) explains that the wage ratio highlights the 'alteration in income distribution' between labor and capital. Thus, generally speaking the wage ratio falls as the investment ratio rises and vice versa. Theoretically this should give rise to a rhythm of highs in or around the beginning years of crises, low points during the years spent under transformation when the investment ratio is rising, and a higher but relatively more stable ratio during the years spent under rationalization. The wage ratio as displayed in figure 2 above largely substantiates this. The ratio peaks are particularly noticeable during the years 1932/1933 and 1946/1947. Less noticeable but still easily observable are the peaks that occur in 1971 and 1974, which are the beginning and ending years of the investment ratio crash, as well as markers of the beginning of the end of the golden era of growth. The least obvious rises in the ratio happen in 1992 and 2001, but they are nevertheless, still apparent. Altogether, these years of high wage ratios relate quite well with the years

<sup>21</sup> The extreme drop in private investment between 1941 and 1944 is attributable to the federal government's involvement in the 'wartime' economy of those years. The same type of occurrence is also responsible for the drop in the ratio from 1952-1953, only this time the war had moved on to Korea. Moreover, while the 1949 recession did not occur on a world wide scale, it was not just confined to the US. A 1949 Federal Reserve 'review of foreign developments' reports that both France and Belgium suffered recession, and other countries were concerned with a down turn in their investments as well.



demarcating investment ratio lows, thus also providing us with a basis for identifying the technology shift in the US<sup>22</sup>.

## **Second Course:**

Now that the timing of the technology shift has been identified, we shall turn our attention towards an integrated presentation of it together with the periodized list of financial innovations that have been categorized according to Perez’s typology in order to see whether or not the nature of financial innovations changes according to its movements.

TABLE 4. Financial innovation and the technology shift in the US 1929-2007

Phase	A	B	C	D	E	F
<b>Crises</b> <b>1929-1931</b>						
<b>Transformation</b> <b>1932-1949</b>	•	••	•	•		
<b>Rationalization</b> <b>1950-1975</b>		•	••••••••	•••••	••••••••	••
<b>Transformation</b> <b>1976-1991</b>		••	•••	••••	••••••••	••
<b>Rationalization</b> <b>1992-2007</b>			•••	•	••	•

Source: Derived from Table 3 and Figure 4

Each one of the bullet points represents a financial innovation<sup>23</sup>. Recalling that the order of innovation is ranked from A to F according to its usefulness to the real economy, we can clearly see both that there is indeed a pattern, as well as the fact that the number of innovations appearing from 1950-1991 highly outnumber those occurring in the other time periods under analysis in either direction. This skew in favor of the years 1950-1991 may have to do with an underlying bias in the data sources towards research on innovations occurring within these years; more likely though, is that this high number is related to the fact that an inordinate amount of innovating occurred within the financial sector during these years due to the break-down of the Bretton-Woods system, as well as to the appearance of a technological regime centered upon improvements in the spread of information and communication – two primary components of finance.

<sup>22</sup> The wage ratio peak occurring in 1983 corresponds to the investment ratio low of the same year and is related to Reagan’s monetary ‘shock policies’ of that era.

<sup>23</sup> Just a reminder that the red asterisk’s represent ‘reincarnated innovations’.

Nevertheless, the fact that a pattern is discernable is highly encouraging. The innovations occurring during the transformation phase of the first technology shift are all largely beneficial to the real economy, whereas the years that take place during the two rationalization phases, 1950-1975 and 1992-2007 respectively, see a dramatic increase in those less useful - even harmful - types of innovations. These results appear to largely fall in line with the expectations outlined in the introduction to this paper – that innovations occurring during the transformation phase will be useful to the expansion of new development blocks, while on the other hand those occurring during the latter stages of the rationalization phase will prove to be largely detrimental. Now the task turns to investigating the rationalization phase in closer detail.

TABLE 5. Financial innovation and the technology shift in the US 1929-2007, deconstructed rationalization phases using aggregate data as delineation indicators.

