

SKYSCRAPERS AND BUSINESS CYCLES

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The skyscraper index, created by economist Andrew Lawrence shows a correlation between the construction of the world's tallest building and the business cycle. Is this just a coincidence, or perhaps do skyscrapers cause business cycles? A theoretical foundation of "Cantillon effects" for the skyscraper index is provided here showing how the basic components of skyscraper construction such as technology are related to key theoretical concepts in economics such as the structure of production. The findings, empirical and theoretical, suggest that the business cycle theory of the Austrian School of economics has much to contribute to our understanding of business cycles, particularly severe ones.

The skyscraper, that unique celebration of secular capitalism and its values, challenges us on every level. It offers unique opportunities for insightful analysis in the broadest terms of twentieth-century art, humanity, and history. When criticism becomes captive to centers of power or prevailing theories or fashions, unwilling or unable to probe the process and the results, something important has gone wrong with one of the stabilizing and balancing forces of a mature society. (Huxtable 1992, p. 120)

In the overheated speculation of the 1920s, as land prices rose, towers grew steadily taller. Or should the order be: as skyscrapers grew taller, land prices rose? The variables that contributed to real estate cycles were even more complex than this "chicken and egg" conundrum. (Willis 1995, p. 88)

The skyscraper is the great architectural contribution of modern capitalistic society and is even one of the yardsticks for twentieth-century superheroes, but no one had ever really connected it with the quintessential feature of modern capitalistic history—the business cycle. Then in 1999, economist Andrew Lawrence created the "skyscraper index" which purported to show that the building of the tallest skyscrapers is coincidental with business

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cycles, in that he found that the building of world's tallest building is a good proxy for dating the onset of major economic downturns. Lawrence described his index as an "unhealthy 100 year correlation."

The ability of the index to predict economic collapse is surprising. For example, the Panic of 1907 was presaged by the building of the Singer Building (completed in 1908) and the Metropolitan Life Building (completed in 1909). The skyscraper index also accurately predicted the Great Depression with the completion of 40 Wall Tower in 1929, the Chrysler Building in 1930, and the Empire State Building in 1931. There are, however, important exceptions in the ability of the index to predict, so the first question is: how good of a predictor is the skyscraper index?

Second, what is the nature of the relationship between skyscraper building and the business cycle? Surely, building the world's tallest building does not cause economic collapse, but just as clearly, there are economic linkages between construction booms and financial busts. What theoretical connections can be made between skyscraper building and business cycles? Andrew Lawrence noted overinvestment, monetary expansion, and speculation as possible foundations for the index, but did not explore these issues. With the destruction of the World Trade Towers and the increased threat of terrorism, the skyscraper index may have already lost its usefulness for future prediction,¹ but even if that were the case, the theoretical linkages between skyscraper building and business cycles may still have usefulness in improving our understanding of business cycles and the economic theory behind them.

In order to better examine the relationship, the evidence in support of the skyscraper index is examined and compared to the reliability of other market indicators. The ability of most market indicators is found to be weak, while the ability of the skyscraper index to predict severe changes in the business cycle is strong. The general relationship between the business cycle and skyscraper building is examined with respect to the role of "Cantillon effects" in skyscraper cycles. The unique and distinguishing features of abnormally large swings in the business cycle, as manifested in record-setting skyscrapers, are then shown to be uncommon features of most business cycle theories and a unique feature of the Austrian school's theory of the business cycle. Finally, the data linking the world's tallest skyscrapers and business cycles is reexamined to evaluate the index's incorrect predictions and as a result the index is shown to be more accurate than previously thought.

¹Glaeser and Shapiro (2001, p. 15) did not find a statistically significant effect between the amount of terrorism and the numbers of skyscrapers built. They also note that the number of skyscrapers may not be market determined because of government intervention (e.g., building codes) as well as the builder's desire for personal aggrandizement.

DO SKYSCRAPERS PREDICT?

Lawrence (1999a) was apparently the first to make the claim that the construction of the world's tallest building was correlated with impending financial crisis although the subject of the world's tallest skyscrapers and their relation to economic crisis is also prominent in Grant (1996). Lawrence showed that in almost all cases the initiation of construction of a new record-breaking skyscraper preceded major financial corrections and turmoil in economic institutions. Generally, the skyscraper project is announced and construction is begun during the late phase of the boom in the business cycle; when the economy is growing and unemployment is low. This is then followed by a sharp downturn in financial markets, economic recession or depression, and significant increases in unemployment. The skyscraper is then completed during the early phase of the economic correction, unless that correction was revealed early enough to delay or scrap plans for construction. For example, the Chrysler Building in New York was conceived and designed in 1928 and the groundbreaking ceremony was conducted on September 19, 1928. "Black Tuesday" occurred on October 29, 1929, marking the beginning of the Great Depression. Opening ceremonies for the Chrysler Building occurred on May 28, 1930, making it the tallest building in the world.

The business press reported Lawrence's findings positively, but not with much fanfare. *Investors' Business Daily* seemed somewhat sympathetic to his "impressive" evidence, but asked "How could something bad come of building the world's biggest skyscraper? After all, bigger is better. Having the biggest building on earth can be a source of national pride" (*Investors' Business Daily* 1999). Also positive was *Barron's* who seemed to agree that it was an "excellent forecasting tool for economic and financial imbalance" (Pesek 1999a). *Business Week* also made mention of the skyscraper index, although the first and most concerned reports of the index came from the *Far Eastern Economic Review* which noted that China was planning on breaking the record for the world's tallest building and constructing three of the 10 tallest buildings on the planet by 2010.²

The reason for the rather muted response to the skyscraper index is that most "indicators" have failed to remain robust and not pass the test of time. Indeed, the skyscraper index has not predicted all major economic collapses such as the depressions of 1920-21, 1937-38, and 1981-82 and has predicted economic collapse when downturns were relatively mild such as 1913 and the early 1970s. The index could easily become obsolete due to factors such as terrorism and the evolving nature of the economy. There have been numerous indicators put forth to help us predict the business cycle and stock markets. The Super Bowl indicator, for example, predicts that if a team from the

²Koretz (May 17, 1999, p. 26) and Granitsas (February 11, 1999 p. 47); also see *Die Abgabewelle Wirtschaftswoche* (May 27, 1999) for a report on the skyscraper index.