Phase	A	B	C	D	E	F
<b>Crises</b> <b>1929-1931</b>						
<b>Transformation</b> <b>1932-1949</b>	•	••	•	•		
<b>Rationalization</b> <b>1950-1960</b>			•		••	
<b>Rationalization</b> <b>1961-1975</b>		•	•••••••	•••••	•••••	••
<b>Transformation</b> <b>1976-1991</b>		••	•••	••••	•••••••	••
<b>Rationalization</b> <b>1992-2000</b>			••	•	••	
<b>Rationalization</b> <b>2001-2007</b>			•			•

Source: see Table 4

In this table we see the rationalization phases of the two technological shifts broken down into halves. Rather than merely ‘chopping’ the phases in two and dividing equally, the timelines are demarcated according to trends contained within the investment ratio, and the years 1960/1961 and 2000/2001 were accordingly chosen as breaking points. Interestingly, the innovations occurring within the rationalization phase of the first technological shift overwhelmingly display the expected tendencies, whereas those appearing in that phase of the most recent cycle do not. However, it is important to realize that it is only the time series that ends at 2007, not the rationalization phase - it is still possible for new innovations to occur.

These results are fairly encouraging, however it is impossible to ignore the fact that the observations appearing during the transformation period of 1976-1991 do not wholly conform to the expectation that during this part of the long cycle innovations are characteristically useful to the growth of the real economy. In fact, both this phase and the (entire) rationalization phase appearing immediately prior to it are in possession of an equal total number of innovations classified in the D, E, and F categories. Though not anticipated by this researcher's expectations, this sort of behavior is in fact quite consistent with Perez's supposition of what goes on during the first half of the transformation phase, the irruption period.

TABLE 6. Financial innovation and the technology shift in the US 1929-2007 delineated by the four sub-periods using aggregate data as indicators.

Phase	A	B	C	D	E	F
<b>Irruption</b> <b>1931-1943</b>		••	•			
<b>Frenzy</b> <b>1943-1949</b>	•			•		
<b>Synergy</b> <b>1950-1960</b>			•		••	
<b>Maturity</b> <b>1961-1975</b>		•	••••••	•••••	•••••	••
<b>Irruption</b> <b>1976-1984</b>		••	•••	••••	•••••	•
<b>Frenzy</b> <b>1985-1991</b>					••	•
<b>Synergy</b> <b>1992-2000</b>			••	•	••	
<b>Maturity</b> <b>2001-2007</b>			•			•

Source: see Table 4

As previously mentioned, Perez (2002, pp.141-143) contends that innovations occurring during the irruption period will cover the spectrum in terms of usefulness to the real economy. During the frenzy phase she asserts that innovations will tend to coalesce into those characteristically un-useful to the real economy, while the reverse is true for those born in the synergy stage. And finally during maturity, she posits that the nature of innovations will tend towards either category B, or conversely – towards categories E and F. The table above is delineated by these four sub-periods rather than the two overarching phases. Additionally, once again the timeline is demarcated according to trends within the investment ratio.

While there is no immediate trend easily distinguishable, the behavior of the transformation phase 1976-1991- split up here into its irruption and frenzy sub-periods, does appear to have become

understandable through the lens of Perez's hypothesis. Additionally, the last five sub-periods - ranging from 'maturity 1961-1975' through 'maturity 2001-2007' – broadly conform to her hypothesis, although there are several exceptions. The first is rather minor, in that maturity phase 1960-1975 contains more items within the C and D categories than it does in the prescribed B, E and F classes - thus suggesting that more complementarities than her hypothesis calls for are still being introduced into the economy at this time. The second issue however, is that the classifications of the innovations occurring during 'synergy 1992-2001' are not convincing with regard to their positive effects on the real economy, relegated as they are to the C, D and E classes.<sup>24</sup> Finally, the innovations contained within the Frenzy 1943-1949 and Synergy 1950-1960 sub-periods are not very consistent at all with her argument. Perhaps there are too few observations during this time to come to any solid conclusions, but there is one glaring example of an innovation falling under a theoretically completely improper category. The sole inhabitant of category A, venture capital, happened to come about in 1946, a year under the aegis of the frenzy phase – a time when no innovations that work for the good of the productive capital are assumed to be created. Moreover, the earlier synergy phase has the same problem as the latter one in that the innovations occurring during this time are theoretically supposed to be beneficial to the real economy - but in reality what we see created are repurchase agreements, credit cards, and leveraged buy-outs.

In all fairness however, Perez's concept of the four sub-periods of a technological regime is in this instance being used in conjunction with the method of looking for long-waves through the use of aggregated time-series – a practice that she utterly disagrees with herself. To make amends and give her hypothesis the fullest benefit of the doubt possible within the parameters of this research project, a fourth table utilizing both Perez's qualitatively determined timeline of the movements of the long cycle as well as her subsequently differing demarcation of the four sub-periods shall be drawn up<sup>25</sup>.