National Football Conference (the old NFL) beats the team from the American Football Conference in the Super Bowl game, it should be a good year for the stock market and *ipso facto* a good year for the economy. This is a classic case of a “coincidental” indicator in that the statistical relationship is only a matter of coincidence.³ There are seasonal indicators like the January effect, which has only questionable causal links, and political indicators relating to the political business cycle theory which also makes suggestions as to when and how the economy and the stock market will perform. Leading indicators with good causal-economic links with the economy include the inverted yield curve and the index of leading economic indicators, the once official crystal ball of the economy that lately has had greater difficulty accurately predicting changes in the economy. In fact, the cost and difficulties of maintaining the index led in recent years to it being privatized.⁴ Economist Richard Roll explained that such indicators have only fleeting value for real-world investing:

I'm not just an academic but also a businessman . . . we could sure do a heck of a lot better for our clients in the money management business than we've been doing. I have personally tried to invest money, my client's money and my own, in every single anomaly and predictive device that academics have dreamed up. . . . I have attempted to exploit the so-called year-end anomalies and a whole variety of strategies supposedly documented by academic research. And I have yet to make a single nickel on any of these supposed market inefficiencies. (Roll 1992, pp. 29-30)

The problems with indicators are many. Some have a poor track record of predictions, while others have a good track record but without any economic rationale (e.g., the Super Bowl indicator) and thus offer little confidence that the track record is not simply a statistical anomaly. Other indicators offer mixed signals, such as the January effect, which can be based either on the performance of the stock market (which one?) during the first week of January, or during the entire month. The January effect is also said to suffer from the fact that once everyone is aware of the effect, it becomes anticipated and therefore no longer offers reliable investment advice or insight into the economy. As a result, such indicators do not have a much better record predicting the business cycle than professional economists.

The skyscraper index, in contrast does have a good record in predicting important downturns in the economy. This index is a leading economic

³This type of coincidental indicator (with no causal connections) should be differentiated from coincidental economic indicators which simply follow or track changes in the business cycle, such as payroll statistics, which are linked with economic activity.

⁴Hershey (1995) notes that the Commerce Department announced that the Conference Board won the bidding against several competitors to take over compilation of the Index of Leading Economic Indicators, and the coincident and lagging indicators.

indicator in that the announcement of building plans predates the onset of the economic downturn. There have been four major skyscraper booms in the twentieth century interspersed by periods of relative normality and less severe business cycles. Table 1 presents the history of the world's tallest buildings that demonstrates that many major economic downturns were associated with the building of the world's tallest skyscrapers. A more visually-enhanced perspective of this history is provided in Figure 1.

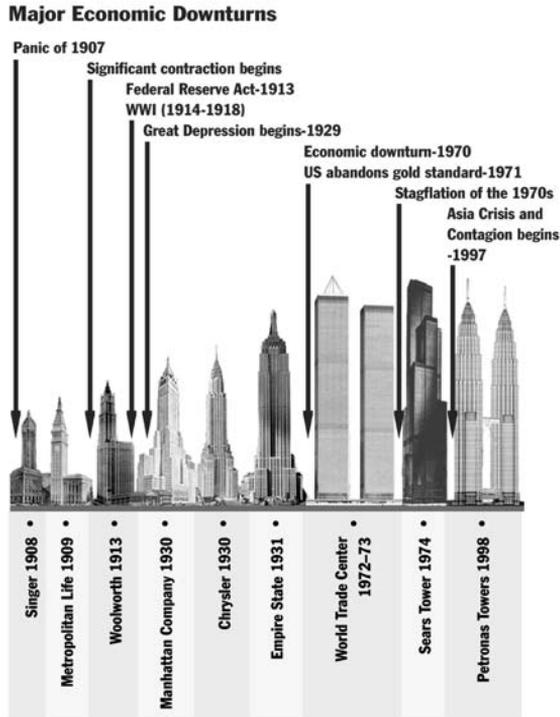
Table 1
World's Tallest Buildings

COMPLETED	BUILDING	LOCATION	HEIGHT	STORIES	ECONOMIC CRISIS
1908	Singer	New York	612 ft.	47	Panic of 1907
1909	Metropolitan Life	New York	700 ft.	50	Panic of 1907
1913	Woolworth	New York	792 ft.	57	-----
1929	40 Wall Street	New York	927 ft.	71	Great Depression
1930	Chrysler	New York	1,046 ft.	77	Great Depression
1931	Empire State	New York	1,250 ft.	102	Great Depression
1972/73	World Trade Center	New York	1,368 ft.	110	1970s stagflation
1974	Sears Tower	Chicago	1,450 ft.	110	1970s stagflation
1997	Petronas Tower	Kuala Lumpur	1,483 ft.	88	East Asian
2012	Shanghai	Shanghai	1,509 ft.	94	China?

The first skyscraper cycle occurred between 1904 and 1909 and included the Singer Building becoming the world's tallest when completed in 1908 and the Metropolitan Life Building setting a new record in 1909. The Panic of 1907 occurred at a time when seasonal factors relating to fall harvests coincided with cyclical factors in money and credit. It was ignited into financial panic when a bank regulated under the National Banking system refused to clear funds for the Knickerbocker, an unregulated trust. The result was widespread runs on banks and one of the sharpest downturns in American economic history. This episode is particularly important and of continuing relevance because it is widely considered to be a key event in the passage of the Federal Reserve Act in 1913. The Panic is widely considered to have been caused by problems associated with the structure and regulation of the National Banking system. The solution adopted was to increase the size and regulatory power of the national government in matters of money and banking, although in recent years some economists have questioned whether that was the proper response.⁵

⁵Naturally members of the Free Banking School such as Lawrence White and George Selgin would be critical of such a policy response. See Rothbard (1984) for a public choice critique of the founding of the Federal Reserve.

Figure 1
Skyscrapers and Economic Crisis



Bypassing the Woolworth Building, which at first does not seem to fit the general pattern in Lawrence's analysis, the second episode of the world's tallest buildings occurred at the onset of the Great Depression. Three record setting skyscrapers were announced during the late 1920s, when the stock market boom was being matched by booms in residential and commercial construction. In 1929, the skyscraper at 40 Wall Street was completed at 71 stories, followed by the Chrysler Building in 1930 at 77 stories, and the Empire State Building in 1931 at 102 stories. Clearly, there was a capital-oriented boom in the construction of ever-taller buildings before the Great Depression.

Economists have offered many different explanations for the Great Depression and Robert Lucas (1987) has even claimed that it defies explanation. What should be clear is that there was a significant increase in the money stock between the founding of the Federal Reserve and the stock market crash, a significant restructuring in banking and bank regulation, a significant decline in the supply of money after the crash, a significant number of bank failures, and a variety of other important factors that contributed to the initiation and duration of the depression, including the Smoot-Hawley tariff and the New Deal.

The third major cycle of skyscraper records occurred in the early 1970s. Once again the economy was coming off a strong and sustained boom in economic activity during the 1960s. The economic downturn of 1970 marked the beginning of more than a decade when the economy struggled with inflation and recession, as well as disrupted institutions and markets. From 1970 to 1982 the American economy suffered from stagflation, several deep recessions, and from high levels of the misery index (inflation rate + unemployment rate). As the last vestiges of the gold standard were being abandoned and the Bretton Woods system was disintegrating, construction workers in New York and Chicago were busy building the next set of the world's tallest buildings. Breaking records set in the early days of the Great Depression, One World Trade Center was completed in 1972 and Two World Trade Center was completed in 1973, both of 110 stories. In Chicago, the Sears Tower was completed in 1974, which was also 110 stories but reached a height of 1,450 feet compared to the 1,368 feet of the World Trade Towers. Once again, economists failed to anticipate the downturn in the economy, failed to provide a good explanation for the economic problems, and did not provide effective remedies for the economic problems of the day. Even though high oil prices occurred after the economy began its contraction, the theory of "supply shocks" was born.⁶

The fourth cycle ushered in the East Asian economic crisis. The Pacific Rim countries such as Hong Kong, Malaysia, Singapore, Vietnam, and South Korea experienced significant economic growth during the 1980s and 1990s.

⁶It is worth quoting academic economist and Federal Reserve Governor Ben Bernanke (2003) at length on the profession's failure to look past the obvious to the *economic*. With the help of 25 years of hindsight, he concludes:

The upshot is that the deep 1973-75 recession was caused only in part by increases in oil prices *per se*. An equally important source of the recession was several years of overexpansionary monetary policy that squandered the Fed's credibility regarding inflation, with the ultimate result that the economic impact of the oil producers' actions was significantly larger than it had to be. Instability in both prices and the real economy continued for the rest of the decade, until the Fed under Chairman Paul Volcker reestablished the Fed's credibility with the painful disinflationary episode of 1980-82. This latter episode and its enormous costs should also be chalked up to the failure to keep inflation and inflation expectations low and stable. In contrast to the 1970s, fluctuations in oil prices have had far smaller effects on both inflation and output in the United States and other industrialized countries since the early 1980s. In part this more moderate effect reflects increased energy efficiency and other structural changes, but I believe the dominant reason is that the use of constrained discretion in the making of monetary policy has led to better anchoring of inflation expectations in the great majority of industrial countries.

With the region's leading economy, Japan, in recession and stagnation for much of the 1990s, the "Asian Tigers" were considered miracle economies because they were strong and durable despite being small and vulnerable. The Petronas Towers were completed in Kuala Lumpur, Malaysia in 1997 setting a new record for the world's tallest building at 1,483 feet beating the old record by 33 feet (the two towers were only 88 stories high compared with the 110 story giants built in the early 1970s). It marked the beginning of the extreme drop in Malaysia's stock market, rapid depreciation of its currency, and widespread social unrest. Financial and economic problems spread to economies throughout the region, a phenomenon known as the "Asian Contagion."

The common pattern in these four historical episodes contains the following features. First, a period of "easy money" leads to a rapid expansion of the economy and a boom in the stock market. In particular, the relatively easy availability of credit fuels a substantial increase in capital expenditures. Capital expenditures flow in the direction of new technologies which in turn creates new industries and transforms some existing industries in terms of their structure and technology. This is when the world's tallest buildings are begun. At some point thereafter negative information ignites panicky behavior in financial markets and there is a decline in the relative price of fixed capital goods. Finally, unemployment increases, particularly in capital and technology-intensive industries. While this analysis concentrates on the U.S. economy, the impact of these crises was often felt outside the domestic economy.

It would be very easy to dismiss the skyscraper index as a predictor of the business cycle, just as other indicators and indexes have been rightly rejected. However, the skyscraper has many of the characteristic features that play critical roles in various business cycle theories. It is these features that make skyscrapers, especially the construction of the world's tallest buildings, a salient marker of the twentieth-century's business cycle; the reoccurring pattern of entrepreneurial error that takes place in the boom phase that is later revealed during the bust phase. In the twentieth century the skyscraper has replaced the factory and railroad, just as the information and service sectors have replaced heavy industry and manufacturing as the dominant sectors of the economy. The skyscraper is the critical nexus of the administration of modern global capitalism and commerce where decisions are made and transmitted throughout the capitalist system and where traders communicate and exchange information and goods, interconnecting with the telecommunications network. Therefore it should not be surprising that the skyscraper is an important manifestation of the twentieth-century business cycle, just as the canals, railroads, and factories were in previous times.

CANTILLON EFFECTS IN SKYSCRAPERS

Cantillon effects are named for their discoverer, Richard Cantillon, who is widely credited as the first economic theorist, and in particular, was the first

to show that changes in the money supply and credit have important impacts on the economy by changing relative prices.⁷ Cantillon showed that an increase in the supply of money would cause economic expansion, but that ultimately the process would be self-reversing as prices would rise and imports would increase, sending money back out of the economy. Cantillon further showed that monetary inflation does not affect all prices equally or at the same time, but in sequences that depend on the spending behavior of money holders all along the channels of monetary flows. These ideas have been adopted and extended by Knut Wicksell, Ludwig von Mises, and F.A. Hayek and more recently by McCulloch (1981) and Garrison (2001).