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<sup>24</sup> Their real life counterparts are even less so. The innovations occurring during these years were: internet ASP (i.e. "paypal"), small business credit scoring, and online banking – all falling under category C; the D ranked innovation was consumer online stock trading; while the two E ranked innovations were sub-prime lending and credit default swaps; the item assigned to the F class is consumer home loan 'bundling'.

<sup>25</sup> The variance between this researcher's ascribed years to the various sub-periods and Perez's are cumulatively not that different. Only the first and last two sub-sections differ to an unusual extent.

TABLE 7. Financial innovation and the technology shift in the US, 1929-2007 using Perez’s suggested timeline and without regard to aggregate data.<sup>26</sup>

Phase	A	B	C	D	E	F
<b>Turning point 1929-1943</b>		••	•			
<b>Synergy 1943-1959</b>	•		•	•	••	
<b>Maturity 1960-1974</b>		•	•••••	•••••	••••	••
<b>Irruption 1971-1987</b>		••	••••••••	••••••••	••••••••	••••
<b>Frenzy 1987-2001</b>			••	•	•••	•
<b>Turning Point 2001-2007</b>			•			•

Source: derived from Table 3 and Perez (2002, p. 57)

The results shown in table 7 above are a bit more in line with her expectations. Although Perez does not posit what sorts of innovations are to be expected during the turning points, one supposes that they must be a combination of those occurring under the frenzy and synergy periods respectively, which is to say that any of the categories would be acceptable. The maturity period still has too many items in the C and D categories to perfectly match up with her theory, however the frenzy period from 1987-2001 certainly appears to be living up to Perez’s surmised in what is essentially picture perfect fashion. Nevertheless - the innovations occurring under the synergy period are still brilliantly non-conformist for the most part.

### **Third Course**

Intriguingly, these results lead us to somewhat of an impasse. However, before it is reached, we pass several points of interest. Table 4 – displaying the technological shift periodized according to aggregate indicators and using the transformation and rationalization phases as place-holders - seems to partially substantiate the claim that the nature of financial innovations changes from phase to phase. Moreover, table 5 disaggregates the rationalization period and the results displayed appear to provide at least some preliminary, although inconclusive, evidence with regard towards the premise that it may indeed

<sup>26</sup> Due to the timing of sub-periods overlapping in some cases, the green bullet points indicate an innovation that was also present in the immediately previous sub-period.

be the latter part of the rationalization phase that the majority of the detrimental innovations first appear. However, the limited number of observations - especially in the 1992/2007 rationalization phase – precludes any concrete inferences from being made. Another issue area lies with the 1976-1991 transformation phase. Unlike the same phase in the previous cycle that occurred from 1932-1949, this phase contains one innovation less in the A and B categories, and a staggering fourteen items ranked either D E or F, as compared to only one D type innovation in the previous cycle.

In an attempt to investigate this issue further, Perez’s hypothesis regarding the movements of financial innovation during four stylized sub-periods of the technology shift was applied to a periodization of the technology shift using aggregate data as indicators (table 6), as well as with her qualitatively derived timeline (table 7). This different approach shows us that the observations appearing under the transformation phase 1976/1991 or 1971/2001 respectively (depending on which table is used), empirically corroborate Perez’s ideas with regard to the behavior of financial innovations during this part of the long cycle – and in contrast to the expectations outlined by this research paper. However, innovations occurring during the synergy period (or periods, again depending on which table is used) were, in every instance save one<sup>27</sup>, blatantly nonconformist with regard to her expectation that they would prove useful to the real economy and production capital alike.

So where does this leave us? Or more specifically, where does this leave non-detrimental financial innovation? Momentarily leaving aside the question of placement of innovations that imbue financial fragility - we have on the one hand, a hypothesis that looks for beneficial innovations to occur primarily in the transformation phase, while on the other there is Perez’s (2002, p. 141) suggestion that they will make appearances both in the first half of the transformation phase as well as throughout the entire rationalization period. Tables 4, 5, and 6 all show that five out of the six total beneficial innovations fall within one of the transformation phases. Conversely, table 7 largely substantiates Perez’s theoretical suggestions, placing one beneficial innovation in the 1943-1959 synergy phase, one in the 1960-1974 maturity phase (which are the theoretical halves of the rationalization phase), and two in the irruption period 1971-1987. The remaining two are located within the turning point 1929-43. And thus, we arrive at the impasse.