Cantillon effects are the real fundamental changes in resource allocation that result from changing relative prices between the time of the creation of new money and the full adjustment to the increase in supply. For Cantillon, an increase in commodity money, such as silver, would increase employment and prices. It would impose “forced savings” and lower real incomes on those whose income was not changed due to monetary inflation, possibly leading to unemployment or emigration. If the money supply increased due to a balance-of-payments surplus, then the additional money could cause an increase in manufacturing or expansion in whatever the new money holders chose to spend their money on.

Most importantly, changes in the supply of money can have effects on the interest rate and once again the effect will depend on how the money enters the economy. On the one hand, if it comes into the hands of traditional borrowers or lenders, such as developers, the rate of interest would initially fall. This is similar to the Austrian theory of the business cycle in that when banks expand the money supply and lower the interest rate below what it would have been borrowers invest in longer term capital projects. On the other hand, if the money came into the hands of consumers, the rate of interest might rise as suppliers attempt to meet the new demand for goods. In the Austrian view, changes in the interest rate change the relative price between longer-term capital projects and shorter-term capital projects. A lowering of the interest rate raises the prices of longer term capital goods relative to shorter term capital goods.

In response to the change in relative prices, more resources are allocated to long-term capital goods. Unlike other aspects of the self-adjusting market process, such as money, land, labor, and short-term or intermediate capital goods, these resources become suspended or fixed in long-term fixed capital goods. These resources become formulated in a highly-specific capital good that may not be well-suited to the alternative production processes of the post-adjustment economy. As a result, all of the adjustment in these long-term fixed capital goods must come from a change in price and this will entail large losses and possible bankruptcies by the owners of these capital goods. To the

⁷See Thornton (1998) for a modern assessment of Cantillon’s contributions.

extent that these types of adjustments are widespread, they pose a threat to capital markets and the banking system.

The Cantillon effect works much like the Alchian and Allen effect, a simple application of price theory, the bread and butter of economic analysis.⁸ Economists Armen Alchian and Richard Allen answered the question: Why are high quality apples shipped out of apple-growing regions, leaving only lower grade apples for the local market? They explain that the cost of transporting apples from Washington State across the country is a “flat” rate per crate of apples. This fee lowers the relative price of higher quality apples for consumers in nonproducing states and raises it in producing states. If a high-quality apple cost \$1 and a standard quality apple cost \$0.50 then the relative price is 2-to-1. If a transport fee of \$0.50 per apple is charged then the prices are \$1.50 for high quality and \$1.00 for standard quality and thus the relative price of the high-quality apples falls from 2-to-1 down to 1.5-to-1. In Washington the consumer must forgo 2 standard quality apples when purchasing 1 high quality apple, but in nonproducing regions the consumer need only forgo 1.5 standard quality apples. Therefore the change in relative prices explains why the preponderance of high-quality apples are shipped out, leaving the local markets with lower-quality apples. The same is true for other products such as lobsters from Maine and potatoes from Idaho, a result now known as the Alchian and Allen effect. The impact of relative price changes has proven to be a useful puzzle solver in areas outside of the grocery store.⁹

Changes in relative prices also affect the type of capital goods produced. Modern economics has great difficulty in dealing with real-world capital goods and mainstream economists have gone to great pains to ignore the heterogeneity of capital and to great lengths to count, or add up what are otherwise dissimilar and unique items like skyscrapers, factories, and mining operations. Treating capital goods as homogeneous goods that can be counted has facilitated much of neoclassical theorizing, but is also a major blind spot for

⁸See Thornton (1991a) for a more complete discussion of the Alchian and Allen Effect and the theory of relative prices.

⁹For example, the reason that illegal drugs such as heroin, cocaine, and marijuana have become so highly potent is that the risk of moving drugs into the market and selling them encourages drug dealers to supply the most concentrated forms of their products, an effect often referred to as the Iron Law of Prohibition (Thornton, 1991a). This effect was also prominent during alcohol prohibition (1920–1933) when a nation consisting mostly of beer drinkers switched to highly potent moonshine and bathtub gin (Thornton, 1991b). The relative price effect also played a role in the American Civil War when running the Union blockade of the Confederacy was a risky business. The “Rhett Butler Effect” meant that blockade runners like the fictional character from *Gone with the Wind* imported high-priced items and luxury goods, like coffee, cognac, and formal dresses rather than bulky items like salt and flour—the fixed risk cost of running the blockade made it more profitable to do so (Ekelund and Thornton 1992). There has been some confusion when economists have tried to apply the Alchian-Allen Effect (Cowen and Tabarrok, 1995), but it continues to show its real world applicability in both complex and simple cases (Sobel and Garrett 1997).

neoclassical economists when issues and answers rest on the heterogeneity of capital. However, some inroads have been made to correct this blind spot and to consider the heterogeneity of capital as a focal issue. For example, Goolsbee (1998) applied the Alchian-Allen effect to the case of tax subsidies for capital good purchases and found that such subsidies induce buyers to purchase higher-priced machinery, rather than greater quantities of capital goods. Basically, tax subsidies allow buyers to substitute tax-subsidized quality for non-subsidized expenditures such as training and future maintenance, thereby tipping the balance of relative prices in favor of higher-quality capital goods. In this very short-run orientation, capital goods do not change, only their composition, and there is a large dead weight loss associated with the tax subsidy.

While this application is certainly illustrative of the impact of changes in relative prices on capital allocation, it did not address the longer run orientation of changes in the production side of the economy. In effect, Goolsbee addressed the issue of how well do two different qualities of cooking pans sell when subject to a 10 percent discount, but not whether new high-tech pans will be introduced or if production will take place in the supplier's garage or in a humongous factory with computers and robots doing much of the work. How productive and "roundabout" the process of production is will depend crucially on what capital goods are selected and built.

The skyscraper is considered an art form, but its construction is essentially a business that must pay heed to incentives and constraints and therefore skyscraper construction can be expected to closely follow even small changes in relative prices. In reevaluating the early skyscraper artistically, Huxtable (1992, pp. 23-24) noted:

Essentially, the early skyscraper was an economic phenomenon in which business was the engine that drove innovation. The patron was the investment banker and the muse was cost-efficiency. Design was tied to the business equation, and style was secondary to the primary factors of investment and use. . . . The priorities of the men who put up these buildings were economy, efficiency, size, and speed.