It seems counter intuitive to accept both hypotheses as correct with regard to the timing and appearance of beneficial financial innovations if what they are each proffering fundamentally conflicts in

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<sup>27</sup> The lone saving grace is found in table 7, where venture capital appears in column ‘A’ during the synergy phase. However taken altogether, this hardly overwhelming – especially considering that there were four other innovations of types C, D, and E also present.

the details. Nevertheless, one possible solution is to simply accept that qualitatively and quantitatively derived delineations of the timing of the technology shift affect the logic behind the theoretical placement of the innovations within the long cycle differently. For instance, it is interesting to note that while they both broadly agree with one another as to the assignment of years to phases of the technology shift, they strongly disagree with regard to the first years and the last years under study in this analysis. Perez (2002, p. 57) contends that the years 1943-1959 make up the synergy period of the previous shift whereas Schön (1998, p. 403) asserts that those are years spent largely under the transformation phase<sup>28</sup>. The same thing happens again from 1987-2001, with Perez maintaining that these years make up the frenzy period while Schön explains that the rationalization phase sets in around 1991.

Yet another possible reason stems from the difference in emphasis the authors make between the cause, content, and repercussions of the two crisis periods. Schön (1998) places relatively more weight on the structural changes that take place during the crisis that connects the end of one long cycle with the beginning of another whereas Perez (2002, p. 114-118) contends that the most important changes take place during the ‘turning point’ between the two halves of one technology shift.

Nevertheless, the important task of taking stock of all the other lessons this research provides us with still remains. Perhaps the most obvious of the remaining lessons - as well as the most unfortunate - is the realization that over a period of 78 years, and out of 53 financial innovations surveyed, only six are found to be characteristically beneficial to the growth of the real economy. Another fifteen of the innovations are related to the ‘modernization of the financial services themselves’, and hence are neither inherently beneficial nor detrimental to the real economy – while eleven more are related to attracting small investors and/or ‘encouraging and facilitating big risk taking’ with investments made - thus introducing an element of speculation into the system. Finally, according to Perez’s typology, twenty one of these innovations are directly related to increased financial fragility of the real economy. If this spread between types of innovations is anywhere near typical - then it indicates that over time, the appearance of a financial innovation belonging to either category E or F is essentially three and half times more likely to occur than the occasion of one belonging to either class A or B!

In addition, although the primary focus of this research is to study the appearance of financial innovations over multiple technology shifts, there is also something to be learned from analyzing the differences between the long cycles. For instance, the distribution between types of financial innovation

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<sup>28</sup> His results refer to the Swedish experience, while this paper looks at the US, hence the slight difference between this paper and Schön’s assessment of the ending and beginning of phases.

that we see presented in every table here shows us that four out of the six beneficial innovations made their appearance during the first technology shift under analysis. In other words, the results of this research indicate that out of the 25 observations (or 27 using Perez's timeline as seen in table 7) contained within the most recent long cycle, only two of them are characteristically beneficial to the real economy. Even more, this trend does not just reflect decreasing beneficial innovation, but also a rise in the total number of innovations found in the E and F classes as well. Table 4 shows us that even though it contains three observations less than the previous shift as a whole, during the most recent long cycle the total number of innovations ascribed to the two lowest ranked categories rose from nine to twelve items.

This general shift in the character of innovations from one long cycle to the other is interesting for several reasons - and the most immediate question that springs to mind is "Why is it like this?" The two most probable causes of this trend have already been cursorily mentioned in this paper once before. The first is the nature of the undergirding GPT of the current technological regime, the microprocessor, and its relationship to the financial industry. The revolution in the IT sector has brought about a corresponding revolution in both aptitude and behavior of finance. The speed at which information, including price and credit information, can be processed has opened the floodgates with regard to new types of services as well as to financial innovation of a fragility imbuing nature. The second most likely suspect is the return of high interest and volatile exchange rates. Beginning around 1970 and quickly accelerating with the breakdown of the Bretton-Woods system circa 1971-1973, financial markets and intermediaries began to develop new ways to deal with unpredictable market fluctuations, some of which ultimately led to even further financial fragility. However, while the advent of IT technology and a new international economic climate may help to explain the increased occurrence of type E and F innovations, it does not at all address the question of the causes of the actual decrease in beneficial innovations.

Why should financial innovations that are beneficial to the real economy be less prone to appear in one technology shift versus another? This is a difficult, yet very important question to consider. Other than the development of a new GPT and the breakdown of the old international economic regime, the other major structural difference between the most recent technological paradigm and the previous one is a profound reversal of national sentiment towards governmental regulation. The suggestion here is not that deregulation puts a stop to the occurrence of financial innovations useful to the real economy while regulation creates them, but that generally speaking, those in the financial sphere may tend to interpret one of the most fundamental concepts of finance - 'risk pooling' - differently under regulatory versus de-regulatory regimes respectively. To that end, while much has been made about what Kane (1986) describes as the 'regulatory dialectic' - that is, the response from the financial industry to the introduction of new



governmental policy or regulations - little attention has been paid to the effect on the financial sector of what could be called the ‘regulatory pendulum’.

## IV.

### **Coffee and Cigars**

The phrase ‘regulatory pendulum’ is useful in both a narrow and expansive sense. Used narrowly, it refers to swings over time from one extreme to the other with regard to the predisposition of government towards either regulation or non-regulation. Conversely, it is used expansively to refer to same movement but with respect towards the perennial change in spirit of not just the government, but the entire nation - between what is best described as a *laissez-faire*, or pro-business mentality on the one hand, and an economically interventionist, or populist, one on the other<sup>29</sup>.

This national change in spirit is easily observed throughout the country’s history – for example, the ‘Gilded age’ of the late nineteenth century was followed by the ‘Progressive era’ of the very early twentieth, only to be replaced again with the *laissez-faire* attitudes of the 1920s, which in turn were shed due to the Great Depression. The mid to late twentieth century manifestation of this pendulum swing is found within the fall from grace of the Keynesians and the corresponding rise to dominance of the Monetarists. However, these days it is beginning to appear as if the sun in the Monetarist horizon lays low in the sky, thus many are predicting the return of an economically activist federal government once again. To be clear, the contention here is not that in the absence of an economically activist government beneficial innovations are not created, but that during these times the focus of the financial sphere tends to contract – returning to work under an assumed munificent ‘invisible hand’ rather than the oversight of their peers, and subsequently focusing less on the social outcomes generated by their activities, and a whole lot more on the ‘utility’ derived from increased pecuniary gain. Thus the composition changes between those whose economic risks are pooled and those facing exposure – potentially working to the disadvantage of other actors in the economy, including both the ‘real’ economy as well as an increased portion of the body politic<sup>30</sup>. Deregulation does not necessarily stifle beneficial financial innovations, but the results of this

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<sup>29</sup> The author is aware that the terms *laissez-faire* and pro-business, and interventionist and populist are not necessarily always equivalents to one another. Indeed, pro-business and interventionism have often gone hand in hand under the guise of both ‘protectionism’ and ‘economic imperialism’. However, the change in national sentiment that is being described here is an attempt to capture opposing ends of the domestic spectrum of interests specifically – and in such a context the respective associations of the terms are considered appropriate.

<sup>30</sup> Indeed, it is a possibility that during these times finance becomes less about risk pooling and more about risk passing.

research indicate that unfettered deregulation does appear to have at least some connection with the rerouting of financial capital efforts towards less useful purposes.

However, this suggestion must be taken in hand with Perez's (2002, p. 164) rejoinder that the objectives of monetary and fiscal policy are themselves not static but 'moving targets', and that "at each turn, the range for creativity in terms of viable responses [is] shaped by the nature of each successive technological revolution and its paradigm, as well as by the character of each phase of its unfolding". That is to say, that rather than stubbornly clinging to ideological preferences about the role of the state in the economy from either extreme of the pendulum, the rules can and should be changed according to both the needs and demands of each new technology shift. It is also very much for the best if the unique dynamics contained within the rationalization and transformation phases are taken into consideration when forming policies as well.

Moreover, it is only logical that industries appearing early on as highly sensitive to the development of a new GPT – as was the case with the financial sector and the microprocessor - are also naturally deserving of both increased ministrations as well as monitoring. After all, while it is indeed true that 'it is not from the benevolence of the butcher, the brewer or the baker that we expect our dinner', there is nevertheless at least one other essential element that must be present in order for self-interest to succeed as a sustainable mechanism of innovation, growth and exchange – and that is the element of trust<sup>31</sup>. If we do not trust the butcher, the brewer or the baker to provide us with un-tainted victuals, then we will either seek our supper elsewhere, or go and make it ourselves. With that in mind while returning to take a look at the final tally of six financial innovations working for the good of the real economy and twenty one working towards a very much more dubious goal – it seems as if financial innovation may not *just* be another word for excessive and reckless leverage, as Ritholz the pundit would have it, but the American public certainly does appear to be justified with regard towards our collective loss of trust in the primary objectives of its creators.