That is not to say that the early skyscrapers were without artistic merit, or that later structures failed to improve artistically, quite to the contrary. Nevertheless, post-World War I skyscrapers continued to emphasize profits and technology. The early skyscraper drew from existing technology and was considered an engine of innovation. Even in modern times, design continues to grow and evolve, but the "structural rationale for such a tall structure is technically and economically inescapable."¹⁰ For Huxtable (1992, p. 105) "Architecture simply doesn't count. . . . With pitifully few exceptions in the past, New York's skyscrapers have never reached for anything but money." And while technology is certainly an awe-inspiring facet of skyscrapers, it should be remembered that the important technology of the first "skyscrapers" in the

¹⁰Helmut Jahn quoted in Huxtable (1992, p. 96).

late nineteenth century was already available before the Civil War and that the basic “structural principles of the tall building, developed by the turn of the century, have remained essentially unchanged.”¹¹ Art, technology, government regulations, and even ego must be considered, but the skyscraper is essentially a captive of economic forces and motives. Therefore when architects are asked what makes for the “super skyscraper,” economic forces are considered preeminent, or as Robert Sobel meekly put it, “I think there are financial forces working to make this happen.”¹²

Changes in the rate of interest (the relative price between consumption goods and capital goods) can have three separate Cantillon effects on skyscrapers. All three effects are reinforcing and all three effects are interconnected to the transformation of the economy toward more roundabout production processes. When the rate of interest is reduced, all three effects contribute to the desire to build taller structures. The world’s tallest buildings are generally built when there is a substantial and sustained divergence between the actual interest rate and the natural rate of interest, where the actual rate is below the natural rate as a result of government intervention. When the rate of interest increases, the financial effects all reduce the value of existing structures and the demand to build tall structures and when combined with depressed economic activity, the desire to build at all.

The first Cantillon effect is the impact of the rate of interest on the value of land and the cost of capital. A lower rate of interest tends to increase the value of land, especially in the central business districts of major metropolitan cities. Land values rise because lower rates of interest reduce the opportunity cost or full price of owning land. Treating the rate of interest as an exogenous cause, a reduction in the interest rate will increase the demand for land and result in an increase in land prices. However, the overriding issue with land is “location, location, location,” so that the interest rate will have differential effects on land prices.

When the rate of interest is falling, the land best suited for the production of the longer term, more capital intensive and more roundabout methods of production will increase in price relative to land better suited for shorter term, more direct methods of production. As land prices generally rise, the yield from any piece of land that would make ownership of it profitable also rises. Combined with a lower cost of capital brought about by a lower rate of interest, land owners will seek to build more capital-intensive structures and at the margin this will cause land to be put to alternative uses. In the central business district this means more intensive use of land and thus higher buildings. Simplified, higher prices for land reduce the ratio of the per-floor cost of tall vs. short buildings and thus create the incentive to build buildings taller to spread the land cost over a larger number of floors. Lower rates of interest also

¹¹The editors of *Architectural Forum* circa 1950 quoted in Huxtable (1992, p. 99).

¹²As quoted in Huxtable (1992, p. 117).

reduce the cost of capital which facilitates the ability to build taller. Thus, higher land cost leads to taller buildings.¹³

The second Cantillon effect from lower rates of interest is the impact on the size of the firm. A lower cost of capital encourages firms to grow in size and to become more capital intensive and to take advantages of economies of scale. Production and distribution become more specialized and take place over a larger territory. Instead of a dairy farmer raising cows and producing milk for the domestic market, larger firms raise a greater quantity of dairy cattle, ship raw milk to processing plants and ship processed dairy products back to wholesale and retail distribution sites. The production of dairy products becomes more roundabout, but also more productive. As part of this more roundabout production process, firms develop central offices or headquarters, as well as marketing offices within their market territory. This increases the demand for office space in central business districts. This demand in turn raises rents and encourages the building of more, and still taller, office buildings within the central market district.

The third Cantillon effect is the impact on technology of constructing taller buildings. Inevitably, record-breaking skyscrapers require innovation and new, untried applications of technology. Buildings that reach new heights pose numerous engineering and technological problems relating to such issues as building a sufficiently strong foundation, ventilation, heating, cooling, lighting, transportation (elevators, stairs, parking), communication, electrical power, plumbing, wind resistance, structural integrity, fire protection and building security. There is also a host of “public” issues connected with increases in employment density brought about by tall structures, such as transportation congestion and environmental concerns.¹⁴ Beyond the mere technology it takes to build the world’s tallest building, every vertical beam, tube, or shaft in a building takes away from rentable space on each floor built, and the more floors in the structure, the greater the required capacity of each system in the building, whether it is plumbing, ventilation, or elevators. Hence, there is a tremendous desire to innovate with technology in order to conserve on the size of building systems or to increase the capacity of those systems. Therefore, as the height of construction rises, input suppliers must go back to the drawing board and reinvent themselves, their products, and their production processes.

All three Cantillon effects resulting from lower rates of interest are, of course, interrelated and reinforcing. All three are generally recognized by those involved in the building of large office buildings including architects, bankers, contractors, design specialists, engineers, entrepreneurs, finance

¹³See Atack and Margo (1996). They examined the market for land in New York City during the nineteenth century. Their evidence suggests that land values tended to increase during deflationary periods, but less so during inflationary periods.

¹⁴Kim (2002) showed how increases in skyscraper building and, in particular, improvements in skyscraper technology, lead to increases in employment density.

specialists such as bond dealers, government regulators, and the tenants themselves. In addition to the location and prestige of a skyscraper address, tenants place higher value on office space with better light, view, and networking opportunities.¹⁵ Higher interest rates discourage the building of taller buildings and of construction in general because capital is scarcer and land is less in demand and available at lower prices. Existing structures experience financial difficulties that relate back to Cantillon effects, such as higher borrowing costs, lower capital asset values, and a decreased demand for office space. Firms engaged in office building construction and their suppliers face a decrease in the demand for their services, the impact of which falls hardest on those firms who specialize in the production of the tallest buildings. It is not atypical for the owners of such buildings and the builders of such elaborate construction projects to go bankrupt during economic slumps.