Nevertheless, it is important here to recall another of the oldest lessons Adam Smith (1759) imparts to us: in a book written nearly twenty years prior to teaching the world about the 'nature and causes of the wealth of nations' he reminds us that best off are those who are 'mutually sympathetic' to one another. Likewise, Schumpeter (1939), Perez (2002, 2007), Schön (1989, 1998) and others' insight that that the blame for many moments of economic crisis throughout our history (and yet to come) falls not on the

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<sup>31</sup> Which Adam Smith paid homage to in his book *The Theory of Moral Sentiments*.

shoulders of discrete agents, but on changing structural conditions that are a part of every dynamic capitalist economy should also be borne in mind. Ultimately, both the aim of this paper – as well as the entire state of the economy (in the humble opinion of this researcher) - must be viewed through the lens of these combined instructions. The goal is not the vilification of financial innovations, or the people and institutions that create them. The priority is rather an attempt to uncover underlying mechanisms that give rise to their changing proclivities. With that said however, at least one element of the evidence brought forth very clearly speaks for itself. Twenty one fragility imbuing innovations out of fifty three is not a good track record – nor is it a helpful recommendation towards the idea that there exists a virtuous invisible hand.

In the final analysis, the results of this research tentatively indicate that there may indeed be a broadly consistent rhythm as to when in the long cycle our collective trust in financial innovation may be the most misplaced – or complementarily, when our guidance may be the most needed. However, discrepancies between qualitatively and quantitatively derived timelines and oblique differences in the results obtained by the two respective models obliges one to come to the conclusion that much further research is required before any concrete conclusions can be reached<sup>32</sup>.

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<sup>32</sup> Curiously, the observations contained within the first technology shift under analysis fit this researcher's expectations almost perfectly (tables 4 and 5), whereas the same is true with regard towards the second shift and Perez's expectations (table 7). This is most likely coincidental – however further research may reveal a tentative explanation or even a causal connection.

## Bibliography

- Abken, P. 1994. Over the counter financial derivatives risky business? *Federal Reserve Bank of Atlanta, Economic Review*
- Acemoglu, D., F. Zilibotti. 1997. Was Prometheus unbound by chance? risk, diversification and growth, *Journal of Political Economy*, Vol. 105
- Bank for International Settlements. 1986. Recent innovations in international banking, *Bank for International Settlements report*, dated April 1986
- Battilossi, S. 2000. Financial innovation and the golden ages of international banking: 1890-1931 and 1958-1981, *Financial History Review*, Vol. 7
- Bencivenga, V.R., B.D. Smith. 1991. Financial intermediation and endogenous growth, *Review of Economic Studies*, Vol. 58
- Bresnahan, T. M., Trajtenberg. 1995. General purpose technologies “engines of growth”?, *NBER*, working paper No. W4148
- Chance, Don. 1998. *Essays in Derivatives*, Hoboken, NJ, John Wiley and Sons
- Chou, Y.K. M.S., Chin. 2004. Financial innovations and technological innovations as twin engines of economic growth, *University of Melbourne dept. of economics working paper*
- Cowan, C. 2003. Hearing on protecting homeowners: preventing abusive lending while preserving access to credit, *statement on behalf of the American Securitization Forum before the Subcommittee on Housing and Community Opportunity and Subcommittee on Financial Institutions and Consumer Credit, United States House of Representatives*
- Cole, David. E. Browning, F. Schroeder. 2003. *Encyclopedia of Modern Everyday Inventions*, Westport, CT, Greenwood Publishing Group
- Dahmén, Erik. 1988 [1950]. ‘Development blocks’ in industrial economics, *The Scandinavian Economic History Review*, Vol. 36
- Eun, Cheol. B. Resnick. 2000. *International Financial Management*, New York, NY, Irwin McGraw-Hill
- Finnerty, J.D. 1988. Financial engineering in corporate finance: an overview, *Financial Management*, Vol. 17