The interest rate is what makes the construction business, in part, such as speculative business. Home builders build “spec houses” and face the risk of finding a buyer at a profitable price. Developers build speculative office buildings which in contrast to many corporate headquarters are investments that rely on an uncertain flow of rental income. Separating the winners from the losers is not as much a matter of greed as it is a matter of time. Carol Willis (1995, p. 157) explained the difference between normal times and boom times.

In normal times, when costs of land, materials, and construction are predictable, developers use well-tested formulas to estimate the economics of a project. These calculations are based on the concept of the capitalization of net income. This value takes into account the net income for thirty or forty years . . . the conventional market formulas and the concept of economic height were widely known and followed in the industry. Most speculative building was not risky, but reserved in its calculations and highly responsive to market desires.

All of the normal calculations that help ensure profit and avoid loss are not, however, reliable during the boom phase of the business cycle. As Willis explained (1995, pp. 157-58):

In booms, the so-called rational basis of land values is disregarded, and the answer to the question “What is the value of land?” becomes “Whatever someone is willing to pay.” Some speculators estimate value on new assumptions of higher rents; others simply plan to turn a property for a quick profit. . . . But due to the cyclical character of the real estate industry, the timing of a project is crucial to its success, and the amount a property reaps in rents or sale depends on when in a cycle it is completed or comes onto the market.

Building the world’s tallest building has been a matter of particularly bad timing by entrepreneurs and even if they were able to successfully steal away

¹⁵See for example the evidence presented by Colwell and Cannaday (1988).

enough tenants from the remaining pool of renters, the economic problem for society is that valuable resources are lost in the process of constructing buildings that are bad investments and underutilized.¹⁶ However, it is not the entrepreneur's formula that is at fault, but a system-wide failure that has occurred periodically throughout the twentieth century and before, known as the business cycle. Hoyt (1933) found the building cycle was a "motion of a definite order" lasting 18 years, on average, from peak to peak. But Willis (1995, p. 159) raised the key issue as it relates to skyscrapers:

Indeed, a key question about cycles is, if their pattern is so predictable, why don't people foresee the inevitable bust? This conundrum can perhaps be answered by looking more closely at the dynamics of speculation and at a typical skyscraper development.

Hoyt suggested that the cycle is long enough for people to forget the lesson of the previous cycle and thus not be able to apply it to the next cycle. However, the building cycle is much more volatile than their 18-year average would suggest and the construction industry is affected by other cycles of shorter duration. Together with the impact of local economic conditions and government intervention, the combination blurs any usefulness of the simple knowledge that business cycles exist. As Willis (p. 164) noted:

After the collapse of an inflated market, it is easy to look back on the grave errors of judgment that preceded a crash; yet the basic indicators of the twenties economy seemed to promise unimpeded growth. Pent-up demand for office space after World War I, the expanding numbers of the white-collar workforce, and the increasing per-person average for office space all fueled the building industry. Each year, the summaries of annual construction figures reported record numbers.

Willis did correctly identify that "easy financing underlie all booms," but this does not answer her conundrum because easy financing and low interest rates are also at the heart of genuine economic growth. The entrepreneur's problem is that profit calculations cannot show for sure whether interest rates will remain low and projects will succeed (economic growth) or rates will rise and projects will fail (business cycle). It seems that only time will tell. Furthermore, it should be made clear that low interest rates and "easy financing" are terms not defined on the basis of their magnitudes, but in relation to their natural rates and levels—based on savings, which are not known or observable. Increases in the money supply will tend to generate increases in construction spending, but nominal interest rates (the most visible rate) tend to move with movements in construction spending (Barth et al., 1988). The business cycle

¹⁶See for example Hendershott and Kane (1992, p. 68) who estimated that there was more than \$130 billion wasted in the commercial construction boom of the 1980s. The Empire State Building was nicknamed the "Empty State Building" because of its high vacancy rates until after World War II.

may indeed have a predictable pattern, but its timing and magnitude may be beyond rational human construction. Overbuilding by the construction industry is not a problem of the construction industry *per se*, but a problem of too much financing and some sort of government-caused distortion. For example, Hendershott and Kane (1992, pp. 61-69) made the following conclusions concerning the construction boom of the 1980s:

Why did our nation overbuild so much and so long? The answer lies largely in the distortion of private incentives by misguided governmental policies on both the regulatory and legislative fronts. . . . Building requires both construction and permanent financing; overbuilding requires too much of each, financed at too low a rate . . . developers have traditionally used substantial debt financing and this tendency was especially strong in the U.S. during the 1980s. Highly leveraged building projects were a natural response to government-distorted incentives.

The history of speculative bubbles in construction is paralleled by a history of big increases in debt financing whether it is generated by endogenous factors, gold flows, central banks, or in this case bank regulators.

CANTILLONED BUILDINGS AND BUSINESS CYCLES

As Abraham and Hendershott (1994, p. 15) have noted: “We don’t really know what starts the speculative bubbles.” The problem with business-cycle theories is that they are often more like descriptions of business cycles rather than theories about business cycles and their causes. Each description emphasizes particular features which are then raised to the status of causal forces. Each stage of the business cycle is characterized by several features (e.g., speculation, unstable supply of money, decreased aggregate demand, and exogenous real factors). As a result, business-cycle theories are generally “perspectives” in which the economist has identified institutions to place blame along with their preferred remedies. One solution to this problem is to recast the business cycle with its paired features and then analyze those features with economic theory to provide a theoretical understanding of the business cycle.

As such, business cycles are reoccurring sequences of varying length of expansions, downturns, contractions, and upturns in many types of economic activity such as production, employment, income, sales, housing starts, money, credit, and prices. Interest rates, inventories, fixed capital, and loans outstanding tend to be procyclical.

Expansions and booms are generally characterized by low and stable interest rates, increased borrowing and credit formation, increases in the monetary stock and money supply, and investment speculation. Employment increases and so does production. Prices of capital assets, stock prices, and land values all tend to increase during the expansion phase of the business cycle. Speculation could cause such an expansion based, for example, on changes in expectations of the future. However, speculation is unlikely to be

the first cause of a reoccurring cyclical phenomenon, although it certainly is a regular component of that phenomenon known as the expansion or boom. Likewise, investment is an important component of the expansion phase but it too has prior causes. Endogenous investment could ignite an expansion and increase the amount of loans and the money supply, but again such a change is unlikely to represent a reoccurring cyclical phenomenon. Most importantly, increased speculation and the related concept of increased investment would normally not represent the potential for systemic error on the part of investors because in each case their actions were based on group-wise assessments of future conditions. It would be most unlikely that such economy-wide assessments would be systemically incorrect on an on-going basis. Therefore, while it is imaginable that entrepreneurs might self-ignite an economic expansion, and that such an expansion could turn out to be false, it is unlikely that they would continue to self-ignite self-defeating expansions on a reoccurring basis.

The economy can also experience an expansion if there is an increase in the supply of loanable funds. If the supply of saving increases due to a decrease in time preference, then interest rates fall and more resources are made available to entrepreneurs to invest in future production. The result is that the rate of economic growth will increase and consumption will increase when the new investments come on line and start producing. Banks can also *simulate* an increase in the supply of saving by reducing bank reserves held against demand deposits. It is unlikely that a single bank could influence the market rates of interest with this approach or orchestrate a significant or sustained reduction in interest rates via this mechanism. It would also be odd for an industry to reduce the price of its product in order to sell more loans to less desirable customers and thereby put the assets of banks at greater risk.¹⁷ It is possible for a central bank or monopoly bank to reduce the market rate of interest by providing banks with additional bank reserves. The lower interest rate will induce a reduced amount of saving and an increase in the amount of borrowing, heavily weighted to investment expenditures. The gap between the increased investment and the decreased savings is filled with resources paid by “forced savings.”

The interest rate, which normally establishes the intertemporal market clearing between saving, investment, and consumption, is here the source of important imbalances. First it establishes an increased responsibility to pay (borrowed funds) with a decreased ability to buy (reduce interest income from savings). Second, when interest rates are perceived to be stable and the market rate is reduced from the natural rate of interest that would have existed in the market, entrepreneurs are enticed to invest in more roundabout

¹⁷See for example Selgin (1992) who shows that there is little in either economic theory or history that indicates lending manias are endogenous to laissez-faire banking systems.

methods of production. Entrepreneurs simultaneously begin the development of new, more capital-intensive and less labor-intensive means of production that are more roundabout and efficient given the new interest rate signals they face.

Investment in more roundabout production processes means that investors are investing in new independent projects involving unique capital goods and new technologies and “ways of doing things” that were previously “on the shelf” but not in general use. Spending money on research and development, for example, is investment in more roundabout production processes, as is building a net to fish rather than using your hands or a crude object such as a sharpened stick. Transportation provides other examples such as building canals to compete with road traffic, or building railroads to compete with canals and river traffic. The most direct way of communicating with someone is to walk over to them and begin talking while a more roundabout method would be to run telephone lines between your location and their location and to use telephones to communicate.

This activity however implies the existence of a wide variety of capital goods as well as the production of wires, phones, telephone poles to string the wires, etc. Phones are therefore more roundabout than the “walk and talk” method, but are definitely more productive. Likewise, replacing regular phone lines with fiber optic cables is more roundabout but more productive. The cables are more roundabout because we have to first build new capital goods to produce the optic cables while the capital goods to produce traditional phone lines already exist for the most part. Fiber optic cables are also more productive than traditional phone lines in that they can do everything a traditional line can do and transmit data at faster speeds. The “technology” of “just in time inventory” systems could also be an example of a more roundabout process. More roundaboutness implies the use of a different technology, in the broad sense of the word. Entrepreneurs do not embark on more roundabout production techniques that are less productive than less roundabout techniques as they seek to produce consumer goods as quickly as possible because time is money.¹⁸

An office building is a capital good that is used to bring a variety of consumer goods to market in the sense that production in the office building involves the decision-making process over all aspects of the firm. Its use is ubiquitous in “big business” and is totally absent in small businesses such as family farms, hot dog stands, plumbing services, auto body repair shops, etc. As such, the office building is a critical capital good in very roundabout production processes that represent virtually all modern production and all

¹⁸Government bureaucrats and college presidents often do consider and implement more roundabout processes that are less or equally productive due to the inability to calculate economically, bribery, and the need to spend the bureau’s budget within a time constraint.

cutting-edge goods and service production. The modern economy is inextricably linked with the large office building or as Carol Willis (1995, p. 181) put it: “Skyscrapers are the ultimate architecture of capitalism.”

The skyscraper is not just a large version of the office building. Skyscrapers can be used to house the offices of a single corporation, the central offices and branch offices of multiple corporations, hotel and residential living space, commercial space, convention space, a wide variety of personal service businesses, and specialized tenants such as stock exchanges, theaters, and television studios. As such, the skyscraper can serve as a much larger and more advanced office building (being both more productive and producing a higher-quality service). It can even take on the status of a business community or specialized form of privately-controlled marketplace. Naturally, greater amounts and diversity of production are possible in larger skyscrapers. The world’s tallest building, past and present, also adds the status of a distinct address.

Economists of the Austrian School have a theory of the business cycle based on capital theory where the structure of production is distorted by artificial changes in the interest rate. Economic activity is based on “fundamentals,” but the fundamentals themselves can be distorted and induce bad investments (hysteria and speculation) that ultimately are revealed to be bad investments during the economic contraction. In contrast, many mainstream economists ignore the structure and roundaboutness of production. Indeed, for more than the last half a century economists have been concentrating on the subject of the quantity of capital while generally ignoring the details of real world capital goods and the intricacies of the structure of how capital goods are actually used to produce goods. This emphasis by the profession has unfortunately left many economists with little knowledge of a most important aspect of economics and the economy; the nexus of capital and entrepreneurship known as technology. As Alan Greenspan (2003) has testified before the U.S. Congress: “Economists understand very little about how technological progress occurs.” Other leading economists feel that markets and investments are not based on rational foundations and that economists would be well advised to study psychology rather than price theory. Still others, like the Austrians, feel that business cycles are based on some sort of technological change, but they either do not know why technology changes or view it as a random process. All of these views are well expressed by Robert Shiller:

I think that most price movements of any size are unrelated to news about fundamentals [p. 26]. . . . The most straightforward explanation, then I think, is one that is *inconsistent* with market efficiency—namely, a speculative bubble. People were selling, in short, simply because they thought other people were going to sell [p. 27]. . . . I will say, however, that such speculative behavior is kind of a depressing lesson for economists. It’s very difficult for us to model these things; it suggests we have learned the wrong research skills. The strong suggestion from this evidence is that

much that occurs in financial markets doesn't make sense in terms of fundamentals.