- Finnerty, J.D. 1992. An overview of corporate securities innovation, *Journal of Applied Corporate Finance*, Vol. 4
- Finnerty, J.D. 2001. *Debt Management*. Cambridge, MA, Harvard Business School Press
- Fisher, Franklin. J. McKie, R. Mancke. 1983. *IBM and the US Data Processing Industry: An Economic History*, Westport, CT, Praeger
- Frame S. L, L.J. White. 2004. Empirical studies of financial innovation: lots of talk, little action?, *Journal of Economic Literature*, Vol. XLII
- Frame S.L. L.J. White. 2009. Technological change, financial innovation, and diffusion in banking, *Federal Reserve Bank of Atlanta*, working paper 2009-10
- Freeman, Christopher. J, Clark. L, Soete. 1982. *Unemployment and Technical Innovation: A Study of Long Waves and Economic Development*, London, U.K., Frances Pinter
- Fuller, G. E. Collett. 2008. Structured investment vehicles: the dullest business on the planet? *Capital Markets Law Journal*, Vol. 3 no. 4
- Fung, W. D, Hsieh. 1991. A primer on hedge funds, *Journal of Empirical Finance* Vol. 6
- Gerardi, K. AH Shapiro, P. Willen. 2007. Subprime outcomes: risky mortgages, homeownership experiences, and foreclosures, *Federal Reserve Bank of Boston*, working paper no. 7-15
- Gompers, Paul. J. Lerner. 2004. *The Venture Capital Cycle*, Boston MA, MIT Press
- Graham, Benjamin. D. Dodd. 1934. *Security Analysis*. New York, NY, Whittlesey House
- Greene, R. S. Wachter. 2005. The American mortgage in historical and international context, *Journal of Economic Perspectives* Vol.19 no. 4
- Hakim, Catherine. 2000. *Research Design: Successful Designs for Social and Economic Research*. New York, NY, Routledge
- Harrington, Richard. 1992. *Financial Innovation and International Banking*, in *Financial Innovation*, Henry Canvanna (ed.) New York NY, Routledge
- Hayashi, F. R, Sullivan. S, Weiner. 2003. A guide to the atm and debit card industry, *Federal Reserve Bank of Kansas City, Payments system research department*
- Herschman, A. 1949. International aspects of a recession, *Board of Governors of the Federal Reserve System Division of Research and Statistics International Section*
- Hester, D. A. Carron, S. Goldfeld. 1981. Innovations and monetary control, *Brookings Papers*

*On Economic Activity* Vol. 1981 no. 1

Jack, S. K. Chang., L. Shanker. 2006. Hedging effectiveness of currency options and currency futures, *Journal of Futures Markets* Vol. 6 no. 2

Kamery, RH. 2005. How accurate is M2? A basic review and analysis of the measurement of the money supply, in *Allied Academics International Internet Conference*, Jo-Ann and Jim Carland (eds.)

Kane, E. 1986. Technology and the regulation of financial markets, in *Technology and the Regulation of Financial Markets: Securities, Futures, and Banking*. Saunders, A and White, L.J., eds. Lexington, MA, Lexington Books

Keirstead, Burton Seely. 1948. *The Theory of Economic Change*. Toronto, Canada, MacMillan

Kareken, J. 1987. The emergence and regulation of contingent commitment banking, *Journal of Banking and Finance* Vol. 11

Lowenstein, L. 1985. Management buyouts, *Columbia Law Review* Vol. 85 No. 4

Lucas, Douglas. L. Goodman, F. Fabozzi. 2006. *Collateralized Debt Obligations: Structures and Analysis, 2<sup>nd</sup> ed.*, Hoboken, NJ, John Wiley and Sons

Lundquist, K.J. L.O., Olander. M., Svensson-Henning. 2007. Decomposing the technology shift: evidence from the Swedish manufacturing sector, *Tijdschrift voor Economische en Sociale Geografie*, Vol. 99 no. 2

Lundquist, K.J. L.O., Olander. M., Svensson-Henning. 2007. Creative destruction and economic welfare in Swedish regions: spatial dimensions of structural change, growth and employment, *SRE Discussion paper* 2008/03

McMahon, P. 2004. Money, markets, and microelectronics: building the infrastructure for the global finance sector, *Prometheus*, Vol. 22 no. 1

Messler, Mark. D. Van Deventer, K. Imai. 2004. *Advanced Financial Risk Management: Tools and Techniques for Integrated Credit Risk and Interest Rate Risk Managements*, Hoboken, NJ, John Wiley and Sons

Mester, L. 1997. What's the point of credit scoring? *Federal Reserve Bank of Philadelphia, Business Review*

Miller, M.H. 1986. Financial innovation: the last twenty years and the next, *Journal of Financial*

*and Quantitative Analysis*, Vol. 21 (4)

- Minsky, H. 1992. The financial instability hypothesis, *The Jerome Levy Economics Institute of Bard College*, working paper no. 74
- Minsky, H. 1992. The capital development of the economy and the structure of financial institutions, *The Jerome Levy Economics Institute of Bard College*, working paper no. 72
- Molyneux, P. N. Shamroukh. 1996. Diffusion of financial innovations: the case of junk bonds and note issuance facilities, *Journal of Money, Credit and Banking* Vol. 28 no. 3 part 2
- Perez, Carlota. 2002. *Technological Revolutions and Financial Capital: The Dynamics of Bubbles and Golden Ages*, Cheltenham, U.K., Edward Elgar Press
- Perez, Carlota. 2007. Finance and technical change: a long-term view, in Hanusch, H. and A. Pyka, eds., 2007, *The Elgar Companion to Neo-Schumpeterian Economics*, Cheltenham, U.K., Edward Elgar Press
- Persons, J.C. V.A., Warther. 1997. Boom and bust patterns in the adoption of financial innovations, *The Review of Financial Studies*, Vol. 10 no. 4
- Pollock, A. 2008. The human foundations of financial risk, *American Enterprise Institute for Public Policy Research*
- Purcell, P. 2002. Retirement savings and household wealth in 2000: analysis of Census Bureau data, *CRS Report for Congress*
- Russell, Ellen. 2007. *New Deal Banking Reforms and Keynesian Welfare State Capitalism*, New York, NY Routledge
- Saint-Paul, G. 1992. Technological choice, financial markets, and economic development *European Economic Review*, Vol. 36
- Schön, Lennart. 1989. *From War Economy to State Debt Policy*, Stockholm SE, Riksgälds Kontoret
- Schön, L. 1998. Industrial crises in a model of long cycles: Sweden in an international perspective, in Myllyntaus, T. (ed), *Economic Crises and Restructuring in History* Stuttgart, Mercaturae
- Schumpeter, Joseph. 1939. *Business Cycles. A Theoretical, Historical, and Statistical Analysis of the Capitalist Process*, New York NY, McGraw-Hill

- Silber, W. 1983. The process of financial innovation, *The American Economic Review*
- Sloven, M. M. Shushka, C. Hudson. 1988. Corporate commercial paper, note issuance facilities and shareholder wealth, *Journal of International Money and Finance*, Vol. 7
- Smith, Adam. 1759 [1761, 2007]. *Theory of Moral Sentiments*, Printed for A. Miller [1761], University of Lausanne [2007 digitized]
- Tavakoli, J. 2001. *Credit Derivatives & Synthetic Structures: A Guide to Instruments and Applications*, Hoboken, NJ, John Wiley and Sons
- Tufano, P. 2002. Financial innovation, in Constantinides, G. M. Harris. R. Stultz (eds.) *The Handbook of the Economics of Finance*, North Holland
- Twiford, JK. 1979. Standby letter of credit: valuable but still uncertain instrument in international business, *Houston Journal of International Law*
- Veblen, Thorstein. 1904 [1978]. *The Theory of Business Enterprise*, Piscataway, NJ, Transaction
- White, L.J. 1996. Technological change, financial innovation and financial regulation in the U.S.: the challenges for public policy, in *Technology and Finance: Papers from the Discussion Series of the New York Academy of Sciences*

Websites:

Chicago Board of Options Exchange: <http://www.cboe.com/>

Kerr, Tom: <http://www.mortgageloan.com/bundled-mortgage-fees-more-trouble-than-theyre-worth-1649>

Pollock, Alex: [http://www.aei.org/publications/pubID.27982/pub\\_detail.asp](http://www.aei.org/publications/pubID.27982/pub_detail.asp)

Poole, William: [http://www.stlouisfed.org/news/speeches/2008/03\\_06\\_08.html](http://www.stlouisfed.org/news/speeches/2008/03_06_08.html)

Ritholz, Barry: <http://bigpicture.typepad.com/comments/2008/09/regulatory-exem.html>

Rodrick, Dani: [http://rodrik.typepad.com/dani\\_rodriks\\_weblog/2008/09/news-the-time-to-sing-the-praises-of-financial-innovation.html](http://rodrik.typepad.com/dani_rodriks_weblog/2008/09/news-the-time-to-sing-the-praises-of-financial-innovation.html)

The Library of Economics and Liberty: <http://www.econlib.org/library/Enc/JunkBonds.html>

The New York Times: <http://www.nytimes.com/1985/05/01/business/finance-new-issues-municipal-bond-futures-contract.html>

Us Bureau of Economic Analysis: <http://www.bea.gov/>