I also suspect that what we have recently learned about financial markets probably extends to macroeconomic issues as well—that is, to matters like the business cycle. For example, there's a recent fashion in the macroeconomics literature called "real" business cycle models. Such models try to make sense out of macroeconomic fluctuations entirely in terms of optimal responses to new information about fundamentals. In fact, the only thing that drives most of these models is technological change. That is, the ups and downs of the business cycle are being caused predominantly by technological progress, which uproots some industries while giving rise to others. (Shiller 1992, pp. 26-28)

Fortunately, there does seem to be a growing appreciation for the Austrian theory of the business cycle, if not an accurate understanding of the theory itself. As Pesek (1999a) has noted, the causal factors relating skyscrapers to the business cycle share the "basic tenet of Austrian economic theory." The Austrian theory is based on the economics of the capital structure and the distinction between true interest rate signals which generate economic development and false interest-rate signals which generate business cycles. Understanding the giant skyscraper as a manifestation of the business cycle and thus understanding how price and interest rate signals can distort the structure of production in the economy into bad investments and improperly allocated labor might go a long way toward improving economists' understanding of business cycles and their cures.¹⁹ Unfortunately, the theory is blind in the sense that it offers no way of knowing if the actual rate of interest is above or below the so-called natural rate and therefore it offers little in the way of exact prediction. It should be clear that despite its good record of predictions, the Skyscraper Index is not recommended as a remedy for this deficiency, but simply as a good illustration of the strengths of the Austrian theory of the business cycle.

WHEN THE SKYSCRAPER INDEX IS WRONG?

No index or predictor is perfect, and the skyscraper index as presented by Andrew Lawrence has a far from perfect record. First, as noted by Lawrence, the skyscraper index failed to predict in the case of the Woolworth building in 1913. Second, the index did not predict in the case of Japan which has suffered a rolling recession since 1990. Lawrence did not mention this presumably

¹⁹See for example Eichengreen and Mitchener (2003) for an excellent analysis of the Great Depression by neoclassical standards. However, their desire to count and their failure to incorporate capital structure leaves them with an incomplete analysis and their admittedly weak proposals for reform such as preempting the boom and eliminating fraud and abuse.

because none of the recessionary periods in Japan were extraordinary, only their cumulative impact. Third, the skyscraper index did not predict the stock market crash in the NASDAQ stock market although this did occur after his article was published and has not yet resulted in what the consensus views as a severe downturn in the economy.²⁰ Nor were there any “predictions” of the severe downturns of 1920–21, 1937–38, and 1980–81. The skyscraper index is primarily an index that predicts *severe* changes in the economy, although it might be possible to improve and refine the data to predict business cycles of various magnitudes.

The primary counterexample to the competence of the skyscraper index is the Woolworth Building. This project was announced in March of 1910, but at first it was planned to be a “modestly tall” building. In November of 1910 its projected height was increased, but it was still only slated to become the third tallest building in the world. In January of 1911 the building was re-planned to become one of the tallest buildings in the world at 750 feet, but latter this figure was raised still higher to more than 792 feet high (Landau and Condit 1996, pp. 381–82). The opening ceremonies for the Woolworth Building were held on the night of April 24th, 1913 although it was not fully completed until latter (p. 390). The economy peaked and began its contraction in the first quarter of 1913 and continued to contract until the fourth quarter of 1914. This contraction included the third worst quarterly decline in real GNP between 1875 and 1918, and was worse than any quarterly performance between 1946 and 1983. We should also add that the founding of the Federal Reserve System in 1913 and the coming of World War I in Europe in 1914 did much to provide short-term stabilization for the American economy and to shorten the life of the contraction.²¹ Therefore, it would seem that the Woolworth Building was not a complete exception or error of the skyscraper index, after all. It could simply be that the intervention of World War I did not provide ample time for the economic slump to deepen and receive the historical label (e.g., “Depression of 1913”) that would have kept it in our historical consciousness. Also, it is worth noting that the completion of the Masonic Temple in Chicago, (the first building to exceed 300 feet) in 1892 was preceded by the beginning of the largest swing (contraction) in recorded U.S. history, culminating in the largest quarterly decline in real GNP in our history and was followed by the Panic of 1893. Likewise the completion of the Park Row Building in 1898—the world’s tallest building—was preceded by the fourth

²⁰This is not entirely true, as Pesek (1999b, p. 14) reported that a new “world’s tallest building” was announced well before the crash/recession began in the spring of 2000, but plans were put on the shelf.

²¹A case could be made that these two events rank as two of the most economically destructive of the century, at least by those who oppose inflation and war and by those who link America’s entry into, and the results of, World War I as the cause of World War II.

largest quarterly decline in real GNP over the period of 1875-1918 and is sometimes called the Panic of 1897.²²

A reexamination of the evidence suggests that the skyscraper index is a better predictor than first formulated by Lawrence (1999). Obviously this does not suggest that building heights should be used as a guide to fiscal and monetary policy or that skyscraper heights should be limited to prevent economic crisis. It does however lend additional standing to the Austrian theory of the business cycle.²³ Furthermore, it does suggest that both the cause of skyscrapers reaching new heights and severe business cycles are related to instability in debt financing and that the institutions that regulate debt financing should be reevaluated, if not replaced with more efficient and stabilizing institutions.

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²²See Zarnowitz (1992, pp. 80-81) for estimates of quarterly changes in real gross national product, 1875-1983.

²³For a comparison of Austrian business cycle theory with many of the competing business cycle theories see Zijp (1993), Cochran and Glahe (1999), and Garrison (2001).

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